Validation of Indigenous Technical Knowledge in Agriculture





Document 3



Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research

Validation of
Indigenous Technical Knowledge in Agriculture

Mission mode Project on
Collection, Documentation and Validation of Indigenous Technical Knowledge

Document 3

Compiled by

P. Das
S.K. Das
A. Mishra
L.R. Verma
R.P. Singh`Ratan'
H.P.S. Arya
G. Subba Reddy
Ms. Geetha Rani
H.S. Gupta
D.P. Ray
Z.D. Kavia

Indian Council of Agricultural Research
New Delhi

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Dr P. Das, Deputy Director General (Agril. Extn.), ICAR, New Delhi
Dr S. K. Das, Zonal Coordinator, Zone II, ICAR, Kolkata, West Bengal
Dr Anupam Mishra, Zonal Coordinator, Zone VII, ICAR, Jabalpur, Madhya Pradesh
Dr H. P. S. Arya, Joint Director, Extension Education, IVRI, Izatnagar, Uttar Pradesh
Dr R. P. Singh 'Ratan', Head, Department of Extension Education, BAU, Ranchi, Jharkhand
Dr L. R. Verma, Mountain Research and Development Associates, Shimla, Himachal Pradesh
Dr G. Subba Reddy, Head, Division of Crop Sciences, CRIDA, Santoshnagar, Hyderabad, Andhra Pradesh
Ms M. Geetha Rani, Senior Scientist, M. S. Swaminathan Research Foundation, Chennai, Tamil Nadu
Dr H. S. Gupta, Director, Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora, Uttranchal
Dr D. P. Ray, Dean, Directorate of Extension Education, OUAT, Bhubanewar, Orissa
Mr Z. D. Kavia, Principal Scientist, CAZRI, Jodhpur, Rajasthan

Database designed by	**:**	**Sanjay Kushwaha** **Sunil Kumar Sinha**
Director (DIPA)	**:**	**Arvinda Chakravarty**
Chief Editor	**:**	**C. S. Vishwanath**
Associate	**:**	**Obaidur Rahman**
Chief Production Officer	**:**	**Virendra Kumar Bharti**
Technical Officer	**:**	**Ashok Shastri**

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Foreword

THE Mission Mode project on Collection, Documentation and Validation *of Indigenous Technical Knowledge (ITK) was sanctioned by the Indian* Council of Agricultural Research in June 2000, under National Agricultural Technology Project (NATP). The outcome of the project has been earlier published in three volumes as Inventory of Indigenous Technical Knowledge in Agriculture—*Document 1, 2 and Supplementary 1 of Document 2, covering 4033 ITKs in agriculture.*

Validation of ITKs is an important aspect, which has remained almost untouched from research agenda. In this direction 111 ITKs have been taken up for validation, which include experimental validation of 14 thematic areas, viz., rain water management, soil and water conservation, tillage practices, crops and cropping systems, pest and disease management, farm implements, seed storage, horticulture, veterinary science and animal husbandry, fisheries, food product development, natural yarns and dyes, ethnic food and thermal efficiency and case studies in two thematic areas, viz., methods of weather forecasting and low-cost housing materials. The results obtained, inspite of availability of limited period, has been very interesting and extremely important for finding the scientific rationale of traditional wisdom and knowledge.

Simultaneously, efforts need to be made to protect the issues relating to intellectual property rights so that the interest of the inventors and the actual users of the technologies are protected.

I am sure that the present publication entitled Validation of Indigenous Technical Knowledge in *Agriculture—Document 3 will open new vistas in agricultural research for appropriate blending of* ITK with modern technology and also to provide effective techniques to meet the global demand for organically produced food products. The splendid efforts made by Dr P. Das, Deputy Director-General (Agricultural Extension) and his dedicated team members in bringing out this publication are commendable.

(MANGALA RAI)
Secretary
Department of Agricultural Research and Education
and
Director-General
Indian Council of Agricultural Research, New Delhi

New Delhi
4 December 2003

Preface

USE of Indigenous Technical Knowledge (ITK) in protecting crops, storage of grains, animal health care and other land-based activities is a continuous process since long. Advancement in scientific knowledge and development of practices based on use of agro-chemicals have gained popularity, replacing the ITK-based practices, particularly in resource endowed farming situations. However, ITKs remain in use for a vast section of farmers of the country.

The Mission Mode Project on Collection, Documentation and Validation of Indigenous Technical *Knowledge (ITK) has been a land mark effort in this direction. The outcome of which has been* published in three volumes of 4033 inventories of ITKs in agriculture.

This publication entitled Validation of Indigenous Technical Knowledge in Agriculture-Document3 provides the results of validations conducted by the specialized ICAR institutes and State Agricultural/ Animal Science Universities across the country. The results of the experiments conducted clearly indicate the rationality and efficacy of the ITKs in solving the problems, faced by the rural people in sustaining their livelihood.

This publication is, perhaps, the first of its kind which has been devoted in documentation of the results of experimentations and case studies on 16 thematic areas of ITKs. It is firmly believed that the findings of the experimentations and case studies would certainly encourage the researchers, planners and policy makers to look back into the wisdom of the indigenous knowledge and incorporate the same in the research/development agenda.

The project team expresses its deep sense of gratitude for constant encouragement from Dr Mangala Rai, Secretary (DARE)/ Director-General (ICAR) from the day of inception of the project. The support, guidance and methodological backstopping received from Dr A. Alam, the then Deputy Director-General (Agricultural Engineering) and Chairman of ITK Information Committee (ITKIC) and presently Vice- Chancellor, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar; and the members of the ITKIC are highly acknowledged. The project team is equally thankful to Dr P. L. Guatam, the then National Director (NATP); Dr S. L. Mehta, National Director (NATP) and Dr K. P. Agrawal, National Coordinator (MM) for their all out support and encouragement. The useful guidance in shaping the experiments for validation provided by the Chairpersons of the Zonal Technical Coordination Committees is acknowledged.

The publication including the previous volumes have been brought out in record time with the help of Mr Arvinda Chakravarty, Director (DIPA); Mr C. S. Viswnath, Chief Editor; and Mr Virendra Kumar Bharti, Chief Production Officer and other Associates. We are thankful to them.

The assistance received from Dr Nirmal Chandra, Senior Scientist, Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora; Dr (Ms) Niva Bara, Scientist, Birsa Agricultural University, Ranchi; Shri Sanjay Kushwaha, Technical Officer, ZC Unit, Jabalpur; Shri Sunil Kumar Sinha and Shri Vikas Jain, both Research Associates and Ms Seema Naberia, Senior Research Fellow of the Lead Centre in compiling this Document is appreciated.

(P D AS)
Deputy Director-General (AE)

New Delhi
4 December 2003

Introduction

THE Indian Council of Agricultural Research (ICAR) under National Agricultural Technology Project (NATP) have sanctioned a Mission Mode project on "Collection, Documentation and Validation of Indigenous Technical Knowledge (ITK)" in June 2000 for a period of three and half years. As indicated in the title, the project envisaged collection of information of the practices related to agriculture and allied aspects based on indigenous knowledge and its documentation, and validation of the ITKs. Information on ITK were initially collected from secondary sources and documented in 2002 in a 411-paged publication entitled Inventory of *Indigenous Technical Knowledge in Agriculture– Document 1. Subsequently, information on ITKs* from primary sources were collected through advertisements in national and local dailies. These were documented in two publications, viz., *Inventory of Indigenous Technical Knowledge in Agriculture – Document 2 (page 680), and Inventory of Indigenous Technical Knowledge in Agriculture–Document 2 (Supplement 1) in 226* pages.

Experimental validation of the ITKs, selected by the group of Zonal Leaders and approved by the ITK Information Committee was initiated in 2002. The ITKs thus selected for validation have been subjected to experimentation and results obtained so far from 111 ITKs have been incorporated in this Document.

Formulation of the technical programme and monitoring the progress of validation was done by the 9 Zonal Technical Coordination Committees (ZTCC), chaired by eminent scientists. The respective Zonal Leader acted as Member- Secretary of the concerned ZTCC with the researchers as the members. The research on validation was carried out by the scientists of ICAR institutes and State Agriculture/ Animal Science Universities. The detail of the ZTCCs are indicated below:

Zone	Chairperson of ZTCC	Zonal Leader
Zone I	Late Dr K.N.K. Chouhan, Head, Department of Extension, Central Arid Zone Research Institute,Central Jodhpur, Rajasthan	Mr Z. D. Kavia, Principal Scientist, Arid Zone Research Institute, Jodhpur (Rajasthan)
Zone II	Dr R. Kadirvel, Vice-Chancellor, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu	Ms Geetha Rani, Senior Scientist, MS Swaminathan Research Foundation, Chennai (Tamil Nadu)
Zone III	Dr K.L. Bhowmick, Dean Post Graduate Studies (Retd.), Bidhan Chandra Krishi Vishwavidyalaya, Nadia, West Bengal	Dr Anupam Mishra, Zonal Coordinator, Zone VII, ICAR, Jabalpur (Madhya Pradesh)
Zone IV	No ITK for validation	Dr K. M. Bazurbaruah, Director, ICAR Research Complex for NEH Region, (Meghalaya)
Zone V	Dr N. Kumar, Director, Defence Agricultural Research Laboratory, Pithuragarh, Uttaranchal	Dr H. S. Gupta, Director, Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (Uttranchal)

Zone	Chairperson of ZTCC	Zonal Leader
Zone VI	Dr P. K. Khosla, Former Vice Chancellor, Y. S. Parmar University of Horticulture and Forestry, Solan and presently Senior Advisor, Bio technology, Govt. of Himachal Pradesh, Shimla, Himachal Pradesh	Dr L. R. Verma, Mountain Research Development Associates, Shimla (Himachal Pradesh)
Zone VII	Dr M.P. Yadav, Director, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh	Dr H. P. S. Arya, Joint Director, Extension Education, IVRI, Izatnagar (Uttar Pradesh)
Zone VIII	Dr S. N. Pandey, Vice-Chancellor, Birsa Agricultural University, Ranchi, Jharkhand	Dr R. P. Singh 'Ratan', Head, Department of Extension Education, BAU, Ranchi (Jharkhand)
Zone IX	Dr B. L. Mishra, Retd. Director, Directorate of Extension Services, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh	Dr D. P. Ray, Dean, Directorate of Extension Education, OUAT, Bhubaneswar (Orissa)
Zone X	Dr H.P. Singh, Director (Retd.), Central Research Institute for Dryland Agriculture, Hyderabad, Andhra Pradesh	Dr G. Subba Reddy, Head, Division of Crop Sciences, CRIDA, Hyderabad (Andhra Pradesh)

Field survey method, using the tools of participatory rural appraisal (PRA), conducted at the sites of use of the ITK (as disclosed by the disclosers of the ITK) helped to ascertain the extent of use of the ITKs and opinions of the users of the ITKs regarding its efficiency on problem. Field / controlled studies were conducted systematically to generate data base for determining the efficacy of the ITKs. Zonal Technical Coordination Committee reviewed the findings of the field survey and decided the ITKs to be taken up for experimentation. At the time of bringing out this publication, the results of experimentation/case studies of 111 ITKs were available for meaningful conclusion regarding the efficacy of the ITKs. The titles of the ITKs, the results of which have been included in this publication are given below theme-wise. The titles and the code numbers of the ITKs given in Document 2 have been used as such in this Document.

The publication provides the details of the experimentations, including materials and methods, results and discussion and the conclusion that could be made regarding the efficacy of each of the ITK. Some of the components of the ITKs were subjected to laboratory test/analysis which has been done outside the network of the project. The contributions of such supporting organizations have been indicated in the concerned chapters in this book.

❑

Prelim

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Introduction

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Rain Water Management

Code	**:**	**2024**
Title of the ITK	**:**	**Rain water measurement using rolu (indigenous rain gauge)**
Description of the ITK	:	*Rolu* (7.4" depth × 9" diameter hole on a 3" × 3" × 1.5" granite stone block) is useful in knowing the quantity of rainfall required for sowing. Sowing of seeds in the field is done when the *rolu* is filled with rainwater. This technique helps the farmers in estimating the rainfall that is sufficient to go for seeding. This method is adopted for sowing dryland crops like sorghum, castor etc. in Alfisols.
Name and address of the discloser	:	Shri Narasimha Reddy, Nallavelli, Ranga Reddy (Andhra Pradesh)
Location of use of the ITK	:	Nallavelli Village, Yacharam Mandal, Ranga Reddy (Andhra Pradesh)
Experimenters	:	Dr V.Maruthi, Senior Scientist (Agronomy), Shri N. N. Srivastava, Principal scientist (Agrometeorology), and Dr G. Subba Reddy, Head, Division of Crop Sciences, Central Research Institute for Dryland Agriculture, Hyderabad

METHODOLOGY

After interaction with the farmers about 10 rain gauges were fabricated with the help of a local mason using the specifications recorded as claimed by the discloser. Indigenous rain gauge and standard rain gauge are shown in Figs 1 and 2. The programme of validation of indigenous rain gauge was implemented under both on-station (CRIDA Research Farm, Gunegal) and on-farm situations in the villages Nallavelli, Nasdiksingaram and Gollapally of Ranga Reddy district during rainy (*kharif*) season 2002. Indigenous rain gauges were installed close to the standard rain gauges that were already established at Gunegal Research Farm, Nasdiksingaram,



Fig. 1. Indigenous rain gauge (*rolu*)



Fig. 2. Standard rain gauge and indigenous rain gauge

Nallavelli and Gollapally to compare their efficiency in terms of correlation and validation in commonly cultivated rainfed crops of sorghum + pigeonpea, castor etc.

At each site, circumference area of 0.5 km was taken as a unit for the study. The area of the study under each site was marked into four directions of north, east, south and west. The fields covering the study area were given code numbers and characterized as per the type of crops grown. Monitoring of various agricultural operations performed by different farmers in the study area under different crops were documented. Further, the quantity of rainfall received in both indigenous and standard rain gauges for different dates from June to October was correlated by taking the parameters of the volume of water stored in the two rain gauges (considering the surface area collecting rainfall in each rain gauge). Based on these parameters, a correction factor was calculated to correlate the quantity of rainfall received in indigenous rain gauge with standard

Table 1. Rainfall received and various agricultural operations carried out at Nasdiksingaram village of Ranga Reddy district of Andhra Pradesh during 2002

Date	Rainfall received			Sorghum+pigeonpea			Castor
	IR						
	SR (mm)	Quantity (mm)	Depth of *Rolu*	Agricultural Operation (duration in days)	Farmers practised (%)	Agricultural Operation (duration in days)	Farmers practised (%)
24/7	12.4	47	□	Sowing (2)	30	Sowing (2)	35
31/7	2.1	8	>□	Interculture (2)	30	-	-
2/8	15.7	56.6	>□	Interculture (1)	15	Sowing (2)	35
6/8	6.3	15.4	<□	Interculture (4)	57	Sowing (1)	17
						Interculture + top dressing (3)	50
7/8	7.5	23	>□	-	-	-	-
8/8			>□	-	-	-	-
9/8			>□	-	-	-	-
10/8			>□	-	-	-	-
11/8			>□	-	-	-	-
12/8			□	-	-	-	-
18/8	3.2	6.3	>□	Interculture (1)	15	Sowing (1)	17
						Interculture (3)	
						Interculture (3)	
23/8	14.6	41.4	<□	Interculture + top dressing (4)	57		
5/9	14.0	43.0	<□	Interculture (2)	30	Interculture + top dressing (5)	83
21/9 to 27/9	-	-	-	Harvesting	-	-	-
3/10	10.0	45.1	□	-	-	Top-dressing (1)	17
onward	-	-	-	-	-	Harvesting	-

Table 2. Rainfall received and various agricultural operations carried out in village Nallavelli of Ranga Reddy district of Andhra Pradesh during 2002

Date	Rainfall received			Sorghum+pigeonpea			Castor
	IR						
	SR (mm)	Quantity (mm)	Depth of *Rolu*	Agricultural Operation (duration in days)	Farmers practised (%)	Agricultural Operation (duration in days)	Farmers practised (%)
4/8 to 5/8	-	-	-	Interculture-dry (1)+ top dressing (1)	40	-	-
7/8	22.4	78.4	>□	-	-	Sowing (3)	60
8/8	8	20.4	< □	-	-	-	-
9/8	29.6	79.2	>□	-	-	-	-
10/8	12	37	>□	-	-	-	-
12/8	26.6	67.2	< □	Interculture (1)	20	Interculture (2)	40
18/8	1	2.4	<□	Inteculture (2)	40	Interculture (2)	40
23/8	14.2	38.4	>□	-	-	Interculture (3)	60
6/9	11.4	33.4	>□	Top dressing (1)	20	Interculture + top dressing (4)	100
18/9	19.7	45	>□	-	-	Interculture + top dressing (3)	60
27/10	-	-	-	Harvesting	-	-	-
2/11	-	-	-	-	-	Harvesting	-

SR-Standard rain gauge, IR-Indigeneous rain gauge

rain gauge. An attempt was made to relate the quantity of rainfall collected through the indigenous rain gauge for various agricultural operations by the farmers at different sites.

RESULTS AND DISCUSSION

A correction factor was developed to quantify the rainfall of indigenous rain gauge (IR) for testing the validity of rainfall in comparison with standard rain gauge (SR).

To correlate the rainfall of indigenous rain-guage with standard rain gauge, derivation of Surface Area Ratio is required. It was arrived at by the formula:

Surface Area Ratio = Area of SR/Area of IR

= 200 cm2/407 cm2

Theoretical correction factor = 0.49

The results were validated over the study area by developing a practical correction factor for its wider applicability with the similar specifications of the rain gauges used in the present study. To develop a correction factor, the rainfall data obtained from both the rain gauges were fitted with the linear relationships, as given below.

$$RS = CF \times RI$$

where RS, Rainfall measured by standard rain guage (mm); CF , Correction factor; and RI, Rainfall measured by indigenous rain gauge (mm).

The correction factor obtained from the results was 0.32.

A positive correlation was observed with the rainfall

Table 3. Rainfall received and the various agricultural operations carried out at village Gollapally of district Nalgonda (Andhra Pradesh) during 2002

Date	Rainfall received			Castor	
		IR			
	SR (mm)	Quantity (mm)	Depth of *Rolu*	Agricultural Operation (duration in days)	Farmers practised (%)
24/7/02	9	17.7	< ½	Sowing (1)	25
2/8/02	27	33	>½	Interculture (1)	25
6/8/02	5	12.4	> ¼	-	-
7/8/02	19	82.5	> ¾	-	-
8/8/02	15	62	< ¾	-	-
9/8/02	28	82.5	> ¾	-	-
10/8/02	10	41.2	> ½	-	-
12/8/02	21	82.5	> ¾	Interculture+ top dressing (4)	100
23/8/02	15.1	27.1	< ½	Interculture + top dressing (3)	75
1/9 /02	5	12.3	>¼	Interculture (2)	50
5/9/02	3	26.7	< ½	Interculture (1)	25
19/9/02	13	57	< ¾	Interculture and top dressing (2)	50
18/10/02	40	92	Nearly full	Harvesting	-

Table 4. Rainfall received and various agricultural operations done at Gunegal Research Farm during 2002

Date	Rainfall received			Sorghum+pigeonpea		Castor	
		IR					
	SR (mm)	Quantity (mm)	Depth of *Rolu*	Agricultural Operation (duration in days)	Farmers practised (%)	Agricultural Operation (duration in days)	Farmers practised (%)
24/7	26.9	81.4	>¾	Sowing (1)	-	Sowing (3)	-
2/8	21.6	68.3	>¾	Interculture+ top dressing (2)	-	Interculture and top dressing (2)	-
7/8	18.6	78.4	>¾	-	-	-	-
8/8	15.4	30	>½	-	-	-	-
9/8	33	94	Nearly full	-	-	-	-
10/8	6.6	48	< ¾	-	-	-	-
11/8	2.2	4.8	<¼	-	-	-	-
12/8	10.6	40.5	< ¾	-	-	-	-
13/8	3.6	28	>½	-	-	-	-
23/8	8.4	63.6	>¾	Interculture+ top dressing (1)	-	Interculture + top dressing (6)	-
28/10 to 5/11	-	-	-	Harvesting	-	Harvesting	-

SR-Standard rain gauge, IR-Indigeneous rain gauge

standard rain gauges, with high coefficient of determination (R^2 = 0.83). Similarly, the correction factor was developed for the rainfall data measured at Gunegal Research Farm, CRIDA, which was 0.35 with R^2 =0.93.

An attempt was made to relate the rainfall of IR with that of the agricultural operations performed by the farmers at different sites (Tables 1, 2, 3 and 4). This process can help utilize the IR for suggesting various agricultural operations to the farmers of remote areas where the facility of recording rainfall through SR is not possible.

During the course of the study focus group interactions with many farmers were organized during the field day at Gunegal Research Farm to understand the perception of the farmers on the utility of IR. The outcome of the focus group interactions are:

1. Farmers felt that IR as disclosed has multiple utilities of recording rain and also in preparation of various food products for home consumption.
2. This IR is simple and can be installed in remote villages for collection of rainfall.
3. Advice on farm operations can be given on the bases of the volume of rain that is filled within the IR.
4. If the rain water is filled to the half of the volume, the farming community will do top dressing of castor.

CONCLUSION

Indigenous rain gauges were installed at on-farm and on-station situations during second fortnight of July 2002. By that time most of the farmers had already sown sorghum + pigeonpea in May 2002 and castor during June 2002. However, a few farmers had sown castor in the first fortnight of August, for which observations in both rain gauges were recorded, the results of which showed the utility of indigenous rain gauge for undertaking agricultural operations.

Code	:	**599**
Title of the ITK	:	**Method of rainwater management in mountainous landscape under apple orchard**
Description of the ITK	:	In several parts of the Himalayas, villages are located at the foot-hills or valleys. Villagers often harvest rain water by building small water storage ponds (ponds are locally called *chaal*).The number of such ponds varies from 30 to 40 depending upon the valleys and villages. Each water pond is 30 feet long, 30 feet wide and three feet deep. During rainy season water gets stored in these water ponds, which not only acts as water reservoir for the villagers but also controls the flood in the low hill areas during rainy season. The water of the ponds are not used for human drinking purpose but provides drinking water for cattle and for irrigation purposes. This is in practice for past several years.
Name and address of the discloser	:	Shri Prem Singh Verma, Village Gawahi, P.O. Sandhu, Tehsil Theog, Shimla (Himachal Pradesh) 171 222
Location of use of the ITK	:	The experimental site is an apple orchard, located in village Gawahi, which is about 45 km from Shimla city on national highway 22 (commonly called as Hindustan Tibet Road) and 8 km from Theog town, which is a gateway to apple belt of Shimla district. The orchard is of about 3 ha area, at about 2,400 m above msl, which was established ten years ago. The landscape is very steep, with a slope of about 70_75%. About 500 apple trees were planted along the visually-observed contours at a spacing of about 3_6 m. The trees are being fertilized regularly with chemical fertilizers and farm yard manure. The orchard is completely rainfed. There is no source of water for irrigation. The rainfall is inadequate and highly variable in distribution. The apple trees, therefore, often experience moisture stress. Consequently, the trees are weak and do not show full vigour.
Experimenters	:	Dr Pradeep K. Sharma, Sr Scientist (Soils), Dr O.C. Kapur, Sr. Scientist (Soils), and Dr S S Masand, Sr Scientist (Soils), Department of Soil Science, Ch. Sarwan Kumar Krishi Viswa Vidyalaya, Palampur (Himachal Pradesh) 176 062

METHODOLOGY

Validation of the claim of the ITK was done by experimentation, as per details given below.

Two sets of treatments were imposed to meet the objectives of the study.

1. For in-situ rain water harvesting and profile moisture conservation, three sets of treatments, in addition to control, were tested: mulching, terracing + mulching and terracing + trenching + mulching.
2. For testing chaal, five types of dug-out tanks were constructed at appropriate locations in the experimental area, viz., (i) silpauline-lined tank, (ii) bitumen (tarcoal) -lined tank, (iii) cement + concrete-lined tank (RCC), (iv) mud-plastered tank, and (v) unlined tank (control).

The whole experimental site was divided into three blocks for imposing these treatments.

i. *Terracing*: land shaping between two apple trees along the contours in such a way that rain water flows towards the tree basins.

ii. *Trenching*: small trenches of appropriate size were dug above the tree basins to harvest rain water in *situ*.

iii. *Mulching*: The tree basins were mulched with FYM, pine needles, pebbles and cocopit, in addition to unmulched control.

Observations were taken on:

i. General features of the area

ii. Initial characterization of soil for texture, water retention, particle density, bulk density, infiltration rate, pH, organic C and available NPK

iii. Soil moisture (0_60 cm depth) in tree basins under different mulch treatments.

iv. Water storage and seepage losses in different dug-out tanks

v. Rainfall and potential evaporation of the area.

The project on evaluating traditional *chaal* system of water harvesting from rains and other natural water springs etc. in the apple orchard was initiated in July 2002. Soil samples were collected at six locations in the orchard up to a depth of 60 cm at 15 cm depth increment. The six soil samples for each depth were thoroughly mixed and a composite sample was prepared. These composite soil samples were analysed in duplicate for texture (International Pipette method), organic carbon (Dichromate oxidation method of Walkley and Black), available N (Alkaline Permanganate method), Olsen's P, exchangeable K (Ammonium acetate method), pH (1:2.5 soil:water suspension) and particle density (Pychnometer method). Soil-moisture retention of disturbed soil samples (soil passed through 2 mm sieve) was determined at saturation —30 and—1,500 kPa water potential, using Pressure Plate apparatus. Bulk density was determined using 3 cm long and 5.6 cm diameter metal cores, by taking soil core from the middle portion of each soil layer.

RESULTS AND DISCUSSION

Soil properties

Important chemical and physical properties of the soil of the experimental site are given in Tables 1 and 2.

Table 1. Important chemical properties of the soil

Soil depth (cm)	pH	Organic carbon (g/kg)	Available nutrients (kg/ha)		
			N	P	K
0-15	5.8	8.4	492.2	44.1	167.9
15-30	5.9	6.8	477.2	39.3	112.0
30-45	5.9	5.5	460.5	30.7	89.6
45-60	5.9	4.4	314.3	28.3	78.6

Table 2. Important physical properties of the soil

Soil depth (cm)	Soil seprates (%)				Soil-moisture retention (%) at					
	Clay	Silt	Sand	Textural class	Saturation	-30 kPa	-1500 kPa	Particle density (mg/m3)	Bulk density (mg/m3)	Total porosity(%)
0-15	9.7	27.0	63.3	Silty loam	49.1	24.9	14.9	2.61	1.14	56.0
15-30	12.8	25.0	62.2	Loam	49.8	24.1	14.8	2.61	1.25	52.1
30-45	11.8	25.4	62.8	Loam	50.5	26.1	15.1	2.60	1.47	43.5
45-60	14.0	22.0	64.0	Loam	51.4	26.6	15.2	2.60	1.45	44.0

The soils of the experimental site were acidic in reaction. The organic carbon was in the medium range in the top 45 cm depth, but low in 45_60 cm depth. The nutrient status was medium for available N, high for Olsen's P, and medium (0_15 cm depth) to low (15_60 cm depth) for available K. It requires applications of recommended doses of N and K; the dose of P may be reduced by 25% of the recommended one.

The soils are gravelly and of medium texture. The bulk density values indicated progressive increase in soil strength with depth, especially below 30 cm. The average particle density of soil was 2.61 mg/m3. The porosity of soil was thus high, especially in the top 30 cm soil layer. Consequently, the soil was highly permeable to water, and hence well drained. The infiltration rate of soil (after 6 hours of initiation of infiltration process) varied between 5,379 and 7,005 mm/d. The water-retention capacity of the soil is poor due to excess sand content.

Terracing

Terracing was done in two blocks of the experimental area, covering 20 plant rows, with a total length of 2,040 m. The average width of these terraces was 1.5 m. It involved an earth-work of about 1,530 m3. A gentle side-wise slope was given on each terrace to direct the run-off during rain storms, if any, towards the tree basins (Figs 1 and 2).



Fig. 1. A view of terraced block

Trenching

Trenches (0.3_0.4 m deep and 0.3_0.4 m wide) were made along the hill-side wall, above the apple-tree basins. The total length of trenching,



Fig. 2. Side-wise sloping terraces

covering 11 plant rows, was 1,122 m. The average breadth and depth of these trenches was 0.304 m each. Trenching involved an earth-work of 103.6m3.

Mulching

The tree basins were mulched with FYM (10_15 cm thick layer),

pine needles, cocopit (prepared from coconut fibre) and pebbles (single layer) (Figs 3_8). The cocopit was either mixed with soil or spread over soil surface in the tree basin. Five trees with each type of mulch, including the control of no-mulch, were tagged for taking observations on the effect of water harvesting/conservation on the growth and vigour of apple trees.

Soil moisture conservation

A 6.2 mm rain was received on 31 December 2002. Soil

moisture was determined in tree basins at different depths after 3 days of rainfall, i.e. on 3 January 2003. The potential evaporation during this period was 1.1 mm/d. Subsequently, soil-moisture content under different moisture conservation treatments were determined on 13 and 21 April 2003. A 36 mm rain was received



Fig. 3. Pine-needle mulch



Fig. 4. Cocopit mulch



Fig. 5. FYM mulch



Fig. 6. Cocopit mixed with soil



Fig. 7. Pebble mulch



Fig. 8. Control (no mulch)

on 18 and 19 April 2003. The potential evaporation during the third week of April was around 2 mm/d.

Effect of land shaping

The effect of land-shaping treatment on soil-moisture conservation is shown in Table 3. Land

Table 3. Effect of land-shaping on soil moisture conservation

Soil depth (cm)	Soil moisture (mm)			
	Basin (control)	Basin+terracing	Basin+terracing+trenching	CD (0.05)
3 *January*, 2003				
0-15	3.7	7.2	22.2	3.1
15-30	3.1	9.0	12.5	3.3
30-45	3.1	10.4	15.2	4.1
45-60	4.0	9.4	15.2	3.7
13 *April, 2003*				
0-15	7.0	5.1	32.5	4.4
15-30	7.1	6.9	36.4	3.6
30-45	22.1	20.3	44.1	3.1
45-60	20.2	18.9	30.4	3.7
21 *April*, 2003				
0-15	14.2	15.2	19.5	2.9
15-30	15.2	15.2	22.9	2.8
30-45	20.3	20.5	24.5	2.6
45-60	21.3	19.6	28.7	3.1

Table 4. Effect of different mulch materials on moisture content in soil

Soil depth (cm)						
	No mulch	FYM mulch	Cocopit mulch	Pine needle mulch	Pebble mulch	CD (0.05)
3 January 2003						
0-15	22.2	25.4	25.7	27.0	25.7	2.2
15-30	12.5	16.2	14.6	13.2	14.8	1.9
30-45	15.2	18.4	16.6	16.3	18.5	NS
45-60	15.2	19.4	15.3	15.0	19.3	NS
13 April 2003						
0-15	6.2	19.5	18.0	22.6	19.5	2.4
15-30	6.9	23.4	22.3	24.8	22.9	1.8
30-45	17.9	28.4	24.9	28.0	26.2	1.9
45-60	16.1	31.8	28.9	31.5	28.7	2.7
21 April 2003						
0-15	13.3	30.8	30.3	32.5	29.7	1.8
15-30	14.0	29.9	30.8	31.8	30.5	1.8
30-45	17.5	27.1	25.5	28.6	27.7	2.0
45-60	17.0	30.5	26.6	27.1	28.0	2.2

NS, NON significant.

shaping had significant effect on soil-moisture conservation. Soil moisture in all soil layers and at all dates was significantly higher in plant basins treated with terracing and trenching. Trenching enhanced water conservation through harvesting of runoff water, and utilizing water directly from the rains and snow. Terracing alone was also effective in conserving moisture by directing the flow of run-off towards plant basins.

Effect of mulching

The effect of mulching on soil moisture conservation is shown in Table. 4. The positive effect of mulching on soil moisture conservation is well known. Mulching retained more soil moisture than no-mulch control. Differences in moisture conservation due to different types of mulches, however, were small, but in many cases significant. Pine needle mulch had an edge over other mulch materials. The choice of mulch material will depend on its availability, cost effectiveness and moisture conservation in the long run. Pine needles are easily available locally. Pebble also appears as a potential mulch material, as it is also locally available in plenty. However, it may interfere with cultural practices like fertilizer application etc.

Moisture content in 0_60 cm soil layer under different mulch
treatments is shown in Fig. 9.

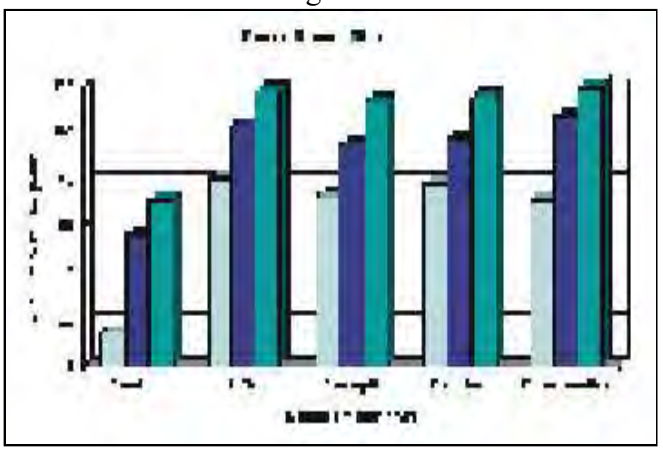


Fig. 9. Moisture content in 0_60 cm soil layer under different mulch treatments

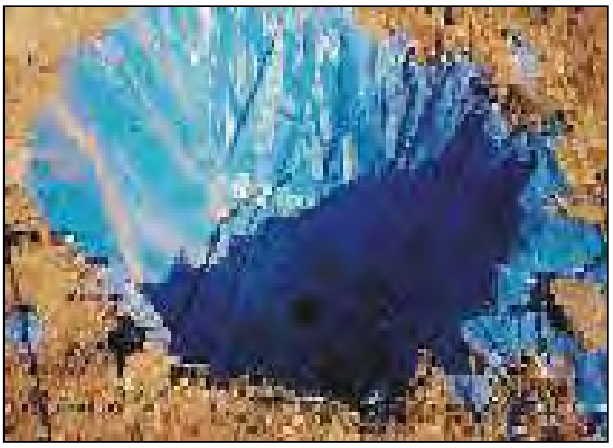


Fig. 10. Silpauline-lined tank



Fig. 11. Silpauline-lined tank



Fig. 12. RCC tank



Fig. 13. Unlined tank (control)

Table 5. Cost of construction of dug-out tanks with different lining materials

Lining material	Volume (m3)	Cost (Rs)			
		Excavation	Lining	Total cost	Cost/m3 water harvested
Silpaulin	17.6	2,335	1,750	4,085	232
Bitumen	10.0	1327	810	2,137	214
RCC (1:6:12)	8.2*	1,088	7,460	8,548	2,849
Mud	9.8	1,300	240	1,540	157
Unlined control	12.7	1,685	-	1,685	133

*Effective volume was 3.0 m3; Excavation cost was Rs 132.67/m3 soil.

Water harvesting

Five dug-out tanks were constructed in the experimental area. Four of these were lined each with silpaulin (Fig. 10), bitumen (Fig. 11), mud (mixed with dry grass in the ratio of 10:1), and cement+concrete layer (RCC) (Fig. 12), and the fifth was kept as unlined control (Fig. 13).

The capacity of silpaulin tank was 17.6 m3, bitumen tank was 10.0 m3, RCC tank was 8.2 m3, mud-plastered tank was 9.8 m3, and the control was 12.7 m3.

Before spreading the silpauline sheet in the dug-out tank, the tank walls were smoothened to avoid puncturing of sheet. Molten bitumen was sprayed on the walls with the help of a metal container having numerous small holes in the side wall. For mud plastering, dry, chopped grass was mixed with dry soil in the ratio of 1:10. The mixture was saturated with water, and kneaded thoroughly to convert it into a soft plastic mud.

No seepage was observed in the RCC and polylined tanks. The bitumen-lined tank did not perform well at this site, because the soil at the experimental site was loose and gravelly. It caved in along with the bitumen layer as the temperature rose and the soil became dry. The mud-lining also did not prove effective, as it developed numerous cracks upon drying. It was also not possible to store water at all in the unlined control tanks due to very high seepage losses. Hence in this type of soil, the *chaal* concept does not seem to work.

The *chaal* has to be lined with some effective sealant like RCC or polyethylene. For bitumen, the mode of application has to be changed under such type of conditions. Probably a mixture of bitumen emulsion and concrete, instead of spraying of bitumen emulsion alone, would be a better choice.

The cost of construction of dug-out tanks is given in Table 5. The cost was highest for RCC tank, followed by polylining and bitumen lining. Although the cost involved in the construction of mud-plastered and unlined tanks was minimum, their utility would depend on the seepage losses and hence the effective water storage.

CONCLUSION

The *chaal* is an effective structure for harvesting water from natural sources such as rains, springs and snow for use in agriculture and domestic purposes. However, chaals without lining are not effective at all locations because of excessive seepage losses. To increase their efficiency in storing harvested water, either the chaals have to be lined with suitable lining materials, or locations have to be identified for constructing chaals that are low lying and naturally have very low permeability to water. Silpauline and RCC were two very effective lining materials for checking the seepage losses in chaals. RCC is very expensive. Hence silpauline is recommended as a lining material. Bitumen, being hydrophobic in

nature, is also effective in reducing seepage losses from farm ponds, but its mode of application needs to be standardized in loose and gravelly soils.

Land shaping (terracing and trenching) was very effective in conserving soil moisture in tree basins by directing the run-off water towards tree basins and harvesting the rain water. The effect of moisture conservation was further enhanced when land shaping was coupled with mulching.Pine-needle mulch was comparatively more effective in moisture conservation. The pebble mulch was equally effective, and easy to apply on farm scale because of its easy availability locally.

Code	:	105
Title of the ITK	:	**Rain water management for teak (Tectona grandis Linn.f.), mango (Mangifera indica Linn.) and neem (Azadirachta indica A. Juss.) in arid and semi-arid regions**
Description of the ITK	:	This practice is to retain rain water in the soil and to grow trees, particularly mango, neem and teak, which are best suited for arid and semi-arid regions. The practice is appropriate for garden or estate where teak, mango or neem trees are grown. A circle in the soil is made around 1-year old teak trees within a distance of 2 feet. Along the line of the circle, a hole of 3 inches depth is made. During the first year, at the time of rainy season, rain water gets collected in these holes. This technique may be adopted in areas where there is less water available. When the tree is 2 years old a circle can be made at a distance of 4 feet, as well as 6□ deep holes on the circle. Similar circle can be made when the tree is 3 years old with the distance of 6 feet as well as 9□ deep holes on the circle to retain water in the successive year. This has been in practice for the last 2 years. There is no practical risk and it is easy to handle, less labour intensive and best suited for such trees. This is in practice in Periakovilankullam village of Tirunelveli district in Tamil Nadu.
Name and address of the discloser	:	Shri S. Murugesan, 1/14, Periakovilankulam, Sankarankovil, Tirunelveli (Tamil Nadu) 627 953
Location of use of the ITK	:	Periakovilankulam, Sankarankovil, Tirunelveli (Tamil Nadu) 627 953
Experimenters	:	Dr K. Koodalingam, Professor (Breeder Seeds), Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) 641 003; and Dr S.V. Kottiswaran, Associate Professor, Forest College and Research Institute, Mettupalayam, Coimbatore (Tamil Nadu) 641 301

Methodology

Location: Forest College and Research Institute, Mettupalayam, Coimbatore

PRA and field study: Unstructured interview was conducted and information were obtained on all the details on the methods and use of the ITK.

Experiment: An experiment was conducted at the research farm of Forest College and Research Institute, Mettupalayam to study the effect of making depressions around the newly planted trees, viz., teak, neem and mango on moisture

content in soil profile (T-1). This was compared with the method of rain water conservation by conventional basin method (T-2). Six trees under each treatment served as replicates. Moisture in soil was estimated at 15 cm depth intervals upto 60 cm by neutron moisture probe. Observations on soil moisture were taken at near the plant stem (S1), 30 cm away from the depression or basin (S2) and 30 cm away from S2 (S3). Moisture content was determined at 3 spots for each depth and treatment and the mean values have been presented in this report. Observations on tree growth recorded monthly.

Rainfall during the study period was 222.3 mm, spread over 15 rainy days with maximum rainfall of 48.0 mm in one occasion. The quantum of rainfall was virtually less and in January 2003 there was no rains.

RESULT AND DISCUSSION

PRA and field study: The idea of the practice was emerged from the concept of percolation pond which is used to recharge ground water table. It was thought that small pits, one per tree may allow the rainwater to percolate and moisture in the surface could be maintained for tree growth. Since the system did not give good results, the farmer tried the technique of providing small depressions around the tree trunk in a circular fashion so that ample moisture could be retained. On the second year, the depressions were extended to another circle of same distance from the first circle. This was followed in the third year also. The technique was applied for trees, such as neem, mavalingam and tamarind. In this practice, the sizes of the depressions are from 15 cm to 22.5 cm diameter and 15 cm to 22.5 cm deep. The practice has been successful.

Information gathered from field survey revealed that moisture retention in soil is more under mango trees than that of neem and teak in different soil types. The rain water conservation system by making depressions around the tree trunk is shown in Fig. 2.

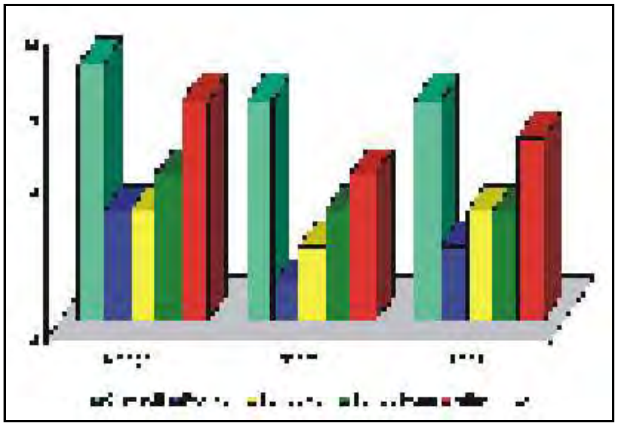


Fig. 1. Moisture retention in soil under different tree covers



Fig. 2. Grownup tree under ITK method with 3 rows of depressions

. **Experiment:** The mean moisture content at various, depths and sites for the different treatments under teak, neem and mango were computed. The results obtained are presented in Table 1 for teak, Table 2 for neem and Table 3 and for mango. The results on moisture distribution showed that in teak the moisture was higher in ITK method as compared to basin method in all the sites and depths of measurement. The same trend existed under neem and mango trees also. The content was maximum at 60 cm depth. Enough moisture was retained in the depressions of the ITK method. Also the moisture was maximum in the sites near to the depression (S1) and least in S3. The biometric observations on growth

Table 1. Moisture content in soil under teak

Soil depth (cm)	Moisture content (%)					
	ITK method (T1)			Basin method (T2)		
	S1	S2	S3	S1	S2	S3
15	20.98	20.42	19.48	20.1	19.60	19.72
30	22.70	22.20	21.06	21.8	22.60	20.83
45	24.70	23.48	23.24	23.6	22.84	22.64
60	26.30	25.60	24.30	25.2	24.60	23.90

S1, Near the plant stem; S2, 30 cm away from the depression or basin; S3, 60 cm away from the depression or basin

Table 2. Moisture content in soil under neem

Soil depth (cm)	Moisture content (%)					
	ITK method (T1)			Basin method (T2)		
	S1	S2	S3	S1	S2	S3
15	21.3	20.85	19.61	21.22	20.4	19.43
30	23.4	21.68	20.92	22.96	21.7	20.64
45	24.8	23.95	22.89	24.68	23.15	22.75
60	27.2	26.81	25.68	26.31	26.78	25.40

S1, Near the plant stem; S2, 30 cm away from the depression or basin; S3, 60 cm away from the depression or basin

Table 3. Moisture content in soil under mango

Soil depth (cm)	Moisture content (%)					
	ITK method (T1)			Basin method (T2)		
	S1	S2	S3	S1	S2	S3
15	19.5	18.3	17.65	18.85	17.9	16.54
30	21.2	20.45	19.8	20.6	18.82	18.31
45	23.45	22.6	22.1	22.96	21.63	21.69
60	24.5	23.9	23.6	23.8	22.47	23.48

S1, Near the plant stem; S2, 30 cm away from the depression or basin; S3, 60 cm away from the depression or basin

parameters as height of trees and collar diameter were measured monthly, the data are presented in Tables 5 and 6.

Results of biometric observations showed that height of the teak, neem and mango trees tended to increase due to depressions made for rain water infiltration as compared to making basins. However, collar diameter for all the 3 trees remained unchanged with the moisture conservation methods.

rainwater management

Table 4. Height of the plants as affected by moisture conservation treatments (cm)

Period	Teak		Neem		Mango	
	T1	T2	T1	T2	T1	T2
October, 2002	25.1	21.2	113.6	115.4	-	-
November, 2002	29.0	26.3	132.9	131.3	-	-
December, 2002	31.9	28.1	142.0	139.4	72.4	71.8
January, 2003	32.6	29.3	157.3	156.7	76.9	75.4
February, 2003	33.1	30.9	165.0	162.6	82.3	80.1

T1, ITK method; T2, Basin method

Table 5. Collar diameter of the plants as affected by moisture conservation treatments (cm)

Period	Teak		Neem		Mango	
	T1	T2	T1	T2	T1	T2
October, 2002	0.44	0.43	1.54	1.55	-	-
November, 2002	0.66	0.63	1.63	1.61	-	-
December, 2002	0.77	0.80	1.72	1.70	1.56	1.61
January, 2003	0.84	0.83	1.91	1.88	1.79	1.73
February, 2003	0.89	0.87	2.07	2.03	2.14	1.96

T1, ITK method; T2, Basin method

CONCLUSION

Results of the studies recorded so far indicate that the ITK method for rain water conservation is useful for light showers with less intensity, as the depressions were able to hold more moisture as compared to basin method.

Soil and Water Management

Code : **615**

Title of the ITK : **Cultivation of apple in Himalayan region**

Description of the ITK : Traditional apple-orchard farming involve use of contour ditches, water-control canal, soil traps, bench terraces and hedge rows of fast-growing leguminous plants, which have been adopted by the farmers of Himlayan region. Soil and water erosion is a serious problem in hilly regions. Since earlier times farmers used to practice this technology in an integrated way to improve soil and water conservation and manage nutrients in apple orchard. This technology helps in stabilizing the fragile eco - system dominated by apple-farming system. Use of such technologies lays focus on soil and water conservation as well as fertility management, resulting in a paradigm shift towards maximization of productivity, profitability and sustainability of hill eco-system. This is in practice for several years.

Name and address of the discloser : Shri Prem Singh, Village Gawai, P.O. Sandhu, Tehsil Theog, Shimla (Himachal Pradesh) 171 222.

Location of use of the ITK : The orchard is located 45 km away from the Shimla city on national highway 22 (commonly called as Hindustan Tibet road) and 8 km from Theog town, which is a gateway to apple belt of Shimla District area of this orchard is 3 ha. There are 500 plants planted already. Trees are about 4-10-years-old; slope of land is 70-75°. Discloser is a small farmer who in lean months of agriculture, work on other orchards. He is well aware about some horticultural as well as agronomic aspects of fruit crop raising but he was not very aware of the environmental factors like soil and water conservation, fertility management methodologies etc. for getting higher returns and to maintain sustainability.

Experimenters : Dr Atul, Head and Dr Rameshwar, Asst. Scientist, Department of Agroforestry and Environment, COA, CSK HPKV, Palampur 176 062 (Himachal Pradesh)

METHODOLOGY

Experiments were conducted for characterization of the site and evaluation of:

(i) Prevalent practice of the hedge-row cultivation of apple plants and others on the sloping lands
(ii) Field mapping of the discloser's area
(iii) Preparation of the stratified diagrams of the plantations
(iv) Collection of soil samples
(v) Contour testing with the use of "A" frame
(vi) Important value index exercise of the area to know the present ecological

status of the land

(vii) Productivity estimation of the area using the quadrat method

(viii) Secondary data collection of the biomass and the economic yield of the SALT practised area of the discloser.

General observations were taken on:

(i) Physical parameters: Topography, slope, soil type, practices for soil and water conservation, fertility management, land preparation, irrigation, seed and fertilizer placement

(ii) Chemical parameters: Nutrients and fertilizers

(iii) Biological parameters: Planting method, cultivar selection and pest control.

RESULT AND DISCUSSION

The ITK is used for soil and water conservation as well as fertility management, throughout the Himalayan region for apple orchard farming under rainfed conditions. Through the use of this technology, the productivity of apple is enhanced and hill eco- system is stabilized. A majority of the farmers use the technologies in marginal lands and unfavourable farming situations. Extreme undulating and steep slopes are the major cause of soil erosion in the area. Terraces were developed with traditional method.

Characteristics of the prevalent practice

The discloser's orchard is on marginal land. There is no source of irrigation. The method adopted by the farmer is traditional and the local technology has been used, as he is not aware of the scientific background of the technical contour making. He did not make any terraces before planting. He was very well aware about the pit size, i.e. 3 в 3 feet, planting depth, method of planting and fertilizer application at the time of planting. The method of planting used was triangular pattern in the initial stages, but keeping in view the slope and the topography this concept



Fig. 1. Discloser helping the evaluator in field mapping for slope and terrace measurements

was not followed. The criterion of shift form this design was to increase the plant population per row. To conserve moisture and to check the soil erosion, the terraces were developed by considering the total number of plants in a row. At the end of row he dug out 4-5 feet of soil away from the last plant, to develop a mud wall of the terrace. The farmer did not get the soil sample analysed for soil quality, soil moisture, fertility, texture and its chemical composition. etc. The plant-to-plant and row-to-row distances varied from one point to another. Mulching application was practised through the technical details were not very sound, but the traditional mechanism with the intrinsic merits were being followed by the discloser. The discloser was well aware of the pollinizer verities as well as grafting technique. Tree spray oil was used for insect pest control.

The disclosure categorically pointed out that this technology is labour intensive and has both merits and demerits.

Field mapping of discloser area The experimental area is an apple orchard of about 2.5 ha area, at about 2,400 m above msl, which was established 10 years ago. The landscape is very steep, with a slope of 70-75%. About 700 apple trees were planted along the visually observed contours at a spacing of 3-6m. The trees are being fertilized regularly with



Fig. 2. General view of the orchard

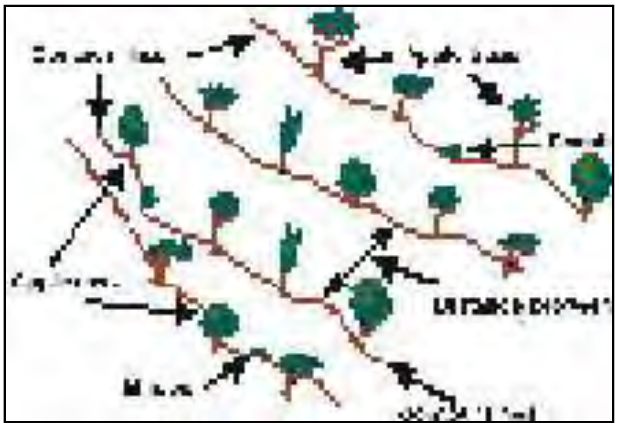


Fig. 3. Stratified diagram of the studied site

chemical fertilizers and FYM. The orchard is completely rainfed. There is no source of water for irrigation. The rainfall is inadequate and highly variable in distribution. The apple trees therefore often experience moisture stress.

The lay-out plan for the study area was developed with the help of project staff. The contour lines were drawn, and each tree was marked to prepare the actual location of the trees. The line transect method was used to calculate and mark the trees, and with the help of `A' frame the actual contour lines were also developed. It was found that the farmer designed the layout using the traditional knowledge and in the high slope he prepared the terraces on the contour line and with the lowering of the slope he discontinued the preparation of slopes. The effect of slope and the preparation of the terraces were studied. It was also noted that the farmer did not undertake the gap filling in the lay-out design. The triangular pattern of the plantation was done to accommodate the maximum number of plants.

Soil properties Soil samples were collected at eight locations, i.e. six in the orchard up to a depth of 60 cm at 15 cm depth increment and two in non-orchard area at two depths at 30 cm intervals. The soil samples for each depth were thoroughly mixed and a composite sample was prepared. The composite soil samples were analysed in duplicate for texture (International Pipette method), organic carbon (Dichromate Oxidation method of Walkley and Black), available N (Alkaline permanganate method), Olsen's P, exchangeable K (Ammonium acetate method), pH (1:2.5 soil:water suspension) and particle density (Pychnometer method). Soil-moisture retention of disturbed soil samples (soil passed through 2 mm sieve) was determined at saturation, -30 and -1,500 kPa water potential, using Pressure Plate apparatus. Bulk density was determined using 3 cm long and 5.6 cm diameter metal cores, by taking soil core from the middle portion of each soil layer. These samples were analysed in the soil testing laboratory of the Department of Soils, College of Agriculture, CSK HPKV, Palampur.

The soil was acidic in nature, irrespective of the orchard and non-orchard area (Table 1). In the orchard area, organic carbon was in the medium range in the top 45 cm depth but was low in 45-60 cm depth. In the non-orchard area, the organic carbon was also low. The nutrient status was medium for available N, high for Olsen's P in both the areas, and medium (0-15 cm depth) to low (15-60 cm depth) for exchangeable K. This clearly showed that with the plantation of the orchard and inputs there was improvement in the status of soil and harnessing of nitrogen by the plants.

Table 1. Soil chemical properties of the studied area

Soil depth (cm)	pH	Organic C (g/kg)	N	Available nutrients P	K
Non-orchard area					
0-30	5.9	4.8	502.4	30.3	156.8
30-60	5.9	4.2	345.7	22.4	134.4
Orchard area					
0-15	5.8	8.4	492.2	44.1	167.9
15-30	5.9	6.8	477.2	39.3	112.0
30-45	5.9	5.5	460.5	30.7	89.6
45-60	5.9	4.4	314.3	28.3	78.6

The soil was gravelly and of medium texture. The bulk density of soil at 0-15, 15-30, 30-45 and 45-60 cm depths was 1.14, 1.25, 1.47 and 1.45 mg/m3 respectively in the orchard area. The average particle density of the soil was 2.61 mg/m3. The porosity of soil was thus high, especially in the top 30 cm soil layer. Consequently, the soil was highly permeable for water. The infiltration rate of soil (after 6 hours of initiation of infiltration process) varied between 5,379 and 7,005 mm/d.s

The `A' frame exercise was undertaken in the field after constructing by using the indigenous materials of the area (Fig. 4). It was also observed that there was deviation in the contour and the planting stock. On planning in the field it was observed that though the data show the variation of more than 7 m but on rough plotting it came out to be crossing of the contours.



Fig. 4. Contour survey using `A' frame

Importance value index exercise of the area

To cover the species diversity and heterogeneity in the SALT and non-SALT areas under study, phyto-sociological studies were carried out for different plant species occurring in those areas.

In the non-SALT area, there was much species diversity. In addition to many grasses (12 species), shrubs like *Rumex, Rubus, Rosa* and *Berberis* spp. were also found. The ecological success of a species in the area appeared to be a function of its cumulative dispersion, numerical strength and relative dominance values, and the minor variations in dispersion or relative dominance failed to affect the order. Higher numerical strength of *Rosa* sp. in non-SALT areas as compared to that of *Rumex* sp. failed to generate a variation in IVI order (Table 2). Species diversity was greatly reduced in the SALT-managed areas. Ecological success of a species was dependent upon the nature of the species with which it is associated in an area. It was interesting to note that grass *Agropyron canaliculatus* was ecologically more successful when grown in association with different grasses and shrubs in non-SALT areas as compared to when it was existing in association with apple trees in SALT areas (Table 3).

Table 2. Dominance and ecological success of different plant species in non-SALT areas

Name of species	Relative frquency (%)	Relative density(%)	Relative dominance (%)	Importance value Index
Chrysopogon fulvus	12.05	28.65	20.0	60.7
Agropyron canaliculatum	13.26	27.06	12.75	53.07
Poa pratensis	13.26	24.60	10.00	47.86
Berberis sp.	9.60	15.01	22.00	46.61
Trifolium repens	17.06	17.16	11.85	46.07
Lolium sp.	12.25	20.50	10.25	43.00
Rumex sp.	9.31	10.20	19.05	38.56
Rubus sp.	8.90	11.35	18.15	38.40
Rosa brumoni	4.50	12.90	17.75	35.15
Agrostis sp.	9.60	5.42	7.65	22.67
Trifolium pratense	8.40	5.19	6.00	19.23
Bromus sp.	5.95	4.37	4.79	15.11
Lotus corniculatus	6.01	2.14	6.80	14.95
Phleum alpinum	4.81	0.54	7.50	12.85

Table 3. Dominance and ecological success of different plant species in SALT areas

Name of species	Relative frquency (%)	Relative density(%)	Relative dominance (%)	Importance value Index
Pyrus malus	45.31	75.00	45.18	165.49
Chrysopogon fulvus	12.00	24.50	21.75	58.25
Agropyron canaliculatum	15.23	15.16	10.21	40.60
Trifolium repens	10.58	11.45	4.7	26.73
Cynodon dactylon	9.14	8.19	7.86	25.19
Bromus sp.	7.42	5.60	6.21	19.23
Lolium sp.	6.50	4.95	2.36	13.81
Poa pratensis	7.50	4.28	0.95	12.73

Table 4. Performance of apple plants in the sloping agriculture orchard land technology areas

Statistical parameter	Deviation from contour	Plant-to-plant distance	Plant height	Plant spread
Mean	3.18	16.69	6.57	4.93
Standard error	0.33	1.03	0.40	0.48
Standard deviation	1.98	6.17	2.39	2.91
Sample variance	3.92	38.11	5.72	8.45
Kurtosis	-0.35	0.03	-0.27	2.05
Skewness	0.21	-0.05	0.40	1.23
Minimum	0.00	5.00	3.00	0.15
Maximum	7.80	33.00	12.00	14.00

Performance and productivity estimation of the area

Line quadrant method was used to evaluate the layout plan and the observations were recorded with respect to the existing plantation survival, plant-to-plant distance, plant height and the plant spread.

It was observed that more than 92% plants planted at such a slope are surviving. The plant to plant distance varies from 5 m to 33 m, because of the death of a few consecutive plants in a row, showing that no replanting was done by the farmer. The mean plant height of the apple orchard on the slope is 6.57 feet with the range of 3 to 12 feet (Table 4). This indicated that this is a unique attempt and the plantation stock is young.

Table 5. Anova tables to show the effect of slope on the apple plant to plant proximity, plant height and spread

Summary		Plant-to-plant distance				
Group	*Count*	*Sum*	*Average*	*Variance*		
Tr Zone 1	9	183	20.33333	6.25		
Tr Zone 2	9	113.8	12.64444	38.83778		
Tr Zone 3	9	138	15.33333	72.5		
T r Zone 4	9	166	18.44444	10.27778		
ANOVA						
Source of variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between groups	311.0311	3	103.677	1.638927	0.199845	2.901118
Within groups	1022.924	32	31.96639			
Total	1333.956	35				
Summary		*Plant height*				
Group	*Count*	*Sum*	*Average*	*Variance*		
Tr Zone 1	9	65	7.222222	0.944444		
Tr Zone 2	9	61.15	6.794444	7.555278		
Tr Zone 3	9	46	5.111111	4.611111		
Tr Zone 4	9	64.5	7.166667	8.5625		
ANOVA						
Source of aviation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between groups	26.664076	3	8.880255	1.638927	0.199845	2.901118
Within groups	173..867	32	5.418333			
Total	200.0274	35				
Summary		*Plant spread*				
Groups	*Count*	*Sum*	*Average*	*Variance*		
Tr Zone 1	9	47.6	5.288889	3.151111		
Tr Zone 2	9	51	5.666667	8		
Tr Zone 3	9	30.15	3.35	3.8775		
Tr Zone 4	9	48.8	5.422222	18.11444		
ANOVA						
Source of variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between groups	30.69132	3	10.23044	1.234701	0.313252	2.901118
Within groups	265.1444	32	8.285764			
Total	295.8358	35				

The spread of the plant is the indicator of its health and establishment state, as can be seen from Table5, that the mean spread is about 5 feet which can be classified as satisfactory growth. The maximum value of the spread of the plants is 14 feet with an exception of very thin growth of plants. The data were analysed keeping in view the two sets of available degree of slopes as treatment, i.e. very high >50% to moderate 30_40% along with the combination of the terraced and non-terraced areas in the orchard (Table 5). T1 represents the plantation on high slope with terraced land, T2 the plantation on moderate slope with terraced land, T3,high slope, non-terraced; and T4, moderate slope non-terraced. The transect were laid out at different slopes. The analysis of variance indicated the significant effect of slope on the spread and height of apple plants. It can be inferred that at high slopes the farmer's intervention of developing small terraces is useful in getting better performance. However, the plantation on the farmer's designed contours is only beneficial in the moderate slopes and with the increase in the slope of land, i.e. more than 50%.

The plant height as well as the spread of the apple plant were generally more in the terraced and high slopes, followed by the terracing at the moderate slope. In addition, the moderate slope contouring also proved beneficial, but not at higher slopes. This may be because the intervention of the farmer in developing small terracing has given the medium to hold the tree roots at the initial stage, which gave boost in its establishment.

The soil characteristics such as pH did not differ in the different systems, because the studied site is being treated by the farmer under the SALT for the last 5 years only. However, organic carbon, available nitrogen, phosphorus, potassium, bulk density and porosity decreased with the increase in soil depth. The soil-moisture retention was more in the top layer of the soil, which supplemented the adoption concept of the SALT farmers of the area.

There was reduction in the species diversity with the introduction of the orchard species and management of the land by the farmer by uprooting the unwanted vegetation. This improved the under-storey grass cover and gave additional income through the fruit plants. The species ecological sucession brought out change in the carrying capacity of the vegetation, because only the dominant species survived; and with the removal of the shrub components the associated species automatically vanished.

Through this indigenous technology the farmer developed a sustainable land management system in terms of ecological biodiversity, soil health and economical enhancement by intervention of the horticultural crops in the area and maintaining the indigenous species on the same piece of land.

CONCLUSION

Contour orchard farming and proper terracing is the pre-requisite of the steep-slope orchard raising, as has been tried by the discloser. To mitigate the water stress and soil erosion condition due to steep slopes, management of the slopes through vegetative structures is essential. This intervention of the farmers helps in developing the ecologically and economically sustainable land-management system.

Code : **1328**

Title of the ITK : **Control of soil erosion through agronomic practices**

Description of the ITK : Farmers of Bahadurpur village of Dhanbad district in Jharkhand use to practice some simple measures to check soil erosion, such as: (a) deep ploughing in summer, (b) ploughing across the slope, (c) composting the land before rainy season, (d) filling the cracked land by ash (wood), (e) cultivation of deep-rooted crops, (f) cover crops, mulching, and (g) plugging of gullies by stone, bricks and mud. The impact of these practices are very effective to control soil and water erosion and to protect fertility of the soil. Total cost of these practices is around Rs 3,000 per ha. This is in practice for last several years by 50% farmers in the village.

Name and address of the discloser : Shri Siromani Singh Choudhary, Village Bahadurpur, Post Bagsuma, Block Govindpur, Dhanbad (Jharkhand)

Location of use of the ITK : Village Bahadurpur, Post Bagsuma, Block Govindpur, Dhanbad (Jharkhand)

Experimenters : Dr. S. Choubey, Sr. Assistant Professor, Department of Agronomy and Dr. R.P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

Village Bahadurpur, Post Bagsuma, Block Govindpur, Dhanbad (Jharkhand)

PRA and field study

The reported practices were assessed through field study using PRA tools to control different types of erosions. Parameters/factors included deep summer ploughing (a), ploughing across the slope (b), composting the land before rainy season (c), filling the cracked land by wood ash (d), cover crops (e), mulching (f) and plugging the gully with stones or brick and mud (g) in controlling different types of erosions, viz., splash, sheet, rill and gully. For validation of the ITK, 20 respondents were randomly selected, who were users of the practices.



Control of different types of soil erosion (splash, sheet, rill, and gully) through agronomic practices

Experiment

A field experiment was conducted in randomized block design (RBD) during *kharif*

season 2003 in village Bahadurpur, block Govindpur, Dhanbad (Jharkhand) having five treatments, viz., T1-Control, T2-Use of cover crop, T3-Mulching by plant leaves, T4-Terracing and bunding of land and T5-Plugging the gully with stone and cement. Each treatment was replicated 10 times in an area of 1000 m2 for each treatment. As cover crop moongbean (variety-Sunaina) was sown with a seed rate of 30 kg/ha. The observations recorded were moisture content in soil and soil accumulation.

RESULTS AND DISCUSSION

PRA and field study

Data recorded through PRA method are presented in Table 1.

Table 1. Matrix scoring for assessing the effect of agronomic practices in controlling different types of erosion

N=20

Type of erosion	Agronomic practices						
	a	b	c	d	e	f	g
Splash	79	70	84	89	93	85	59
Sheet	69	74	81	85	82	86	68
Rill	68	85	78	71	72	83	79
Gully	52	74	69	60	81	83	92

a, deep summer ploughing; b, ploughing across the slope; c, composting the land before rainy season; d, filling the cracked land by wood ash; e, growing cover crops; f, mulching; g, plugging the gully with stones or brick and mud.

Results presented in Table 1 reveal that splash erosion was controlled (93) by growing cover crops which was at par with the treatment of filling up the cracks of land by wood ash (89). Sheet erosion was controlled maximum (86 score) through mulching which was at par with the treatment of filling the cracks by wood ash (85 score) and these two treatments were superior over rest of the treatments. Rill erosion was controlled by treatment of ploughing the land across the slope which was similar to the treatment of mulching having scores value (83) and these two treatments were superior over rest of the treatments. Gully erosion may be controlled maximum by plugging it with stone or bricks and mud/cement and it was superior over rest of the treatments.

As reported by the farmers these practices were not adopted specially for controlling erosion but were part of their cultivation practices for growing crops along with protecting the soil and moisture loss, resulting in maintaining soil health for sustainable production of the crops.

Experiment

Data presented in Table 2 reveal that the highest soil moisture content (19.8%) was recorded when terracing and bunding were done in sloppy unbunded upland followed by land treated with mulching (19.5%). These were at par with the land treated with the cover crop. Plugging

Table 2. Soil moisture content (%) and soil accumulation (Cum/m2) as influenced by different soil erosion control measures

N=10

Treatment	Soil moisture content (%)	Soil accumulation (Cum /m2)
T1 : Control	16.5	-
T2 : Use of cover crop	18.3	0.00052
T3 : Mulching	19.5	0.00050
T4 : Terracing and bunding of land	19.8	0.00150
T5 : Plugging thegully with stone and cement	18.0	0.00075

the gully with stone and cement was efficient in conserving moisture in soil. Untreated plot had 16.5% moisture. These agronomical practices were significantly superior to control (no agronomical practice).

The highest soil accumulation (0.0015 Cum/m2) was recorded by terracing and bunding. Soil accumulation was 0.00075 Cum/m2 when gully was plugged with stone and cement. These two treatments were significantly superior over the treatments of mulching and use of cover crop. There was no perceptible difference in soil accumulation due to use of cover crop and mulching.

CONCLUSION

Agronomical practices like growing of cover crops and mulching, and plugging of gully with stone and cement, and terracing and bunding were found to be effective to control soil erosion.

Tillage Practices

Code : **1350**

Title of the ITK : **Moisture and weed management in ginger (*Zingiber officinale*)**

Description of the ITK : The whole field is covered with wheat husk or rice straw to reduce the evaporation losses of moisture from field and also to minimize the favourable environment for growth of weeds. In addition, straw mulch also helps to create favourable environment for germination of ginger tubers. After sowing of ginger in the field, the whole field is covered by 2 inch thin layer of wheat husk or rice straw, and cover is replaced after two to two and half months after sowing. Extent of soil erosion is very severe in the region. Out of 840 farm families, 560 families adopt this age-old practice.

Intercultural practices: This practice is used by the vegetable growers of Karge Panchayat of Mandar Block of Ranchi district (Jharkhand). About 60% irrigation water is saved and about 80% weed problem is solved. This practice helped to get uniform germination (100%) in farmers fields where this practice is adopted.

Name and address of the discloser : Shri Ranjay Kumar Singh, Department of Extension Education, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

Location of use of the ITK : Karge, Mander, Ranchi (Jharkhand)

Experimenters : Dr A. Wadood, Head, Department of Agriculture Physics, Shri Sanjeev Kumar, Research Associate and Dr R. P Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location
Village Karge, block Mander, district Ranchi (Jharkhand).

PRA and field study
The field study was conducted involving 41 respondents. Matrix was prepared following focused group interview on five parameters, i.e. conservation of soil moisture, germination, control of weed, yield and plant health.



Fig. 1. Indigenous rain gauge (*rolu*)

Experiment
An experiment was conducted in Karge and



Fig. 2. Polythene mulching in ginger field

Bara Hatma villages of Mandar Block in Ranchi district (Jharkhand) in 8 replications with 4 treatments, viz., T1: control (no mulch); T2: ITK (rice straw); T3, ITK (wheat husk mulch); and T4, improved practice (polythene mulch), each plot having 35 × 25 m area. The observations were recorded on parameters like soil moisture status, seedling emergence and vegetative growth.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 revealed that the indigenous practice of
mulching in ginger by rice straw or wheat husk was rated highly effective in terms of all the five selected parameters, viz.

Table 1. Matrix scoring for assessment of indigenous mulching practice in ginger

N=41

Parameter	Mean Score
Conservation and maintenance of soil moisture	8.88
Germination	7.98
Weed control	7.29
Yield	7.20
Plant health	7.41
Overall performance	7.75

conservation and maintenance of soil moisture, germination of rhizomes, weed control, increase of yield, and improvement of plant health. The mean scores on all the parameters ranged between 7.20 and 8.88, out of total score of 10. This indicated that the reported ITK was highly effective as per the farmers perception.

Experiment

Data presented in Table 2 reveal that the maximum moisture was
conserved by polythene mulch, followed by mulching by rice straw and wheat husk. Consequently germination of ginger rhizome was better with mulching by rice straw and wheat husk. Although polythene sheet mulching helped to conserve more moisture in soil, it affected adversely the emergence of seedlings due to unfavourable aeration created by polythene mulching.

Table 2. Soil moisture status (0_15 cm), seedling emergence and crop stand in ginger fields due to different types of mulching

Treatments	Soil moisture content (%)	Germination (%)	Crop stand
Control (no mulching)	10.47	49.75	3.62
Rice straw mulching	19.97	94.87	9.37
Wheat husk mulching	15.05	65.12	6.37
Polythene mulching	18.62	10.50	0.00

CONCLUSION

Farmers practice of spreading rice straw/wheat husk in the fields of ginger just after sowing was found to be a very suitable practice for conserving moisture in soil and to have better plant stand. Among the two mulching materials by rice straw was better than use of wheat husk.

Grops and Cropping Systems

Code : **1366**

Title of the ITK : **Agricultural practices in East Singhbhum district of Jharkhand(*Zingiber officinale*)**

Description of the ITK : Cultivation Practices for direct-seeded paddy are described below operation-wise: .

***Tillage and intercultural management* :**

Land preparation

After harvesting of paddy during December, when the soil is moist, first ploughing is done through old (small) plough which continues till February. This operation is called *ugal*. With receipt of rains during February-March, the ploughed soil is settle and the second spell of ploughing (called *shamul*) is done by new (big size) plough during April to middle of May. By this ploughing the lower soil comes upward and all the plant residues are covered with soil, which increases soil fertility after its decomposition. Cowdung is dried from first week of May and applied @ 50 to 60 q/ha in the field. The applied cowdung is mixed in soil by ploughing during May. Sometimes incorporation of cowdung and sowing of paddy are done simultaneously.

Sowing

Paddy seed @ 65_80 kg per ha is broadcast and covered with soil by ploughing.

Intercultural operations

When paddy plants reach the height of 7-8 inches and sufficient standing water (5-6 inches) is there in the field, the first intercultural ploughing (called *kadau*) is done. This ploughing is done during rainy days.

The second intercultural ploughing is done after 7-9 days of first intercultural ploughing when 6-7 inches water is standing in the field. It is done only in sandy loam soils, while in dry soils only one intercultural ploughing is done. This operation is followed by planking with *moi* (bamboo plank) over the standing crop. The plants are laid down in the mud. This kills the insects that stay over the foliage. The field is also leveled by this operation. This operation is called *moi dona*.

After *moi* operation, paddy plants stand straight. Weeds are decomposed in soil and the yellow, damaged and decomposed leaves of paddy are pruned and covered in soil (mud) along with decomposed weeds. The weeds which

remain undecomposed are taken out. This operation is called nikoni. After 2-5 days of nikoni operation, some of the tillers of paddy are taken out and transplanted where there is no plant (gap space). This operation of equalizing the plant population is called gachhian. The operation makes the plants more vigorous. When the plants attain a height of 1-1.5 feet, branches of kendu, bhelwa, sinduar, mahua, sal or padoi are placed in the field in standing position at different places. This helps in getting away insects. The birds also sit on these branches and feed on the insects.

At the time of panicle formation, 4-5 days before flowering, the second weeding nikoni and bachhai are done.

Harvesting

When the grain is matured, the plants are arranged in standing position at some level with the help of long bamboo, so that harvesting can be done conveniently and ears are not disposed off here and there. In the mean time, preparations for threshing-yard are done during September. Tand and Aush paddy is harvested 4-6 inches above the ground level. The small plants of 4-5 handful and big plants of 2 handfuls are kept separately in lines while harvesting. The long plants are harvested upto 1 foot above the ground level. The bundles are tied after drying in the field itself.

Post-harvesting

The harvested paddy is transported to threshing floor/yard (khawari) either by bullock cart or manually. Threshing yard is prepared by pasting cowdung and Kodan ash or mud paste. Paddy is set in the yard and bhelwa branch is placed over it in standing position. Paddy plants are sometimes set over kodo straw. Threshing of small paddy plants is done by bullocks or by man with the help of their feet. Threshing is done also with the help of bamboo. Paddy plants are beaten by chanchad made of bamboo or plank (pata) made of wood or on stone rock. After threshing paddy, grain is separated with the help of bamboo sup. This practice is called dhukai. After dhukai (separation of grain), the paddy grain is stored for consumption and seed purpose by separate methods. Paddy grains are stored in bamboo dedmi, oldi, kotha, wooden box or muva handi, etc. Paddy straw is also stored by special method to be used as fodder for animals.

Cultivation practices for transplanted paddy are as follows:

Tillage and intercultural practices

Land preparation

First ploughing is done in dry field when soil is moist or when 2-3 inches water is standing in the field. Second ploughing is done after 3-4 days of first ploughing, so that all weeds and crop residues are buried in the soil. After ploughing, leveling is done with the help of moi. Third ploughing (preparation of kado) is done when weeds and crop residues are decomposed. It takes 3-4 days, when kado (third ploughing) is done. After ploughing moi is used for leveling. If field is uneven and there are heaps of soils at some places, the soil is scraped with the help of kado kural and leveling is done.

Transplanting

Paddy seedlings of handful bundles are thrown/distributed in the field and then transplanted. At the time of transplanting either the field is kept dry or filled with 1-inch height of water. When the roots of paddy seedlings are set in the soil, the field is submerged with 3 inches water.

Weeding

Nikoni (weeding) is done after 1 month of transplanting. All other operations in transplanting paddy are done in the same manner as in the case of dry seeded paddy.

Pest and disease management

Branches of sinduar plant are buried in the field when the paddy is attacked by diseases. Paddy crop is protected from insects by spreading tender leaves of podsi plant @ 50-60 kg/ha. Branches of podsi plant are also buried in the soil, as well as of rata plant. Flowers or gujari, neem and karanj are spread in the field to protect paddy from diseases. About 40-60 kg/ha of flowers are applied in the field. Moi made of bahera tree wood is used for operation at the time of kadan (ploughing in the standing paddy). This protects the crop from insects. There are other methods also to protect paddy crop from insect and diseases e.g. wood logs are burnt on the bunds of the field and the insects get away due to fire. Insects also get away by drum sound. This method is adopted to save the crop from tiddi insects Similarly, fresh cowdung is mixed with soil and sprayed to control diseases in paddy.

Pests and diseases are controlled by changing water in the paddy fields. Disease and insect preventive trees like *neem, karanj, ashan, arjun, jamun, palash, sinduar,* etc are planted on the bunds to protect the paddy crop from pests. Fur of *konda* is picked and applied in the land. This controls insects and pests in paddy crop. About 20_30 kg/ha of *kanchi bans* pieces are broadcast in standing water with cowdung. Water is kept standing for 3_4 days. This controls white (*safed rog*) disease in paddy which is caused by rice case worm.

Calendar of agricultural operations

For ploughing and application of cow dung manure, 15th January and first day of *Magh* month are considered good. Second ploughing is considered better in February_March. Paddy sown on 25_26 May and 13_14 of *Jyestha* month avoids insect and pest attack. Transplanting of paddy, *kadan* and *gachhiyan* in paddy before *Bhadra*, 12 is considered better for paddy crop.

Farm implements

Implements used for land preparation are bullock-drawn plough (small and big), *moi,* spade, *gaita, kadokurol, hasua* and *gachian.*

Name and address of the discloser	:	M/s Paryavaran Chetna Kendra of village _ Bada Sigdi, Post _ Potka, East Singhbhum (Jharkhand).
Location of use of the ITK	:	Village Bada Sigdi and nearby villages, Block Potka, East Singhbhum (Jharkhand)
Experimenters	:	Dr S. Choubey, Senior Assistant Professor, Department of Agronomy; Shri R. K. Singh, Research Associate (IVLP) and Dr R. P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand).
Facilitator	:	Shri Sidheswar Jee, M/s Paryavaran Chetna Kendra, Village Bada Sigdi, Post Potka, East Singhbhum (Jharkhand).

Methodology

Location

The study was conducted in village Bada sigdi and nearby villages, block Potka, East Singhbhum (Jharkhand).

PRA and field study

PRA tools was applied to determine the efficacy of indigenous rice cultivation practices in terms of availability of seed, tolerance to water stress, compatibility to local sowing or transplanting method, control of pest, additional

nutrients required, liking of the growers and yield. Matrix scoring was done involving randomly selected 20 practitioners of the practice. For validation, the ITK was compared with the corresponding improved practices.

Experiment

A field experiment was conducted in rainy (kharif) season of 2002–03 at Bada Sigdi village with three treatments, viz., T_1 control (indigenous rice variety (Malto) with 10 q/ha FYM), T_2 use of ITK [indigenous seed (Malto), use of FYM as in the control, bushening, indigenous insect-pest control method, i.e. use of sinduar leaves and use of 50–60 kg podsi leaves andbamboo shoot pieces @ 20 kg/ha]; and T_3 recommended practice (improved rice variety IR 36 @ 75 kg/ha seed rate with 100: 50: 40 kg NPK/ha and application of monocrotophos @ 2 litres/ha thrice at 20 days interval and 2 kg/ha DM-45). The experiment was laid out in RBD design using 20 replications. Each treatment covered 1,000 m^2. Observations on crop growth, pest infestation, yield and economics of cultivation were taken.

The experiment was conducted under rainfed conditions. Total rain received during the crop growth period was 1,057 mm. There was short-term dry spell during 15th July to 25th August which affected the yield.

RESULTS AND DISCUSSION

PRA and field study

Results obtained by PRA method are presented in Table 1. The ITK of rice cultivation was superior to improved practices as per the scoring done by the respondents. Except yield, the indigenous practice was found superior for all the parameters to the improved pratices.

Table 1. Assessment of performance of indigenous and improved practices of rice cultivation by matrix scoring

Parameter	ITK practice	Improved practice
Availability of seed	10	2
Tolerance to water stress	8	4
Pest control	10	4
Requirement of additional nutrients	4	
Liking of farmers	10	4
Yield	6	8

Experiment

The yield parameters and economics of rice through different cultivation practices are given in Table 2.

Yield and yield attributes

The highest number of tillers (458/m^2) was recorded in the improved practice, followed by 324 tillers/m^2 under indigenous practice (Table 2). The improved practice produced 29% and 53% more tillers than indigenous practice and control respectively. Similarly, indigenous practice produced 33.3% higher number of tillers/m^2 than than the control (216/m^2).

Highest number of insect infestation (46/m^2)

Table 2. Yield attributes, yield and economics of indigenous and improved practices of rice cultivation

Treatment	Tiller/ m^2	Insect infestation/ m^2	Yield (q/ha)	Net return (Rs/ha)	Return/rupee spent
Control	216	46	12.2	(–) 180	-
Indigenous practice	324	7	22.8	5,180	1.61
Improved practice	458	5	24.6	6,240	1.71
CD (P=0.05)	47.69	3.24	4.21	1,027	0.23

was recorded under control treatment and the lowest under improved practice (5/m2). There was no difference in number of insect infested plant either due to adoption of improved practice or indigenous practice of insect-pest control.

Highest grain yield (24.6 q/ha) was recorded under improved practice, followed by 22.8 q/ha under indigenous rice cultivation practice, which was only 7.3% higher than with the indigenous rice-cultivation practice. The improved practice and indigenous practice both were, however, statistically at par in respect to grain yield, they gave double the grain yield than the control (12.2 q/ha).

Highest net return (Rs 6,240/ha) was obtained in improved practice, which was 17% higher than the net return (Rs 5,180/ha) obtained under indigenous practice. The highest return/rupee spent (Rs 1.71/Re) was recorded under improved practice, which was Rs 1.61/Re under indigenous practice.

CONCLUSION

On the basis of the data of the experimentation as well as field study, it was concluded that the performance of indigenous practice of rice cultivation was equal to the improved practice.



Code	:	**677**
Title of the ITK	:	**Method of snow melting**
Description of the ITK	:	In Spiti valley of Himachal Pradesh farmers adopt a traditional method for snow melting. For sowing barley early, farmers spread ash over the field for melting snow. Ash is having such properties to melt snow fast. This is in practice for several years.
Name and address of the discloser	:	Ms Indira Thakur, C\o Shri K.L. Thakur, House No. 28, Type IV, Brock Host, Shimla (Himachal Pradesh)
Location of use of the ITK	:	The district of Lahaul and Spiti in Himachal Pradesh is situated in the west of Great Himalayan range between 30° 21" and 30° 50" 57' north latitude and 75° 46" 29' and 78° 41" 34' East latitudes. Basically, the people have agriculture and animal husbandry as the main occupations. The climate of the district is most suited for production of temperate fruits and vegetables of very high quality. Majority of the area is under cold desert and is isolated, fragile, marginal and inaccessible. These areas are known for traditional ethos and wisdom for natural resource management.
Experimenters	:	Dr M.L. Parmar, Professor of Physical Chemistry and Shri Ajay Thakur, Scientific Assistant, Department of Chemistry, Himachal Pradesh University, Shimla (Himachal Pradesh) 171 005

METHODOLOGY

PRA and field study

Different areas of Lahaul and Spiti in Himachal Pradesh were visited and information provided by the farmers on use of ash for snow melting was collected.

Experiment

The following experimental techniques were used for determining the scientific reasoning for snow melting by ash or any other material.

Experiment 1

The first experiment was designed to know whether the dissolution of ash in water generates heat or absorbs heat from the surroundings. In other words, whether the dissolution process of ash in water is exothermic or endothermic.

First a calorimeter was calibrated, i.e. its specific heat or water equivalent was determined. The heat of solution of the ash, collected from the villages of Spiti valley, was determined. Then 400 ml cold water, at room temperature was taken in the calorimeter, fitted with stirrer and 1/10° thermometer. Different amounts of ash (10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 g) were taken and the experiment was repeated for each amount separately.

Experiment 2

The second experiment was designed to see the effect of sprinkling of ash on ice in the open system. To see the effect of sprinkling of ash, two

trays each containing 1,500 ml water were taken. The water was allowed to freeze in a deep freezer. The next day both the trays were placed in open, under direct solar heat. On the first tray 5 g ash was sprinkled and the other was left as such (without ash). The amount of water melted from each tray was measured separately with the help of a measuring cylinder after at intervals of time. The experiment was repeated by sprinkling 10 g and 15 g ash. Similar experiment was repeated by adding 5 and 10 g soil. Also the rate of melting of ice by adding ash and soil powder was compared by adding 5, 10, 15 g ash and soil in different trays respectively.

RESULTS AND DISCUSSION

In this investigation, Pattan, Tinnan and Gar valleys of Lahaul area were surveyed. This survey data are summarized in Table 1.

The PRA and field survey results reveal that altitude of the area varies from 2,500 to 3,100 m above sea level and remains snow bound from October to April. Thus this area has a very short season for growing agricultural crops. To prolong the crop-growing season,it is essential to enhance early melting of snow, for which the farmers use ash. Spreading of ash over snow hastens the melting of snow and the fields are available for sowing at an earlier time of the year. The source of ash is mainly willow tree, which the farmers grow as a source of fuel, fodder and plant nutrient. Because of recent climate-warming phenomenon, there is reduced snowfall in the area, and this traditional technique of early melting of snow is now on the decline. Also, if only one crop is to be grown in a year in the area such as in Tinnam valley, there is also no need to spread ash for early melting of snow.

Field survey results reveal that adding of ash advances snow melting by 8 days. Since wood ash is now available in limited quantity, its use is on the decline and it is being substituted by the addition of soil dug out from the same field. Farmers feel that ash is more efficient in early melting of snow than soil.

In experiment I no change in temperature was observed each time. The observations revealed that the dissolution process is neither exothermic nor endothermic, meaning that the dissolution of ash in water neither generates heat nor absorbs heat. It may be due to the presence of oxides, which are insoluble in water.

In experiment II (Figs. 1 to 3) the rate of melting of ice is much faster by sprinkling of ash as compared to natural melting of ice under similar conditions. The complete melting of ice

Table 1. Observations during field survey and PRA

Character	Pattan valley	Tinnan valley	Gar valley
Altitude (a.s.l. in m)	<2,500	<3,000	<3,100
Snowfall occurence	November–April	October–May	November–April
Percentage of farmers using soil/ash for snow melting	20	70–80 (mostly soil not ash)	80 soil, 10 ash 10 nil
Crops grown	Potato, peas, hops, vegetables,	Peas	Potato, peas, barley and buckwheat
Source of ash	Willow trees	Willow trees	Willow trees
Other uses of ash	Snow melting near house	Snow melting near house	Snow melting near house
Substitute of ash	Soil	Soil	Soil

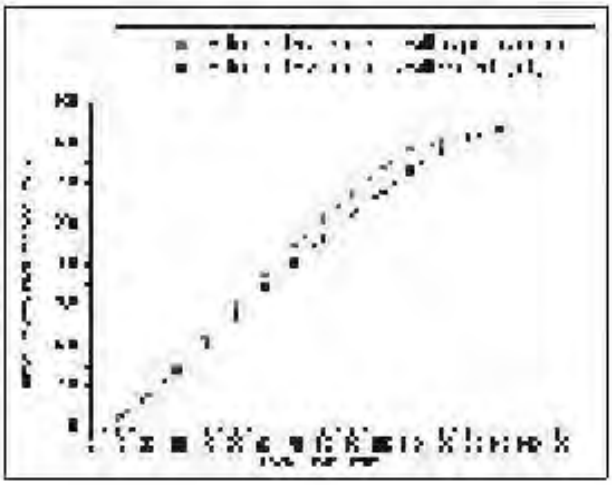


Fig. 1. Variation of melting of ice with time for 5 g ash

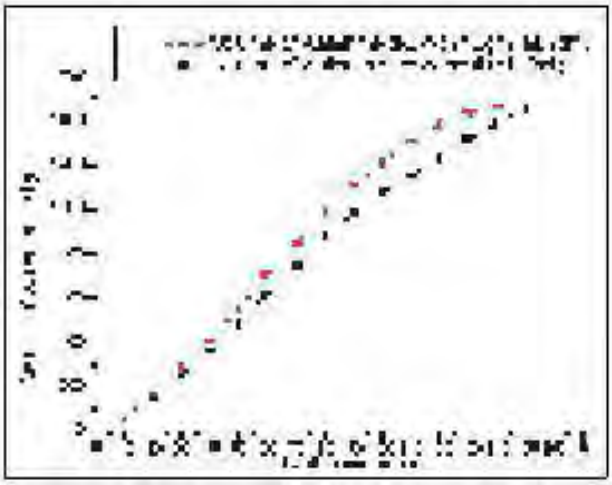


Fig. 2. Variation of melting of ice with time for 10 g ash

by sprinkling ash on the surface of ice took 20 to 35 minutes per 1.5 kg ice less than the natural melting. It shows that the melting of ice can be hastened by sprinkling ash on the surface of ice. The faster melting may be due to slight by dark colour of ash, which absorbs heat more quickly, as the black bodies are good absorbers. The second reason may be the presence of small amounts of soluble salts, which lower the melting points of ice.

Data presented in Figs 1 to 3 also show that the melting of ice, by sprinkling of ash, is independent of the amount of ash sprinkled. Almost same time was recorded for the complete melting of ice with 5, 10 and 15 g ash respectively, meaning that only small amount of ash, which should be enough to cover the surface of ice, can help in faster melting.

During the interaction with local people of Lahaul-Spiti valley, it was also known that on non-availability of ash or if the quantity of ash is not enough to cover the entire snow-fields, the local people also use soil powder for faster melting of ice. The results with 5 g and 10 g soil powder (Figs 4 and 5) respectively show that melting of ice is quite faster with soil powder as compared with natural melting. The time taken for complete melting of ice was 12 min. less with 5 g soil, whereas it was 18 min. less with 10 g

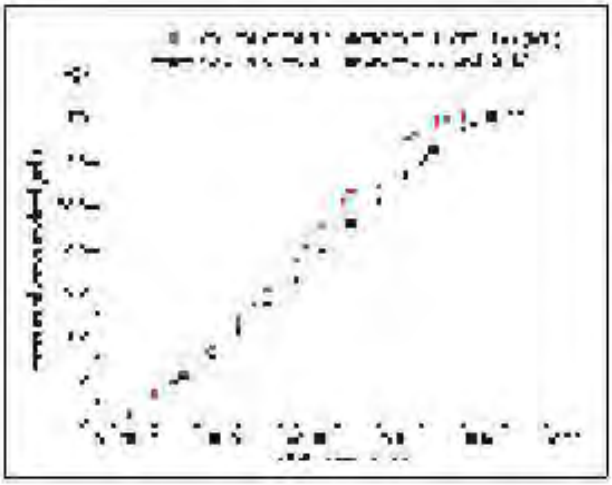


Fig. 3. Variation of melting of ice with time for 15 g ash

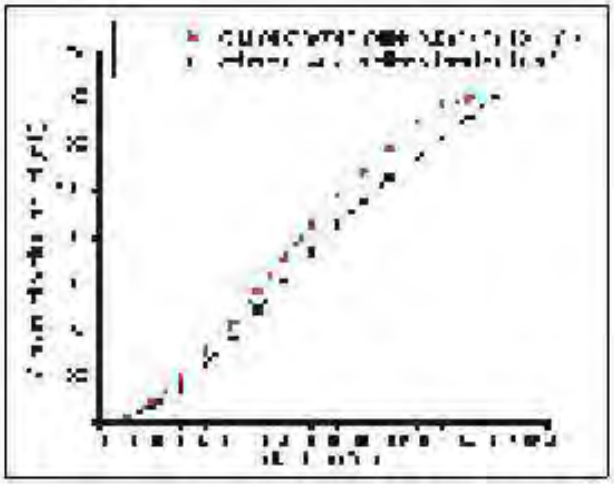


Fig. 4. Variation of melting of ice with time for 5 g soil

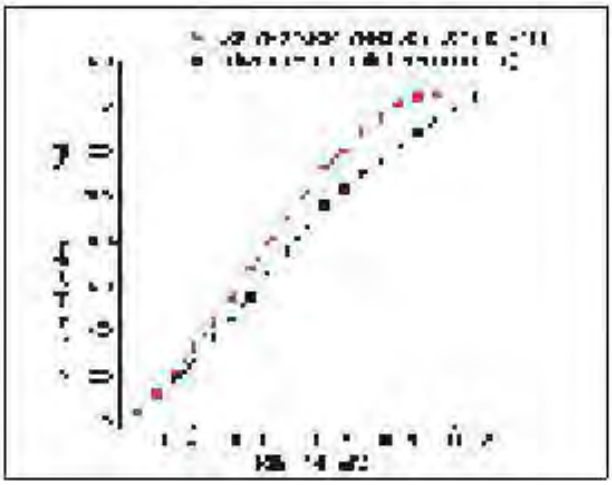


Fig. 5. Variation of melting of ice with time for 10 g ash

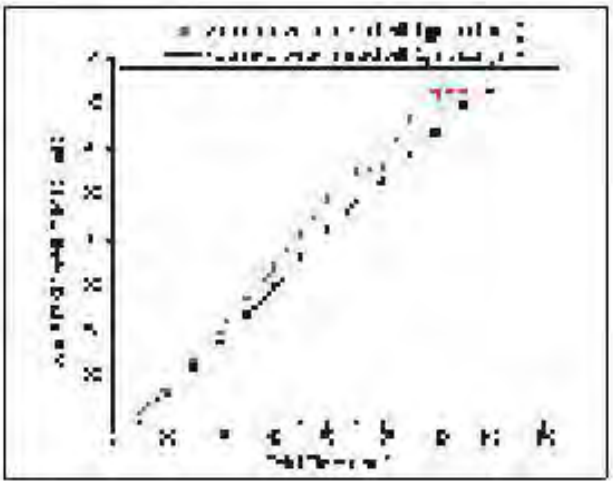


Fig. 6. Variation of melting of ice with time for 5 g ash and 5g soil

soil powder in comparison with natural melting. It indicates that the time taken for complete melting of ice (1.5 kg) is lesser with soil powder as compared to natural melting.

Thus the presence of small amounts of soluble minerals or particles as in fine soil lower the melting point of ice, while results in faster melting. Hence both ash as well as soil powder can be used for faster melting of ice. Its a result the fields covered with snow can be made available for early sowing by the spray of ash as well as soil powder.

As the time taken for melting of ice with ash and soil powder was different, it was also thought appropriate to compare the results of melting of ice with ash and soil powder.

The melting of ice was carried out with 5 g, 10 g and 15 g of ash as well as soil powder. The data are shown in Figs 6, 7 and 8, respectively.

The melting of ice with ash was faster by 20–25 min. per 1.5 kg ice taken in each tray. The melting of ice with ash took lesser time in comparison to soil powder. But if the results of 5 g, 10 g and 15 g ash as well soil powder are compared, there is no difference in the time taken for melting. In other words, it supports the previous data that the melting of ice is independent of the amount of ash or soil powder used for melting purposes. Only small amount of

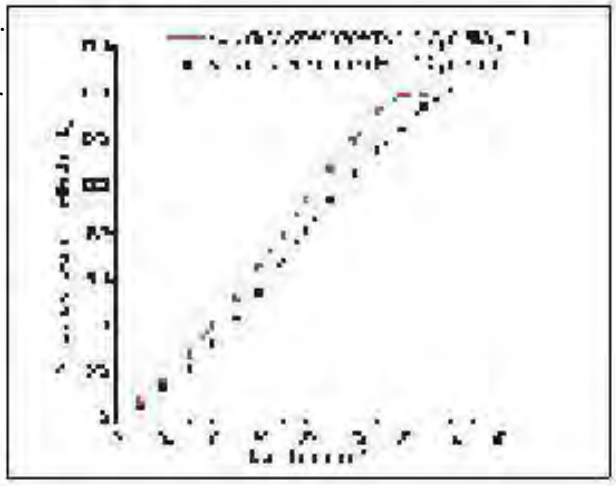


Fig. 7. Variation of melting of ice with time for 10 g ash and 10 g soil

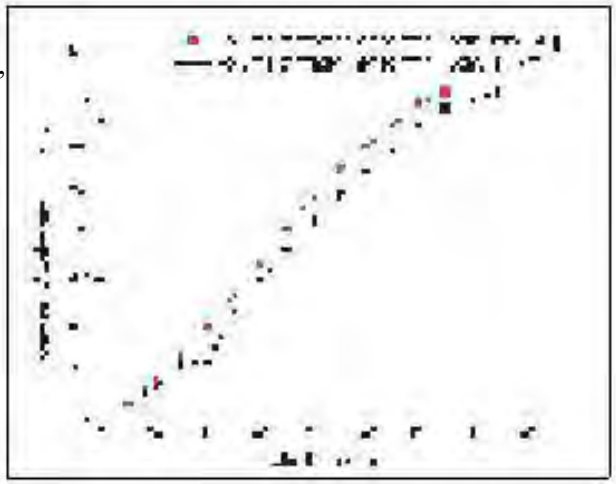


Fig. 8. Variation of melting of ice with time for 15 g ash and 15 g soil

either ash or soil powder, which can cover the entire surface of snow, will be sufficient.

CONCLUSION

The results obtained show that melting can be hastened by sprinkling ash as well as soil powder. The melting is relatively faster with ash than with soil powder. Presence of soluble materials in ash and soil lower the melting point, due to which the snow melting becomes faster.

The present experiments confirm the claim of the discloser that the addition of ash helps in early melting of snow and facilitates timely sowing of the crop in cold desert area of Lahaul and Spiti in Himachal Pradesh.

❑

Code	:	**676**
Title of the ITK	:	**Intercropping (maize + sesame)**
Description of the ITK	:	To overcome the insect and pest attack the farmers of Baldhar village of Kangra district of Himachal Pradesh adopt mixed cropping method. Sesame seeds are sown in maize field: By this mixed cropping pattern more than one crop is grown in the same field at a particular period. Fertility of the soil is maintained, and the attack of insect and pest is reduced.
Name and address of the discloser	:	Shri Rajiv Kumar, Room No. 32 P, PBH_II Hostel, Himachal Pradesh University, Shimla (Himachal Pradesh) 171 005
Location of use of the ITK	:	Substantial area in Kangra, Hamirpur and Una are under such intercropping systems. The study area is located in Palampur, district Kangra of Himachal Pradesh. This area is situated at 32°6' N latitude, 76°3' E longitude and at an altitude of 1290.8 m above mean sea level. The area falls in the wet temperate zone of the mid hills of Shivalik ranges in Himalayas. This experiences heavy rainfall and most of which is received during summer season (June_August). Maize is the major cereal crops grown by the farmers in Himachal Pradesh. The average yield of the state is 1990 kg/ha, respectively. Though, the yield of maize is higher than the national average however, it has further scope to increase. In Himachal Pradesh 83% area under this crop is rainfed. The uncertainty inherent in such agricultural systems tends to make maize growing risky, particularly at the time of sowing. The amount and the distribution of rainfall in a particular crop season decide the level of production. This situation alongwith diversified needs of the cultivator might have led them to the adoption of intercropping. Under such conditions intercropping, especially with oilseeds and pulses has proved superior to mono-cropping systems. The farmers in these areas are aware that this practice of growing crops together simultaneously has many advantages, viz., an assurance against the inclemency of weather, efficient utilization of various growth factors, conservation of soil on sloppy land and so on. The farmers' knowledge further suggested that, instances are not uncommon when mixed cropping has been found helpful

in reducing the incidence of pests and diseases when these inter crops acts as trap.

Experimenters : Dr K. Bassi, Sr. Agronomist, Dr D. Badiyala, Scientist and Dr O.C. Kapur, Sr. Soil Scientist, Department of Agronomy, CSK HPKV, Palampur, Himachal Pradesh

METHODOLOGY

The experiment consisting of 4 treatments (plots) was laid out in rainy (kharif) season of 2002–03. The treatments were farmers' practice, maize + sesame 1:2, maize sole 60 cm apart and sesame sole 30 cm apart.

Maize variety Girija Composite and LTK-4 (Rajeshwari) sesame were used in the study. Experiments were conducted at two sites, viz. University Research Station (Site I) and farmers' field (Site II).

RESULTS AND DISCUSSION

The results are given in Tables 1, 2, 3, 4 and 5.

The data presented in Table 1 reveal that intercropping treatment did not influence plant height of maize at both the locations and leaf area index at location - II. However, maize + sesame (1:1) intercropping system recorded compared to f armers' practice. Days taken to flowering (tasselling) was also not affected significantly due to different treatments.Maizealone took maximum number of days for maturity in sole maize.

Table 1. Effect on growth and yield attributes in maize+sesame intercropping system at two locations

Treatment	Plant height (cm)		Leaf area index		Days taken to flowering (50%)		Maturity (75%)	
	I	II	I	II	I	II	I	II
Farmer's practice	192.8	195.9	4.02	3.05	61	56	118	115
Maize + sesame (1:2)	193.9	195.0	5.42	3.24	59	55	114	115
Maize sole (60 cm apart)	190.0	188.0	5.03	3.18	60	57	120	120
Sesame sole (30 cm apart)	-	-	-	-	-	-	-	-

I, Location 1; II, location II.

Table 2. Effect of intercropping treatments on yield attributes of maize

Treatment	Plant population ('000/ha)		Length of cobs (cm)		No. of cobs/plant		No. of grains/cob	
	I	II	I	II	I	II	I	II
Farmer's practice	63.5	61.2	19.2	19.0	1.0	1.0	413	376
Maize + sesame (1:2)	73.3	70.8	22.9	21.6	1.8	1.6	496	456
Maize sole (60 cm apart)	73.6	68.2	19.2	19.0	1.5	1.5	498	371
Sesame sole (30 cm apart)	-	-	-	-	-	-	-	-

I, Location I; II, location II.

Table 3. Effect of intercropping treatments on growth and yield attributes of sesame

Treatment	Plant height (cm)		No. of capsule/plant		Seeds/capsule		1,000-seed weight (g)	
	I		II		I	II	I	II
Farmer's practice	82.2	80.4	34.6	36.3	36.3	39.3	2.97	2.82
Maize + sesame (1:2)	90.4	89.1	48.2	52.3	47.7	46.0	3.12	2.99
Maize sole	-	-	-	-	-	-	-	-
Sesame sole	105.4	103.3	50.3	52.3	50.0	49.3	2.95	2.99

I, Location; II, location II.

Table 4. Effect of intercropping treatments on maize, sesame and maize equivalent yield

Treatment	Maize-grain yield (kg/ha)		Sesame yield (kg/ha)		Maize-equivalent yield (kg/ha)	
	I	II	I	II	I	II
Farmer's practice	4,600	4,326	72	55	4,927	4,576
Maize + sesame (1:2)	5,820	5,600	117	90	6,352 [a]	6,016 [a]
Maize sole (60 cm apart)	5,900	5,616	-	-	5,900 [b]	5,616 [b]
Sesame sole (30 cm apart)	-	-	226	175	1,028	796
CD (P=0.05)	257	245.0	6.25	7.63	354.0	384

I, Location I; II, location II.

Table 5. Effect of intercropping system on gross return, net return and net return per rupee invested

Treatment	Gross return (Rs./ha)		Net return (Rs/ha)		Net return per Re. invested	
	I	II	I	II	I	II
Farmer's practice	33,498	30,800	20,573	17,875	1.59	1.38
Maize + sesame (1:2)	43,552	41,504	30,427	28,379	2.31	2.16
Maize sole (60 cm apart)	40,618	38,568	27,393	25,443	2.09	1.94
Sesame sole (30 cm apart)	5,654	4,378	2,814	2,173	1.25	0.99

I, Site I, II, site II.

Intercropping treatment registered higher plant population than farmers' practice. The length of cob, number of cobs/plant and number of grains/ cob were also higher in maize + sesame (1:1) treatment (Table 2).

Data in Table 3 reveal that intercropping treatment recorded significantly higher plant height and yield attributes compared to farmer's practice. Yield-attributing factors were higher in sole sesame than in intercropping.

The grain yield of maize was not affected much by intercropping of sesame in 1: 1 system, which recorded the highest yield at both location and remained at par with maize sole treatment.

Significantly highest maize-equivalent yield was recorded with maize + sesame (1:1)

intercropping treatment compared to all other treatments, and the lowest was recorded with farmer's practice at both the locations (Table 4).

The yield of sesame was in general low because of the moisture stress at later stages of the crop growth.

Benefit _ cost analysis

A perusal of the data presented in Table 5 reveal that highest gross returns of Rs 43,552 and 41,504/ha were recorded when sesame was intercropped with maize in 1:2 row ratio at sites I and II respectively.

Similarly, net return (Rs/ha) was also significantly higher with this treatment. It recorded Rs 30,427 and Rs 28,379 per ha at first and second locations. The net return per rupee invested was also maximum, i.e. Rs 2.31 and 2.16 at sites I and II respectively in the intercropping system.

CONCLUSION

The experimental results reveal that maize + sesame (1:2) intercropping system recorded the highest LAI, plant population, growth and yield attributes and net returns per rupee invested than any other treatment, including farmer's practice.

Code : 1789

Title of the ITK : Weed management in irrigated crops

Description of ITK : Farmers of Sangli districts in Maharashtra are adopting this weed management practices in irrigated fields. Urea solution is sprayed in sugarcane crop to control weeds. Cynodon *dactylon and Cyprus rotundus weeds are controlled by* sowing rajgira (Amaranthus species) in the field. About 50–60% weed infestation by urea spray and 20–25% weed infestation by amaranthus is reduced in the field. About 5 to 10% of the village farmers are adopting this practice since 10 years.

Name and address of the discloser:Prof. S.S.Patil, At/Post Tasgaon, Bhillawadi Road, Sangli (Maharashtra).

Location of the use of the ITK:Villages in Mallnagar, Kasegoan, Miraj, Pungat, Valva, Tasgaon, Famgaon, Fainwadi, Korti, Kasebe, Olaraj of Sangli and Solapur districts of Maharashtra.

Experimenter : Dr B. D. Koli, Associate Professor of Agronomy, Zonal Agricultural Research Station , 97 , Raviwarpeth Solapur (Maharashtra).

METHODOLOGY

Field trials were conducted with sugarcane, pomegranate and grape during rainy season kharif 2003.

Location

Mallnagar, Kasegoan, Miraj, Pungat, Valva, Tasgaon, Famgaon, Fainwadi, Korti, Kasebe, Olaraj of Sangli and Solapur districts of Maharashtra.

Experiment

To determine the efficiency of controlling weeds (Cyperus rotundus and Cynodon dactylon) in irrigated sugarcane, pomegranate and grape, the following three treatments were imposed:

1 Sowing of Amaranthus in infested patches of C. rotundus and C. dactylon
2. Spraying of 20% urea solution on C. *rotundus and C. dactylon*
3. Farmers' practice (two weedings and one hoeing for sugarcane, two hoeing, clearing and earthing up of grape and pomegranate) . In addition, the weedy check plot was maintained.

Table 1. Particulars about the number and area of trials for the experimentation of ITK

Name of the crop	No. of trials	Area of each trial (sq. m)	Total area (sq.m)
Sugarcane	5	15	75
Grape	5	15	75
Pomegranate	5	15	75

Before sowing of Amaranthus and spraying of urea on area of 0.5×0.5 m was selected for weed count in each treatment. Weed coun was recorded before and 6 weeks after sowing in case of *Amaranthus,and 3–4 weeks after spraying of 20%* urea. Similar count was also recorded in weedy

Table 2. Weed control efficiency (%) of different management methods in suagrcane, pomegranate and grape

Method of weed control	Sugarcane		Pomegranate		Grape	
	Cyperus rotundus	*Cynodon dactylon*	*Cyperus rotundus*	*Cynodon dactylon*	*Cyperus rotundus*	*Cynodon dactylon*
Amaranthus sowing	*34.85*	0.1	33.91	0.00	38.46	–0.4
Urea spray (20%)	12.00	9.68	15.43	15.08	23.20	4.70
Farmers' practice	23.34	11.00	24.59	6.72	22.60	14.32

check for determining weed control efficiency, which was done by using the following formula:

$$\text{Weed efficiency (\%)} = \frac{\text{Dry matter of weed check} - \text{dry matter of treated plot}}{\text{Dry matter of weedy check}} \cdot 100$$

The particulars of the trial are given in Table1.

RESULTS AND DISCUSSION

The effect of different methods for control of *Cyperus rotandus and Cynodon dactylon is* illustrated in Table 2. It is observed that control of Cyperus rotandus in all the plots of sugarcane, pomegranate and grape was highest by *Amaranthus sowing with weed control of* efficiency of 35.85%, 33.91% and 38.46% for sugarcane, pomegranate and grape, respectively. It is followed by farmers' practice in sugarcane and pomegranate. Urea spray gave second best result in grape. In case of Cynodon dactylon, farmers' practice gave best result in sugarcane (weed control efficiency of 11%) and grape (weed control effecinecy of 14.32%), whereas urea spray proved to be the best (15.08%) for weed control in pomegranate field.

CONCLUSION

The results obtained indicate that growing of *Amaranthus is effective in controlling Cyprus rotundus. However, this practice is not effective* for controlling Cynodon dactylon.

Code : 328

Title of the ITK : Banana as an indicator plant to irrigate sugarcane

Description of the ITK : In the sugarcane plot one or two plants of banana are planted. As the banana is sensitive to moisture stress, it shows symptoms of water deficiency earlier than sugarcane. Farmers apply irrigation when the water-stress deficiency in banana is noticed. By this practice, farmers in Karadabadi village of Ganjam in Orissa save 15 to 20% water and are able toprovide irrigation to sugarcane crop in time, resulting in 10 to 15% higher yield of sugarcane as compared to normal practice of irrigation indiscriminately. About 90% of the farmers in the village adopt this practice.

Name and address of the discloser:Shri Ramchandra Dangua, A Karadabadi, Ballipadar, Ganjam (Orissa) 761 127

Location of use of the ITK : A Karadabadi, Ballipadar, Ganjam (Orissa) 761 127

Experimenters : Dr A.K. Das, Associate Professor, Department of Horticulture, Orrisa University of Agriculture and Technology, Bhubaneswar (Orissa) 751 003, Shri N. Nayak, Training Organiser and Shri M. M. Mohapatra, Training Assistant, KVK, Bhanjanagar (Orissa)

METHODOLOGY

Location

Evaluation of efficacy of banana as an indicator plant for irrigation in sugarcane was done by Participatory Rural Appraisal (PRA) and field survey in village A Karadabadi, Buguda, dist. Ganjam (Orissa) 761 127.

PRA and field study

The PRA was conducted to determine the

Table 1. Matrix table for assessing the efficacy of banana plant as indicator plant for irrigation in sugarcane

Parameter	Planting banana plant in sugarcane field	No planting of banana plant in sugarcane field
No. of tillers/plant	More	Less
No. of internodes/plant	More	Less
Length of cane/plant	More	Less
Single-cane weight	More	Less
Brix	More	Less
Cane yield	More	Less
No. of irrigations	Less	More
Germination of setts	85%	80%

Table 2. Performance of sugarcane crop in different methods

Character	Treatment		
	Random irrigation	ITK method (irrigation on wilting of banana)	Irrigation as per schedule (at 50% soil moisture)
Average number of tillers per plant	4.26	4.54	4.65
Length of cane (m)	3.44	3.85	3.96
Brix reading (degree)	17.10	17.22	17.22
Weight of single-cane (kg)	0.79	0.88	0.91
No. of irrigations	13	10	12

efficacy of indigenous practice (use of banana plant as indicator for irrigating sugarcane) compared to other practices. The parameters were: number of tillers / plant, number of internodes/plant, length of cane/plant, single-cane weight, brix, cane yield, number of irrigations and germination (%) of setts.

Experiments

An experiment was conducted with the following three treatments: (i) random flood irrigation (ii) ITK method (providing irrigation on wilting of banana leaves and (iii) providing irrigation as per schedule at 50% soil moisture. Date of planting of setts was 15 February 2003. The experiment was laid out in CRD design with 10 replications. Observations were recorded on the following parameters: (i) germinations of setts, (ii) number of tillers/plant (iii) number of irrigations, (v) length of cane, (v) weight of single cane, (vi) cane yield, (vii) time of standard brix reading (>180 brix), and (viii) moisture content in soil at the time of wilting of banana plant at 0–15 cm. 15–30 cm and 30–45 cm depths.

RESULT AND DISCUSSION

PRA and field study

Performance of sugarcane by planting banana plant as an indicator for irrigation was found to be superior as compared to without planting any indicator plant.

Experiment

The number of tillers, internodes/plant, length of cane/plant, cane weight, brix, cane yield and germination of setts were found more in indigenous knowledge-based practice, whereas the number of irrigation requirement was found to be less under ITK method (Tables 1 and 2).

CONCLUSION

It is concluded that performance of sugarcane by planting banana plant as an indicator for irrigation was found to be superior as compared to that without planting an indicator plant.

Pest and Disease Management

Code : **368**

Title of the ITK : **Management of gundhi (harmfull green algae) in paddy field by karada (Cleistanthus collinus) leaves**

Description of the ITK : Gallfly *(Chara)* which occurs in *kharif* paddy fields in stagnant water can be controlled by broadcasting 50_100 kg freshly plucked *karada* leaves in August. The algae consume oxygen from water of the rice field and produces carbon dioxide that results in yellowing and dwarfing of rice plants. The toxicants present in the karada leaves damage chlorophyll of green algae. This practice has been in use since time immemorial in the Panipila village of Nayagarh district in Orissa.

Name and address of the discloser : Shri M. Mohanty, Senior Research Fellow, Agroforestry Wing, Directorate of Research, Orissa University of Agriculture and Technology, Bhubaneshwar (Orissa) 751003

Location of use of the ITK : Panipaila, Nayagarh, (Orissa)

Geographical indicators : *Cleistanthus collinus (Roxb.) Benth and Hook f:* A small deciduous tree distributed from the Deccan peninsula, northwards up to the Ganges. It thrives well on dry rocky ground.

Experimenters : Dr (Ms) Mayabini Jena, Senior Scientist and Dr T.K. Dangar, Scientist, Department of Entomology, Central Rice Research Institute, Cuttack (Orissa) 753 006

METHODOLOGY

Location

Efficacy of *karada* leaf against a harmful green algae in rice was evaluated by participatory rural appraisal (PRA) and experimental methods. The participatory rural appraisal was done at village Panipaila, Nayagarh (Orissa) and the experiments were conducted at CRRI, Cuttack and village Panipaila, Nayagarh (Orissa).

Extent and coverage

A green algae appears in rice fields in lowland ecosystem. It forms a cushion slowly around the young plant, thereby compressing it and limiting



Fig. 1. *Cleistanthus collinus* plant



Fig. 2. Gundhi chara infestation in farmer's field



Fig. 3. Application of karada against gundhi



Fig. 4. Karada turns the water black

its growth. Tillering and growth of the rice plant is affected to such an extent that sometimes the yield loss exceeds to 50% or more. Gundhi consumes oxygen from rice-field water, adversely affecting the respiration of rice plants, which become dwarf with yellowing, and leading to tillering.

Chara was found to be Chara (Division Charophyata, Class Charophyceae, Order Charaleas, Family Characeae). In some places *Nitella spp. was found along with it. The algae* occurs in kharif paddy field during August–September in stagnant water. Chara omits foul smell, for which it is known as gundhi.

PRA and field study

The PRA tools were applied to evaluate the performance of karada leaves in controlling chara in different doses. There were four treatments differing in application rates of karada leaves, viz. (i) 200 kg/ha, (ii) 250 kg/ha, (iii) 300 kg/ha and (iv) 350 kg/ha. Observations on reduction in *chara and yield of rice were taken at village* Panipaila of dist. Nayagarh, Orissa.

Experiment

The experiment was conducted at Central Rice Research Institute (CRRI), Cuttack in controlled condition and at village Panipaila, (Orissa) in farmer's field. In CRRI a series of doses ranging from 1 to 5 g leaf samples of karada were applied to the 45 days old potted plants of variety Jaya with 50 g chara in each replication. Copper sulphate was also applied as a treatment.
Untreated plants with chara were considered as control. Each treatment was replicated thrice. Observations were taken at 5 days interval upto 15 days of transplanting of the quantity of chara species. In farmer's field, chara and copper sulphate were applied @ 300 kg and 10 g/ha respectively.

RESULTS AND DISCUSSION

PRA and field study

Chara appears after about 50 days of transplanting and becomes more abundant 70 days onwards. It suppresses the growth of rice plant, reducing tillering and yield. Farmers of Panipaila use karada leaves to protect crop from chara infestation. About 70% of the farmers using

Table 1. Efficacy of karada leaves in controlling chara

Dose of karada leaf (kg/ha)	Reduction (%) of chara*	Yield (%)	
		Treated	Untreated
200	90	93	53
250	91	94	48
300	95	97	53
350	95	98	46

*Percentage of data in comparison to 100% for absolute control and yield

treatment the crop yield was reduced by 50%. The results obtained by field study are presented in Table 1. Data suggest that reduction in chara is associated with increasing dose of karada leaf application.

Experiment

An experiment was conducted under controlled conditions at Central Rice Research Institute (CRRI) using different levels of karada leaves to study the effect of the treatments on

Table 2. Reduction (%) in chara with karada treatment

Dose (g/pot)	5 DAT		10 DAT		15 DAT	
	Chara (mature)	*Chara* (vegetative)	*Chara* (mature)	*Chara* (vegetative)	*Chara* (mature)	*Chara* (vegetative)
1	5	20	8	30	14	45
2	5.5	25	9.5	38	16	60
3	5.8	28	12	45	20	75
4	8	28	16.7	60	23	85
5	8.5	30	20	64	40	100
CD (P=0.05)	3.68	3.93	4.24	4.60	4.59	7.85

DAT, Days after treatment.

Table 3. Reduction in chara sp. in farmers' fields

Treatment	CRRI (Chara)*	Farmers' field	Yield (t/ha)
Karada (300 kg/ha)	99.03 (98.29)**	66.03 (66.48)	2.92
Cu SO_4	60.12 (61.98)	60.12 (61.98)	2.91
Control	0.00	0.00	2.74
CD (P=0.05)	3.81	3.81	0.55

*Average of 5 replications, each replication representing a farmer; **Figures in parentheses are transformed angular values.

karada leaves reported complete control of chara, whereas about 30% observed 60–70% reduction. But almost all the farmers reported higher yield on karada leaf application whereas without the control of chara. The chara material was collected from the field of the discloser. There were two stages of chara, Chara (mature) and *chara vegetative stage.Results obtained showed* that reduction of chara is associated with increasing dose (1 to 5 g) of karada and with time (Table 2).

Trial conducted in farmers' fields showed that yield of rice increased from 2.74 tonnes/ha to 2.92 tonnes/ha by applying karada leaf. This also reduced the incidence of chara sp. (Table 3).

CONCLUSION

Karada leaf proved to be useful in controlling chara sp. a harmful green algae in rice field, increasing the yield of rice. Application of leaf at the initiation of chara population or at vegetative stage was more effective.

Code	:	**1116**
Title of the ITK	:	**Control of gundhi bug by spray of garlic and tobacco leaves extract with washing powder in water**
Description of the ITK	:	**Gundhi** bug is a highly damaging insect of paddy crop. The insect sucks milk of the tender paddy grains at the initial stage. The grain formation is stopped and the paddy seeds remain hollow. The yield is affected very badly, up to 80%. The solution is made of extract of 1 kg garlic, 200 g tobacco leaves and 200 g washing powder dissolved in 200 litres water. The solution is sprayed on the affected crop of paddy. One spray controls the insect by 80%. This practice is used by the progressive and well-to-do farmers in Bareilly and Badaun districts of Uttar Pradesh.
Name and address of the discloser	:	Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia, Jamia Nagar (New Delhi) 110 025
Location of use of the ITK	:	The progressive and well-to-do farmers in Bareilly and Badaun districts of Uttar Pradesh use this practice. Earlier, the practice was used by more number of farmers. But now it is rarely used due to more complex and complicated procedure.
Experimenters	:	Dr Baldeo Singh, Principal Scientist, Division of Agricultural Extension, Indian Agricultural Research Institute, New Delhi; Dr D.K.Garg, Principal Scientist, NCIPM, New Delhi, Dr Jitendra Kumar, Scientist (SS), Ag. Chemicals, Dr R.N.Padaria, Sr. Scientist, Dr Poonam Sharma, Scientist (S.S.) Division of Agricultural Extension, Indian Agricultural Research Institute (New Delhi) 110 012

METHODOLOGY

Location

A field study through PRA was conducted in seven villages of Bareilly district, viz. Dohna, Manda, Kamua, Purenatal, Dobhora, Tanda and Bhagwantpur. On-farm trials were conducted in three villages (Dohna, Pathi and Manda) of Bareilly district.

PRA and field study

Farmers of seven villages (Dohna, Manda, Kamuan, Purena taal, Dabhora, Tanda, Bhagwantapur) as well as staff of Integrated Pest Management (IPM) Centre, Bilwa in Bareilly district were interviewed to gather information about this ITK. Staff of IPM centre had found convincing results from this technology, so they are disseminating it among farmers through demonstrations and trainings under their IPM programme.

Matrix of various criteria (efficacy, resource availability, cost of option, labour intensiveness, case in use and yield) related to use and

comparative performance of technological options for management of gundhi bug pest (ITK, chemical measures, spray of neem extract) was administrated to 20 key informants individually as well as in groups. For every criterion, the technology options were ranked with scoring of 0 to 10. The mean value for farmers' preference for different technological options were collected.

Literature support

No useful informations was available on the usage of the suggested ITK, "Gundhi bug insect pest management in rice with extracts of garlic and tobacco leaves mixed with washing powder in water." However, the usage of tobacco and its important chemical constituents as insecticides is well documented. The information on the use of garlic as insecticides is scanty. The mixing of washing powder or detergent with pesticidal active component is used as dispersing, wetting or emulsifying agent.

Tobacco

Nicotine has had a long history of use in IPM programme for fuit trees in the form of crude extracts of tobacco. Systematic use of nicotine sulphate started around 1910 with the introduction of standardized pesticide formulation containing 40% actual nicotine. Before Second World War, nicotine sulphate was a very popular insecticide around the globe. It is effective against a wide range of pests. Its efficacy against soft- bodied insects like aphids is well known, but it has also been found effective against whitefly, thrips and bollworm in cotton; brown planthopper and green leafhopper in rice; grubs in brinjal, potato and cauliflower etc. It was also used for the control of pear psylla and certain other tree fruit pests (Hamillton, 1947). Recently, nicotine sulphate (0.2 and 0.4% a.i.) was found to be highly toxic to eggs and neonate larvae of Helicoverpa *armigera (Hubner) and Spodoptera litura* (Fabricius). It was also found effective against *Bemisia tabaci (Gennadius) under field* conditions.Nicotine sulphate is widely used as a greenhouse fumigant due to its high toxicity and volatility.

Spray of the extract of tobacco leaves on cotton and vegetable crops (brinjal, tomato and beans) for Helicoverpa and other borers @ 10 g/litre water, 2–3 times in one season in the morning has been in practice in some villages of Maharashtra (Anonymous, 2002). There is another report in which tobacco decoction when applied against sesame capsule borer provided some control.

Garlic

Information could not be available on the management of gundhi bug in rice by using tobacco and garlic extracts. However, garlic extract has been reported as grain protectant in paddy storage (Prakash et al. 1982). Its use has also have been reported against storage insect pests and against f lower gall midge in chilli (David et al. 1990), cotton aphid, (Aphis gossypii), (Chitra et al. 1997) and also for management of sorghum shootfly, (Atherigona soccata) (Akashe *et al. 1995).*

Intercropping with garlic plants for insect control is a long-established practice in tropical and subtropical agricultural regions* (Potts 1990). Home gardeners use garlic preparations for insect control, although it is known to have a wide range of insecticidal properties and is repellent or toxic to beneficial as well as pest insects* (Masseh, 1982). Garlic formulations have been reported to kill pest insects from several orders as well as other arthropods* (Flitit et al. 1995).

Diluted garlic juice was sprayed on the resting areas (flowers, grass, shrubs, trees, turf, and vines) to repel Aedes, Anopheles, Culex and other species of mosquitoes in field tests. Applications were made at different intervals using various spraying equipment at maximum-labelled rates. The effects of applications were determined from landing rate counts (LC) of adult mosquitoes and visual sightings were utilized to evaluate the annoyance effects. A diluted solution containing 0.99% of

garlic juice repelled mosquitoes for multiple weeks in field tests conducted at assorted geographical locations. In aggregate, the results indicate that garlic juice (with the trade name of Mosquito *Barrier ", a product of North American Organic* Products Company) was found effective in repelling adult mosquitoes from their resting areas.

Experiment

On-farm trials were laid out with participation of farmers for validation of the ITK. RBD experiment with nine treatments and three replications was used. The treatments were:

T_1, Control

T_2, Water extract of garlic (1 kg) per acre

$T_{3,}$ Water extract of tobacco leaves (200g) per acre

T_4, ITK i.e. Extract of garlic (1 kg) + tobacco (200 g) + washing powder (200 gm) mixed in 200 litres of water per acre

T_5, Neem seed kernal extract (5 kg) per acre

T_6, Neem oil E-C (1 litre per acre)

T_7, Alcoholic extract of Neem Leaves (1,500 ppm)

T_8, Malathion dust (10ñ12 acre)

T_9, Nicotine sulphate (0.6ñ1.0%)

The technical parameters considered for observation were: (i) insect pest infestation pattern, (ii) varietal difference in pest infestation and response to ITK, (iii) pest reduction percentage and (iv) impact on healthy crop stand. The economic parameters were: yield and cost-benefit analysis.

RESULTS AND DISCUSSION

PRA and field study

The mean value of ranking by farmers revealed that the ITK (application of extracts of garlic and tobacco leaves and extracts of leaves of neem) efficiently managed the pest and saved the loss in yield (Table 1). However,

Table 1. Average score obtained through PRA tools of validation

Criteria	Average ranking for technology options		
	Extracts of garlic and tobacco leaves + washing powder	Chemical control	Extract of neem leaves
Efficacy	7	8.3	7.25
Resource availability	5.45	7.95	5.7
Cost of options	5.7	7.6	6
Labour intensiveness	5.4	7.55	5.7
Ease in use	5.7	7.8	6.05
Yield	7.15	8.25	7.25
Average	6.06	7.91	6.33

Table 2. Incidence of insect-pest complex observed in trial plots

Trial site	Pest complex	Predators/natural enemies
Dohna	Stem borer, rice hispa, white grub, Clavigralla bug, green leaf hopper, gundhi bug, rice weevil	Spiders, lady bird beetle, coccinellids parasitic fly
Manda	Leaf-folder, green leaf hopper, stem borer, *Gundhi bug, tiger beetle, rice skipper, rodents*	Parasitic wasp, Grass hopper
Kamua	Clavigralla bug, leaf-folder, tiger beetle, rice skipper	Parasitic wasp, Grass hopper

Table 3. General description of trial sites

Particular	Trial site		
	A	B	C
Name of village	Dohna	Patti	Manda
Name of farmers	Ch. Pratap Singh	Amzad Khan	Sher Singh
Variety	Sugandh-2	Sarbati	PB-1
Transplanting	3 July	18 July	23 July
Colour of crop	Green	Yellow green	Green
Source of irrigation	Tube well	Tube well	Tube well
Plot size	6 × 2.6 m	5 × 3m	12 × 5 m
Treatment	9	9	9
Field size	26 × 18m	15 × 30m	12 × 30 m
Replication	3	3	3
Total no. of plots	27	27	21

Table 4. Yield obtained in on-farm trials

Treatment	Average yield (q/ha)	
	Trial site: Dohana (variety: Sarbati)	Trial site: Manda (variety: Pb-1)
Extract of neem leaves	14.75	Not applied
Neem-seed kernel extract (NSKE)	14.50	33.13
Garlic	17.55	33.61
Tobacco	16.50	33.88
ITK		
Garlic + Tobacco + washing powder in water	19.90	31.66
Nicotine sulphate	17.95	39.44
Neem E.C.	20.05	32.00
Neem E.C. 1,500 ppm	19.50	31.62
Alcoholic Extract 1,00,000 ppm	19.80	37.68
Malathion dust	20.00	33.33
Ash	Not applied	33.91
Control	13.55	28.35

unavailability of the required materials, cost and labour intensiveness as well as the cumbersome process of extract preparation were the limiting factors with.

Incidence of pest infestation

Population count of insect pests per square metre at random places in the trial plots was undertaken. The population complex of insect



Fig. 1. Estimation of gundhi bug infestation in rice



Fig. 2. Trial plot with low infestation of gundhi bug during 2002

pests comprised stem borer, rice hispa, white grub, clavig ralla bug, gundhi bug, rice weevil, tiger beetle, rice skipper, leaf folder, rodents etc. (Table2).

Population of gundhi bug was found to be low. Its incidence was affected due to prevailing weather conditions during crop stage.

Validation trials were laid out in plots having some incidence of gundhi bug, using RBD experimental design with nine treatments and three replications.

The yield data recorded from trial plots under different treatments (Table 4) showed that the ITK was effective in management of rice pests. As against 13.55 q/ha and 28.35 q/ha from control plots at Dohna and Manda villages respectively, the yield harvested from the plots with ITK treatments were 19.90 q/ha. and 31.66 q/ha.

CONCLUSION

The gundhi bug infestation was too low to establish any effect of ITK on its management. The ITK was, however, seems to be effective in management of other rice pests. Trials have to be laidout again to check the effectiveness of the ITK in the management of gundhi insect.

Code	:	**1418**
Title of the ITK	:	**Control of caseworm (*Nymphula depunctalis*) in rice by leaves of *parsa* and *sali***
Description of the ITK	:	Caseworms are very common in the area of Khaspokharia village of west Singhbhum district in Jharkhand. Fresh leaves of *parsa* (*Cleistanthus collinus*) and *sali* (*Boswellia serrata*)are spread on the insect-infested field @ 5 kg leaves per 100 m^2. Majority of insects (about 70_80%) are controlled with this practice.
Name and address of the discloser	:	Shri Sanat Kumar Sawaiyan, Dumbisai, Chaibasa, West Singhbhum (Jharkhand)
Location of use of the ITK	:	Village Khaspokharia, Block Tantnagar, West Singhbhum (Jharkhand)
Geographical indicators	:	*Parsa* (*Cleistanthus collinus*) is a small deciduous tree distributed from the Deccan peninsula, north wards up to Ganges. It thrives well on dry rocky ground. *Sali* (*Boswellia serrata*) is a moderate or large branching tree with a bole, 12_15 feet in height and 3_5 feet in girth, generally found in dry hilly areas. It is common in most parts of Bihar, Orissa, Rajputana, Central Provinces, Central India, the Deccan, eastern states and north Gujarat.
Experimenter	:	Dr. N. Kudada, Assistant Professor cum-Junior Scientist, Department of Plant Pathology and Dr. R.P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

Village Khaspokharia, Block Tantnagar, West Singhbhum (Jharkhand)

Extend and coverage

The extent of damage caused by caseworm is about 60 per cent.

PRA and field study

Field study was conducted following the PRA methodology with 15 respondents. The parameters/factors included were efficacy in controlling pests, cost effectiveness, availability of materials and yield. The ITK was compared on the above parameters with the recommended



Leaves of *parsa*

chemical control measure and another ITK i.e. use of puru leaves.

Experiment

The experimental design followed was RBD in 15 replications with four treatments, viz., T_1-Control, T_2-Application of parsa leaves @ 100 kg/ha, T_3-Application of sali leaves @100 kg/ha and T_4-Application of chlorpyriphos @ 1.0 litre/ha. Parsa and sali leaves were spread after 5 days of transplanting. Observations were taken on number of toal and damaged leaves/m^2.

RESULTS AND DISCUSSION

PRA and field study

The data on field study have been presented in Table 1.

Results indicate that the performance of parsa and puru leaves was at par with each other and superior to use of sali leaves on all the parameters studied. The leaves of parsa and puru were found to be effective. These two materials are available in the area and farmers could get them free of cost. However, use of chemical insecticide was superior in controlling the insect and getting higher yield, but it was costly and not easily available.

Experiment

Data presented in Table 2 indicate that percentage of caseworm infested leaves in control plot was 80.11 at 30 DAT which remained more or less same (79.42%) at 60 DAT. In case of use of parsa leaves the percent infestation was 73.51 and 25.35 at 30 DAT and 60 DAT, respectively. Chlorpyriphos application reduced the infestation

Table 1. Matrix scoring for assessment of performance of parsa, puru and sali leaves in control of rice caseworm

N= 15

Parameter	Treatment			
	Parsa leaves	*Puru leaves*	*Sali leaves*	*Chemical insecticide*
Insect control	6.40 ± 0.31	6.00 ± 0.21	3.60 ± 0.31	7.30 ± 0.21
Cost effectiveness	8.90 ± 0.26	8.70 ± 0.22	6.00 ± 0.36	2.90 ± 0.23
Availability	8.80 ± 0.22	8.30 ± 0.26	6.20 ± 0.32	3.00 ± 0.23
Yield	5.70 ± 0.26	6.20 ± 0.25	4.20 ± 0.25	6.90 ± 0.23

Table 2. Effect of application of parsa and sali leaves on the number of caseworm infested leaves in rice crop

Treatments	No. of total and damaged leaves/m^2					
	30 DAT			60 DAT		
	Total leaves	Damaged leaves	% of damaged leaves	Total leaves	Damaged leaves	% of damaged leaves
T_1 - Control	155	124	80.11	170	135	79.42
T_2 – Application of parsa leaves @ 100 kg/ha	155	114	73.51	169	43	25.35
T_3 – Application of sali leaves @ 100 kg/ha	163	125	76.81	163	47	28.78
T_4–Application of chlorpyriphos @ 1.0 litre/ha	155	113	72.90	168	38	23.56
CD (P=0.05)			NS			4.37

DAT - Days after transplanting

from 72.90% at 30 DAT to 23.56% at 60 DAT. Application of sali leaves (T_3) recorded 76.81% and 28.78% infestation of leaves at 30 DAT and 60 DAT, respectively. While the treatment effect was not significant at 30 DAT, incidence of caseworm damaged leaves reduced substantially over the control at 60 DAT. Use of parsa or sali leaves produced similar effect as that of use of chlorpyriphos.

CONCLUSION

On the basis of results obtained, it may be concluded that the ITK is effective in controlling rice caseworm at par with the efficacy of chlorpyriphos.

Code : **365**

Title of the ITK : **Planting of wild Saccharum spontaneum in paddy field for controlling leaf folder**

Description of the ITK : Wild sugarcane (Saccharum spontaneum) twigs of height 4 to 5 feet and 4 to 5 cm diameter are planted after 15 days of transplanting in rice field for control of leaf-roller. These erected branches harbour the predators at the time of occurrence of leaf-roller, thereby suppressing the incidence of pest. About 90% farmers in the Benakunda village of Ganjam district in Orissa adopt this practice.

Extent and coverage

Paddy is grown in rainy *(kharif)* season only in Benakunda village. The area covered under paddy is about 30 ha. Besides paddy, farmers also grow pulses, oilseeds, vegetables etc. In rice, caseworm a leaf-roller is a major problem. It makes appearance every year in a devastating form. In a survey out of 90 farmers, about 30 farmers experience caseworm (leaf roller) infestation in their fields each year.

Name and address of the discloser : Shri Birendra Nayak, Bhanjanagar, Ganjam (Orissa) 761126.

Location of use of the ITK : Village-Benakunda, Block-Bhanjanagar, Ganjam (Orissa) 761 126.

Experimenters : Dr (Mrs.) Mayabini Jena, Senior Scientist and Shri K.S. Behera Senior Scientist, Department of Entomology, Central Rice Research Institute, Cuttack (Orissa) 753 006.

METHODOLOGY

Location

Efficacy of wild *Saccharum spontaneum* in paddy field for controlling leaf roller (caseworm) was evaluated by participatory rural appraisal (PRA) and experimental methods. The participatory rural appraisal was done at village Benakunda, block Bhanjanagar, Ganjam (Orissa) and the experiments were conducted at Central Rice Research Institute (CRRI), Cuttack (Orissa); village Benakunda, block Bhanjanagar, Cuttack (Orissa) and village Vogra, block Athagarh,



Fig. 1. Wild sugarcane plantation in rice field for control of caseworm

Cuttack (Orissa).

PRA and field study

Participatory Rural Appraisal (PRA) tools were applied to determine the efficacy of wild *Saccharum spontaneum as compared to* insecticide treatment.The study was conducted at Benakunda village, covering 10 practitioners. The parameters studied were: reduction of caseworm (leaf roller) and percentage of plant that became healthy 1 month after application.

Experiment

Field experiments were laid out at three locations i.e. at (i) CRRI, Cuttack, (ii) village Vogra, and (iii) village Benakunda. At CRRI Cuttack the following treatments were taken, i.e. planting Saccharum spontaneum at 7 days after transplanting (DAT), planting of Saccharum *spontaneum at 14 DAT, planting Saccharum spontaneum after infestation, foliar spray of* insecticide (Imidacloprid) @ 0.05 kg ai/ha and untreated control . Seeds were sown on 5 July. Seedlings were raised in the nursery with all the recommended agronomic practices to obtain healthy seedlings. Seedlings at 30 days were transplanted on 5 August in randomized block design (RBD), each treatment in 4 replications with 40 m^2 area for each microplot (replication). Fertilizer application was made @ 60 N: 30 P:30 K kg/ha. Half the dose was applied basal whereas the rest was applied in two split doses, one at the tillering and the other at panicle-initiation stages. First and second treatments of wild sugarcane were made at the scheduled period. Source of availability of wild sugarcane was found within 60 km of CRRI. Observations on percentage hill infestation and yield of rice were taken.

In farmers' fields three treatments were used: (i) planting S. spontaneum at insect infestation, (ii) insecticide treatment, and (iii) untreated control. Each farmer represented one replication with three plots as three treatments. Each plot size is within the range of 600–800 m ^{2}The same experiment was conducted at Benakunda village of Bhanjanagar, Ganjam with 8 replications as well as at Vogra village of Athagarh block, Cuttack with 6 replications.

RESULTS AND DISCUSSION

PRA and field survey

Matrix analysis pertaining to the use of wild *Saccharum spontaneum was done at village* Benakunda of Ganjam district by covering 10 farmers. Saccharum spontaneum is planted after 7 days of transplanting by 40% of the farmers, and after 15 days or more by 60% farmers or sometimes after observing the insect incidence also. The farmers' informed that where wild sugarcane is planted, the field remains almost free from caseworm. Under severe infestation, the population gradually comes down and infested rice plants recover from the damage. The practice

Table 1. Matrix ranking for assessing the performance of wild Saccharum spontaneum for controlling caseworm/leaf roller in rice vis-à-vis other methods

Parameter/character	Method and score				
	Saccharum spontaneum			*Insecticide*	*Untreated*
	At 7 DAT	At 14 DAT	At heavy infestation		
Reduction (%) of caseworm/leaf-roller	85	75	55	70	0
Plant healthy (%) after 1 month of application	90	90	60	85	20

DAT, Days after transplanting.

Table 2. Hill infestation by caseworm at CRRI farm

Treatment	Hill infestation (%)			Yield (q/ ha)
	5 DAP	10 DAP	20 DAP	
Saccharum spontaneum (7 DAT)	20	22	0	64.0
Saccharum spontaneum (14 DAT)	25	25	0	63.2
Saccharum spontaneum (after infestation)30		45	15	57.0
Insecticide (Imidacloprid)	40	5	0	68.0
Untreated control	40	55	20	51.7
CD (P=0.05)	3.03	3.13	1.02	1.02

DAT, Days after transplanting; DAP= days after planting of S. spontaneum.

gives better yield than the field where it is not used (untreated). About 20% farmers feel that without this practice the yield loss of grain may be up to 80%.

Data of matrix ranking indicate that planting of wild sugarcane after 7 days of transplanting helps the most to reduce incidence of caseworm (Table 1) than delayed planting of Saccharum *spontaneum. It was more efficacious than use of* insecticide for reducing the insect incidence and to obtain healthy plants.

Experiment

Results of the experiment conducted at CRRI research station showed that planting of wild sugarcane at 5 DAT is more effective than the other treatments tried (Table 2). Incidence of caseworm was not observed on 20 DAT due to planting of wild sugarcane at 7 DAT and 14 DAT, and with application of imidacloprid. Planting of wild sugarcane before infestation by case worm helped obtain yield of rice up to 63.2 to 64.0 q/ ha, which was 68.0 q/ha when insecticide was applied. Untreated plot gave the lowest yield (51.7 q/ha).

Substantial reduction in incidence of case-worm, as determined by infestation of hill, was obtained in the experiments conducted at both Vogra (Table 3) and Bhanjanagar village (Table4).

However, increase in yield of rice due to planting of wild sugarcane and insecticide application was significant over control at Vogra village. Yield of rice was similar in all the three treatments at Benakunda , as the incidence of caseworm was not observed after 20 DAT.

Mode of action of S. spontaneum

Observations taken on the micro-ecosystem

Table 3. Percent hill infestation in farmer's field and grain yield (Vogra village)

Treatment	Hill infestation (%) at different DAP		Yield (q/ha)
	10	20	
Saccharam spontaneum	40.0	1.5	49.5
Insecticide (Imidacloprid)	3.2	0.5	50.4
Untreated control	70.0	80.0	26.6
CD at (P=0.05)	5.9	4.92	4.86

DAP, Days after planting of S. spontaneum.

Table 4. Percent hill infestation in farmer's field and grain yield (Bhanjanagar village)

Treatment	Hill infestation (%) at different DAP		Yield (q/ha)
	10	20	
Saccharam spontaneum	26.0	0	30.3
Insecticide (monocrotophos)	2.4	0	32.2
Untreated control	29.6	0	29.1
CD at (P=0.05)	4.0	-	3.3

DAP, Days after planting of S. spontaneum.

after planting of Saccharam spontaneum revealed the following:

1. Almost all the leaves of S. spontaneum provided habitation for spiders.
2. Spider eggs were available in 65% of S. *spontaneum implanted in both leaf surface* and at the leaf-sheath portion.
3. Spider population was 2–3/m ^{2} after 5 days of planting of S. spontaneum, which gradually increased to 6–8 after 15 days with small spider nymphs all over the field.
4. Spiders, collected from CRRI, Vogra and Bhanjanagar belongs to 9 types. A tentative identification has been made of 6 spiders which are: Neoscona sp., *Araneus sp., Oxyopes sp., Tetragnatha sp., Clubirna sp. and Argeiops sp.*
5. Two types of spiders Araneus sp. and *Oxyopes sp. were observed to kill and* devour the larvae of caseworm.
6. Web formation is perhaps another mode of action for controlling the caseworm by trapping it at moth stage.
7. High rate of egg-laying of some of the spiders was observed on the broad leaf surface of S.spontaneum, which perhaps helped in spreading the population within less time.

CONCLUSION

Treatment with w ild sugarcane (Saccharum *spontaneum) reduced the infestation of rice* caseworm in field conditions of CRRI and also in farmers' fields of Vogra village of Athagarh block, Cuttack.

Code : 1420

Title of the ITK : Control of banki disease of paddy by Sandhna

Description of the ITK : Banki or rice caseworm infestation in paddy is common in Chandwe village of Kanke block of Ranchi. To control the pest, sandhna is mixed with water. The water is then sprayed or sprinkled on the affected paddy plant. The benefit claimed by this method is more than 50%. The target pest is rice caseworm, which cuts paddy leaves , makes pipe-like encasings and feeds inside.In severe attack the loss in yield goes up to 90%. The incidence of this pest is sporadic and depends upon particular weather conditions like continuous rainfall for 4–5 days, cloudy sky, no sunshine etc.

Name and address of the discloser: **Shri Rajeev Kumar Jha, Research Associate, Department** of Fisheries, Ranchi Veterinary College, Ranchi (Jharkhand)

Location of use of the ITK : Village- Chandwe, Block- Kanke, Ranchi (Jharkhand)

Geographical indicators : Bamboo is a medium sized plant with tall, green stems, about 80 feet high, distributed throughout India.

Experimenters : Shri K. K. Sinha, Assistant. Professor cum Junior Scientist, Department of Entomology and Dr R. P. Singh 'Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand).

METHODOLOGY

Location

The experiment was conducted in village Deori, block Tamar, dist Ranchi (Jharkhand).

PRA and field study

The reported ITK was compared with corresponding scientific recommendation through PRA tools with a total number of 20 respondents. The parameters or factors included in the study were, efficacy of the ITK in controlling banki, persistence of the effect, eco-friendly value, efficacy in controlling other pests, cost effectiveness and availability of the material.

Experiment

A field experiment was conducted in



Fig. 1. Tender bamboo rhizome

randomized block design with 10 replications using three treatments, viz. T_1 control (no treatment); T_2 use of sandhna water @ 25 litre *sandhna water diluted to 1:2 (75 litre/ha); and* T_3 use of chemical pesticide (chlorpyriphos 20 EC) @ 1 litre/ha. Each treatment covered 2,000 m^2 area. Observations on number of larvae/cases/ m^2, and total number of leaves/m^2, damaged leaves/m^2 and percentage of damaged leaves/m^2 were taken.

RESULTS AND DISCUSSION

PRA and field study

The data on selected parameters or factors for comparing the reported ITK (sandhna water) with use of chemical pesticide (chlorpyriphos) are presented in Table 1.

Experiment

The results show that the ITK practice is at par with the recommended technology in efficacy in controlling banki. For eco-friendly value, cost effectiveness and availability of material, sandhna water had the advantage over chlorpyriphos.

The experiment was conducted in rainy season (kharif) 2002–2003, when due to late monsoon the sowing and subsequent transplanting were delayed. Sowing in nursery was done between

Table 1. Matrix scoring for comparison of the ITK using sandhna water with recommended practice (use of chlorpyriphos) on selected parameter in controlling rice caseworm

N= 20

Parameter	*Sandhna water*	Chemical insecticides	't' value
Efficacy in controlling banki	80.00 ± 4.59	82.00 ± 4.08	0.309NS
Persistence of effect	58.00 ± 3.52	66.00 ± 3.87	1.405NS
Eco-friendly value	56.00 ± 3.11	35.00 ± 1.99	6.185**
Efficacy in controlling other pests	27.00 ± 3.63	38.00 ± 2.47	3.240*
Cost effectiveness	34.00 ± 2.55	75.00 ± 2.55	8.731**
Availability of materials	87.00 ± 2.63	48.00 ± 2.68	10.563**

*Significant at P=0.05; **Significant at0.01; NS, nonsignificant.

Table 2. Effect of application of sandhna water and chlorpyriphos on the number of caseworm-infested leaves in rice crop

Treatment	No. of total and damaged leaves/m^2								
	30 DAT			45 DAT			60 DAT		
	Total leaves	Damaged leaves	% of damaged leaves	Total levels	Damaged leaves	% of damaged leaves	Total leves	Dam-aged leaves	% of damaged leaves
T_1: Control(No treatment)	149	120	80.5	160	131	81.8	177	139	78.5
T_2: Application of *sandhna water*	152	117	76.9	178	84	47.2	191	52	27.2
T_3: Application of chloropyriphos	163	123	75.4	180	72	40.0	202	43	21.2

DAT, Days after transplanting.

Table 3. Effect of application of sandhna water and chlorpyriphos on the number of caseworm larvae in rice crop

Treatment	No. of total and damaged leaves/m²								
	30 DAT			45 DAT			60 DAT		
	Total leaves	No. of cases	% of case worm	Total leaves	No. of cases	% of case worm	Total leaves	No. of cases	% of case worm
Control	149	38	25.5	160	43	26.87	177	49	27.6
Application *sandhna water*	152	27	17.7	178	22	12.37	191	20	10.4
Application of chlorpyriphos	163	30	18.4	180	20	11.11	202	18	8.9

24 and 30 July and transplanting from 26 to 30 August. Observations were made on fortnightly basis i.e. on 30, 45 and 60 days after transplanting. Application of sandhna water and chlorpyriphos was done on September 17, 2002. The results obtained are presented in Table 2.

Data presented in Table 2 show that in control plot the percentage of banki affected leaves was 80.5 at 30 DAT which remained more or less same (78%) at 60 DAT. In sandhna water application, the infestation was 76.9% at 30 DAT and 27.2% at 60 DAT. Chlorpyriphos application reduced the infestation from 75.4% at 30 DAT to 21.2% at 60 DAT.

Further, the number of caseworm larvae was counted by counting the number of cases per square meter. The results obtained are presented in Table 3.

Data presented in Table 3 show that the use of *sandhna was effective in reducing the number of* larvae of case-worm, which is similar to use of chlorpyriplus in effectiveness.

CONCLUSION

It may be concluded that the ITK is effective to a substantial extent in controlling caseworm in rice. ❑

Code	:	**1422**
Title of the ITK	:	**Control of gall fly (Pachydiplosis oryzae) in rice**
Description of the ITK	:	Gallfly (Pachydiplosis oryzae) is very harmful to rice crop. It damages whole crop of rice. Farmers of Tamar block of Ranchi district in Jharkhand use parso/persu (Ceistanthus collinus) leaves for controlling gallfly. In this practice, fresh leaves of parsu/persu are collected and spread in the infested field without processing. About 10 kg leaves are required for 1,000 m² area. These leaves are spread at the initial stage of infestation. These controlled 70_80% insects. All farmers of the village use this age-old practice. Paddy gallfly is a major insect pest in various parts of Jharkhand. In gall midge endemic areas, it is a regular pest attacking the rice crop year after year. In severe attack the loss in yield may go up 50%.
Name and address of the discloser	:	Shri R.S. Prasad, Department of Extension Education, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006
Location of use of the ITK	:	Village Deori, Block Tamar, Ranchi (Jharkhand)
Geographical indicators	:	Parso/persu (Cleistanthus collinus) is a small deciduous tree distributed from the Deccan peninsula, northwards up to the Ganges. It thrives well on dry rocky ground.
Experimenters	:	Shri K. K. Sinha, Assistant Professor cum Junior Scientist, Department of Entomology and Dr R. P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

The study was conducted in village Deori, block Tamar, Ranchi (Jharkhand).

PRA and field study

Field study was done by using PRA tools to determine the efficacy of parso leaf as compared to the application of chemical pesticides in controlling gallfly. The parameters included efficacy, persistence of effect, eco-friendliness, efficacy in controlling other pests, cost effectiveness and availability of materials. The study was conducted covering randomly selected 20 practitioners.

Experiment

Field experiment was conducted in rainy (kharif) season of 2002_03 in randomized block design with three treatments, viz. T1: control; T2: Parso leaf @ 25 kg/ha and T3: application of carbofuran 3 G @ 15 kg/ha (two doses), having 10 replications. Each treatment covered an area of 2,000 m2. Observations on number of tillers/m2, number of affected tillers/m2, percentage of infestation, and extent of control were taken.

Table 1. Comparison of the ITK (parso leaves) with recommended practice through matrix scoring

N=20

Parameter	*Parso leaves*	Chemical insecticides	't' value
Efficacy in controlling gallfly	95.00+2.46	86.00+3.58	2.651*
Persistence of effect	87.00+3.91	64.00+4.00	4.721**
Eco-friendly value	87.00+2.62	29.00+3.97	10.355**
Efficacy in controlling other pests	94.00+2.10	31.00+2.28	18.905**
Cost effectiveness	90.00+2.29	34.00+3.28	11.854**
Availability of materials	98.00+1.38	24.00+1.84	28.967**

*Significant at P=0.05; ** significant at 0.01.

Table 2. Effect of application of parso leaves and carbofuradon on gallfly affected tillers (silver shoots) of rice

Treatment	No. of total and affected tillers/m ^{2}								
	30 DAT			45 DAT			60 DAT		
	Total tillers	Silver shoot affected tillers	% affected tillers	Total tillers	Silver shoot affected tillers	% affected tillers	Total tillers	Silver shoot affected tillers	% of affected tillers
T_1: Control (no treatment)	200	12	6.0	217	18	8.3	225	22	9.8
T_2: Application of parso leaves @ 25 kg/ha	218	7	3.2	237	5	2.1	245	5	2.0
T_3: Application of carbofuran twice @ 3 G 15 kg/ha	223	9	4.0	240	7	2.9	248	5	2.0

DAT, Days after transplanting.



Fig. 1. Application of parso leaves in rice field to control paddy gallfly

RESULTS AND DISCUSSION

Results obtained through PRA are presented in Table 1. The matrix scoring reveals that use of *parso leaves is more efficacious than use of* chemical insecticides in controlling allflies. *Parso leaves had also advantage over the use of* chemical pesticides on the other parameters studied.

Experiment

Results obtained through field experimentation are presented in Table 2. When the crop was not given any treatment, (in the control plot), the percentage of infestation of gall midge (% of the

silver shoot) increased from 6% at 30 days after transplanting (30 DAT) to 9.8% at 60 DAT. In the parso leaf application, the intensity of infestation was reduced from 3.2% at 30 DAT to 2.1% at 45 DAT and finally to 2.0% at 60 DAT. In carbofuran application, the percentage of infestation was reduced from 4% at 30 DAT to 2.0% at 60 DAT.

CONCLUSION

It was concluded that the ITK using parso leaves to control rice gallfly is quite effective and almost at par with the recommended practice of using carbofuran 3G.

Code	**:**	**344**
Title of the ITK	**:**	**Management of yellow stem borer in paddy by use of parasi (Cleistanthus collinus) leaf**
Description of the ITK	:	Application of 75-150 kg parasi (Cleistanthus collinus) leaves by broadcasting once in the rice field at 3 days after transplanting controls yellow stem borer during kharif. All the rice-growing farmers in the Aralkocha village of Purulia district in West Bengal follow this practice for the last 50 years. Paddy is the main crop in this area in kharif. Other than paddy, blackgram, greengram, redgram, niger, mustard, groundnut, tomato, brinjal, cowpea and bhindi are also grown in this area. Yellow stem-borer (attacking in all the growth stages, except flowering and onward stage) of paddy is the most important and major pest problem in lowland cultivation of paddy. The larva enters the stem and feeds upon the internal plant material, thereby disrupting the vascular passage to the terminal portion (which may be leaf or panicle). It results on drying of the portion, causing the symptoms (dead-heart at the vegetative stage and white ear in the mature stage).
Name and address of the discloser	:	Thirty six farmers of Aralkocha village, C/o Secretary, Aralkocha Kansabati club, Village Aralkocha, P.O. Konnapara, Block-Hura, Purulia (West Bengal) 723 128, through Kalyan Krishi Vigyan Kendra, Vivekanandanagar, Purulia (West Bengal) 723 147
Location of use of the ITK	:	Villages Aralkocha, Rahemda, Siju, Arujnjora,Chirumarcha Block-Hura, Purulia (West Bengal) 723 147
Geographical indicator	:	*Cleistanthus collinus (Roxb.) Benth and Hook f:* A small deciduous tree distributed from the Deccan peninsula, northwards up to Ganges. It thrives well on dry rocky ground.
Experimenters	:	Dr (Ms) Mayabini Jena, Senior Scientist, Entomology and Dr T. K. Dangar, Scientist, Department of Soil Microbiology, Central Rice Research Institute, Cuttack (Orissa) 753 006.



Fig. 1. View of karada plant



Fig. 2. Yellow stem-borer of rice

METHODOLOGY

Location

Effectiveness of parasi was evaluated by participatory rural appraisal (PRA) and experimental methods. The participatory rural appraisal was done at village Aralkocha, Purulia (West Bengal) and the experiments were conducted at Central Rice Research Institute, Cuttack (Orissa) and village Aralkocha , dist. Purulia (West Bengal).

Paddy is the main crop in this area in kharif. Other than paddy, blackgram, greengram, redgram, niger, mustard, groundnut, tomato, brinjal, cowpea and bhindi are also grown in this area. Yellow stem- borer (attacking in all the growth stages, except flowering and onward stage) of paddy is the most important and major pest problem in lowland cultivation of paddy. The larva enters the stem and feeds upon the internal plant material, thereby disrupting the vascular passage to the terminal portion (which may be leaf or panicle). It results on drying of the portion, causing the symptoms (dead- heart at the vegetative stage and white ear in the mature stage).

PRA and field study

Efficacy of parasi leaves in different doses was evaluated as compared to the use of insecticide in controlling yellow stem borer by using PRA tools. The data were collected from 38 tribal families residing in the Aralkocha village of Purulia district (West Bengal). The study was done in terms of reduction in the incidence of yellow stem borer and yield of rice.

Experiment

Experiments were carried out during rainy season (kharif) 2002 at Central Rice Research Institute (CRRI), Cuttack and at farmers' fields of Aralkocha village. The treatments followed in the experiment of CRRI farm were: (i) use of *parasi (75 kg/ha) at 30 days after transplanting* (DAT), (ii) use of parasi (75 kg/ha) each at 30,60

Table 1. Effect of parasi leaves on white earhead (caused by yellow stem borer) and yield of rice

Treatment	Reduction in white ear (%)	Yield (q/ha)
Use of parasi leaves @ 75kg/ha	55	21.0
Use of parasi leaves @ 100kg/ha	63	24.0
Use of parasi leaves @ 150kg/ha	75	31.0
Insecticide application	60	29.0
Control (no treatment)	No reduction	11.0

and 90 DAT, (iii) use of parasi (100 kg/ha) at 30 DAT, (iv) use of parasi (100 kg/ha) each at 30,60 and 90 DAT, (v) use of parasi (150 kg/ha) each at 30 DAT, (vi) use of parasi (150 kg/ha) each at 30,60 and 90 DAT, (vii) use of carbofuran (1 kg/ha) at 60 and 90 DAT, and (viii) untreated control. Seedlings at 35 days were transplanted during fourth week of July in randomized block design by using 3 replications. Observations on dead-heart and white ear formation were taken after 10 days of each treatment application. Soil sample of 30 cm length в 30 cm width 50 cm depth was collected from each replication after harvest for recording earthworm population.

An experiment was also conducted in the Aralkocha village with 10 farmers; each with 3 treatments, i.e. application of parasi leaves @ 150 kg/ha, application of carbofuran granules @ 1 kg/ha, and untreated control. Due to scanty rainfall during the initial part of this season, transplanting was delayed to first and second week of August. Stem borer moth did not appear till September, though the treatments were imposed at 30 DAT. Another application of treatments was made at 60 DAT. Observations on insect population/m^2, white ear/m^2 and grain yield were recorded.

RESULTS AND DISCUSSION

PRA and field study

Information available from the farmers using *parasi leaves revealed that about 23% of them* use leaves @ 75 kg/ha, 50% use 100 kg/ha and rest of the farmers use 150 kg/ha to control yellow stem-borer in rice. Data presented in Table 1 show that farmers using 75 kg parasi leaves /ha get nearly 55%, reduction in yellow stem borer damage, whereas about 63% reduction is obtained with 100 kg/ha. Maximum reduction of 75% is obtained with application of leaves @ 150 kg/ha. Even insecticide application was inferior to parasi leaf treatment, showing only about 60% reductions. Higher yield is obtained in parasi treatments, which is even more than double than the untreated one.

Experiment

Data obtained from the field experiment conducted at Central Rice Research Institute (CRRI) farm showed that the dead heart formation was very less, remaining less than 6% in all the treatments, including untreated control plot after 30 and 60 days of treatment (Table 2). This may be attributed to low insect population during this

Table 2. Effect of parasi treatment on yellow stem borer incidence

Treatment	Dead-heart (%)		White ear (%)	Yield (q/ha)	Earthworm (no.)
	30 DAT	60 DAT			
Parasi (75 kg/ha) 30 DAT	4.8	5.9	16.1	54.5	58
Parasi (75 kg/ha) 30, 60 and 90 DAT	-	5.5	11.5	57.3	59
Parasi (100 kg/ha) 30DAT	4.5	5.8	13.1	57.0	62
Parasi (100 kg/ha) 30, 60 and 90 DAT	-	5.0	9.7	60.6	68
Parasi (150 kg/ha) 30 DAT	4.2	4.4	9.7	62.6	73
Parasi (150 kg/ha) 30,60 and 90 DAT	-	4.3	7.9	66.5	89
Carbofuran (1 kg a.i./ha) 60 and 90 DAT	3.2	3.5	10.3	58.2	24
Untreated control	5.3	6.7	16.8	52.1	46
CD (P=0.05)	0.906	0.604	2.0	6.10	9.38

DAT, Days after transplanting.

period. But significant difference was achieved in the white ear formation, which ranged from 7.92 to 16.82%. There was high percentage of white ear in only one-time application at 30 DAT, than in repeated application at 30, 60 and 90 DAT. Though it was not significantly different from repeated treatment except in 75 kg/ha, it showed a trend of increasing efficacy. Again, application of parasi at panicle initiation stage showed efficacy at par with insecticide treatment. However, significantly less while ear formation was observed in comparison to control, except the treatment of 75 kg a.i./ha at 30 DAT.

Yield was significantly higher in both the application of 150 kg/ha and in the repeated application of 100 kg/ha. Though the remaining treatments were not significantly high, they were higher than the yield obtained in control plot. A gradual increase in earthworm population was observed with the increase of parasi dose. It was highest in the repeated application of 150 kg/ha. Lowest population was observed in carbofuran treatment (Table 2).

Data obtained from the experiment conducted on 10 farmers' fields showed very less population of moth this year, ranging from 0.1 to 0.4/m^2. White ear formation was also meagre, ranging from 0.2 to 0.5. Reduction in population was due to drought situation. Yield of rice was 59.1 q/ha (both in parasi and carbofuran treatments) in comparison to 49.3 q/ha in untreated control. Though the insect did not contribute to significant yield loss due to its less or no infestation, there was increase in yield with parasi treatment in comparison to untreated control (Table 3).

Table 3. Effect of parasi on yellow stem borer incidence and grain yield of rice

Treatments	Moth/m^2	White ear/ m^2	Yield (q/ha)
Parasi (150 kg/ ha)	0.1	0.2	59.1
Carbofuran (1 kg a.i/ ha)	0.1	0.2	59.1
Untreated control	0.4	0.5	49.3

CONCLUSION

Parasi leaf was found to be effective in controlling yellow stem-borer when it was used thrice in rice fields.

Code : **357**

Title of the ITK : **Control of insect-pest in lowland rice using *parasi (Cleistanthus collinus*)**

Description of the ITK : Approximately 0.4 to 0.5 kg fresh, tender branches of Cleistanthus collinus are planted erect/spread in the standing water after establishment of summer rice with the anticipation of the pest outbreak. This practice is being followed by a good number of farmers belonging to Kapgari village under Jhargram subdivision in Midnapur district of West Bengal. This practice has been in vogue over generations without any modification and is being followed in patches vulnerable to insect pest incidence. Gundhi bug is a major problem of this rice-growing area. Gundhi bug regularly infests the local scented rice variety (Basnabhog) and other early maturing varieties. The insect incidence occurs at milk stage of flowering. Yield loss is more due to the formation of chaffy husk.

Name and address of the discloser : Dr G. B Manna, Ex Principal Scientist, 85 H, Hijli Co-operative, Prembazar, Kharagpur (West Bengal) 721 306.

Location of use of the ITK : Village Kapgari, block-Jhargram, Midnapur of West Bengal, Balasore and Mayurbhanj districts of Orissa.

Geographical indicators : *Cleistanthus collinus* (*Roxb.*) *Benth and Hook f:* A small deciduous tree distributed from the Deccan peninsula, northwards up to Ganges. It thrives well on dry rocky ground.

Experimenters : Dr (Mrs) Mayabini Jena, Senior Scientist, and Dr T.K. Dangar, Scientist, Department of Entomology, Central Rice Research Institute, Cuttack (Orissa) 753 006

METHODOLOGY

Location

Effectiveness of parasi was evaluated by participatory rural appraisal (PRA) and experimental methods. The participatory rural appraisal was done at Balasore and Mayurbhanj districts of Orissa and the experiments were conducted at Central Rice Research Institute, Cuttack and Balasore (Orissa).

PRA and field study

Fifty-five farmers were interviewed for field study. This method was applied to determine the efficacy of *parasi* twigs as affected by management systems as compared to use of gammaxin for controlling *gundhi* bug in rice.

Experiment

Experiment was conducted at CRRI research farm, Cuttack and farmer's field at village Ajodhya, Balasore (Orissa). In the research station, 30 days old seedlings were transplanted in randomized block design for six treatments each with four replications. Fertilizer was applied



Fig. 1. Implantation of parasi twig in farmer's field (Balasore)

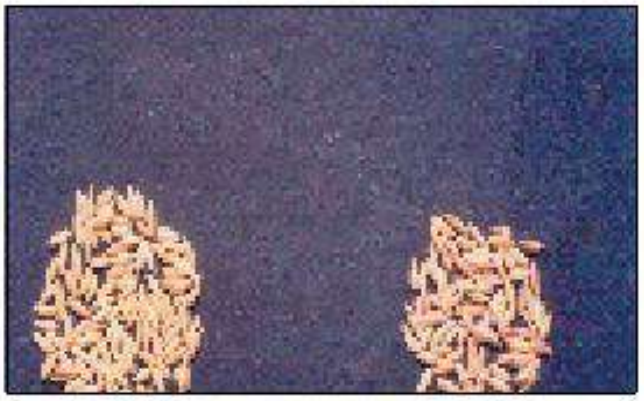


Fig. 2. Healthy grain (left) and gundhi bug-infested grains (right)

@ 60:30:30 kg NPK/ha. Twigs were planted @ 5/plot (25 m ^{2}) and leaves were applied @ 100 kg/ha. Malathion dust was applied @ 25 kg/ha. Observations were taken on population of gundhi bug (after 5 and 10 days of treatment by sweeping net method) and yield of rice. In farmer's field, only three treatments each with six replications were taken, i.e. implanting parasi twigs, applying insecticides and untreated control.

RESULTS AND DISCUSSION

PRA and field survey

Extensive survey was undertaken on the use of parasi plant against gundhi bug in rice by farmers of Balasore district in Orissa. Information

Table 1. Effect of parasi on grain yield of rice

Time and frequency of application	Yield (q/ha)
Leaf broadcasting before flowering: 3% of total farmers	30.0
Twigs implanting after flowering before insect attack: 10% of total farmers	37.5
Twigs implanting after insect attack: 55% of total farmers	37.5
Twigs implanting + leaf broadcast after insect attack: 10% of total farmers	40.0
Application of gammaxin: 9% of total farmers	32.5
Not applying any thing: 13% of total farmers	17.5

Table 2. Population of gundhi bug and rice yield obtained with parasi treatment

Treatment	Insect no./sweep net			Yield (q/ha)	
	CRRI		Farmer's field*	CRRI	Farmer's field
	5 DAT	10 DAT	10 DAT		
Twig implantation + leaf (at the time of flowering)9		12	-	27.7	-
Twig implantation (at the time of flowering)	10	14	-	26.9	-
Twig implantation + leaf (after insect infestation)5		8	-	31.2	-
Twig implantation (after infestation)	6	10	4	28.7	22.0
Malathion dust	1	3	2	30.0	23.1
Control	10	17	10	27.3	20.1
CD (P=0.05)	0.38	0.32		5.1	2.0

*Average of 6 farmers; DAT, days after treatment.

revealed that parasi was used as a tradition against rice-insect pest by all the farmers, 25 or 30 years back. Fifty five farmers were interviewed for validation. About 76% farmers use parasi against gundhi bug. Though they are aware of chemical pesticides such as monocrotophos, phospho-midon, phorate and quinolphos, they use parasi to control pests other than gundhi bug also. About 20% of the farmers use insecticide dusts whichever is available in the market. Farmers broadcast leaves and also put twigs of parasi, @ 40_45 twigs per acre. Accordingly, increase in yield was also reported by the farmers by using parasi (Table 1).

Experiment

Results obtained from the experiment conducted at Central Rice Research Institute (CRRI) and in farmer's field revealed that gundhi bug infested the paddy inspite of application of parasi. But there was decrease in population for the treatment where it was applied after infestation and applied as fresh twigs or leaf. The yield was also highest in the treatment. But a significant increase in yield was not obtained in parasi treatment than in untreated control (Table2).

CONCLUSION

Gundhi bug population was reduced by applying both fresh leaves and planting twigs after gundhi bug infestation.

Code : **1115**

Title of the ITK : **Control of *khaira* disease in paddy by application of lime and cowdung**

Description of the ITK : *Khaira* disease has been reported in many villages of Bareilly and Badaun districts of Uttar Pradesh. The disease is caused by mineral deficiency. About 2_3 kg of lime and one bucket of cowdung are mixed in 200 litres of water. This solution is sprayed on the affected crop of paddy. One spray controls the disease by 50%. The farmers use this indigenous practice to control the disease.

Name and address of the discloser : Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia, Jamia Nagar, New Delhi 110 025

Location of use of the ITK : The disclosure mentions that the practice is being used in the villages of Bareilly and Badaun districts of Uttar Pradesh. The *khaira* disease of rice is a serious problem in *tarai* area of Uttar Pradesh. The name *khaira* was given by local farmers to indicate a reddish brown discolouration of the leaves of the diseased plants. The disease has been responsible for causing serious damage to rice crop, some times up to 100 per cent. *khaira* disease can be identified by stunting and poor growth of affected plants, brown specks on leaf and leaf sheath and brittleness of the leaves.

Experimenter : Dr Baldeo Singh, Principal Scientist, Division of Agrilcultural Extension, Dr B.M.Sharma, Principal Scientist, Division of Soil Science; Dr R.N.Padaria, Senior Scientist and Dr Poonam Sharma, Scientist (S.S.) Division of Agricultural Extension, Indian Agricultural Research Institute, New Delhi 110 012

METHODOLOGY

Location

The study on both PRA and on-farm-trials were conducted in Bareilly district of Uttar Pradesh. Field study was conducted in Manda and Kamua villages, whereas on-farm trials were conducted in Manda, Kamua and Patti villages.

PRA and field study

Field study was conducted through PRA in Bareilly district of Uttar Pradesh. The results of matrix scoring using 20 key informants on five criteria for three alternative practices were obtained in respect of scores out of 10 by putting stones in each column of matrix. The five criteria were: efficacy, resource availability, cost, case in use and yield. The options were: lime + cowdung, lime and zinc application.

Experiment

On-farm trials were laid out with participation

Table 1. Treatments used in trial for management of *khaira disease of rice*

	Treatment
T_1	Control
T_2	ITK Spray of lime (3 kg) + cowdung (1 bucket) mixed in 200 litre water
T_3	Spray of lime (0.25%) + zinc sulphate %)
T_4	Spray of zinc sulphate (0.5%) alone
T_5	Soil application of lime (35 kg/ha) + sodium chloride (75 kg/ha)

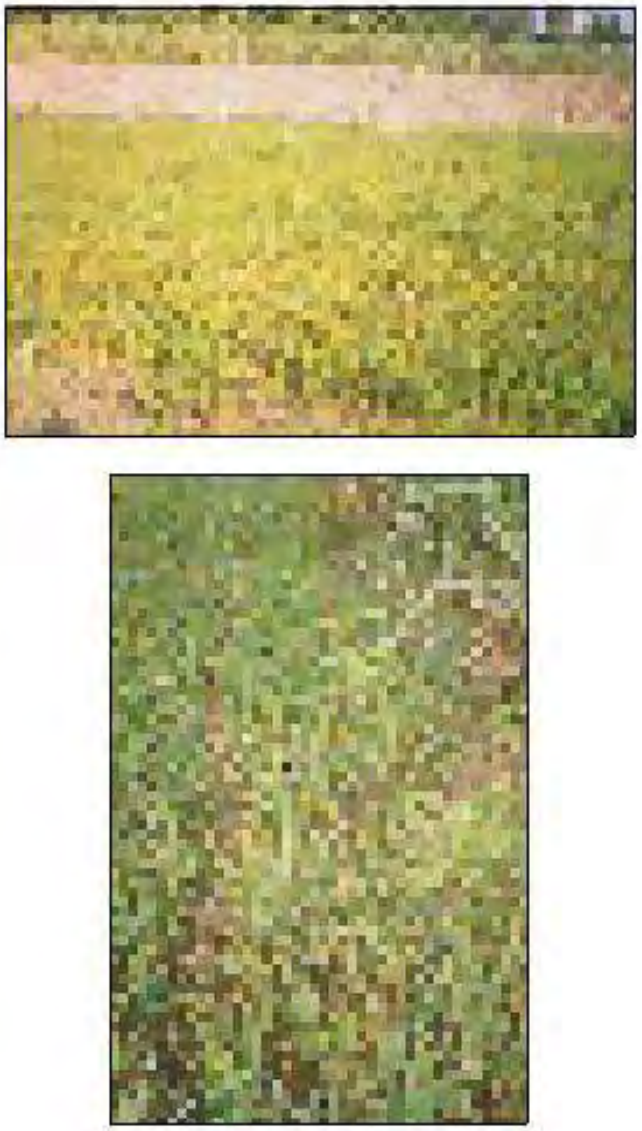


Fig. 1. Infestation of khaira disease in nursery (top) and transplanted (bottom) crop of rice

of farmers for validation of the ITK. RBD experimental design with 5 treatments and three replications were used (Table 1).

Observations were taken on (insect pest infestation pattern, varietal difference in pest infestation and response to ITK, pest reduction percentage and impact on healthy crop stand, yield and cost- benefit analysis) during the experimental study.

RESULTS AND DISCUSSION

PRA and field study

Rice-cultivating areas with problem of khaira incidence in Bareilly district were surveyed. Matrix of decision criteria for using technological options (use of lime + cowdung, lime and zinc) for management of khaira disease in rice was administered to 20 key informants individually as well as in groups. Matrix ranking for the relative performance of the options for each criteria was done with scoring pattern of 0–10.

As per criteria ranking made by the farmers, differences in performance of the technological options were observed (Table 2). Use of lime and zinc were preferred options for management of *khaira disease in comparison to lime with* cowdung. Among lime and zinc options, farmers preferred the former.

Experiment

The on-farm validation trials were laid out in three villages, viz. Patti, Manda and Kamua of Bareilly district. Selection of farms was made on the basis of history of khaira disease incidence in rice and use of reported ITK for its management besides the other factors of willingness of farmers for participations in trials and their orientation towards experimentation with new ideas and technologies. General description of trial sites is mentioned in Table 3.

Since the khaira disease occurs due to zinc deficiency, soil analysis of trial plot was undertaken prior to lay-out of the trial. Analysis of soil samples collected from the trial plots

Table 2. Score obtained through PRA method of validation

N=20

Criteria	Average ranking for technology options		
	Lime + cowdung (foliar spray)	Lime (soil application)	Zinc (soil application)
Efficacy	6.6	7.3	7.8
Resource availability	5.6	7.85	7.5
Cost of options	5.75	8.55	6.9
Ease in use	6.75	7.75	7
Yield	7.05	7.65	8.6

Table 3. Description of the trial sites

Particulars	Trial sites		
	A	B	C
Name of village	Patti	Manda	Kamua
Soil type	Sandy loam	Clay loam	Clay loan
Variety	Sarbati	Indrashan	Sarbati
Date of transplanting	18 July	23 July	9 August
Spacing (inches)	6	6	6

Table 4. Soil status of trial plots

Trial site (village)	Class	pH	EC	Organic carbon (%)	Available P (kg/ha)	Available K(kg/ha)	Available Zn (ppm)
Patti	Sandy loam	7.6	0.32	.48	17.1	18.4	0.4
Manda	Clay loam	7.9	0.21	.74	22.5	15.6	0.64
Kamua	Clay loam	7.4	0.23	.80	34.2	19.0	0.45

Table 5. Incidence of khaira disease in trial plots

Trial site	Incidence (%)
Patti	50–60
Manda	35–40
Kamua	20–25

revealed deficiency of zinc availability in the plots of Patti and Kamua villages. The levels of available zinc were found below the critical limit of 0.6 ppm (Table 4). At village Manda, analysis did not show the zinc deficiency.

On-farm validation trials were laid out using randomized block design with 5 treatments and 3 replications as indicated earlier in Table 1.

Regarding pre-treatment incidence of khaira disease; trial plots at village Patti, Manda and Kamua showed incidence of khaira disease 50–60, 35–40 and 20–25% of crop stand respectively (Table 5).

Regarding post-treatment incidence of khaira

Table 6. Persistence /incidence of disease after treatment

Treatment	Disease incidence (%)		
	Patti	Manda	Kamua
(T_1)Control	60–70	40–50	20–30
(T_2)Spray of lime (3 kg) + cowdung (1 bucket) mixed in 200 litre water	30–40	15–20	10–15
(T_3)Spray of lime (0.25%) + zinc sulphate (0.5%)	0–2	0–2	0–3
(T_4)Spray of zinc sulphate (0.5%) alone	0–3	0-2	0–2
(T_5)Soil application of lime (35 kg/ha) + sodium chloride (75 kg/ha)	20–30	10–15	7–10

Table 7. Average yield of paddy

Treatment	Average yield (q/ha)		
	Patti (Sarbati)	Kamua (Sarbati)	Manda (Indrasan)
Control	26.67	33.06	33.10
ITK Lime + cowdung (foliar spray)	27.50	33.84	33.93
Lime (0.25%) + zinc sulphate (0.5%) (foliar spray)	38.33	37.81	39.70
Zinc sulphate alone (0.5%) (foliar spray)	36.08	38.52	43.67
Lime (35 kg/ha) + sodium chloride (75 kg./ha) (soil application)	26.42	33.31	31.37

disease; after application of treatment the incidence of khaira disease was reduced in all the cases, but at varying degrees (Table 6). Symptoms nearly disappeared in the treatments T_3 and T_4. All the treatments performed better than the ITK. The symptoms increased in the control plot.

Yield obtained was higher in case of treatment with zinc spray (Table 7).

CONCLUSION

It was observed in the on-farm trials that the recommended practice of zinc application performed better than the ITK, with regard to management of khaira disease as well as yield. Performance of ITK and the control was similar. ❑

Code : 702

Title of the ITK : Herbal pesticides for control of insect pests in wheat **and rice crop**

Description of the ITK : Wheat and rice are infested by a number of pests.Use of herbal pesticide minimizes the attack of insect pest on paddy. This herbal pesticide is prepared by mixing cow urine, nirgandi (Vitex negundo) leaves and hing (asafoetida). This mixture in appropriate proportion is considered effective bio-pesticide for wheat/rice pests. It contains certain ingredients having insecticidal as well as insect-repellant property, which makes it useful for control of insect pests of paddy crop. The leaves of nirgandi (Vitex *negundo) are boiled in water (about 30–40 leaves in 10* litres water) till condensed to one liters. About 10 g asafoetida is then mixed in it. These ingredients are mixed in about 5 litres cow urine. This mixture is then filtered and used (sprayed) as bio–pesticide over affected crops. This spray is effective for all sowing seasons i.e. early sowing, normal or late sowing seasons of the crops. This ITK has been practised in Theog area of Shimla district, Himachal Pradesh since time immemorial. Now-a-days only cash crops such as cabbage, cauliflower, tomato etc. are grown in this area,with declining acreage under paddy.

Name and address of the discloser: **Shri Rajinder Rajan, Rajan Tyre Service, Theog, Tehsil** Theog, Shimla (Himachal Pradesh) 171 201

Location of use of the ITK : This ITK was prevalent in Theog area of Shimla district in Himachal Pradesh. This area forms a part of high hills temperate wet Himalayan region and lies between the longitudes 77° - 0" and 78° - 19" east and latitudes 30° - 45" and 31° - 44". This zone is physio-graphically a mountainous trait. Farming is done under rainfed conditions in terraces. Soils are shallow, silt and loam in texture and acidic in nature. This zone at present contributes to about 96% of the total temperate fruit production. Apple is the most pre-dominant fruit grown in the zone.

Experimenter : Dr L.R. Verma, Professor, Department of Bio-Sciences and Shri Chaman Lal, Scientific Assistant, Department of Bio-Sciences, Himachal Pradesh University, Summerhill, Shimla (Himachal Pradesh) 171 005

METHODOLOGY

PRA and field study

Field trials were conducted for evaluation of above mentioned eco-friendly insecticide against wheat aphid and armyworm on wheat variety HS-295 at Regional Research Station, Himachal Pradesh Krishivisavidalya, Dhaulakuan, Sirmour district, and at Mountain Research and Development Associates experiment field station in Theog area of Himachal Pradesh during 2002–2003.

This disclosed ITK was in use since a long time, and during the present PRA studies only a few elderly farmers knew about this method of insect control, as it is now replaced by modern method of chemical control.

Experiment

Six treatments were adopted i.e.control, cow urine (CU), cow urine (CU) + Vitex nigundo (50:50), cow urine (CU) + Ferula a safoetida (FA) (50:50), cow urine (CU) + Vitex nigundo (VN) + Ferula asafoetida (FA) (50:25:25) and monocrotophos (0.05%).

Each formulation was sprayed in six different plots with 50 plants each. The insecticides were applied at ear-emergence stage. Mean aphids and armyworm incidence was recorded from 10 randomly selected plants per plot on 1, 10, 20, 30, 40 and 50 day after the first spray. A total of three sprays were given at 45 days after sowing and thereafter repeated on 20 and 40 days (i.e 20 days interval).

Data obtained from the various studies were statistically analysed using t-test and F test to find out the level of significance.

RESULTS AND DISCUSSION

The results on the effectiveness of bio- and chemical insecticide are summarized in Tables 1 to 3 and Figs 1 to 3. The chemical composition of the cow urine as revealed in the literature is given in Annexure I. Ecological habitat, chemical composition and properties of asafotetida or

Table 1. Efficacy of different insecticides against wheat aphids

Treatment	Aphid population at different time intervals (in days) after treatment					
	1	10	20	30	40	50
C	4.40	5.20	15.20	16.40	14.20	4.00
CU	4.60	1.40	10.80	7.20	4.00	0.60
CU+VN	4.00	1.20	7.60	5.80	1.40	1.00
CU+FA	3.80	1.60	6.60	3.60	1.60	0.40
CU+VN+FA	4.20	0.80	7.00	2.20	0.40	0.00
MC	0.00	0.00	4.40	0.00	0.00	0.00
Mean	3.50	1.70	8.60	5.87	3.60	1.00
SE-diff	0.63	0.90	2.90	1.62	1.67	1.02
CD(5%)	1.31	1.86	5.98	3.34	3.44	2.10
Sig	1%	1%	5%	1%	1%	1%
SE diff (dates)0.73						
CD at P=0.051.44						

C, Control; CU, cow urine; CU + VN, cow urine + Vitex negundo; CU+FA, cow urine + Ferula asafoetida; CU+VN+FA, cow urine + Vitex negundo + Ferula asafoetida; and MC, monocrotophos.

Table 2. Efficacy of different insecticides against larvae of armyworm in wheat crop

Treatment	No. of larvae of armyworm at different time interval (in days) after treatment					
	1	10	20	30	40	50
C	0.40	3.20	4.80	3.40	3.40	0.80
CU	0.40	1.80	2.00	2.40	1.00	0.40
CU+VN	0.60	0.80	0.60	0.80	0.60	0.20
CU+FA	0.40	0.20	0.00	0.60	0.40	0.40
CU+VN+FA	0.40	1.40	0.00	0.00	0.40	0.20
MC	0.00	0.80	1.00	0.00	0.20	0.00
Mean	0.37	1.37	1.40	1.20	1.00	0.33
SE-diff	0.32	0.89	0.91	0.80	0.57	0.42
CD (5%)	0.65	1.83	1.88	1.65	1.18	0.88
Sig	NS	5%	1%	1%	1%	NS
SE-diff (dates) 0.31 CD at (P=0.05) 0.60						

C, Control; CU, cow urine; CU + VN, cow urine + Vitex negundo; CU+FA, cow urine + Ferula asafoetida; CU+VN+FA, cow urine + Vitex negundo + Ferula asafoetida; and MC, monocrotophos.

Table 3. Efficacy of different insecticides against number of infested plants in wheat crop

Treatments	No. of infested plants /plot at different time intervals (in days) after treatments					
	1	10	20	30	40	50
C	11.33	12	13.33	12.33	8.33	3
CU	9.67	9.33	10.67	7.67	4.67	1.67
CU+VN	9	7.67	8.67	5.67	4.33	1.33
CU+FA	12	8.67	9	6.00	4.33	0.67
CU+VN+FA	8.67	4.33	5.33	4.33	2.33	0.67
MC	0	4	4.33	0	0.33	0
MEAN	8.44	7.67	8.56	6	4.06	1.22
SE – diff	2.58	2.24	1.99	1.26	0.88	0.84
CD	5.36	4.89	4.34	2.75	1.92	1.83
Sig	1%	5%	1%	1%	1%	5%
SE – diff (dates) 0.79 CD at (P=0.05) 1.57						

C, Control; CU, cow urine; CU + VN, cow urine + Vitex negundo; CU+FA, cow urine + Ferula asafoetida; CU+VN+FA, cow urine + Vitex negundo + Ferula asafoetida; and MC, monocrotophos.

(hing) and Vitex negundo are given in Annexures II and III.

The effect of this pesticide in controlling the insect pest of wheat over a period of time is given below:

On first day after spray

All aphids and armyworm larvae were killed with monocrotophos spray. But the number of these insects significantly declined after treatment with cow urine and its mixing with different herbal pesticides.

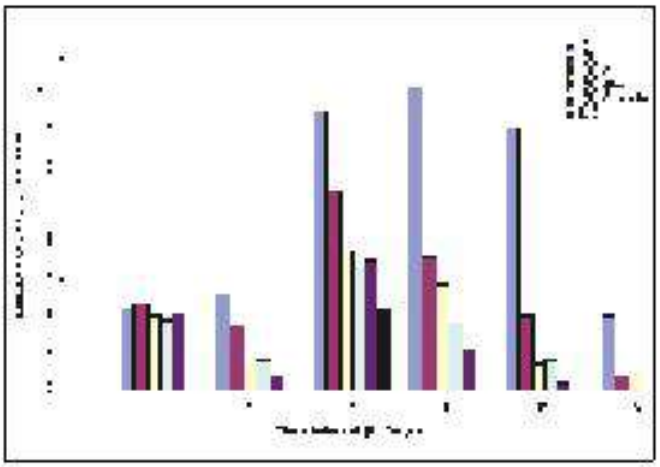


Fig. 1. Efficacy of different insecticidal sprays against wheat aphid

On tenth day after spray

The number of aphids increased under control conditions and significantly declined under treated conditions. Same pattern was observed in case of number of armyworm larvae and number of infested plants per plot.The total control of wheat aphid was observed with monocrotophos.

On twentieth day after spray

The increase in the number of aphids showed an interesting phenomenon. Here the population of aphids significantly increased to maximum number besides insecticidal treatment and also in the control. The infestation ratio in plant was maximum at this stage. Such an increase in population can be attributed to migration and peculiar reproduction pattern of the aphids

On thirtieth day after spray

The number of aphids increased only under control condition. The population of aphids and armyworm significantly declined with all other insecticidal formulations used. Total eradication of wheat aphids took place with monocrotophos treatment.

On fortieth day after spray

The number of aphids marginally decreased in control conditions but there was significant decline in the number of aphids with different herbal and chemical insecticidal treatments used. The number of armyworm larvae and the plant infestation rate showed similar declining pattern.

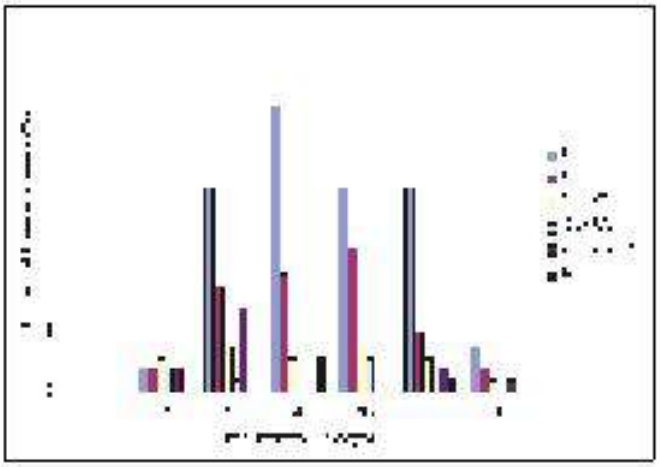


Fig. 2. Effectiveness of different insecticidal treatments against larvae of armyworm

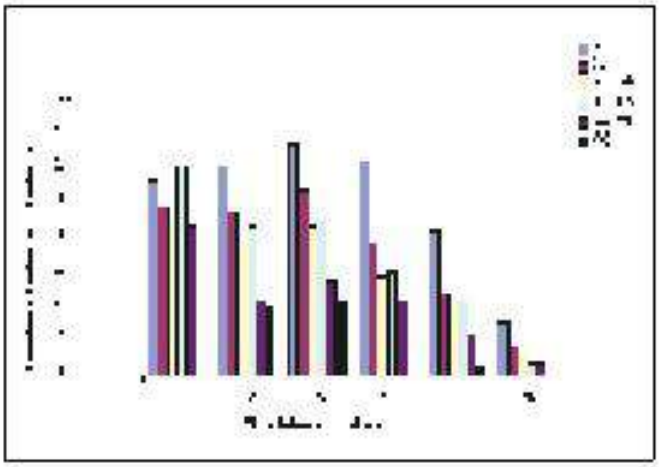


Fig. 3. Efficacy of different insecticidal spray against number of infested plants per plot

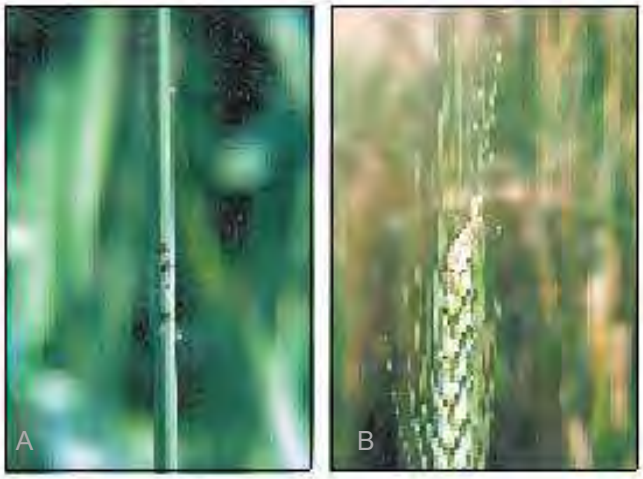


Fig. 4. Wheat plants affected with aphid (a) and armyworm (b)

population of aphids. Regarding the comparative efficacy of different treatments, statistically they were at par, though CU + VN + FA was the best, followed by CU + FA and CU + VN for aphid control.

Similar was the case with larvae of armyworm, but CU + VN + FA was followed by CU + VN, CU + FA and CU respectively. Regarding infested plant/ plot, CU + VN + FA and MC treatments showed significantly less infested plants as compared to control. The other treatments did not give significant results and the results remained consistent in different days of observations.

Statistically it is revealed that MC was the most



Fig. 5. Armyworm larvae infesting wheat crop on day 40; wheat crop on day 40 after spray and the crop at maturity

On fiftieth day after spray

The decrease in number of aphids and armyworm larvae took place in all the plots with a marginal difference in CU + VN and CU + FA treatments. The total eradication of wheat aphids and larvae of armyworm took place in plots treated with monocrotophos and CU + VN + FA. These results show that the combination of CU + VN + FA as bio-pesticide was significantly more effective in controlling the infestation of wheat aphid as compared to other biopesticide treatments.

Statistically all the treatments are at par. Though quantitatively the CU+VN was least effective, followed by CU, CU + FA, the remaining two, i.e. CU + VN + FA and MC were significantly most effective in reducing effective treatment in controlling the aphids fully except on 20th day. The CU + VN + FA controlled the insect pest completely only after 40th day. Other treatments did not fully control the pests, though they reduced the aphid population significantly as compared to control. Combined treatments was more effective than sole treatments, and the best combined treatments was CU + VN + FA.

The population of armyworm larvae showed an increase till 20th day, after which it declined. All the treatments were effective after 1st day. All the treatments except CU alone, including MC were almost equally effective in controlling the larvae of armyworm.

The results revealed that toxicity in terms of different insecticide formulation was maximum

with CU + VN + FA in comparison with CU+VN and CU+FA, suggesting that addition of *nirgandi* (*Vitex negundo*) and hing (*Ferula asafotida*) to cow urine acts as a catalyst. These results also indicate that cow urine with addition to above mentioned herbs is a slow-acting insecticide in comparison to chemical method of insect control with monocrotophos.

CONCLUSION

The results revealed that cow urine in combination with *nirgandi (Vitex negundo)* and hing *(Ferula asafoetida)* helps in reducing infestation of aphid and armyworm in wheat crop. However, these pesticides act at a slower rate in comparison to monocrotophos.

Code : **169**

Title of the ITK : **Control of *Helicoverpa* in groundnut**

Description of the ITK : *Helicoverpa armigera* in groundnut is controlled by spraying leaf extract of *Prosopis juliflora*. Total 200 ml of prosopis leaf extract is taken in 10 litres water for spraying. This practice is in use in village Thummanayakkanpatty village of Madurai district in Tamil Nadu.

Name and address of the discloser : Shri M. Jagadeesan, S/o. Shri C. Muniyandi, South Street, Chelaimalaipatty, Thumanayakkampatty, Peraiyur, Madurai (Tamil Nadu) 625 703

Location of use of the ITK : South Street, Chelaimalaipatty, Thumanayakkampatty, Peraiyur, Madurai, (Tamil Nadu) 626 703

Geographical indicators : *Prosopis juliflora*

Common name : *Karuvelam* in Tamil

Botanical name : *Prosopis juliflora*

Family : Mimosoideae

Description

Perennial deciduous thorny shrub or small tree, about 12m tall; trunk to 1.2 m in diameter, bark thick, brown or blackish, shallowly fissured; leaves compound, commonly many more than 9 pairs, the leaflets mostly 5_10 mm long, linear-oblong, glabrous, often hairy, commonly rounded at the apex; stipular spines, if any, yellowish, often stout; flowers perfect, greenish-yellow, sweet-scented, spikelike; corolla deeply lobate. Pods several-seeded, strongly compressed when young, thick at maturity, more or less constricted between the seeds, 10_25 cm long, brown or yellowish, 10_30_seeded. Seed compressed and oval or elliptic, 2.5_7 mm long, brown (Reed, 1970).

Distribution

Originally Central and/or South American, the mesquite is now pantropically introduced and establishing, often as a weed. It is classified as a principal weed in Mexico, a common weed in the US (but does not naturally occur in the US, this report due to the long prevailing taxonomic confusion), and a weed in Australia, Dominican Republic, India, Iraq, and Venezuela. According to the NAS, the tree ranges from sea level to 1,500 m. According to the taxonomic work of Burkart (1976), neither *P. juliflora nor P. chilensis, as now defined, occur in the US.*

Experimenters : Dr Sabitha Doraiswamy, Professor of Plant Pathology, Centre for Plant Protection Studies; Dr S. Palaniswamy, Professor and Head; Dr P. Karuppuchamy, Professor of Entomology, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) 641 003

METHODOLOGY

Location

The experiment was conducted in farmers field at Aliyar Nagar, Pollachi, Coimbatore.

Unstructured interview was conducted to obtain information on the use and methods of ITK.

Experiment

Groundnut is attacked by a polyphagous pest, called Helicoverpa armigera. This makes irregular feeding marks on the leaves and flowers. It causes up to 20% damage to groundnut in many parts of the groundnut growing areas.

The incidence of leafminer (Aproaerema *modicella) was also recorded.*

A field experiment was cnducted with the following 3 treatments: (a) Prosopis juliflora leaf extract spray, (b) Spray of Endosulfan 35EC (0.07%), and (c) Untreated check.

Each treatment was put in an area of 2 cents with seven replications. Endosperm and leaf extract of Prosopis juliflora were sprayed thrice at 15 days interval.

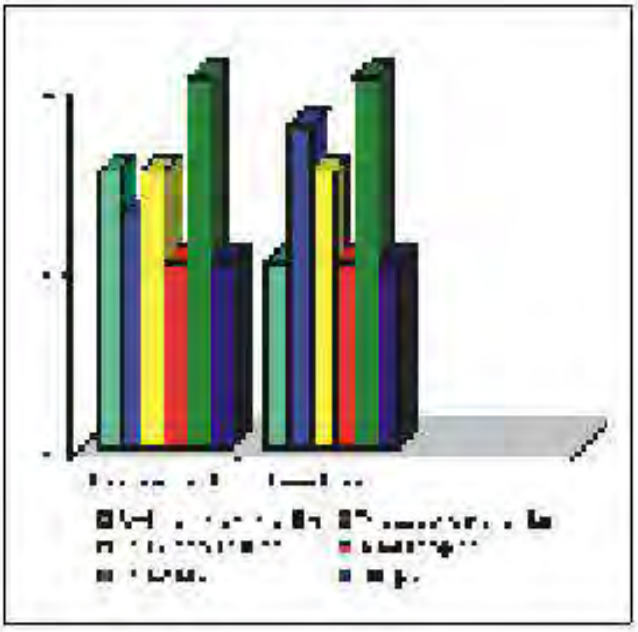


Fig. 1. Relative performance of Prosopis juliflora leaf extract on groundnut pest control

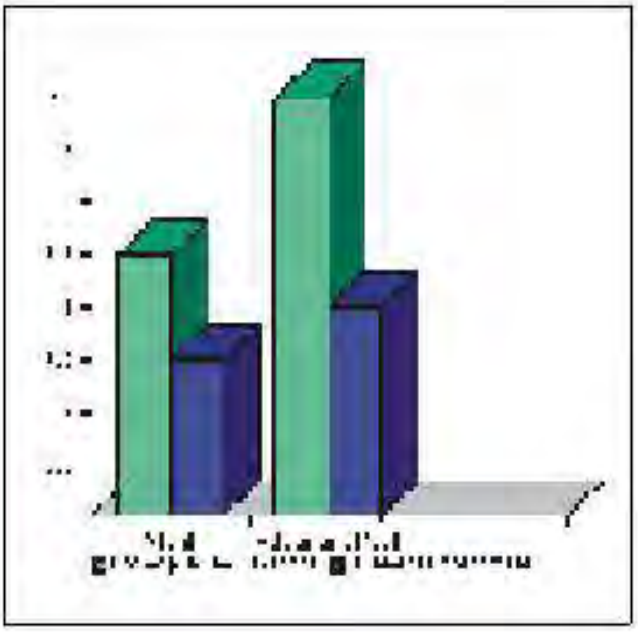


Fig. 2. Relative performance of Prosopis juliflora leaf extract on groundnut yield

RESULTS AND DISCUSSION

PRA and field study

As a result of the unstructured interview that was conducted, the following observations were made on how to prepare and use the leaf extract. *Prosopis juliflora leaves collected and ground* well with water. The filtrate is taken separately. Then 200 ml extract was mixed with water to make up into one spray tank. Hand spray or power spray are used to spray in the field. Spraying continued with an interval of 15 days until it got cured. This resulted in minimizing damage of

Table 1. Management of Helicoverpa armigera in groundnut using Prosopis juliflora leaf extract

Treatment	Pre- treat-ment count	Larvae/20 plants			Yield (kg/ plot)
		After I spray	After II spray	After III spray	
Prosopis juliflora extract0.29		0.29[a]	2.86[b]	2.14[b]	9.80[b]
Endosulfan (0.07%)	0.29	0.00[a]	0.57[a]	0.14[a]	11.85[a]
Untreated check	0.43	0.43[a]	3.14[b]	3.00[b]	9.60[b]

Note: Means followed by a common letter are not significantly different at P=0.01.

Table 2. Management of surul poochi (Aproaerema modicella) in groundnut using *Prosopis juliflora leaf extract*

Treatment	Pre- treat-ment count	Larvae/10 plants			Yield (kg/ plot)
		After I spray	After II spray	After III spray	
Prosopis juliflora extract0.86		3.14[a]	3.00[b]	3.71[b]	9.80[b]
Endosulfan 0.07%	1.14	0.57[a]	0.71[a]	0.57[a]	11.85[a]
Untreated check	1.14	4.14[a]	3.57[b]	4.29[b]	9.60[b]

Note: Means followed by a common letter (a and b) are not significantly different at 5% level.

groundnut , caused by Helicoverpa armigera.

The matrix scores shown in Figs 1 and 2 indicate the relative performance of Prosopis *juliflora leaf extract on control of pest and yield* of groundnut.

The results obtained suggest that leaf extract of Prosopis juliflora is more effective in control of Helicoverpa than other pests. Its application also improves the yield of ground as compared to chemical treatment.

The results obtained (Tables 1 and 2) show that spraying of Endosulfan at 0.07% was highly effective against Helicoverpa armigera and surul *poochi (Aproaerema modicella) in groundnut by* recording very low population as compared to the other two treatments. Spray of Prosopis juliflora leaf extract recorded higher larval population, which was on a par with that of untreated check. Hence spraying of Prosopis juliflora leaf extract three times at 15 days interval was not effective in reducing the population of Helicoverpa *armigera and surul poochi. The yield was also* higher and significantly superior in Endosulfan-sprayed plots than is the other two treatments. There was no significant reduction of the pest.

CONCLUSION

Spraying of Prosopis juliflora leaf extract three times at 15 days interval starting from the occurrence of the pest is not effective in reducing the population of Helicoverpa armigera and surul *poochi (Aproaerema modicella) as claimed by the* discloser.

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Code : 1117

Title of the ITK : Control of termites in sugarcane field by applying lime **and salt**

Description of the ITK : Farmers grow wheat, sugarcane and pearl millet in sandy loam and loam soils. About 60% to 70% of cultivated area is irrigated. Termite attack is observed mostly in sugarcane crop. Wheat crop is also attacked by termites. Lime and salt are very effective in controlling the termites in sugarcane field. Farmers apply 2.5 kg lime and 5 kg salt to the soil of sugarcane field to control termites. Sugarcane crop is saved from termites by 60% to 70%. This practice is in use in Bareilly and Shahjahanpur districts in Uttar Pradesh.

Name and address of the discloser: **Ms Husan Afzal, Primary School Teacher, C/o (late) Ilyas** Fatima, Vedon Tola, Bund Gali, Buduan (Uttar Pradesh)

Location of use of the ITK : The ITK is used in Bareilly and Shahjahanpur Districts of Uttar Pradesh

Experimenters : Dr Baldeo Singh, Principal Scientist, Division of Agricultural Extension, Indian Agricultural Research Institute, New Delhi; Dr D.K.Garg, National Centre on Integrated Pest Management, New Delhi, Dr R.N.Padaria, Sr. Scientist and Dr Poonam Sharma, Scientist (S.S.) Division of Agricultural Extension, Indian Agricultural Research Institute, New Delhi

METHODOLOGY

Location

Field study through PRA was conducted in seven villages (Dohna, Manda, Kamua, Purenatal, Daura, Tanda and Khata) of Bareilly district and Harela and Hareli villages of Shahjahanpur district of Uttar Pradesh. On-farm trials were conducted in Dohna, Dabhora and Manda villages of Bareilly district and Hareli village of Shahjahanpur district of Uttar Pradesh.

PRA and field study

Farmers of Khata, Kamuan, Manda, Dohna, Daura Tanda and purenatal villages of Bareilly district were interviewed through PRA matrix. The matrix was ranked on seven criteria with respect to technological options (lime + salt, salt alone and chemical control) for management of termites in sugarcane. It was administered to 20 key informants individually as well as in groups. Matrix ranking for the relative performance of the options with respect to each criterion was done with scoring pattern of 0–10. The criteria for scoring were efficacy, resource availability, cost of options, ease in use, yield and side effect to soil and crop.

There are certain reports indicating the use of lime (calcium carbonate) along with other substances against termites in sugarcane. Thin films of gelatin solutions containing 10% calcium carbonate or 5% copper sulphate or sodium



Fig. 1. Termites in mid-rib of infested cane setts

silicate containing 12% calcium carbonate (lime) + 10% zinc oxide coated on wooden stakes prevented the termite attack for 2, 4, 5 years in Pakistan (Roomi, 1990).

When used as an mixture with plant powder against stored maize and bean pests, it increased the effectiveness of some plant powders (Araya *et al. 1996).*

Mineral salts (calcium carbonate, sodium chloride) proved effective against red flour beetle, (Tribolium castaneum) (Reddy et al. 1999).

In Brazil, salt mixed with insecticides proved effective against pentatomid bug, Nezara viridula, especially methamidophos 90 g a.i./ha + NaCl (0.5%), which gave excellent results (Corso and Gazzoni 1988).

Salt was also included in a study for controlling cotton leaf- worm, (Spodoptera littoralis), in which it was found antifeedant and caused larval mortality (Farrag, 1991).

Efficacy of bio insecticide (Delfin) against S. *littoralis larvae increased with addition of sodium* chloride (1%) solution (1996).

Protection of wood against longhorn beetle has been reported with vaccum impregnation of 100 g/ litre sodium chloride with complete mortality of larvae within 4 weeks (Hertel, 1997).

Sodium chloride as insecticide enhancer for controlling pentatomids of soyabean (with monocrotophos and methamidophos) has also been reported (Sosa-Gomez et al. 1993).

Singh and Ram Kishan (1946) found 40–60% eye-buds destroyed by the termites. Agarwal (1955) estimated a loss of 2.5% in tonnage and 4.47% in sugar output. In infested plant, the outer leaves begin to dry up first. Severely damaged plants can be easily pulled out. They attack eye-buds, setts, shoots and the cane stalks during pre-monsoon months.



Fig. 2. Cane setts infested with termites

The work on devising control measures against termites appears to have been initiated in 1934 mostly with plant products, wood preservatives, sanitary fluids, proprietary products, and inorganic and other pesticides. Soaking of setts for 24 hours in lime and lead arsenate in 10:1 ratio has been reported by Agarwal and Siddiqi (1964) for the management of this pest.

Experiment

On-farm validation trials were laid out at village Dohna of Bareilly district with October planting of sugarcane. Further trials were also laid out with February planting of sugarcane.

Four trials, one at Dabhora and three at Manda village of Bareilly district were laid out with pre-sowing treatments of lime and salt (ITK), salt alone, and phorate as chemical control measure. At Hareli village of Shahjehanpur district, trial

was laid out with treatments in standing crop.

Just before placing the setts in the trench, soil applications of treatments were made based upon germination percentage of setts the infestation percentage was worked out. Those setts which failed to germinate were dug out in all cases of the treatments.

On-farm trials were laid out with the farmers for validation of the ITK using RBD design having four treatments, viz. T_1 (lime 39 kg/ha + salt 78 kg/ha), T_2 (salt alone 78 kg/ha), T_3 (phorate 10 kg/ha) and T_4 (control).

The technical parameters considered weire: (i) pattern of insect pest infestation , (ii) soil type, (iii) crop stage for appropriate management and applications, (iv) Impact on healthy crop stand, (v) percentage of insect pest reduction and (vi) association with other pests. The economic parameters were: yield and cost-benefit analysis.

RESULTS AND DISCUSSION

PRA and field study

The result of PRA matrix ranking shows significant difference in technological options of chemical control, application of lime and salt as well as salt alone (Table 1). For efficacy, chemical control measure ranked higher.
Application of salt alone ranked higher for cost effectiveness, ease of use and yield. Variation among the technological options for criteria of side effect to soil and crop was not significant, though they ranked chemical measure higher for it.

Matrix ranking was repeated among farmers of Harela and Hareli villages of Shajahanpur district. (Table 2). Farmers of Shajahanpur region too perceived chemical measures more efficacious in management of termites in

Table 1. Matrix ranking for management of termite in sugarcane in Bareilly district

Criteria	Technology options		
	Lime + salt	Salt alone	Chemical control
Efficacy	6.6	7.6	8.35
Resource availability	7.55	7.65	7.40
Cost of options	8.30	8.35	6.00
Ease in use	6.80	8.60	6.95
Yield	8.00	8.30	6.55
Side effect to soil and crop	5.95	6.85	7.10

Table 2. Matrix ranking for management of termite in sugarcane in Shahjahanpur district

Criteria	Technology option		
	Lime and salt	Salt alone	Chemical control
Efficacy	4.90	5.80	7.60
Resource availability	7.10	7.50	4.90
Cost of options	6.30	7.10	4.70
Ease in use	6.90	7.60	4.80
Yield	6.10	6.60	5.40
Side effect to soil and crop	4.60	5.10	7.30

Table 3. Pre-sowing treatment and impact on germination of setts and pest infestation

Treatment	Germination	Infestation
Lime + salt (ITK)	78.6	14.6
Salt	77.4	12.8
Chemical control (phorate)	81.3	11.5
Control	58.6	34.2

comparison to the salt, though they ranked salt higher for other criteria like availability, cost, ease in application, yield and harmful effect to soil and crop.

Farmers reported that incidence of termite is more in light soil . Soil application of lime and salt in trenches before placing the cane setts kills the termites and thus setts are saved from their damage. Users felt that soil being light, the salt is leached with irrigation and thus the side- effect of salt to soil is minimized.They considered lime helpful for their soil. It helped in managing termites in sugarcane as well as khaira disease in rice. Common salt was found to be a very useful input. They stressed that common salt not only helped in management of termites in sugarcane as well as rice but also improved the health of both the crops. When they found these crops becoming yellow, common salt was broadcast after irrigation. They claimed that its impact was quick. Plants turned dark green and remained healthy. Common salt performed better than urea. Also, lime and salt were cheaply and readily available.

They also stressed that yield was higher with use of salt in sugarcane and rice; however, in sugarcane the sweetness become poor.

Common salt is mostly used in uplands and light soil as well as leased- in lands. Educated farmers shared that salt application was popular with small and marginal farmers as well as share-croppers. They expressed concern about fertility of soil in their area with continuous use of salt by uneducated farmers.

Experiment

In the control plot, about 34% setts were damaged by termites (Table 3). The termite infestation were found to be 14.6,12.8 and 11.5 in plots with treatments of ITK, salt alone and phorate respectively.

Besides other factors like diseased setts, termite infestation was mainly responsible for effecting the germination of setts. The setts were eaten up and made hollow by the termites. About 5–10 termites were found per sett. Apparently the finding showed that termite infestation was managed by the application of salt along with lime as well as alone, though it was not at par with phorate. However, the mode of action of lime and salt in controlling the termites needs closer examination to draw conclusion about the effectiveness of lime and salt for termite management in soil.

The trial is in progress. Three trials had to be abandoned in midway as the farmer obtained for intercrops in the plots. With intercropping and varied agronomic practices the conditions did not remain ideal for the trial.

Trial in standing crop

Trial was also laid out with treatments in standing crop at Hareli village. The plots selected for the trial was ideal , as about 90% infestation was observed. The standing crop was yellow, with germination gap of 30–40%. Even the germinated setts had infestation of termite. The population range of termite was 10–20 per sett. The soil of the trial plot was sandy loam.

The standing crop was treated with lime and salt, salt alone and phorate. Observations for population of termite, crop health and new germination were taken after 7 days and 15 days. Incidence of 61.3, 64.6, 44.2% was observed in the plots treated with lime and salt, salt alone and phorate respectively (Table 4). The findings indicate that population of termites around the setts is reduced with the use of ITK.

Table 4. Treatment in standing crop and incidence of termites

Treatment		Incidence (%)
T_1	Lime + salt (ITK)	61.3
T_2	Salt	64.6
T_3	Phorate	44.2
T_4	Control	90.4

CONCLUSION

The use of ITK (lime+salt) showed positive effect on the control of termite, though comparatively less than the recommended practice of using phorate. However, the reduction in population of termites could not be attributed to lime and salt, as the irrigation too affected the mobility pattern of termites in the soil. Further, the replications were not sufficient to draw valid conclusion. The experiments are still in progress and the results are awaited.

In the second condition of ITK application in standing crop, though termite infestation was observed in the setts, restoration of health and vigour of the crop were observed. Earlier, the crop was pale yellow in colour, sickly and with poor growth.

❑

Code : 1419

Title of the ITK : Control of termite by horse droppings in sugarcane field

Description of the ITK : Insecticidal properties present in horse drop controls termite infestation in sugarcane field. Horse droppings are mixed with the soil of sugarcane field @ 100 g/ha by ploughing and left for a few days. This ITK is practised in Trikuti village of Deoghar Block of Deoghar district (Jharkhand). It controlled 70% of t ermite infestation. Cost: benefit of this practice is approximately 1:10. About 30–40% loss in production, and almost all sugarcane fields are affected by termite in the referred village.

Name and address of the discloser: **Shri Satyendra Singh, Agrarian Assistance Association,** Bandarjori, Dumka (Jharkhand)

Location of use of the ITK : Village Trikuti, Block Deoghar, Deoghar (Jharkhand)

Experimenters : Dr P.K. Singh, Jr. Scientist (Entomology) and Dr Moti Ram, Associate Director, Zonal Research Station, Dumka (Jharkhand)

METHODOLOGY

Location

The experiment was conducted in village Trikuti, block dis Deoghar, Deoghar (Jharkhand).

PRA and field study

The reported ITK was compared with chemical control measure and another ITK i.e. use of kerosene oil through PRA by involving 15 respondents. The parameters or factors included the extent of termite control, performance of crop and yield.

Experiment

The experiment was conducted in the third week of February 2003 in RBD design in 10 replications having four treatments, viz. T_1:



Fig. 1. Sugarcane field treated by horse droppings to control termite

Table 1. Matrix scoring for assessing the performance of application of horse droppings in controlling termite infestation in sugarcane field

Parameter	Use of horse droppingsoil	Use of kerosene	Chemical control
Extent of termite control	7.8	5.6	7.2
Performance of crop	8.5	6.0	8.0
Yield	8.4	6.5	8.2
Availability	4.9	8.0	6.4
Cost effectiveness	9.0	5.0	8.0

Table 2. Effect of application of horse droppings on termite incidence and mortality in sugarcane

Treatment	15 DAP		45 DAP	
	Termite incidence (%)	Mortality due to other factors (%)	Termite incidence (%)	Mortality due to other factors (%)
Control (T_1)	26.41 (30.92)	0.48 (3.97)	37.29 (37.64)	0.34 (3.34)
Folidol dust @ 25 kg/ha (T_2)	7.43 (15.82)	0.32 (3.24)	4.97 (12.88)	0.27 (2.98)
Horse droppings @ 100 kg/ha (T_3)	3.51 (10.74)	0.62 (4.52)	4.57 (12.34)	0.29 (3.09)
Kerosene oil (cane tip dipping) (T_3)	11.66 (19.97)	8.45 (16.99)	12.68 (20.86)	0.40 (3.63)
SEMą	0.82	0.98	0.73	NS
CD at (P=0.05)	2.40	2.94	2.19	NS

DAP, Days after planting.

control, T_2: soil treatment with folidol dust @ 25 kg/ha (15 days before transplant of sugarcane); T_3: use of horse droppings @ 100 kg/ha; and T_4: sugarcane tip dipped in kerosene oil. The plot size was 500 m^2 **for each treatment.**

RESULTS AND DISCUSSION

PRA and field study

Data on the field study conducted through PRA have been presented in Table 1. The results show that the reported ITK, i.e., application of horse droppings, was rated superior to both the chemical control measure and use of kerosene oil in all respects except availability, as the population of horses nowadays has decreased. This ITK is an age-old practice, regarding which a majority of the respondents (72%) opined that the ITK was effective up to 80%.

Experiment

The results given in Table 2 indicate that application of horse droppings 15 days before planting reduced the infestation of termite (3.5%) as compared to use of chemical insecticide (7.43%) and kerosene oil (11.66%). Maximum damage (26.41%) was recorded in control plots. Significantly higher percentage (8.45%) in mortality of plants was recorded in kerosene oil treatment due to its toxic effect, which hampered the germination of sugarcane. Low incidence (4.57%) of termite was recorded in horse droppings at 45 days after planting which was at par (4.97%) in chemical insecticide treatments. Incidence of termite was 12.68% in kerosene oil-treated plots, which was maximum (37.29%) in the control. At 45 days after planting low percentage of mortality was recorded in all the treatments due to other factors.

CONCLUSION

The ITK (application of horse droppings) was found to be effective as that of use of folidol for controlling termite in sugarcane field.

Code : **2039**

Title of the ITK : **Pingali dhanti for intercultural operation in tomato.**

Description of the ITK : Bullock drawn pingali dhanti can be effectively used for weed control in tomato both during kharif and rabi instead of hand weeding. It can cover an area of one acre per day with a cost of operation of Rs 150/ha. By adopting this, clean weeding is achieved. It costs about Rs 100.

Name and address of the discloser : Shri B. Narsimha Rao, Meerkhanpet, Kandukur, Ranga Reddy (Andhra Pradesh)

Location of use of the ITK : Meerkhanpet Village, Kandukur Mandal, Ranga Reddy (Andhra Pradesh)

Experimenters : Dr B. Sanjeeva Reddy, Scientist (FMP), Dr G. Nirmala, Scientist, (Sr. Scale, Agricultural Extension) and Dr G.Subba Reddy, Scientist (Agronomy), Central Research Institute for Dryland Agriculture, Hyderabad

METHODOLOGY

The Meerkhanpet village of Kandukur mandal of Ranga Reddy district where the ITK is being practiced was chosen for validation during 2001_02. The farmers in that village were stratified as per the size of the holding into marginal (<1.0 ha), small (1_2 ha), medium (2_4 ha) and big (> 4.0 ha). The farmers for this investigation were selected by stratified random sampling, representing 5% under each category. Focus group interactions were organized to identify the farmers voluntarily to participate in the validation process.

The implement as per the specifications of pingali dhanti was fabricated with the help of local artisan during June 2002. Six farmers representing different categories were selected and trained to acquaint the various methodologies to implement the programme of validation. Based upon the interaction of selected farmers, an understanding was developed between the farmers and facilitators of the investigation in selection of the experimental sites, implemen-tation of the programme and collection of the pertinent data. The data for the investigation were collected jointly by the farmers and facilitators. This process facilitated increase in the participation of the farming community and also bringing about awareness on the utility of the indigenous implement and recording the farmers' indicators on the efficiency and effectiveness of the implement under their own situations. Each farmer was treated as a replication, and statistical analysis of data was done for various parameters to find out actual effectiveness of the treatments.

The parameters such as field capacity, weeding efficiency and draft of the implements were worked out based upon the following considerations.

Fieldcapacity: It is the actual average rate of field coverage by the implement (ha/day or ha/hr)

Weeding efficiency: It is the ratio of weeds removed by interculture implement/weeding tool to the weeds present in the field before weeding operation; generally the weeding efficiency is computed by the following formula:

$$Wn = [(Wc \_ Wt)/Wc] в 100$$



Fig. 1. Pingali dhanti



Fig. 2. Traditional blade harrow

Where, Wn, weeding efficiency; Wc, total weed count before weeding per unit area; and Wt, total weed count after weeding per unit area.

Draft of implement: The horizontal component of pull requirement to pull each implement was measured using spring-type dynamometer (kg).

Energy expenditure: To obtain better comparative results, the energy required to carry out interculture and weeding operations under each treatment were converted into energy units using standard conversion factors, and total energy expenditure per hectare was calculated.

Thr specifications of the implements used for validation of ITK are as follows:

Pingali dhanti (Fig. 1.) 500/-

Frame width: 25 cm
Frame length: 30 cm
Height of the frame at the blade point: 60 cm
Effective blade length: 35 cm
Total weight of the implement: 45 kg

Traditional blade harrow (Fig. 2) 500/-

Frame length: 53 cm
Height of the frame at the blade point: 38 cm
Effective blade length: 29 cm
Total weight of the implement: 25 kg

Filed trials were conducted in Meerkhanpet village with the following treatments using five replications in farmers' fields : T_1, Interculture with pingali dhanti; T_2, Interculture with traditional blade harrow; T_3, T_1 + hand weeding twice; and T_4, T_2 + hand weeding twice.

Tomato (Kanchana) was used as the test crop during kharif 2002.

Table 1. Evaluation of indigenous pingali dhanti in tomato in rainfed alfisols

Treatment		Fruit yield (kg/ha)	Gross income (Rs/ha)	Cost of production (Rs/ha)	Net income (Rs/ha)	B:C Ratio
T_1	Interculture with pingali *dhanti*	2,204.4	11,022	9,419	1,603	1.170
T_2	Interculture with traditional blade harrow	2,216.0	11,080	9,397	1,683	1.179
T_3	T1 + hand-weeding	2,541.6	12,708	9,745	2,945	1.304
T_4	T2 + hand-weeding	2,459.6	12,298	9,772	2,526	1.258
	CD (P=0.05)	128.19	641	104	603	0.063

Farm Implements

Observations recorded were: 1. Field capacity of the implements (ha/day), 2. Drudgery or draft (kg), 3. Weeding efficiency (%), 4. Total energy expenditure (MJ/ha), 5. Cost of each operation for various implements, 6. Cost of production (Rs/ha), 7. Gross income (Rs/ha), 8. Net income (Rs/ha), 9. Cost benefit ratio, 10. Farmers reaction (performance of the implements).

RESULTS AND DISCUSSION

The experimental site in Meerkhanpet village on an average received 394 mm rainfall as against a normal rainfall of 552 mm received during May to October 2002. The crop in different farmer's fields experienced a dry spell of 30 days during vegetative phase and 13 days at the time of flowering during life-cycle of the crop. However,

Table 2. Engineering parameters as influenced by intercultural tools in rainfed tomato

Treatment		Field capacity (ha/day)		Weeding efficiency (%)		Drought (kg)		Energy (MJ/ha)	
		Days after transplanting							
		15	45	15	45	15	45	15	45
T_1	Interculture with pingali dhanti	0.650	0.464	69.06	57.76	163.98	179.7	149.74	210.46
T_2	Interculture with Traditional blade harrow	0.664	0.482	68.16	59.38	164.22	182.9	145.94	205.94
T_3	T_1 + hand weeding	0.650	0.464	92.38	85.60	163.98	179.7	181.52	319.38
T_4	T_2 + hand weeding	0.664	0.482	90.60	87.76	164.22	182.9	179.30	339.14
	CD (0.05)	NS	NS	7.288	6.324	NS	NS	14.878	43.91

Table 3. Perceptions of farmers on performance of intercultural tools in rainfed tomato

Performance indicator	Traditional interculture	Indigenous interculture
Coverage of the implement	* * * *	* * * * *
Time of operation during the crop growth period	* * * *	* * * * * *
Effect on controlling of weeds	* * *	* * * *
Draught power	* * * * *	* * * * * *
Cost of implement	* * * *	* * * *
Economic benefit with the operation	* * *	* * * * *
Availability of the implement	* * * * *	* *
Ease in handling	* * *	* * * *
Cost effectiveness	* * * *	* * * * *
Ease in fabrication	* * * * *	* * *
Ease in repair and maintenance	* * * *	* * *
Drudgery in operation	* * *	* * * * *
Durability of the implement	* * * * * *	* * * * * * *
Replicability of the implement	* * * * * * * *	* * * * * * *
Suitability of the implement for different categories of the farmers	* * * *	* * * * * *

*Indicates number of stones preferred by the farmers to know the advantage of the parameter.

rainfall (90 mm) received during October improved the productivity of tomato in different pickings. The results obtained over the farmers fields indicated that there was significant difference with regard to yield, gross and net returns and B:C ratio between the indigenous intercultural tool (pingali dhanti) and traditional blade harrow (Table 1). There was no significant variation between pingali dhanti and indigenous blade harrow in respect of field capacity, draft and energy at 15 and 45 days after transplanting of rainfed tomato (Table 2). However in combination of hand weeding either with pingali dhanti or blade harrow enhanced the fruit yield of tomato by 13% compared to the interculture implements only (2,164 kg/ha). The operation of the interculture tools beyond 45 days could not be implemented due to severe drought that followed. To verify the fact of feasibility of pingali dhanti, its use more number of times beyond 45 days could not be established during this year. However, the perception of the farmers regarding the performance of pingali dhanti up to 45 days was collected by the group of the farmers while operating the tool in the farmer's fields (Table 3). The conclusions derived from the focus group interactions are: pingali dhanti is superior to traditional blade harrow in terms of coverage, extended period of operation during the crop growth period and high effect on controlling of weeds, easy in handling, cost effectiveness, durability and replicability of the implement. The traditional blade harrow has edge over indigenous tool in terms of the cost, availability and ease in fabrication.

CONCLUSION

The draught power and energy requirement of pingali dhanti is within the limit of power available from an average pair of draught animals. The work rate and weeding efficiency observed for the pingali dhanti are comparable with those of blade harrow.

Code : 1434

Title of the ITK : Evaluation of kurur - farm implement for land levelling

Description of the ITK : Kurur is cheap and simple equipment for land levelling. Rectangular wooden board tagged with iron chain on the front side (chain is pulled by drought animal) is slid over the ploughed unlevelled field. It carries the soil from upper side of the field to lower side and is levelled. The practice is followed in Asanbra village of Tethaitangar block in Simdega district (Jharkhand). About 20% increase in yield was noticed due to levelled soil and equal distribution of soil moisture.

Name and address of the discloser: **Shri Anjelus Kerketta, Village Aasanbera Katahar Toli, P.O.** Latha Khaman, Block Thethaitanger, Simdega (Jharkhand)

Location of use of the ITK : Village Aasanbera, Post Latha Khamhan, Block Thethaitanger, Simdega (Jharkhand)

Experimenters : Dr. S. Choubey, Sr. Assistant Professor, Department of Agronomy, and Dr. R. P. Singh 'Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

Village Aasanbera, Post Latha Khamhan, Block Thethaitanger, Simdega (Jharkhand).

PRA and field study

In order to assess the performance of kurur in land levelling, participatory rural appraisal (PRA) was done. Kurur was compared with bullock drawn improved land leveller on the parameters of cost effectiveness, output per day, simplicity in use, availability of the implement, type of land where implement is used and choice of the farmers. In PRA exercise 20 respondents were involved.

Experiment

A field experiment was conducted in kharif season 2003 in Aasanbera village with three treatments, viz, T_1-Control (no levelling), T_2-Use of kurur for land levelling and T_3-Use of improved bullock drawn land leveller (patella). The experiment was laid out in randomized block design with 20 replications. Each treatment covered an area of 1,000 m^2. Rice was taken as a test crop. Observations on land and soil physical parameters, yield and yield attributes of rice were recorded to compare the performance of the two levellers, tried in the experiment.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 reveal that the improved leveller (patella) was rated to be superior in terms of output, whereas in terms of cost effectiveness, kurur was rated to be superior to the improved leveller. On other parameters also the kurur was rated to be superior than the improved leveller.

Table 1. Matrix scoring for assessment of kurur in comparison with improved land leveller

N=20

Parameter	*Kurur*	*Bullock drawn* improved land leveller (patella)
Cost effectiveness	8	(-) 2
Output	4	8
Simplicity in use	8	3
Availability	8	2
Type of land where used	8	2
Choice of the farmer	8	4

Table 2. Performance of land levellers on tillage characteristics and yield of rice

N=20

Parameter	Treatment		
	Control	Kurur	Patella
Area levelled (ha/day)	–	0.052	0.07
Percentage slope maintained	–	0.024	0.032
Distance of soil removal (m)	–	13.2	11.25
Seed germination (%)	73.9	86.8	89.9
Plant population/m^2	34	37	38
Plant tillers/m^2	208	379	392
Yield (q/ha)	13.25	23.18	23.73

Experiment

Results obtained showed that use of patella was advantageous in maintaining land slope effected by levelling compared to kurur (Table2). An area of 0.07 ha was covered using patella which was 0.052 ha by using kurur. Soil removal was also lesser with patella (11.25 m) as compared to kurur (13.2 m). Results on yield attributes reveal that the highest germination of seeds (89.9%) and plant population (38/m^2) were recorded where improved land leveller was used followed by plant population of 37/m^2 under T_2 where kurur was used. In the control plot (T_1), where land levelling was not done, the plant population was 34/m^2. However, there was no significant difference in plant population between the treatments.

The highest number of tillers (392/m^2) was recorded due to use of improved land leveller and it was similar to (379/m^2) after use of indigenous land levelling implement kurur. Improvement in crop growing environment that was resulted by use of patella, helped to harvest 23.73 q/ha rice which was 13.25 q/ha when preparatory tillage was not done. Use of kurur, however, gave a yield of 23.18 q/ha.

CONCLUSION

The results of the study showed that use of kurur for land levelling was as good as improved land leveler (patella) for establishing stand of rice crop. However, farmers reported that the improved land leveller is more efficient and less time consuming as compared to kurur. But kurur was reported to be local made, cheaper and compatible to the small sized draught animals, available in the area.

Code	**:**	**2132**
Title of the ITK	**:**	***Guddeli* to uproot ginger**
Description of the ITK	:	Good harvest with total recovery of ginger with less power is obtained by use of *guddeli* at harvest. It is easy to operate and cost of operation per hour is 300. The cost of *guddeli* is Rs 60 per piece.
Name and address of the discloser	:	Shri Pandu, Girgitpally, Vikarabad, Ranga Reddy (Andhra Pradesh)
Location of use of the ITK	:	Girgitpally Village, Vikarabad mandal, Ranga Reddy (Andhra Pradesh)
Experimenters	:	Dr B.Sanjeeva Reddy, Scientist, (Sr. Scale, FMP), Dr G. Nirmala, Scientist, (Sr. Scale, Ag Extn), and Dr V. Maruthi, Senior Scientist (Agron), Central Research Institute Dryland Agriculture, Hyderabad

METHODOLOGY

PRA and field study

The Girigatepalli village of Vikarabad mandal of Ranga Reddy district, where the ITK is being practised, was chosen for validation during 2002_03. The farmers in that village were stratified as per the size of the land holding into marginal (< 1.0 ha), small (1_2 ha), medium (2_4 ha) and big (>4 ha) farmers. The farmers for this investigation were selected by stratified random sampling,



Fig. 1. *Gudelli*- an indigenous tool for harvesting of ginger

representing 10% under each category. Focus group interactions were organized to identify the farmers voluntarily to participate in the validation process. The hand tools as per the specification of *guddeli* (Fig. 1) were fabricated with the help of local artisan during May 2002.

Experiment

Five farmers representing different categories were selected and trained to acquaint the various methodologies to implement the programme of validation. Based up on the interaction of the selected farmers, an understanding was developed between the farmers and facilitators of the investigation in selection of the experimental sites, implementation of the programme and collection of the pertainent data. The data of the investigation were jointly collected by the farmers and facilitators. This process facilitated increase in the participation of the farming community and also in bringing about awareness on the utility of the indigenous implements and recording the farmers' indicators on the efficiency and effectiveness of the implements under his own situation. Each farmer was treated as a replication, and statistical analysis of data was computed for

Table 1. Field capacity, energy, cost of planting, yield, gross income and net income as influenced by tools in ginger planting

Treatments		Field capacity (ha/day)	Energy (MJ/ha)	Cost of planting (Rs/ha)	Yield (kg/ha)	Gross income (Rs/ha)	Net income (Rs/ha)
T_1	Farmers method of planting	0.020	4461.368	1,225	12,695	1,52,340	87,165
T_2	Planting with *guddeli*	0.029	337.152	1,000	13,020	1,56,240	91,290
	Result	S	S	S	NS	NS	NS

S, Significant; NS, nonsignificant.

various parameters to find out actual effectiveness of the treatments. The parameters such as field capacity and energy required to carry out the operation using different hand tools were worked out based upon the following considerations.

Field capacity: It is the actual average rate of field coverage by the implement (ha/day or ha/hr)

Energy expenditure: To obtain better comparative results the energy required to carry out interculture and weeding operations under each treatment were converted into energy units using standard conversion factors and the total energy expenditure per hectare was calculated.

The experiment with the following four treatments was conducted in Girgitpally village of Ranga Reddy district on Andhra Pradesh with five farmers. Ginger (local variety) was taken as the test crop. T_1:farmers method of planting, T_2: planting with guddeli, T_3: farmers method of harvesting, and T_4: Harvesting with guddeli.

Observations were taken on the following aspects:

1. Field capacity of the implements (ha/day),
2. Total energy expenditure (MJ/ha),
3. Cost of each operation for various implements,
4. Cost of production (Rs/ha),
5. Gross income (Rs/ha),
6. Net income (Rs/ha),
7. Cost benefit ratio and
8. Farmers reaction (performance of the treatments).

RESULTS AND DISCUSSION

Experiment

The experimental site where the programme was implemented experienced delayed monsoon

Table 2. Field capacity, energy, cost of uprooting, yield, gross income and net income as influenced by tools in Ginger harvesting

Treatments		Field capacity (ha/day)	Energy (MJ/ha)	Cost of harvesting (Rs/ha)	Yield (kg/ha)	Gross income (Rs/ha)	Net income (Rs/ha)
T_1	Farmers method of planting	0.00442	1,841.92	5,644	12,990	1,55,880	86,286
T_2	Planting with *guddeli*	0.0053	1,537.45	4,648	13,167	1,58,004	90,486
	Result	S	S	S	NS	NS	NS

S, Significant; NS, nonsignificant.

Table 3. Cost of cultivation (Rs/ha) as influenced by planting and harvesting tools in ginger crop

Item	F_1	F_2	F_3	F_4	F_5
Land preparation					
No. of ploughing (3)	8,000	8,000	8,000	8,000	8,000
Furrow forming (1)	1,500	1,500	1,500	1,500	1,500
Cost of FYM	13,600	13,600	13,600	13,600	13,600
Seed cost/ha	31,500	31,500	31,500	31,500	31,500
Cost of basal application	2,250	2,250	2,250	2,250	2,250
Cost of top dressing	3,600	3,600	3,600	3,600	3,600
Plant protection operations	500	500	500	500	500
Weeding (3 times)	3,000	3,000	3,000	3,000	3,000
Total cost	63,950	63,950	63,950	63,950	63,950

arrival. Hence farmers took up planting only in June. Use o sickle and guddeli in planting of ginger is shown in Figs.1 and 2, respectively. The data pertaining to planting and harvesting operations are presented in Tables 1 and 2 respectively.

The results obtained indicate that there was not much difference in the field capacity among the treatments. However planting with guddeli reduced the energy expenditure and cost of operation considerably, i.e 36% and 22.5%, respectively in planting and harvesting of ginger (Table 3). This could be achieved because in treatment T_1 the planting operation was carried out by solely women labour in sitting posture, whereas in treatment T_2 it needed both women and men labour. Men labours loosen the soil on both sides of the ridge in a bending posture, followed by planting by women labour. The energy expenditure and cost of operation in harvesting of ginger roots were reduced by 19.8% and 21.43% in treatment T_4 when compared with T_3. This is because the impact of energy to penetrate the sickle to the root zone of ginger is not enough; it needed repeated action, which delayed the operation, resulting in more energy expenditure and cost of operation (Table 4).

Table 4. Additional cost (Rs/ha) involved towards imposition of treatments

T_1	Farmers method of planting	1,250	1,200	1,300	1,250	1,125
T_2	Planting with guddeli	1,100	950	1,025	1,000	1,000
T_3	Farmers method of harvesting	5,100	5,800	6,000	5,620	5,700
T_4	harvesting with guddeli	4,500	4,750	4,950	4,300	4,740

F, Farmer.

CONCLUSION

The guddeli can harvest 0.0053 ha/day compared to 0.0035 ha/day by farmer's method, i.e. using sickle. Nearly Rs 225 and Rs 1052 ha can be saved respectively in planting and uprooting of ginger roots by using guddeli compared to sickle. ❑

Code : **1856**

Title of the ITK : **Direct seeding of onion/lucerne seeds by using hand operated tool**

Description of the ITK : Direct seeding of onion/lucerne seeds is done by hand operated single bowl seed drill by the farmers of Ahmednagar district in Maharastra. It is a single purpose machine and man power is needed for operation. The cost of the implement is Rs 500 and it weighs 5 kg. 1.2 ha area is covered by a single pair of human labour in a day. The approximate life time of the implement is 3 years. The cost of operation is Rs 22/ha. Twenty five farmers of this village are using this method since 10 years.

Name and address of the discloser : Head, Department of Agronomy, Mahatma Phule Krishi Vishwavidyalaya, Rahuri (Maharashtra) 413 722

Location of use of the ITK : The seed drill is being used in Brahmani, Umbre, Vambori, Dhamori, Khadambe villages of Rahuri block in Ahmednagar district of Maharashtra.

Experimenters : Dr A.G.Wani, Sorghum Agronomist, Sorghum Improvement Project, Mahatma Phule Krishi Vishwavidyalaya, Rahuri (Maharashtra) 413 722

METHODOLOGY

Experimental method

Five experiments with onion and lucerne were conducted in farmers' fields during rabi season of 2002_03. Sowing was done in medium black soil having depth of 45_60 cm. The sowing by single bowl seed drill at a spacing of 12 cm between rows and 7.5 cm between the two plants was done with two labourers. The seeds were placed 2_3 cm depth with good soil contact and seed covering in flat beds having size of 3.0_2.4 m with fine soil tilth. Fertilization and plant protection measures were given as per the recommendation of each crop. Irrigations were applied as per the requirement of the crops.

Farmers method

Broadcasting method of sowing in flat beds in case of lucerne, and transplanting of seedlings of onion on ridges and furrows was done. The distance between two rows of lucerne was 30 cm and transplanting of seedlings of onion was done on both sides of the ridges with distance of 7.5 cm between two plants. Fertilization, plant protection and irrigation were applied as per the recommendations and requirement of the respective crops. For lucerne, N_P_K were applied @ 15_15_40 kg/ha at the time of sowing. Onion received 50_50_50 kg N_P_K/ha before transplanting. Top dressing with 50 kg/ha was done after one month of transplanting. Harvesting of onion was carried out in the month of April. Five cuttings were obtained from lucerne crop.

RESULT AND DISCUSSIONS

Experiment

*Onion:*Observations on growth recorded in onion crop, indicated that germination was upto 97% with use of seeding implement and the crop

Table 1. Growth, yield of onion and return as affected by seeding methods

Character		Sowing by implement	Sowing by farmers' method
Germination/survival		97%	95%
Plant height (cm) at	30 DAS	52	42
	60 DAS	62	56
	90 DAS	70	67
	At harvest	74	69
Green leaves/plant at	30 DAS	6.0	6.0
	60 DAS	7.8	7.2
	90 DAS	10.2	8.2
	At harvest	12.2	9.6
Bulb yield (q/ha)		321.8	424.4
Gross income (Rs/ha)		1,33,547	1,76,126
Net return (Rs/ha)		1,18,917	1,57,946

Table 2. Yield and economic parameters as influenced by different seeding methods in lucerne

Characters		Implement method (0.10 ha)	Farmer's method (0.10 ha)
Germination (%)		98	96
Green forage weight (q/ha) at		5.38	4.52
	1st cutting	11.96	10.32
	2nd cutting	12.84	11.60
	3rd cutting	13.15	11.65
	4th cutting	13.15	11.73
	5th cutting	56.39	498.2
	Total (tons/ha)		
Gross income (Rs/ha)		1,12,780	99,640
Cost of production (Rs/ha)		15,245	12,995
Net return (Rs/ha)		97,535	86,645

growth was excellent in the both the methods of sowing. Average plant height and number of green leaves were higher in implement method of sowing than farmer's method. However, average bulb yield of onion was 424.4 q/ha in case of farmer's method and 321.8 q/ha in case of implement method (Table 1). A net return of Rs 118917/ha was obtained by sowing onion by the implement which was Rs 1,57,946/ha in farmers method.

Lucerne: Observations on stand establishment, recorded in lucerne indicated that there was upto 98% germination. Forage yield of Lucerne in 5 cuttings was 563.9 q/ha by using the seed drill which was 498.2 q/ha in farmers' method. Net income in implement method and farmers' method were Rs 97,535 and Rs 86,645/ha, respectively

CONCLUSION

Results of the experiments suggest that use of seed-drill is advantageous to raising lucerne which is not true in case of onion. ❑

Grain/Seed Storage

Code	:	1463
Title of the ITK	:	Control of insect-pest infestation in stored grains/seeds through use of sinduar (*Vitex negundo*) leaves
Description of the ITK	:	Insect/pest attacks on the seed grains are very common. It is controlled by *sinduar* leaves. *Sinduar* leaves are dried and mixed with grains for storage. One kg *sinduar* leaf is required to store 100 kg food grains. By the help of this practice, 70_75% food grains are saved from grain weevil. This is in practice for last 40 years by maximum number of farmers in the Nawada district of Bihar.
Name and address of the discloser	:	Shri Md. Mahmood Alam, Tikodih, Paharpur, Kawakol, Nawada (Bihar)
Location of use of the ITK	:	In and around Sokhodeora and other villages of Nawada district (Bihar)
Geographical indicators	:	*Vitex negundo* is a large aromatic shrub with quadrangular, densely whitish, tomatoes branchlet, upto 4.5 m in height or some time a small, slender tree, found through out the greater parts of India ascending to an altitude of 1500 m in outer Himalayas.
Experimenters	:	Dr. S. Choubey, Sr. Assistant Professor, Department of Agronomy, and Dr. R. P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)
Facilitator	:	Shri N.P. Singh, Training Associate, K.V.K., Sokhodeora, Block Kawakol, Nawada (Bihar)

Methodology

Location

Village Sokhodeora, Block Kawakol, Nawada (Bihar)

PRA and field study

PRA method was applied to determine the efficacy of *sinduar* leaves in controlling the insect-pest of stored grain/seed with randomly selected 20 respondents, who were using this practice. The efficacy of the ITK was assessed in terms of extent of control of stored grain, germination percentage, duration of control, cost effectiveness, simplicity in use, availability and choice of the farmers in comparison to the use of recommended chemical pesticide.

Experiment

An experiment was initiated in April 2003 with 20 replications in villages of Kawakol, Tikodih and Sokhodeora to assess the effectiveness of *sinduar* leaves in controlling stored grain pests of wheat in three sets of conditions having three treatments in each condition. Thus altogether 9 treatments were taken into consideration under CRD design. The treatments were; T1-Grain/seed stored in gunny bag without any treatment; T2- Grain/seed stored in earthen pitcher without any treatment: T3- Grain/

seed stored in metal bin without any treatment, T4- Grain/seed stored in gunny bag with *sinduar* leaves @ 1.0 kg/q of grain, T5- Grain/seed stored in earthen pitcher with sinduar leaves @ 1.0 kg/q grain, T6- Grain/seed stored in metal bin with *sinduar* leaves @ 1.0 kg/q grain, T7- Grain/seed stored in gunny bag with chemical pesticide (aluminium phosphide @ 4 tablets/q grain); T8- Grain/seed stored in earthen pitcher with chemical pesticide (aluminium phosphide @ 4 tab/q of grain) and T9- Grain/seed stored in metal bin with chemical pesticide (aluminium phosphide @ 4 tab/q grain). All the treatments received similar condition i.e. they were kept in cool and dry place inside the house. Observations were taken on percentage of infested grains and germination percentage after five months of storage during the first week of September, 2003.

RESULT AND DISCUSSION

PRA and field study

It appears from data presented in Table 1 that *sinduar* leaves are as effective as chemical pesticides in controlling stored grain pest, considering all the parameters taken into account.

Experiment Data presented in Table 2 reveal that the highest insect infestation (42%) in wheat grain was found when the grains were stored in gunny bag without any treatment, whereas least (3%) infestation was recorded when it was stored in metal bin with chemical/pesticides (aluminium phosphide). There was no difference in insect infestation in stored grains in metal bin either with *sinduar* leaves or with aluminium phosphide.

Grains stored in metal bin and earthen pitcher, either with *sinduar* leaves or with aluminium phosphide, showed better germination (87-98%) of seeds.

Table 1. Matrix scoring for assessment of performance of control of stored grain/seed pest through use of *sinduar* leaves and chemical pesticides

N=20

Parameter	*Sinduar*leaves	chemical pesticides
Extent of control	9	8
Germination	9	8
Duration of control	10	6
Cost effectiveness	2	10
Simplicity in use	10	4
Availability	10	4
Choice of the farmer	10	6

Table 2. Percentage of infested grains and germination percentage of wheat as influenced by different methods of storage

N=20

Treatment	Infested grain (%)	Germination (%)
T_1	24	59
T_2	26	72
T_3	19	79
T_4	27	69
T_5	16	87
T_6	9	93
T_7	12	77
T_8	5	94
T_9	3	398
C.D. at 5%	7.43	9.52

The low-cost practice of using *sinduar* leaves along with earthen pitcher (locally available) or aluminium phosphide in earthen pitcher was found equally good in respect of farmers' socio-economic compatibility.

CONCLUSION

For saving the grains/seeds in storage, use of *sinduar* leaves @ 1 kg /q grain either in metal bin or in earthen pitcher was found as good as when the grains/seeds were stored with chemical pesticides (aluminium phosphide) @ 4 tablet/quintal either in earthen pitcher or in metal bin.

Code	:	392
Title of the ITK	:	Storing of pulse grains by using dry chilli
Description of the ITK	:	IAfter drying and removal of chaffy grains and inert matter, the pulse seeds are mixed with dry chilli @ 1 kg per quintal and are stored in earthen pots, metal bins or tin containers with sand up to 3" to 4" on the top and bottom of the container. The seeds can be economically and effectively stored for 1 year, avoiding the infestation of stored grain pests. Pungency of the red chilli might have repelling action against the stored grain pests. It is being followed by all the farmers of Benakunda village in Ganjam district of Orissa.
Name and address of the discloser	:	Shri Narendra Bisoyi, Benakunda, Dihapadhal Bhanjanagar, Ganjam (Orissa) 761 162
Location of use of the ITK	:	Benakunda, Bhanjanagar, Ganjam (Orissa) 761 162
Geographical indicators	:	*Capsicum annum* Linn: This is extensively cultivated throughout India and constitutes the principle source of dry chilli of commerce. The fruits are bright red, slender and with thin wall.
Experimenters	:	Dr M. P. S. Arya, Principal Scientist (Agronomy) and Ms. Laxmi Priya Sahoo, Scientist (Seed Technology), National Research Centre for Women in Agriculture, 1199_Jagamara, Khandagiri, Bhubaneswar (Orissa) 751 030

Methodology

Location

Evaluation of efficacy of dry chillies in controlling storage pests of blackgram and greengram was done by participatory rural appraisal (PRA), field survey and experimental methods. Participatory rural appraisal and field survey were done at village Benakunda, Bhanjanagar, dist. Ganjam (Orissa) 761 126.

PRA and field study

The PRA was conducted to evaluate the performance of dry chillies for storage of blackgram and greengram as compared to other seed treatment methods like storing with leaves of *begunia,* neem and chemicals like aluminum phosphide powder. Storage of different containers such as earthen pots, metal bins and tin containers etc. were also compared. The study was conducted at Benakunda village covering 10 farmers, who use dry chillies for storage of blackgram and greengram. The parameters studied focused on easy availability, ease to use, effectiveness, safety and cost effectiveness, longevity of storage, seed quality and cooking quality.

Experiment

An experiment was conducted using four treatments: (i) mixed with dry chillies, (ii) chemical treatment, (iii) treatment with mustard oil and (iv) no treatment (control). The experiment

was conducted for 5 months using 5 replications. Metal bin and earthen pot were used for storage.

RESULTS AND DISCUSSION

PRA and field survey

Summer pulses are grown extensively in the region. The productivity of greengram varies between 13 and 15 q. After harvesting, the grains are dried properly and stored both for seed and *dal purposes. The major storage pest in greengram* is borer (Callosobruchus chinensis). The infestation starts from the field and intensified in the storage. Sometimes it results in total loss of seed. Use of chemicals in the form of fumigants is recommended for reducing the infestation. The ITK (dry chilli) the farmers are using for long as traditional method for storage of pulse seeds is safe, effective and eco-friendly. As per discloser there were three components of ITK:

(i) Pest control agent: Chilli, begonia and *neem leaves*
(ii) Containers: Earthen pot, metal bin, tin or plastic container and gunny bags
(iii) Fillers: Sand at the bottom and top of the container.

Field survey and use of chilli and its options

On the matrix ranking of the practioners (Table1), chemical treatment stood highest with 8.25 average points. The farmers are using aluminum phosphide (Celphos) powder for storing their produce. The effectiveness, longevity of storage, ease in application and lower cost of the chemical were the factors responsible for its practice. Safety factor in chemical use recorded the lowest score (6.75). Mustard oil recorded the second rank with 8.19 points, followed by neem leaves (8.12) and dry chilli (8.00). The difference in the score of all the four treatments was, however marginal begunia (Vitex negundo) leaves scored the lowest (7.06). The practioners also reported that dried red chillis are mixed with 1 q. properly dried greengram @ 400 g/q and kept in the containers. The easy availability of neem leaves and chilli was found the most important factor of its use in storage of pulse grains/seeds. Cooking quality of the pulses grains was highest when it was stored using mustard oil (Fig. 1) and chilli (Fig. 2). It was also reported that chilli-treated seeds cause irritation while handling.

Mustard oil is applied @ 0.5 l/q seed or grain

Table 1. Matrix scoring of the practices of storing pulses by using different additives

Factor	Method of storing				
	Dry chilli	Begunia leaves	Neem leaves	Mustard oil	Chemical (Aluminum phosphide)
Availability	9.00	6.00	10.00	8.00	8.00
Application	8.25	8.00	9.00	8.50	9.00
Effectiveness	8.00	6.00	8.00	9.50	9.50
Safety	8.00	7.00	8.00	8.00	6.75
Cost effectiveness	8.00	8.50	8.00	7.00	8.50
Longevity of storage7.25		7.50	7.00	7.50	8.75
Seed quality	7.25	6.50	7.00	8.50	8.50
Cooking quality	8.00	7.00	8.00	8.50	7.00
Total	64.00	56.50	65.00	65.50	66.00
Average	8.00	7.06	8.12	8.19	8.25



Fig. 1. Mixing chillies in greengram for storage



Fig. 2. Mustard oil treated greengram ready to store in gunny bag

and mixed thoroughly, whereas Neem leaves, chilli or begunia leaves are mixed with the produce before keeping it in the containers. These are properly dried before mixing with grains or seeds.

Experiment

Efficacy of containers

Plastic containers recorded the highest average score of 8.61, followed by gunny bags (7.56) and earthen pots (7.14). However, use of gunny bags was reported to be the most popular of all the containers. Storing more quantity of produce, easy availability and ease in handling were important criteria in favour of gunny bags (Table2). Earthen pots, tin or plastic containers were reported for storing small quantities specifically that of seeds.

From discussion with practioners it was found that layer of sand at the bottom and top of the container was not in the practice. The mouth of gunny bags was normally stitched, whereas that of earthen pot, metal bins, tin or plastic container was covered with a lid. Straw is sometimes used

Table 2. Matrix scoring for different containers for storage of pulses

Factor	Earthen pot	Metal bin	Tin container	Plastic container	Gunny bag
Easy availability	7.4	4.5	10.0	10.0	10.0
Easiness to use	6.7	7.5	7.0	9.0	9.0
Effectiveness	8.1	7.0	5.0	8.5	8.0
Safety in using	6.7	6.5	4.5	9.0	8.0
Cost effectiveness	6.1	2.5	6.0	9.0	7.0
Reusability	7.8	6.0	8.0	7.0	5.0
Longevity of storage-		-	-	8.0	6.0
Seed quality	-	-	-	9.0	7.0
Cooking quality	-	-	-	8.0	8.0
Family tradition	7.2	1.0	4.0	-	-
Total	50	35	44.5	72.0	63.0
Average	7.14	5.00	6.35	8.61	7.56

Table 3. Initial evaluation of greengram seeds collected from Benakunda village

Sample no.	Physical condition of seed	Physical purity (%)	Germination (%)
1.	Good; insect free, 8–9% seed were wrinkled and discoloured	92	98
2.	Severaly affected	25	20
3.	Good; insect free, 8–9% seed were wrinkled and discoloured	98	76
4.	Good; insect free, 8–9% seed were wrinkled and discoloured	99	84
5.	Insect affected	60	50
6.	Insect affected	35	30
7.	Good; insect free, 8–9% seed were wrinkled and discoloured	98	97
8.	Insect affected 10%; discoloured	88	84
9.	Insect affected 20%; discoloured	80	74
10.	Good; insect free, 8–9% seed were wrinkled and discoloured	98	96

at the top of the containers, especially when the lid is not available to cover the mouth. This is followed by mud plastering.

Laboratory studies: Samples of already stored greengram seeds at the farmers' level were collected from the Benakunda village twice and were analysed for seed quality. Dry chilies were used in storage as protection against pests.

In the initial evaluation the samples of greengram seeds, three each from 10 practitioners, were taken from the Benakunda village. These samples were drawn during August 2001 within 2 months of putting the seeds for storage and were subjected to initial physical purity and germination studies. Physical purity was found to vary from 25% to 99% and g ermination from 20% to 98% (Table 4) at the level of different practitioners. This clearly indicated the variation in the processing of seed at the farmer's level.

In order to study the effect of chilli along with other methods of ITK being practiced in the village, 20 samples were collected randomly almost just before sowing in January. The seeds were stored in August and kept for about 6 months in gunny bags. The quality testing was done by State Seed Testing Laboratory, Bhubaneshwar.

Table 4. Status of seeds stored in gunny bags under different treatments at farmer's level just before sowing

Treatment	Moisture (%)	Purity (%)	Germination (%)	Infected seeds (%)
Mixed with dry chillies (ITK),	10.49	99.60	66.00	4.72
Treated with chemical (aluminum 4 phosphide powder)	10.27	99.56	73.60	7.50
Smeared with mustard oil, n = 1	9.80	99.64	90.00	4.00
No treatment (control), n = 3	10.88	99.54	55.00	5.33

The seeds treated with mustard oil (Table 5) were found to be the best in respect of moisture (9.8%), purity (99.8%), germination (90.0%) and seed health (4.0%). The disclosed ITK, i.e. mixed with dry chillies, stood second best with respect to purity (99.60%) and seed health (4.72%) and third in moisture (10.49%) and germination (66.00%). Seeds without any treatment showed lowest germination (55.00) and highest moisture content. *Fusarium* spp. was the dominant fungus which affected (from 3_15%) almost all the seed samples. *Rhizophus, Alternaria, Penicillium* and *Sclerotium* were among the other fungus species reported in the samples.

CONCLUSION

Use of dry chillies in storing pulses has been found in practice in Benakunda village. The farmers also use alternative methods like use of chemicals (aluminum phosphide) mustard oil, neem leaves and *begunia* leaves. Use of gunny bag in storing seeds is more popular than metal or tin containers. Sand layering either at the bottom or top was not in practice, instead sealing of the containers with lid of straw and mud plastering was reported. Treatments of dry chillies and mustard oil helped store the seeds fairly effectively. ❑

Code : **1465**

Title of the ITK : **To protect cereals and pulses during storage through use of fingermillet heads**

Description of the ITK : The *ragi* (fingermillet) cobs have some smell and produce some chemical which helps in keeping away insect pests from stored grains. The mature cobs of ragi are put inside the grain stores along with rice, wheat and pulses during storage. It is used @ about 500 g cobs per 100 kg grains kept in *pucca* houses having partition walls. This practice is used by about 10% of the villagers in Rajpur of Nabinagar block of Aurangabad district in Bihar State and has potentials for its spread among farmers having *pucca* houses. About 85% grains are saved by this practice. Cost: benefit is 1:7 approx.

Name and address of the discloser : Sri Ranjay Kumar Singh, Department of Extension, Birsa Agricultural University, Kanke, Ranchi (Jharkhand)

Location of use of the ITK : Village Rajpur, Post Nabinagar, Aurangabad (Bihar)

Experimenter : Dr R.L. Singh, Senior Scientist-cum-Associate Professor, Zonal Research Station, Chainki, Palamu, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) and R. K. Singh, Deputy Project Director, ATMA, Daltonganj (Jharkhand)

METHODOLOGY

Location

The experiment was conducted in village Rajpur, Post Nabinagar, Aurangabad (Bihar).

PRA and field study

The PRA or field study was carried out with 20 respondents on parameters like extent of control, germination percentage, duration of safe storage, availability of materials, cost effectiveness and effect on human health. Matrix scoring was done for comparing the effectiveness of the ITK with improved practice.

Experiment

Experiment was conducted at Rajpur village of Aurangabad district of Bihar during 2002-03 in 10 replications with three treatments, viz. T1_Control, T2-Dried fingermillet cob mixed with grain @ 250 g/100 kg of grain; and T3-Application of methyl parathion dust @ 200 g/100 kg grains. Observations were recorded on the effect of the treatments on pest infestation and germination of the seeds. The experiment was conducted for 4 months.

RESULT AND DISCUSSION

PRA and field study

Data presented in Table 1 indicate that in case of availability, cost effectiveness and effect on human health, use of mature fingermillet (*ragi*) cobs were rated higher in controlling the insect pests in pulses and cereals as compared to the chemical control. Fingermillet cobs and chemical

Table 1. Comparison of the ITK using fingermillet cobs with recommended practice of chemical pesticides for control of insect pest of stored grains

Parameter	Treatment	
	Mature crops of ragi	Use of pesticides
Extent of protection from insect pest infestation	6	8
Germination percentage	8	8
Duration of safe storage	8	8
Availability of materials	10	8
Cost effectiveness	8	7
Mean	8.33	7.83

Table 2. Effect of seed storage by using fingermillet cobs and methyl parathion on the incidence of storage grain pests

Parameter	Treatments		
	Control	Fingermillet cob mixed @ 250 g 100 kg grain	Methyl parathion dust @ 250 g/ 100 kg grain
Percentage of storage pest infestation	18	11	2
Percentage of germination	80	82	95

control were rated equal on two parameters, i.e. germination percentage and duration of safe storage, whereas the chemical control was rated high in only one parameter, i.e. extent of protection from insect-pest attack.

Experiment

It was found that 18 per cent of grain was infested with pest in case of control and 11 per cent in case of ITK whereas only 2 per cent infestation occurred in chemically treated seeds after four months of storage (Table 2). Ninety five per cent seed germination was recorded in chemically treated seeds, 80% in control and 82% in ITK practice.

CONCLUSION

On the basis of the findings of the study conducted for 4 months, it may be concluded that use of fingermillet cobs is effective in control of storage pests. However, better effect was observed when the seeds were stored by using parathion dust. ❑

Code : **1462**

Title of the ITK : ***Mora* - a grain-storage structure**

Description of the ITK : *Mora* is a storage structure in which grains of rice, wheat, *marua* (finger millet), etc. are stored for a long time. It protects grains from moist air and water. It also protects grains from rodent and storage insect pests. Its size and capacity varies from 0.1 to 2.0 t. Farmers of Mundatoil Kurpani village of the Thaitanger block in Simdega district (Jharkhand) use *mora* to store grains for seed purposes. Mora is made by binding the heap of grains from all sides with the help of straw made rope. Mora is used as storage for the last several years without any modification made by the users.

Name and address of the discloser : Shri Ashian Jojo, Kurpani Mundatoli, Simdega (Jharkhand) 835 235

Location of use of the ITK : Kurpani Mundatoli, Block Tethaitanger, Simdega (Jharkhand)

Experimenter : Dr A. K. Jaiswal, Senior Scientist, Indian Lac Research Institute, Namkum, Ranchi (Jharkhand) 834 010

METHODOLOGY

Location

The experiment was conducted at Kurpani Mundatoli block Tethaitanger, Dist. Simdega (Jharkhand).

PRA and field study

The field study was conducted using PRA tools with 20 respondents. The parameters/factors



Fig. 1. For storing paddy seeds



For storing paddy seeds Fig. 2. A relatively smaller size *mora* (paddy seed)

Table 1. Matrix scoring for comparative analysis of *mora* with other storage devices

Parameter	Storage structure				
	Mora	Metal bin	Gunny bag	Plastic bag	Earthen pot/pitcher
No or less insect infestation	9.5	6.9	6.5	7.4	7.9
No or less fungal infestation	10	7.3	6.7	7.2	3.4
No or less extent of seed damage	10	7.9	7.5	7.7	8.3
Germination	9.9	7.9	7.3	6.5	8.5
No or less rat attack	5.6	9.9	5.5	5.5	9.9

Score 10 indicates suitability at the most.

Table 2. Characteristics of locally used paddy seeds of variety Orissa 1001 prior to storage

Replication	Total no. of sunk seeds	No. of seeds germinated	No. of seeds not germinated
I	25	20	5
II	25	23	2
III	25	24	1
IV	25	24	1
V	25	24	1

Percentage of germinated seed amongst floated seed=Nil; Percentage of seed floated at initial stage, 7.2; Average percentage of seed germination, 92.0.

Table 3. Characteristics of locally used paddy seeds after 3 months of storage

Mode of preservation/ treatments	Total seeds	Floated seeds	No.of sunk seed	Floated Seed			% of seeds germinated
				Insect damage	Hollow	Others	
Plastic bag	100	16.2	83.8	7.5	5.5	3.2	96.5
Metal bin	100	13.6	86.4	7.6	3.6	2.4	93.4
Bamboo basket	100	18.7	81.3	7.3	5.7	5.7	94.9
Mora	100	15.8	84.2	6.6	5.4	3.8	93.8
Jute bag	100	11.3	88.7	4.1	4.9	2.3	92.7

studied were; insect infestation, disease/pathogen, damage by rodents, extent of damage, moisture content and percentage of seed germination.

Experiment

The experiment was conducted to evaluate the efficacy of *mora* for grain storage as compared to other methods in 10 replications with five treatments, viz., T1_Control (Bamboo basket), T2_*mora*, T3_Metal bins, T4_Plastic bag and T5_Gunny bag. In each treatment 50 kg paddy seed was stored for a period of three months. Observations were recorded on germination of seeds after 3 months of storage.

RESULT AND DISCUSSION

PRA and field study

Data presented in Table 1 show that *mora* was considered a convenient and effective method of grain or seed storage, followed by the storage in metal bin. Other practices, namely, storing the seeds in gunny bag, plastic bag and earthen pot/pitcher were less effective.

Experiment

Results presented in Table 2 and 3 indicate that germination percentage of paddy seeds after 3 months of storage varied from 92.7 to 96.5. Germination percentage of stored grain in mora was 93.8.

CONCLUSION

No apparent difference has been observed for germination percentage of rice after 3 months of storage among the categories. It indicates that the indigenous practice of grain/seed storage in *mora* is an effective and efficient method. ❑

Code : **1151**

Title of the ITK : **To protect pulses (greengram, blackgram, gram etc.) from storage pests**

Description of the ITK : Mustard oil and sesame (*til*) oil repel the insects. A little quantity of mustard oil or *til* oil is mixed with pulse grains while storing. This protects the pulses from storage pests. This costs Rs 10_15 per quintal pulse grain. This practice is adopted in Razzi Sarai village of Etah district in Uttar Pradesh.

Name and address of the discloser : Shri Prem Pal Singh C/o Shri Dal Chand House No. 38, Purva Ahiran, Indira Chowk, Meerut (Uttar Pradesh)

Location of use of the ITK : The ITK is being followed for protecting pulse grains both splitted one as well as the whole, from various storage pests. The ITK is reported from Razzi Sarai village of Etah district in Uttar Pradesh and was reported to be in use in the villages of Etah and Badaun district of Uttar Pradesh. The villagers generally keep the pulses in earthen pots and also in plastic pots with closed lid. Still in 50 to 60 per cent cases, the pulses are damaged by storage pests. Mustard or til oil have the antiseptic and stringent effect which might be helping in protecting pulses from pests.

Experimenter : Dr (Ms) Shagufta Jamal, Reader, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia University, Jamianagar, New Delhi 110 025.

METHODOLOGY

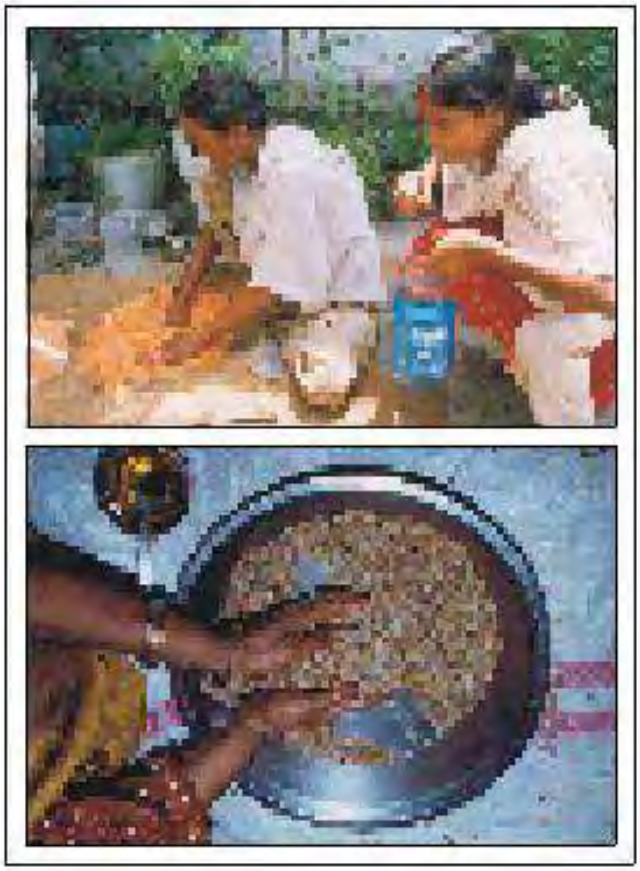
Location

The study was conducted in five villages three villages (Marhera, Dholna and Ishepur) of Etah district and two villages (Khairpur and Baghwala) of Badaun district, The ITK has been in practice in these villages. Both PRA studies as well as the experiments were conducted in these villages.

PRA and field study

The pilot study conducted in the five villages of Etah and Badaun districts indicated that there is acute problem of different kinds of insect pests damaging the pulses while stored in kitchen for more than 2 months, especially during rainy as well as in summer season. The pulse grain is eaten by the insect and is turned into powder. The problem is more acute where humidity and temperature are more. Farm women sometimes use poison baits or capsules purchased from the market. The villagers, however, felt that this could have made the pulse poisonous for human consumption. In view of this, mostly the villagers used to adopt ITK for storage of pulse grains for home consumption.

To quantify the efficiency of ITK through matrix ranking of PRA techniques, 20 key informants were asked to score four treatment, viz., control, after 2 months, and after 3 months. They were asked to rate and put scores out of 10



Application of mustard oil in lentil

on five criteria, viz. free from insects, weight, appearance, cooking quality and keeping quality. The matrix table was prepared after calculating the average score for 20 key informants for each column. The data were subjected to ANOVA test for significance of difference.

Experiment

Experiments were conducted in five villages mentioned earlier in two phases, once during winter season and the during summer season. During the first phase, 10 replications were made with three treatments each for three pulses viz. lentil, greengram and blackgram, both for whole grain as well as for splitt grain. The three treatments were control , 2 drops of mustard oil mixed per kg of pulse,and 5 drops of mustard oil mixed per kg of pulse. Two observations were made, first after 2 months and the next after four months.

The first-phase data indicated that there was no damage when mustard oil was applied at the rate of 5 drops per kg whereas the damage was seen when only 2 drops per kg of pulse was applied. In view of this, the experiment conducted during summer season had the modified treatments such as control, 3 drops of oil and 5 drops oil mixed with 1 kg each of pulse grains. In all 10 replications were used in five villages, two experiment in each village during second phase also.

RESULTS AND DISCUSSION

PRA and field study

The result of matrix ranking by 20 key informants on five criteria for four treatments are given in Table 1.

Table 1. PRA matrix ranking on efficacy of oil in storage of pulse grains (maximum score 10)

Criterion	Treatment				
	Control (after 2 months)	Control (after 3 months)	After 2 months of application of oil	After 3 months of application of oil	Significance of difference
Free from insects	7.05	4.85	9.70	9.15	**
Weight	7.80	6.35	9.75	9.50	**
Appearance	7.20	5.85	9.70	9.15	**
Cooking quality	9.00	8.40	9.70	9.45	**
Keeping quality	7.10	5.05	9.60	8.85	**
Average	7.63	6.10	9.69	9.22	**

**Significant at P=0.01.

Table 2. Effect of application of mustard oil while preserving pulse grains (observations taken after 1 month)

Phase-I

Replication/ pulse	Whole pulse (grain)						Splitted Pulse (*Dali dal*)					
	Control		2 drops		5 drops		Control		2 drops		5 drops	
	No of damaged grains/100	Weight loss(g)	No. of damaged grains	Weight loss (g)	No. of damaged grains	Weight loss(g)	No. of damaged grain	Weight loss (g)	No. of damaged grain	Weight loss (g)	No. of damaged grain	Weight loss (g)
Lentil												
	2	75	1	20	-	-	2	50	-	-	-	-
	2	60	-	-	-	-	3	50	-	-	-	-
	3	90	1	25	-	-	3	60	-	-	-	-
	2	65	-	-	-	-	1	25	-	-	-	-
Blackgram												
	3	95	-	-	-	-	1	15	-	-	-	-
	4	100	2	40	-	-	1	25	-	-	-	-
	3	70	-	-	-	-	-	-	-	-	-	-
	3	80	-	-	-	-	-	-	-	-	-	-
	4	95	1	25	-	-	-	-	-	-	-	-
Greengram												
	2	75	-	-	-	-	-	-	-	-	-	-
	2	60	-	-	-	-	-	-	-	-	-	-
	1	40	-	-	-	-	-	-	-	-	-	-
	2	65	-	-	-	-	-	-	-	-	-	-
	3	80	1	25	-	-	1	20	-	-	-	-

During September to January, due to low temperature, the insect attack on pulse was not severe. In 154 samples out of 180, no insect pest was observed, which included 39 untreated samples also (Table 3).

Table 3. Effect of application of mustard oil while preserving pulse grains (observations taken after 4 months)

Phase-I

Replication/ pulse	Whole pulse (*sabut*)						Splitted pulse (*dali dal*)					
	Control		2 drops		5 drops		Control		2 drops		5 drops	
	No. of damaged grains	Weight loss (g)	No. of damaged grains	Weight loss (g)	No. of damaged grains	Weight loss(g)	No. of damaged grains	Weight loss (g)	No. of damaged grains	Weight loss (g)	No. of damaged grains	Weight loss (g)
Lentil												
	6	150	3	75	-	-	3	75	-	-	-	-
	4	100	1	25	-	-	-	-	-	-	-	-
	5	125	-	-	-	-	4	75	-	-	-	-
	8	200	2	40	-	-	5	90	-	-	-	-
	3	90	-	-	-	-	3	50	-	-	-	-
Blackgram												
	7	200	-	-	-	-	2	25	-	-	-	-
	8	250	4	60	-	-	3	30	-	-	-	-
	7	200	-	-	-	-	1	20	-	-	-	-
	8	200	-	-	-	-	2	30	-	-	-	-
	10	300	2	40	-	-	-	-	-	-	-	-
Greengram												
	5	150	1	25	-	-	1	25	-	-	-	-
	4	100	-	-	-	-	-	-	-	-	-	-
	4	125	2	50	-	-	1	20	-	-	-	-
	5	160	-	-	-	-	-	-	-	-	-	-
	7	175	1	25	-	-	2	40	-	-	-	-

The results observed indicated that:

1. The villagers considered that pulse treated with oil had the best protection from stored grain pests, observed after 2 months only, whereas the treatment where oil was not used had the least protection after 3 months from insects.
2. Weight loss was the highest in untreated pulse after 3 months, but was least in treated pulse after 2 months or even 3 months.
3. Pulse in appearance remained as such when treated with oil, but got spoiled in appearance when oil was not applied.
4. Cooking quality did not change much except in control treatment after 3 months.
5. Keeping quality of pulse was best when treated with oil and it was worst when not treated.
6. The difference among treatments was found to be significant when ANOVA test was used.

Experiment

Phase I (September to January)

Three pulses, viz. lentil, blackgram and greengram were used in this experiment both as whole grain as well as the splitt pulse (*dali*). The experiment was conducted with 10 replications. The pulses were placed during September with three treatments, viz. (i) control, (ii) application of mustard oil at the rate of 2 drops per kg, and (iii) 5 drops per kg. In all there were 180 samples for the experiment. Two observations were made, one after 2 months and the other after 4 months.

After 2 months, the stored grain pests were observed in 26 samples out of 180 samples, out of which 21 samples belong to control treatment, where oil was not applied (Table 2). Among the 21 samples, 14 samples were of whole grain (blackgram 5, greengram 5 and lentil 4), whereas 7 samples were of splitt pulse (lentil 4, blackgram 1 and greengram 1). Five samples of whole pulse treated with two drops of mustard oil were observed having few insects. In none of the samples, treated with 5 drops of oil, the insect was observed.

During the months-September to January due to low temperature, the insect attack on pulse was not severe. In 154 samples out of 180, no insect pest was observed, which included 39 untreated samples also (Table 3).

In most of the samples, which showed the presence of insects after 2 months had the damage of 1 to 4 grains/100 grains (40 g to 100 g weight loss in 1 kg pulse). The damage was more than double in the next 2 months. It was expected that once the insect has come, it will grow fast. But the growth was not very much perhaps due to low temperature. The results, however, indicated about 25% loss in two cases of blackgram in 4 months.

The damage and the loss in weight was less of splitt pulse. The insect attack was also less in the number of samples (7 samples in 2 months and 11 samples in 4 months) dali dal. It has also been noted that insect attack was comparatively more in blackgram, followed by greengram and least in lentil.

Phase II (March to July)

During the second phase, 10 experiments were conducted for three pulses, viz. lentil, blackgram and greengram, both for whole grain as well as for splitt grain. There were three treatments, viz. control with 3 drops and with 5 drops per kg pulse. Observations were taken after 2 months and after four months.

After 2 months the stored grain pests were observed in 30 samples, out of 180 samples out of which 27 samples belong to control treatment (Table 4). In other words 50% of the control treatment indicated damaged after 2 months due to insect pests. Among the 27 samples 13 belongs to whole pulse grain (lentil 4, black gram 4 and

Table 4. Effectiveness of mustard oil in controlling storage pests of lentil, blackgram and greengram (observations taken after 2 months)

	Whole pulse						Spilt pulse					
	Control		3 drops		5 drops		Control		3 drops		5 drops	
	DG/100	WL	DG	WL	DG	WL	DG	WL	DG	WL	DG	WL
Lentil	15	160	-	10	-	15	5	60	-	10	-	10
1	6	65	-	15	-	15	4	45	-	10	-	10
2	6	70	-	10	-	15	4	45	-	10	-	10
3	6	70	-	10	-	15	4	40	-	5	15	
4	8	90	-	20	-	10	3	30	-	10	-	15
Blackgram												
1	18	185	10	115	-	10	6	60	-	10	-	10
2	10	110	-	10	-	10	5	55	-	10	-	15
3	17	180	-	10	-	15	4	40	-	10	-	5
4	8	85	-	15	-	10	3	30	-	10	-	5
Green gram												
1	19	200	25	230	32	300	10	110	-	15	15	150
2	10	115	-	10	-	20	5	55	-	10	-	10
3	12	125	-	10	-	10	4	40	-	5	-	5
4	14	150	-	10	-	10	4	40	-	5	-	5
5	10	120	-	20	-	20	3	30	-	5	-	5
6	-	15	-	10	-	10	4	45	-	5	-	5

DG, Damaged grain/100 grains; WL, weight loss/ kg.

greengram 5), whereas 14 samples belong to splitt pulse (lentil 4, blackgram 4 and greengram 6).

Two samples of whole pulse (blackgram and greengram one each)
where three drops of mustard oil was applied showed damage of grains. Among split pulse only one sample of greengram in which five drops of oil was applied showed damage due to insect pests.

In the samples of whole pulse grain which were observed to have
the presence of insect after 2 months, the damage was 10 to 18 grains/100 grain. Similarly, the weight loss in whole pulse grain ranged from 85 to 200 g, whereas the loss in splitt pulse grain was 30 to 60 g/kg.

After 4 months the damage was increased to 45 samples out of 180,
out of which 36 samples belonged to control treatment where oil was not applied. Only in 9 samples out of 120 samples where oil was applied showed damage by insects. The damage was more in greengram (Table 5).

In greengram 200 to 360 g. weight loss per kg (25 to 35 grains/100)
was observed, whereas the weight loss ranged from 150 to 260 g (15 to 20 grain per 100) in lentil and blackgram.

Damages were seen only in 5 cases out of 60 in the pulses where 3
drops of mustard oil were applied per kg grain. Similarly, where 5 drops were applied the damage was observed in 3 samples out of 60.

The results indicate that application of mustard oil reduced the insect
attack in stored pulses. It can also be said that 3 to 5 drops of oil may be applied in pulses.

Table 4. Effectiveness of mustard oil in controlling storage pests of lentil, blackgram and greengram (observations taken after 4 months)

	Whole pulse						Spilt pulse					
	Control		3 drops		5 drops		Control		3 drops		5 drops	
	DG/100	WL	DG	WL	DG	WL	DG	WL	DG	WL	DG	WL
Lentil												
1	25	250	3	40	-	20	15	150	-	10	-	15
2	15	160	-	10	-	10	10	115	-	10	-	15
3	20	200	-	20	-	20	10	100	-	15	-	10
4	15	150	-	15	-	15	8	85	-	15	-	10
5	25	260	-	15	-	15	15	150	-	15	-	10
6	15	160	-	10	-	10	-	10	-	10	-	10
Blackgram												
1	25	260	3	35	-	15	20	200	-	10	-	10
2	20	200	-	10	-	10	20	210	-	15	-	10
3	20	210	-	10	-	10	15	150	-	10	-	10
4	15	150	-	15	-	15	15	150	-	15	-	15
5	18	190	-	10	-	10	10	100	-	15	-	15
5	16	160	-	15	-	15	-	15	-	15	-	15
Green gram												
1	25	250	30	320	42	450	25	250	20	200	20	200
2	20	200	5	60	-	15	10	200	-	15	-	10
3	25	260	-	15	-	10	15	150	-	10	-	15
4	30	3600	-	15	-	10	20	200	-	10	-	10
5	35	360	-	10	-	15	20	190	-	15	-	10
6	25	250	-	15	-	10	18	175	-	10	-	15
7	30	310	-	10	-	15	15	150	-	10	-	10

DG, Damaged grain/100 grains; WL, weight loss/ kg.

CONCLUSION

Perceptible effect of application of mustard oil in controlling storage pests of greengram, blackgram and lentil was observed from the experimental results, thus corroborating the ITK practice. The results, however, are based only 10 experiments in winter and 10 experiments in summer. ❑

GRAIN/SEED STORAGE

Code : **1464**

Title of the ITK : **Evaluation of different methods for storing of vegetable seeds**

Description of the ITK : About 50 to 100 g *sinduar* leaf powder is mixed with seeds m of blackgram, pigeonpea, chickpea, lathyrus, ridge gourd, lady-finger, *barbate* etc. are kept with dry *sal* leaves in a bag like container and hanged in the roof over the *chulha* in the kitchen. Seeds of tomato, guava, bitter gourd, *khira* etc are pasted on the wall for storage. Seeds of paddy are kept in bamboo baskets and the mouth is covered by paddy straw and mud. Paddy seeds of the same variety are also stored in the storage bin made of mud in the house over raised platform. Paddy seeds are stored in box made with wood. Seeds of paddy are stored in *mora* (*pura*). *Mora* is made of paddy straw and tied tightly with ropes made of paddy straw. Seeds can be stored for 5_10 years in *mora* where even rats cannot enter. About 5 to 10g paddy seed is stored in earthen pot. For storing seeds of maize, blackgram, greengram, lathyrus and pigeonpea, 250_500 g powder of *sinduar* leaves is mixed. Fully matured bottle gourd, ridge gourd, etc. are kept in sun over the roof top. During rains, these are kept in shade. Seeds of leafy vegetables, bitter gourd, *kakri* etc. are stored in cloth bag.

Name and address of the discloser : Paryavaaran Chetna Kendra, Bada Sigdi, Potka, East Singhbhum (Jharkhand)

Location of use of the ITK : At & P.O. Bada Sigdi, Block Potka, East Singhbhum (Jharkhand).

Experimenters : Dr. A.K. Jaiswal, Sr. Scientist (Entomology), Indian Lac Research Institute, Namkum, Ranchi and Dr. R. P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

Village Bada Sigdi, Block Potka, East Singhbhum (Jharkhand)

PRA and field study

The field study was conducted using PRA methods with 33 respondents. The parameters/ factors studied were insect infestation, disease/pathogen infestation, extent of damaged grains, rodent damage, moisture content and germination percentage.

Experiment

An experiment was conducted in 10 replications with five treatments, viz., T1 -



A close look of *potam*



Earthen pot/pitcher-covered with paddy straw and sealed with soil for paddy seed storage



Storage structure of bamboo for paddy seed storage

Control, T2 _ Storage in potam, T3 _ Sticking seeds to earthen wall, T4 _ storage in wooden box and T5 _ Storage in earthen pitcher. In each treatment 250 g seeds was stored. The same design was followed for three vegetable seeds i.e. lobia (cowpea), bitter gourd and lady'sfinger. Seeds used for experimentation were free from any insecticide. Seeds wrapped in muslin cloth were regarded as control (T1). Five hundred seeds were collected from each treatment belonging to 10 replications for the three sets of experiments as samples. Evaluation of germination of seeds was done and seeds not germinated were evaluated for insect and pathogen infestation, rodent damage and damage due to unidentified reasons. Normally all structures were kept in such a way as to protect them from rodents. Since seeds of lobia and lady'sfinger were conventionally not preserved by sticking with wall and earthen pot was not used for storage of bitter gourd seeds, these were excluded from the respective treatments. For lady's finger seeds in treatment (T5) seeka (rope) was taken in place of earthen pitcher. The experiment was conducted for 6 months.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 reveal that in respect of insect and fungal attack, there was no difference between potam, mora and earthen pitcher, while the three methods differed from those of dermi, earthen wall and kotha. In respect of damaged seeds, there was no difference between potam, mora and earthen pitchers but both potam and mora were more suitable than dermi and other storage structures. In respect of attack by rat, no difference was noticed between earthen pitcher and dermi but the two methods differed from other storage structures. Although performance of potam, mora and earthen pitcher was same, but their purposes of utility differed in respect of quantum of seeds to be stored. Potam has very low capacity to store and hence, it is suited for vegetable seeds. Mora is of variable size and it is suited for paddy seeds as it has capacity of storing up to quintals of seeds, and earthen pots are generally of medium capacity and hence, it is suited for storing about 10 kg seeds in single container.

Table 1. Matrix scoring for assessment of different methods of seed storage on selected parameters

N=33

Parameter	Method of storage					
	Potam	Sticking with earthen wall	Dermi (wooden box)	Mora	Earthen pitchers	Kotha (room terrace)
Insect infestation	9.9	8.7	9.0	9.5	9.5	7.9
Fungal attack	9.9	7.5	8.7	9.7	9.6	4.7
Extent of grain damage	9.9	8.3	9.6	9.9	9.7	7.8
Germination	9.0	7.7	8.3	9.7	9.0	7.9
Rat attack	8.2	7.7	9.5	7.6	9.6	6.4

Experiment

Data for three sets of experiments i.e. for *lobia*, bitter gourd and lady's finger are presented in Tables 2, 3 and 4, respectively.

The results obtained indicate the following:

Seed germination: The percent seed germinated was found maximum in *potam* than in other storage structures/methods for all the three seeds, viz, *lobia*, bittergourd and lady's finger. For storage of *lobia* seeds the order of efficient storage structure is *potam*>earthen pitcher> *dermi*> muslin cloth (control). For seeds of bitter gourd, the order was *potam*>sticking with wall> *dermi* > muslin cloth (control). For seeds of lady's finger, the order is *potam*> *seeka* >*dermi* >muslin cloth (control).

Insect infestation: The un-germinated seeds were categorised for possible reasons for not germination. The efficiency of different structures/ methods was in the order of potam>dermi> control (muslin cloth) > earthen pitcher for lobia, potam> sticking with wall> dermi> muslin cloth for bitter gourd and potam> seeka>dermi>muslin cloth for lady's finger.

Table 2. Evaluation of lobia seeds preserved through selected storage methods/structures after 6 months of storage

Storage method (structure treatment)	Number of seeds evulated	Seeds germinated (number)	Seeds not germinated (number)	Insect infestation (number)	Pathogen infestation (number)	Rodent damage (number)	Damaged (unknown reason) (number)
T1 -Control (muslin cloth)	500	430 (86.0)	70 (14.0)	32 (6.4)	22 (4.4)	0 (0)	16 (3.2)
T2-*Potam*	500	482 (96.4)	18 (3.6)	0 (0)	0 (0)	0 (0)	18 (3.6)
T3-*Dermi* (wooden box)	500	445 (89.0)	55 (11.0)	28 (5.6)	16 (3.2)	0 (0)	11 (2.2)
T4-Earthen pitcher	500	445 (91.0)	45 (9.0)	38 (7.6)	5 (1.0)	0 (0)	2 (0.4)

Figures in parentheses indicate

Table 3. Evaluation of bitter gourd seeds preserved through selected storage methods/structures after 6 months of storage

Storage method (structure treatment)	Number of seeds evulated	Seeds germinated (number)	Seeds not germinated (number)	Insect infestation (number)	Pathogen infestation (number)	Rodent damage (number)	Damaged (unknown reason) (number)
T1 -Control (muslin cloth)	500	400 (80.0)	100 (20.0)	48 (9.6)	29 (5.8)	0 (0)	23 (4.6)
T2-*Potam*	500	477 (95.4)	23 (4.6)	0 (0)	0 (0)	0 (0)	23 (4.6)
T3-Sticking seeds to earthen wall	500	455 (91.0)	45 (9.0)	38 (7.6)	5 (1.0)	0 (0)	2 (0.4)
T4-*Dermi* (wooden box)	500	445 (91.0)	45 (9.0)	23 (4.6)	15 (3.0)	0 (0)	7 (1.4)

Figures in parentheses indicate percentage

Table 4. Evaluation of lady's finger seeds preserved through selected storage methods/structures after six months of storage

Storage method (structure treatment)	Number of seeds evulated	Seeds germinated (number)	Seeds not germinated (number)	Insect infestation (number)	Pathogen infestation (number)	Rodent damage (number)	Damaged (unknown reason) (number)
T1 -Control (muslin cloth)	500	395 (79.0)	105 (21.0)	65 (13)	15 (3)	0 (0)	25 (5.0)
T2-*Potam*	500	480 (96.0)	20 (4.0)	0 (0)	0 (0)	0 (0)	20 (4.0)
T3-*Dermi* (wooden box)	500	425 (85.0)	75 (15.0)	64 (12.8)	6 (1.2)	0 (0)	5 (1.0)
T4-Seeka (rope)	500	456 (91.0)	44 (8.8)	32 (6.4)	0 (0)	0 (0)	12 (2.4)

Figures in parentheses indicate percentage

Pathogen infestation: The efficiency of different structures/ methods was in the order of *potam*> earthen pitcher >*dermi*> control (muslin cloth) for *lobia*, *potam*> sticking with wall> muslin cloth for bitter gourd and *potam*= *seeka*>*dermi*>muslin cloth for lady's finger.

CONCLUSION

The findings led to conclusion that *potam* is superior to all the methods/ structures tried for storage of vegetable seeds.

❑

Code : **1313**

Title of the ITK : **Protection of sugar and sugar products from ants**

Description of the ITK : Cloves might be having repelling quality. A few cloves are placed with the sugar or sugar products. This repels ants and all ants get away from the sugar or sugar products. This is practised by the villagers of Samaspur in Etah district of Uttar Pradesh.

Name and address of the discloser : Shri Prem Pal Singh C/o Shri Dal Chand House No. 38, Purva Ahiran, Indira Chowk, Meerut (Uttar Pradesh)

Location of use of the ITK : The ITK is being practiced in Etah district as reported from Samaspur village of the district. Cloves have stringent smell which might be repelling ants.

Experimenter : Dr (Ms) Shagufta Jamal, Reader, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia University, Jamianagar, New Delhi 110 025.

METHODOLOGY

Location

The study was conducted in six villages, viz. Danpur, Nayabas and Sabalpur villages of Bulandshahar, and Marhera, Ishepur and Dholna villages of Etah districts of Uttar Pradesh. The area is located in semi-arid zone. The climate is extremely hot in summer and extremely cold in winter.

PRA and field study

To determine the reliability of this ITK, matrix ranking of PRA method was used. Thirty key informants were selected for ranking on five treatments and five criteria with the help of putting scores out of 10 in each column. The five treatments were: control, sugar with cloves in open container, sugar with cloves in loose container, cloves placed in sugar where ants are present in open container and cloves placed in sugar where ants are present in loose container. The five criteria for ranking were: extent of protection of sugar from ants during rainy season, extent of protection of sugar from ants during winter season, extent of protection of sugar from ants in kitchen and extent of protection of sugar from ants in store. The key informants were asked to give score separately on each criterion for each treatment. The average score was calculated and the data were subjected to ANOVA test.

Experiment

Experiments were conducted in six villages in two phases. During the first phase there were 20 experiments for sugar and 10 for sugar products with three treatments each.

The first phase, treatments were: control, with 15 cloves per kg sugar and 25 cloves per kg sugar. For sugar products the treatments were: control, with 20 cloves per kg and 30 cloves per kg.

The results of the first-phase experiment indicated that where the cloves were placed with sugar or sugar products irrespective of quantity, no ants were observed even after 10 days, though ants were observed in a few cases under control treatment. Hence the experiment could not provide the exact quantity of cloves to be placed. In view of this, during second phase the number of cloves was reduced and the treatments were:

Table 1. Number of replications used in the study

Village	No. of replications									Grand total
	I Phase			II Phase						
	Sept.	Dec.	Total	Cloves placed with sugar without ants			Cloves placed with sugar with ants			
				June	July	Total	June	July	Total	
Badaun	5	5	10	5	5	10	2	3	5	25
Nayabas	5	5	10	5	5	10	2	3	5	25
Manda	2	-	2	-	5	5	-	-	-	7
Kamua	2	-	2	-	-	-	-	-	-	2
Marhera	4	-	4	-	5	5	-	5	5	14
Dohna	2	-	2	-	-	-	-	-	-	2
Total	20	10	30	10	20	30	4	11	15	75
Sugar Product										
Nayabas	3			2	3	5	2	3	5	13
Badaun	4			3	4	7	2	3	5	16
Dohna	3			-	3	3	-	2	2	8
Total	10			5	10	15	4	8	12	37

control, 5 cloves, 10 cloves and 15 cloves in case of sugar and control, and 10 cloves, 15 cloves and 20 cloves in case of sugar products. In addition, experiments were conducted where ants were already present to see the effect of placing 5 cloves, 10 cloves and 15 cloves per kg in case of sugar, and 10 cloves, 15 cloves and 20 cloves per kg in case of sugar products. Table 1 provides the number of replications used during the study.

RESULTS AND DISCUSSION

PRA and field survey

As many as 60 villagers from six villagers were contacted during the pilot field study. It was reported that they generally put cloves when they see that small ants are there with sugar or sugar products. There is no other method by which they can separate or get away these ants. If the ants are removed mechanically by hand or by other means, many of them are killed and then it is not possible to remove. Sometimes, the whole sugar or sugar product is spoiled and has to be thrown away. Once they keep 10–15 cloves (per kg sugar) in the pot where sugar or sugar product is kept, the ants get away in 6 to 10 hours.

The results of matrix scoring done by 30 key informants on five criteria for five aspects of the technology are given in Table 2.

The key informants gave maximum score to Treatment 3, indicating that when cloves are put with sugar in loose container, the extent of protection from ants during summer, rainy and winter seasons was maximum. It was also found that the extent of protection of sugar from ants was maximum when it is placed in kitchen and store. The difference between treatments in respect of all the criteria was significant.

Field experiment

Phase I

Sugar: Experiments were conducted during

Table 2. Matrix scores of different aspects of protection of sugar and sugar products by use of clove (maximum score 10)

Criteria	Performance of the technology					
	Control (sugar with no clove in loose container) (T_1)	Sugar with cloves in open container (T_2)	Sugar with clove in loose container (T_3)	Cloves placed in sugar with ants in open container (T_4)	Cloves placed in sugar with antsin loose container (T_5)	
Extent of protection of sugar from ants during summer season	1.6	5.68.4		3.1	4.3	**
Extent of protection of sugar from ants during rainy season	1.3	4.37.0		2.4	3.0	**
Extent of protection of sugar from ants during winter season	4.8	6.99.5		4.8	5.7	**
Extent of protection of sugar from ants placed in kitchen	3.2	5.58.4		3.8	4.4	**
Extent of protection of sugar from ants placed in store	3.2	4.47.6		3.0	3.7	**

**Significant at P=0.01.

September 2002 with 20 replications to study the effect of clove on presence of ants in sugar. Results obtained are presented in Table 3.

It is observed that in the sugar where cloves were placed during September, no ants were observed even after 10 days. This is irrespective of the number of cloves placed in the sugar. But where the cloves were not placed, ants were observed in 5 cases on 5th day, and on 10th day ants were observed in 10 cases.

Further, critical observation of a few cases in Buduan indicated that the sugar under control treatment became moist, whereas the sugar where cloves were placed remained dry. This was

Table 3. Number of ants in sugar as affected by action of clove

Observation interval	Control	With 15 cloves	With 25 cloves
After 2 days	No	No	No
After 5 days	5	No	No
After 10 days	10	No	No

Table 4. Number of ants in sugar products as affected by addition of clove

Observation intervals	Control	With 20 cloves	With 30 cloves
After 2 days	2	No	No
After 5 days	8	No	No
After 10 days	-	No	No

checked with a little increase in weight (30 g increase under control treatment). This indicates that cloves also absorb moisture and help in keeping the sugar dry.

Sugar products: Burfee sweet was used in case of sugar product for experimentation. Burfee (1kg) was placed in loose open plastic containers at 10 places with three treatments, viz. control or without cloves; with 20 cloves; and with 30 cloves. The experiment was conducted in September.

The results (Table 4) indicate that in the sweet where cloves were placed, no ants were observed even after 10 days. This is irrespective of number of cloves placed in the sugar. But where the cloves were not placed, ants were observed in two cases on the second day and on 5th day the ants were observed in all the remaining eight cases.

The results of the experiment indicate that cloves acted as repellent to ants and the sweet remained safe from them.

II Phase

Sugar: Experiments were conducted during the last week of June and first week of July, 2003. The results (Table 5) indicate that in the sugar where cloves were not placed (control), ants were seen in 25 cases. In 15 cases the ants were seen within 2 days, whereas in 8 cases the ants were observed within 5 days and in the next 5 days the ants were seen in seven more cases. Among the samples, where 15 cloves were placed, no ant was observed even in 10 days. But where 10 cloves were placed, ants were observed after 10 days of observation. In one case the ants were seen even on fifth day of observation. No ant was observed in this category during first 2 days. In the samples where only five cloves were placed, ants were seen in 20 samples out of 30. In two cases ants were seen on the third day of observation, whereas in another 8 cases ants were observed after 5 days. After 10 days the ants were seen in 10 additional samples.

Thus for proper protection of sugar from ants, cloves may be placed with sugar in the pot at the rate of 15 cloves/kg sugar.

Table 5. Numbers of ants in sugar

Observation intervals	Control without clove	With 5 cloves	With 10 cloves	With 15 cloves
After 2 days	15	2	Nil	Nil
After 5 days	8	8	1	Nil
After 10 days	7	10	4	Nil
Total	30	20	5	Nil

Table 6. Number of ants in sugar products

Observation intervals	Control without clove	With 10 cloves	With 15 cloves	With 20 cloves
After 2 days	10	Nil	Nil	Nil
After 5 days	5	5	3	Nil
After 10 days	-	5	2	Nil
Total	15	10	5	Nil

Sugar products: The results presented in Table6 indicate that in the sugar products (burfee) where cloves were not placed (control), ants were seen in all the 15 cases, in 10 cases after 2 days and in 5 cases after 5 days. Among the samples

Table 7. Number of ants in sugar treated with clove

Observation interval	Control	With 5 cloves	With 10 cloves	With 15 cloves
After 6 hours	15	15	12	2
After 12 hours	15	14	10	Nil
After 24 hours	15	13	8	Nil

where 20 cloves were placed, no ant was observed in any sample even after 10 days (Table 6).

Among the samples where 10 cloves were placed the ants were seen in 10 cases, in five cases after 5 days and in another five cases after 10 days. In the samples where 15 cloves were placed, ants were seen in five cases only, in three cases after 5 days and in additional two cases after 10 days.

two cases after 24 hours. In eight cases ants did not go. Similarly, where 5 cloves were placed the ants did not go in 13 cases. It is, therefore, clear that for removing ants from sugar, 15 cloves per kg of sugar need to be placed in the pot.

Cloves placed in sugar product with ants: Results presented in Table 8 indicate that in the sugar products (burfee) where ants are present, if 20 cloves are placed in pot, the ants got away in

Table 8. Number of ants in burfee treated with cloves

Observation intervalsControl		With 10 cloves	With 15 cloves	With 20 cloves
After 6 hours	12	10	8	2
After 12 hours	12	8	5	Nil
After 24 hours	12	8	4	Nil

Thus for proper protection of sugar products (burfee) from ants, the cloves may be placed in the pot at the rate of 20 cloves per kg sugar product. This, however, may vary according to the sugar product.

Cloves placed in sugar with ants: The data presented in Table 7 indicate that if 15 cloves are placed, all the ants present in the sugar went away after 12 hours. In 6 hours, however, ants were removed in 13 out of 15 cases.

Further, where 10 cloves were present, ants could be removed in 3 cases during first 6 hours, in another two cases after 12 hours, and in another

12 hours in all the samples. In 10 cases ants got away within 6 hours. If the number of cloves is reduced to 15 or 10, the ants could not be moved from all the samples. Hence, if the ants are to be removed from sugar product (burfee), 20 cloves per kg of sweet need to be placed in the pot. This, however, may vary from product to product.

CONCLUSION

The experimental results obtained from the studies indicate that sugar and sugar products can be protected from ants by use of cloves. ❑

Code : **1150**

Title of the ITK : ***Sheetal* for preservation of vegetables and fruits**

Description of the ITK : The preservation of vegetables and fruits by *sheetal* is very useful. *Sheetal* keeps the vegetables and fruits fresh for several days during the summer season. It keeps temperature low by absorption of heat. *Sheetal* is made of two earthen pots, one big and one small. The small pot with vegetables and fruits is placed in the bigger one and clean water is filled between the space of the two pots. *Sheetal* is then placed in a heap of sand. It keeps the temperature low. The materials used in *sheetal* are of low cost. The total cost will not be more than Rs 15. *Sheetal* can be used for 15_30 days, after which the pots need to be changed. This practice is in use in many villages in Badaun and Bareilly districts of Uttar Pradesh.

Name and address of the discloser : Dr (Miss) Shagufta Jamal, Reader, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia, Jamianagar, New Delhi 110 025.

Location of use of the ITK : This practice is in use in many villages of Badaun and Bareilly district. There is no specific size or type of sheetal available. The villagers use the pots at their own convenience depending upon the availability of pots and the quantity of vegetables to be stored. The ITK is used only during summer. Sometime the villagers use this ITK during the months of October_November and also during winter or rainy season specially when the days are sunny. The water filled in the larger pot percolates into the smaller pot towards stored vegetables. On its evaporation the whole pot becomes cool and humid. This checks water evaporation from the vegetables and thus checks shrinkage in vegetables. They remain fresh and hard.

Experimenter : Dr (Ms) Shagufta Jamal, Reader, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia, Jamianagar (New Delhi) 110 025

METHODOLOGY

Location

The study was conducted by both PRA as well as experiment in seven villages, viz. Dohna and Manda in Bareilly and Sahaswan, Khairpur, Baghwala, Nawada and Sarai in Badaun districts (Uttar Pradesh).

PRA and field study

Pilot study of the villages where the ITK is in use indicated that there is extreme hot and dry



Fig. 1. A view of sheetal with fresh vegetables for storage



Fig. 2. A view of sheetal with fresh vegetables for storage

climate during summer season. The temperature goes up to 44°C, when the vegetables like brinjal, bhindi, and tomato are picked from the field or kitchen garden or are purchased from market for own consumption. If kept even in shade it gets spoiled, shrinked and dried, within a few days. To keep the small quantity of vegetables, the villagers use this ITK. It was reported that the vegetables remain fresh and hard up to 3 days. The villagers, however, reported that sometimes when there is more humidity in the atmosphere, some water comes into the small pot, which spoils some of the vegetables. Hence the villagers keep a watch and remove the water on every 6 hours, if any, from the small pot.

To determine the efficiency of ITK through matrix ranking of PRA, 20 key informants from seven villages were asked to score four treatments on seven criteria. The treatments were control and keeping in sheetal for 3 and 5 days respectively. The criteria on which the key informants were asked to put scores out of 10 (scoring) were: weight, safe from spoilage, colour, taste, cooking quality, shine and smell. The matrix table was prepared after calculating the average score for 20 key informants for each column. The data were subjected to ANOVA test for significance of difference.

Experiment

During the first phase, five experiments were conducted in the selected five villages of Badaun district using three vegetable, viz. brinjal, torai and bhindi. The experiments were conducted during November. Three observations, viz. fresh, on third day and on fifth day were taken in respect of weight, shrinkage and spoilage.

During the second phase, 10 experiments were conducted in June using brinjal, bhindi and pointed gourd vegetables. Three observations were taken as during the first phase. The average weights were calculated for each vegetable at each observation.

RESULTS AND DISCUSSION

PRA and field study

The results of matrix ranking by 20 key informants on seven criteria for two treatments on day 3 and day 5, respectively are given in Table1.

The results obtained suggest that: ITK, i.e keeping vegetables in sheetal was considered to be far better than control. The villagers perceived that on all the parameters vegetables were better, when kept in sheetal even after 3 days or 5 days.

The vegetables remained almost as such (no major change) on all the parameters by keeping in sheetal for first 2 days, and even after 5 days only a little change was observed in weight. The change in respect of taste, shine and smell was maximum but far less by keeping in sheetal as compared to control. Villagers considered that ITK as reliable especially during summer season.

Table 1. Matrix ranking on performance of sheetal

Criterion	Methods of preservation of vegetables				SD
	Control		Keeping in sheetal for		
	after 3 days	after 5 days	3 days	5 days	
Weight	7.65	6.25	9.25	8.30	**
Safe from spoilage	7.45	4.05	9.10	7.85	**
Colour	6.90	3.75	8.15	6.90	**
Taste	6.75	2.75	7.95	5.65	**
Cooking quality	8.00	5.95	8.65	6.85	**
Shine	5.55	3.05	8.05	6.10	**
Smell	7.10	3.85	9.00	6.20	**

**Significance at P=0.01.

Experiment

Phase I

The data in respect of phase I of study conducted during November 2002 are presented in Table 2.

Brinjal: The results of the ITK were highly encouraging for brinjal. In all the replications, the weight of brinjal remained as such while kept in *sheetal. But under control treatment the weight* of brinjal was reduced from 40 to 80 g on day 3. On day 5, not only 40 to 60 g weight was reduced again, but also one fourth of the vegetable (brinjal) was spoiled. About 250 to 300 g. brinjal was spoiled by much shrinkage. Their shine disappeared and the colour turned to dark. Smell of freshness disappeared.

Torai: The results of the ITK were not much encouraging in case of torai in comparison to the control. There was little reduction in weight, while kept in sheetal. But there was a lot of spoilage (200 to 360 g) on day 5, even when kept in sheetal. Spoilage, however, was much more (340 to 420 g) under control treatment in addition to reduction of weight.

In two replications, more torai remained better under control than in sheetal on day 3. In these cases, torai kept in sheetal was spoiled on the third day itself. In fact, vegetable got percolated water, which spoiled it. The vegetable became black and rotten. On the fifth day, however, the spoilage was more in control treatment.

It was observed that in November, water evaporation was very little, which on one hand did not have bad effect under control, while it increased humidity and water in torai, which spoiled the vegetable.

Bhindi: The results obtained by use of sheetal were quite encouraging for keeping bhindi fresh. The observations indicated that under control treatment the vegetable had loss of water and weight. There was a lots of shrinkage on day 5. On day 3, however, bhindi r emained unaffected except loss of 70 to 125 g weight in 1 kg vegetable.

When kept in sheetal, the loss of weight on day 3 was only 25 to 75 g. In three samples, a few bhindi were spoiled also. On day 5 the loss was slight, whereas it was quite high in the control treatment (160 to 200 g). In addition, there was little spoilage also in sheetal on day 5. Still more vegetable remained as such (unaffected) in sheetal on day 5 also.

It has been observed that spoilage in sheetal was due to water that percolated into the inner pot, where the vegetable was placed. This could

Table 2. Effect of preservation of vegetables in *sheetal* (weight of vegetable in g)

Experiment and location	Control			*Sheetal*	
	Fresh	day 3	day 5	day 3	day 5
Brinjal					
Location-1	1000	950	620+290*	1000	1000
Location-II	1000	930	600+300*	1000	1000
Location-III	1000	950	620+290*	1000	1000
Location-IV	1000	920	600+280*	1000	1000
Location-V	1000	940	630+250*	1000	1000
Torai					
Location-1	1000	920	450+420*	800+150*	560+350*
Location-II	1000	900	420+420*	750+175*	550+350*
Location-III	1000	930	500+400*	950+25*	650+250*
Location-IV	1000	900	500+350*	920+55*	625+250*
Location-V	1000	910	520+340*	950+25*	600+300*
Bhindi					
Location-I	1000	910	800	960+10*	880+20*
Location-II	1000	920	830	970	890+30*
Location-III	1000	900	800	975	900+50*
Location-IV	1000	930	840	950+20*	900+50*
Location-V	1000	875	820	925+50*	900+60*

*Weight of spoiled/rotten vegetable.

have been dried during summer, and hence there may not be spoilage during summer.

Phase II

As reported earlier, 10 experiments were conducted during June 2003 on three vegetables, viz. brinjal, *bhindi* and pointed gourd. The average weights were calculated for each vegetable at different intervals. The data are presented in Table 3.

Brinjal: The results obtained by storing brinjal in *sheetal* were encouraging. The weight of brinjal remained less than half on the fifth day when kept outside. But in *sheetal* only 100 g weight was reduced on the fifth day. The loss of weight on third day was only about 40 g, whereas outside it was 370 g. In fact brinjal was not fit to be consumed even on day 3 when kept outside due to much shrinkage, change in colour and shine, hardness etc. But brinjal remained fresh on third day when kept in *sheetal*. Even on day 5, through there was slight shrinkage on a few brinjal fruits, it was fit to be consumed.

Bhindi: The results obtained in respect of *bhindi* were also encouraging. The weight of *bhindi* remained about one- third on the fifth day when kept outside (380 g out of 1,000 g), whereas in *sheetal* only 230 g weight was reduced, out of which 50 g was spoilage. The loss of weight on the third day was 484 g. when kept outside, whereas it was only 130 g when kept in *sheetal*. The *bhindi* kept outside for 5 days was completely

Table 2. Effect of preservation of vegetables in *sheetal* (weight of vegetable in g)

Vegetable	Control			*Sheetal*	
	Fresh	3 day	5 day	3 day	5 day
Brinjal	1000	630	416	958	900
Bhindi	1000	616	380	910 + 30*	820 + 50*
Pointed gourd	100	550	368	858 + 20*	800 + 50*

*Weight of spoiled vegetable.

shrunk and dried and was not fit for consumption. But when kept in *sheetal* after throwing the spoilage, about 820 g *bhindi* remained fit for consumption. The colour shine and hardness also did not change much. There were no shrinkage and dryness. On the third day, bhindi was almost fresh when kept in *sheetal*. The point to be noted is that when kept in sheetal some *bhindi* was spoiled due to high humidity inside the pot. In fact some water also comes into it, which spoil the vegetable.

Pointed gourd (*parwal*): In pointed gourd also the results were encouraging. The weight of *parwal* was reduced to almost one third on the fifth day (368 g) when kept outside *sheetal*. But when kept in *sheetal* the weight remained about 750 g on the fifth day. About 200 g weight was reduced and there was 50 g spoilage. *Parwal* kept outside was completely unfit for consumption on the fifth day. It was shrinkes and dried. The colour and shining changed completely. But 800 g *parwal* that, remained in *sheetal* looked almost fresh, hard, without shrinkage and with some shine. It was fit for consumption. Similarly, on the third day the weight of *parwal* remained almost half (550 g) when kept outside. There was shrinkage. However, it was fit for consumption. The vegetable kept in *sheetal*, showed the weight loss only 160 g on the third day. There was no change in colour, hardness and shine. It was almost fresh.

CONCLUSION

Experimental results based on five experiments in winter and 10 in summer suggest that *sheetal* can be used for storing vegetables for home consumption for about 5 days. The ITK is more effective during summer.

Code : **239**

Title of the ITK : **Enhancement of onion productivity**

Description of the ITK

: By applying 75 kg fresh Cassia leaves mixed with 125 kg cowdung, bulb size and onion yield is increased by 25–30%. Improvement in onion bulb colour may be from light red to dark red if this mixture is applied. This is best suited under irrigated condition for a local variety of onion. Best season is rabi. Depth of sowing may be 10 cm. Five farmers are using this technology for more than 10 years.

Name and address of the discloser : **Shri S. Gopal, Training Associate, Tamil Nadu Veterinary** and Animal Sciences University, Krishi Vigyan Kendra, Kundrakudi, Sivagangai (Tamil Nadu) 630 206

Location of use of the ITK : Sundakadu, Thirupathur, Sivagangai (Tamil Nadu) 630 206

Geographical indicators

Common name : Cassia

Botanical name : Cassia tora Linn.

Family : Caesalpiniaceae

Description

This small plant grows in dry soil in tropical India. It is an Ayurvedic herb. Also used in Chinese medicine. The green color of the pod turns into light yellowish brown colour on drying.

Habitat

It grows below 1,500 m above sea level along riversides and roadsides of hotwarm and low altitude regions in sandy and gravel grounds.Commonly found growing in countries like Tibet, India etc. Grows in dry soil throughout tropical parts of India.

Experimenters : Dr S. Ganeshan, Principal Scientist , Dr M.Prabhakar , Head, Division of Vegetable Crops, and Dr S.Shankara Hebbar, Scientist (SS), Division of Vegetable Crops, Indian Institute of Horticultural Research , Hessaraghatta Lake Post, Bangalore (Karnataka) 560 089

METHODOLOGY

Location

The experiment was conducted at Indian Institute of Horticultural Research, Bangalore.

Experiment

There was three treatment used as follows:

T_1 as per ITK: FYM at the rate of 25 tonnes/ha was applied along with Cassia application. Cassia leaves (75 kg/ha) with cowdung (125 kg/ha) was

Horticultural Crops



Cassia tora

made to decompose for 15 days. This compost was then applied to the treatment at the bulb formation stage.

T_2: Cultivation with recommended practice—FYM 25 t/ha with addition of NPK/ha @ 125:50:25 kg.

T_3: Cultivation as per farmers practice—FYM @ 25 tonnes/ha only.

Each treatment was followed in rainy (kharif) and winter (rabi) seasons with seven replications. Observations were taken on plant height, number of leaves, leaf area, dry matter production and distribution, bulb diameter, mean bulb weight, bulb yield per hectare, bulb girth and colour of the bulb.

RESULTS AND DISCUSSION

Experiment

Rainy season highest bulb yield of onion (339 t/ha) was recorded by following the recommended practice (T_2). The ITK practice (T_1) gave a yield of 337 t/ha which was 332 tonnes/ha by applying FYM (T_3). However these treatments did not differ significantly among themselves. Similarly, other parameters studied namely plant height and number of leaves at 45 days after transplanting, mean bulb weight and bulb girth also did not differ significantly among the treatments (Table 1). Visual observation on colour of the bulb also observed to be similar in all the treatments.

Rabi season trial: 2002–03: Plant height, number of leaves, leaf area per plant and dry leaf weight recorded at 40 and 70 days after transplanting showed that fertilized plot (T_2 : RDF + FYM) head significantly higher values of these parameters as compared to ITK (T_1) and farmers practice (T_3) (Table 2). The difference may be because of higher nutrients available in the fertilized plot. ITK practice and farmers practice did not differ significantly among the growth parameters studied.

Table 1. Influence of Cassia leaf compost, FYM and fertilizers on growth and yield of kharif onion (2002)

Treatment	Plant height (cm)	No. of leaves/plant	Girth of bulb (cm)	Mean bulb weight (g/bulb)	Bulb yield (q/ha)
T_1: Cassia application (ITK practice)	54.6	10.1	21.9	81.9	337
T_2: Recommended dose of fertilizer + FYM	57.1	10.0	22.4	82.2	339
T_3: Farmers practice (FYM only)	56.5	09.8	22.7	82.5	332
F test	NS	NS	NS	NS	NS

RDF, Recommended dose of fertilizer; FYM, Farmyard manure.

Table 2. Influence of *Cassia* leaf compost, FYM and fertilizers on growth of *rabi* onion (2002–03)

Treatment	Plant height (cm)		No of leaves/plant		Leaf area/ plant (cm)		Dry weight of leaves (g/plant)	
	40 DAT	70 DAT	40 DAT	70 DAT	40 DAT	70 DAT	40 DAT	70 DAT
T: Cassia application (ITK practice)	37.2	37.4	7.9	10.63	208.5	324.0	3.0	14.3
T: Recommended fertilizer + FYM	55.8	53.2	8.4	10.1	412.3	418.4	4.0	20.0
T: Farmers practice (FYM only)	33.6	41.0	7.0	10.5	191.2	313.1	2.4	14.7
CD (P=0.05)	6.44	5.89	2.19	1.46	160.36	65.43	0.86	5.50

DAT, Days after transplanting

CONCLUSION

Based on the results of the experiment conducted in *kharif* and *rabi* seasons 2002 – 03, the superiority of ITK practice in terms of yield, quality and bulb colour was not observed.

Code : **170**

Title of the ITK : **Pest management in tomato (*Lycopersicon esculentum* by using leaf extract of *Cynodon dactylon***

Description of the ITK :]Root rot and damping off in tomato is controlled by applying *Cynodon* leaf extract. This is applicable only for tomato PKM-1 (local variety) in Karikuttanoor village at Dharmapuri. Fresh leaves of *Cynodon dactylon* (*doob* in Hindi, *arugampul* in Tamil) are dried in shade. The dried sample is powdered and then mixed with water and placed in an air tight mud pot and left undisturbed for 24 hours. This mixture is filtered twice, first using gunny cloth and then with a white piece of cloth. The clear mixture is ready for use. One litre of this mixture is added to one llitre water, which is sprayed either by using hand sprayer or by power sprayer. When tomato seedling is 15 days old, this mixture can be sprayed at frequent intervals until harvest. For 1 acre of land, 10 litres of this solution is recommended. Control of root rot and damping will result in good yield. It is best suited only for tomato PKM-1 in Thai pattam (January season).

Name and address of the discloser : Shri. P. Krishnamoorthy, S/o. Shri. Perumal, Karikuttanoor, Thirumalvadi, Palacode, Dharmapuri (Tamil Nadu) 636 808

Location of use of the ITK : Karikuttanoor, Thirumalvadi, Palacode, Dharmapuri (Tamil Nadu) 636 808

Geographical indicators : *Cynodon dactylon*

Common name : Arugampul

Botanical name : Cynodon dactylon

Family : Poaceae

Description

Creeping perennial (grass), rooting at the nodes either on the surface of the ground (stolons) or underground (white rhizomes); culms slightly flattened, prostrate or somewhat ascending or erect; inflorescence purplish, digitate; leaf-blades short, usually 3_10 cm long, 3_6 cm wide, the edges rough. Spikes 2_6, often 5 or 4, 2.5_7 cm long. Spikelets imbricate, sessile, up to 3 mm long. Lemma longer than either glume (Stone, 1970).

Habitat/ecology

Experimenters : Will grow in very poor soil. In drought, dies above ground but will re-grow from rhizomes. Prefers warm, moist conditions.

Dr. Sabitha Doraiswamy, Director, Centre for Plant Protection Studies; Dr. S. Palaniswamy, Professor & Head; Dr. P. Karuppuchamy, Professor, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) 641 003 for the experiments conducted at Coimbatore and Dr. S. Ganeshan, Principal Scientist, Dr. Girija Ganeshan, Principal Scientist (Plant Pathology), Dr. N.K. Krishna Kumar, Head, Division of Entomology, Dr. P.N. Krishnamoorthy, Principal Scientist (Entomology), Dr. Poonam Sinha, Sr. Scientist (Plant Pathology), Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore (Karnataka) 560 089 for the experiments conducted at Bangalore

METHODOLOGY

Location

Tamil Nadu agricultural University Coimbatore and Indian Institute of Horticultural Research, Bangalore.

The experimental details, results obtained and its discussion are presented here under location-wise.

PRA and field study

Unstructured interview was conducted and all



Leaves of *Cynodon dactylon*

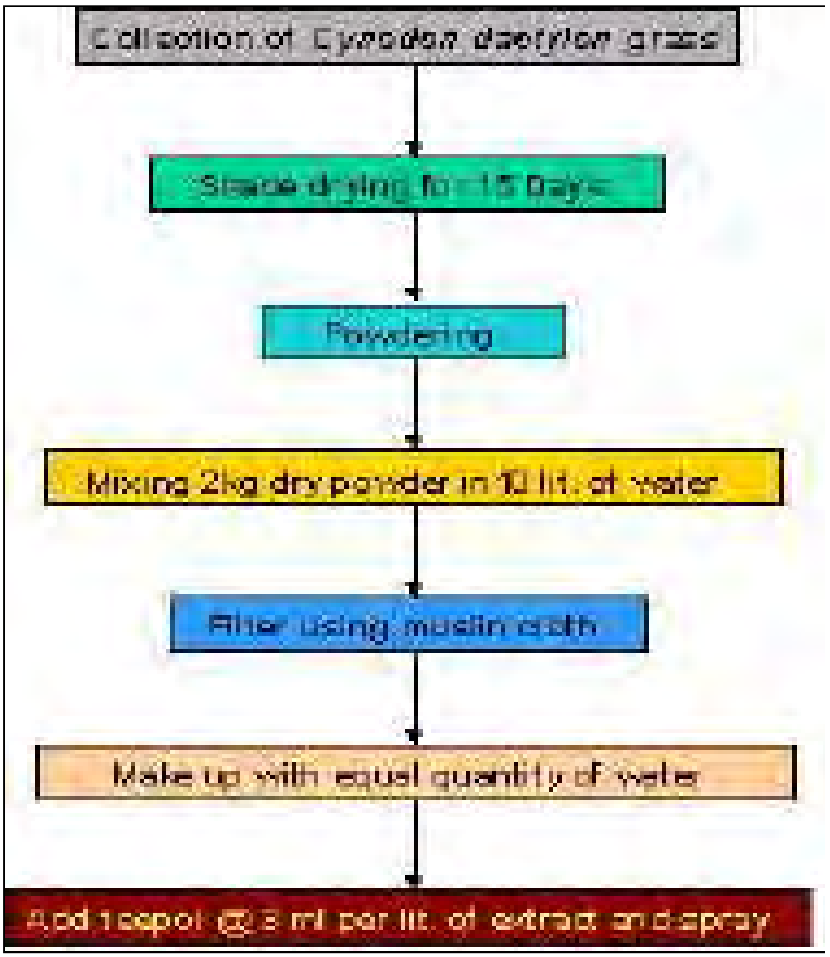


Fig. 1. Preparation of extract from *Cynodon dactylon* extract

Table 1. Effect of spray of Cynodon dactylon extract on pest incidence and yield of tomato, Coimbatore

Treatment		After 1 spray		After 2spray		After 3spray		
	Pretreatment count	Larvae/ 20 plants	% fruit damage	Larvae/ 20 plants	% fruit damage	Larvae/ 20 plants	% fruit damage	Yield (kg / 45m2 plot)
Cynodon dactylon extract	2.29	2.14b	14.08b	4.29a	8.68b	3.00b	8.20b	106.71a
Endosulfan (0.07%)	2.57	1.00a	8.02a	2.57a	5.20a	1.14a	3.80a	114.43a
Untreated check	2.57	3.57b	22.41b	7.29b	13.91c	3.86b	13.62c	97.86b

(Means followed by a common letter are not significantly different at 5% level)

the details were obtained on the use and methods of the ITK.

Experiment

Field experiment was conducted with 3 treatments (i) *Cynodon dactylon* extract spray, (ii) Endosulfan 35EC 0.07% spray, and (iii) untreated check. Tomato (variety PKM-1) was raised in 45m2 plots in 7 replications. Incidence of pest and yield were recorded.

Preparation of Cynodon decoction

Fresh leaves of *cynodon* are sun dried and powdered. 2 kg, powder is mixed with 10 litres of water in a mud pot and is left for 24 hours. Filtrate obtained is diluted with equal quantity of water and sprayed at 15 days interval until harvest. Preparation method is depicted in Fig. 1.

RESULTS AND DISCUSSION

PRA and field study

Matrix ranking on the efficacy of the practice vis-à-vis other alternative was done through unstructured interview using PRA methods. The results obtained are depicted in Fig.2 and 3.

Experiment

Observation on *Helicoverpa armigera* was recorded with respect to the treatments. The results showed that the spraying of Endosulfan at 0.07% is highly effective against fruit borer. The results obtained on the three treatments are chalked out in the Table 1.

Spraying of *Cynodon dactylon* extract three times at 15 days interval starting from flowering stage reduced the fruit damage caused by

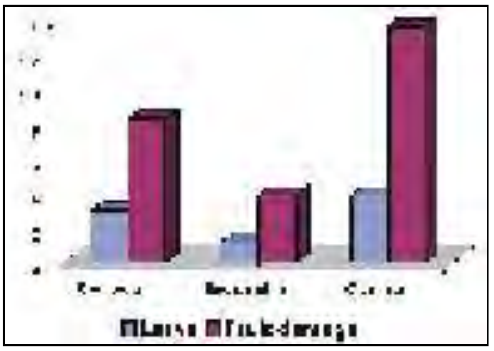


Fig. 2. Fruit borer management in tomato using *Cynodon dactylon* extract

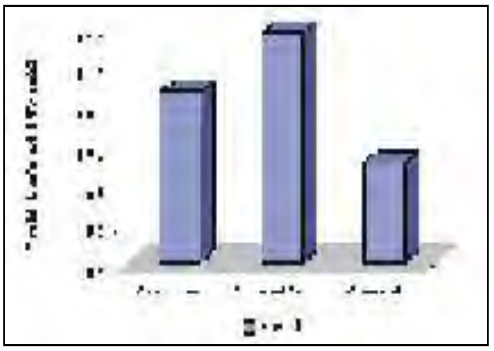


Fig. 3. Yield of tomato using *Cynodon dactylon* extract

Table 2. Incidence of different diseases and yield of tomato as affected by treatments, Bangalore

Treatment	Wilt (%)	Leaf curl (%)	Early blight (%)	Borer (%)	Fruit rot (%)	Leaf miner (%)	Yield (kg/ 100 m2)
Chemical	4.7	38.7	31.0	3.47	12.78	2.1	221.2
Cynodon dactylon	5.3	32.3	35.0	3.15	11.31	2.15	229.9
Control	12.7	37.0	53.7	4.25	8.15	3.5	236.2

Helicoverpa armigera when compared to untreated check. However, Endosulfan 35EC at 0.07% gave the maximum control of the pest. There was no difference in the yield of healthy tomato in both Cynodon dactylon and Endosulfan treated plots.

METHODOLOGY

Location

Indian Institute of Horticultural Research Bangalore.

PRA and field study

Unstructured interview was conducted and information were obtained on the methods and use of the ITK.

Experiment

A field experiment was conducted with 3 treatments, viz., (i) Chemical- Chlorothalonil, Hostothion and Imidacloprid spray, (ii) Spray of *Cynodon dactylon* extract _ 15 days interval till harvest, and (iii) Control _ No spray. Tomato (Variety PKM-1) was taken in 100 m2 plots.

Extract of *Cynodon dactylon* which was used as one of the treatments was prepared in the following way: 1 kg grass was soaked in 12 litre water. Eight litre extract was obtained after 24 hours of soaking. Observations on wilt, leaf curl, early blight, fruit rot, leaf miner, borer and yield were recorded.

RESULTS AND DISCUSSION

Experiment

Observations on the incidence of wilt, leaf curl, early blight,fruit rot, leaf miner, borer and yield were recorded. Data presented in Table 2 give the results on different disease parameters observed with the three treatments.

The results obtained indicated that *Cynodon dactylon* soaked water is effective in the management of pests in tomato. It was also observed that it is effective against wilt and root rots. The observations recorded have shown a reduction in the incidence of wilt, leaf curl, early blight, borer and leaf miner in *Cynodon dactylon* treated plots as compared to untreated control. However, yield of tomato was similar in all the 3 treatments.

CONCLUSION

Reduced incidence of pests and diseases was observed both at Coimbatore and Bangalore with the use of *Cynodon dactylon* soaked water in tomato as claimed by the discloser.

REFERENCE

Stone, Benjamin. 1970. The flora of Guam. *Micronesica* 6: 194.

Code : **1416**

Title of the ITK : **Control of insect-pest by spraying starch, animal urine and dusting of cowdung ash in vegetables**

Description of the ITK : The sticky nature of starch and uric acid of animal urine helps in killing the insects. Dusting of cowdung ash helps in control of biting and chewing type insects specially aphids. Rice starch and animal urine are spread on vegetable plants. These traditional practices are adopted by 85% farmers in the Kurchi village of Dhanbad district in Jharkhand.

Name and address of the discloser : Shri Sitaram Mahto, Kurchi, Govindpur, Dhanbad (Jharkhand)

Location of use of the ITK : Village Kurchi, Block Govindpur, Dhanbad (Jharkhand)

Experimenters : Dr N. Kudada, Assistant Professor cum-Junior Scientist, Department of Plant Pathology and Dr (Ms) N. Bara, Scientist, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

Village Kurchi, Block Govindpur, Dhanbad (Jharkhand)

PRA and field study

Field study was conducted following the PRA methodology with 15 respondents. The reported ITK was compared with recommended chemical control measure on four parameters i.e. insect control, cost effectiveness, availability of materials and yield.

Experiment

An experiment was conducted in Kurchi village. The design was R.B.D. with 10 replications and three treatments, viz., T1-Control, T2-Spraying of animal urine mixed with starch, followed by dusting of cowdung ash (@ 500 litres of animal urine mixed with 5 lit. of rice starch followed by dusting of 40 kg cowdung ash per ha.), T3-Application of monocrotophos @ 1. 0 l/ ha. Lady's finger was taken as the test crop and observations were recorded on parameters like number of infested fruits/m2 and extent of control.

RESULTS AND DISCUSSION

PRA and field study

Data on PRA have been presented in Table 1 which show that spraying of animal urine mixed with starch followed by dusting of cowdung ash

Table 1. Matrix scoring for assessment of efficacy of starch, animal urine and cowdung ash with chemical insecticide in control of fruit borer in lady's finger

N=15

Parameter	Traetment	
	Animal urine starch and cow dung ash	Chemical insecticide
Insect control	6.93	8.53
Cost effectiveness	9.07	4.53
Availability	7.93	3.87
Yield	6.27	6.47

Table 2. Number of infested lady's finger fruits and extent of control due to use of ITK and chemical pesticide

Treatment	Number of infested fruits/m2	Extent of control (%)
Control	20.2	-
Spraying of animal urine mixed with starch followed by dusting of cow dung ash	9.4	53.6
Application of monocrotophos	4.22	79.4
CD at 5 %	4.2	

is slightly inferior than chemical insecticide in controlling the insect-pests. However, in terms of yield both the methods were rated to be at par and on other parameters the reported ITK was rated to be superior than the chemical insecticide.

Experiment

The results obtained indicate that least number of infested fruits (4.2/m2) was recorded due to application of monocrotophos. Application of monocrotophos also recorded 79.4% less infestation than control. In treatment (T2), i.e. spraying of animal urine mixed with starch, followed by dusting of cow dung ash, the number of infested fruits was 9.4/m2. It also recorded 53.6% less infestation than the control. Substantial reduction in infestation by the insect-pest was observed with the ITK method.

CONCLUSION

Spraying of animal urine mixed with starch followed by dusting of cow dung ash was found to be effective in controlling insects in lady's finger.

Code : **1415**

Title of the ITK : **Control of insect pests in cucurbits, cowpea and lady's finger by spraying urine of domestic animals mixed with tobacco soaked water**

Description of the ITK : Insects on leaves and fruits of cucurbits, cowpea and lady's finger are very common. These are controlled by spraying urine of domestic animals mixed with tobacco soaked water. This age-old practice has been adopted by 56% farmers in Bahadurpur village of Dhanbad district in Jharkhand.

Name and address of the discloser : Shri Nepal Chandar Ojha, Bahadurpur, Bagsuma, Dhanbad (Jharkhand)

Location of use of the ITK : Village Bahadurpur, Post Bagsuma, Block Govindpur, Dhanbad (Jharkhand)

Experimenters : Dr. N. Kudada, Assistant Professor cum _Junior Scientist, Department of Plant Pathology, Shri S.K. Sawaiyan, SRF (ITK-NATP) and Dr. R.P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

Village Bahadurpur, Post Bagsuma, Block Govindpur,

Dhanbad (Jharkhand)

PRA and field study

Field study was conducted following the PRA methodology with 15 respondents. The reported ITK was compared with recommended chemical control measure on four parameters i.e. insect control, cost effectiveness, availability of materials and popularity.

Experiment

An experiment was conducted on lady's finger in R.B.D. in 12 replications with three treatments, viz., T1 - Control, T2 - Use of animal urine mixed with tobacco soaked water (@ 25 kg tobacco stalk soaked in water and mixed with 500 litre of animal urine/ha) and T3 - Application of monocrotophos @ 1.0 litre/ha. Observations were recorded on the parameters like number of infested fruits and extent of control.

RESULTS AND DISCUSSION

PRA and field study

The data presented in Table1 show that spraying of chemical insecticide was more effective in controlling insect pests in cucurbits and cowpea than the ITK. The ITK was more effective than chemical insecticide for lady's finger.

Experiment

Results obtained have been presented in Table2 which indicate that use of monocrotophos reduced the number of infested fruit which was 2.9/m2 as compared to 19.8/m2 fruits in control. In the treatment where animal urine mixed with tobacco soaked water was used, the number of infested fruits/m2 was 6.3 which was at par with use of monocrotophos. Extent of control of fruit

Table 1. Matrix scoring for assessment of performance of spraying of cowurine of domestic animals with tobacco soaked water vis-à-vis use of chemical insecticide

N=15

Parameter	Animal urine+tobacco soaked water			Chemical insecticide		
	Cucurbits	Cowpea	Lady's finger	Curcurbits	Cowpea	Lady's finger
Insect control	6.26	6.13	8.93	8.93	8.53	8.66
Cost effectiveness	5.06	5.46	6.93	3.86	5.06	5.20
Availability	4.66	5.60	5.60	3.73	3.86	3.46
Popularity	3.86	4.40	5.73	5.33	4.93	5.60

Table 2. Number of infested lady's finger fruits /m2 and extent of control (%) due to use of ITK and chemical pesticide

Treatment	Number of infested fruits /m2	Extent of control (%)
T1 : Control	19.8	-
T2 : Use of animal urine mixed with tobacco soaked water	6.3	68.8
T3 : Spraying of Monocrotophos	2.9	85.5
CD (P=0.05)	3.9	-

borers by use of monocrotophos and ITK practice was 85.5 and 68.8%, respectively.

CONCLUSION

Use of animal urine mixed with tobacco soaked water was found to be equally effective as that of use of monocrotophos in controlling fruit borer in lady's finger.

Code : **1417**

Title of the ITK : **Control of shoot and fruit borer by tobacco-soaked water with soap**

Description of the ITK : The shoot and fruit borers in brinjal are very common in Kowakol, Sokhodeora, Jorawardih and Mananiyatari villages of Nawada district of Bihar. Tobacco is soaked in water overnight and the extracted liquid is filtered and sprayed on the affected plants with soap or detergent powder. The ratio of water and tobacco in solution is 10:2. This is in practice for last 30 years by maximum number of farmers in the village. Due to shoot and fruit borer brinjal yield reduces up to about 75%. Its control in brinjal through the use of tobacco-soaked water is effective up to 80_85%.

Name and address of the discloser : Shri Mahavir Singh, Kawakol, Nawada (Bihar) 805 106

Location of use of the ITK : Kawakol and Sokhodeora, Block Kawakol, Nawada (Bihar) 805 106

Geographical indicators : Tobacco, a stout viscid annual, 1to 3 m high, unknown in the wild state at present. It was first grown for commercial purposes in Gujarat and Maharashtra. Important tobacco cultivated areas in India lie in Andhra Pradesh, Gujarat, Maharashtra, Karnataka, Bihar and West Bengal.

Experimenters : Dr S. Choubey, Senior Assistant Professor, Department of Agronomy and Dr R. P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006.

METHODOLOGY

Location

The field study was conducted in village Kawakol and Sokhodeora, block Kawakol, dist. Nawada (Bihar).

PRA and field study

Participatory Rural Appraisal (PRA) tools were used with randomly selected 20 respondents in Kawakol and Sokhodeora villages in Nawada district to elucidate information on the efficacy of the practice focusing the points such as extent of control, effect on quality, effect on human health and environment, availability of related inputs, cost effectiveness, and impact on the yield of brinjal.

Experiment

The experiment was conducted with brinjal crop in randomized block design with 20 replications using 3 treatments, viz. T1: control, T2: spray of tobacco-soaked water; and T3 recommended practice (spray of endosulphan). Each treatment covered an area of 1,000 m2. Observations on extent of control, number of infected plant/m2 and fruit/m2, yield and economics of cultivation were taken.

Seedlings of brinjal (Pusa purple long) was raised. The seed bed was prepared 10" long and

4" wide and about 6" high. Between two seed beds, two feet wide path was provided for management of the nursery plant. About 25 days old seedlings were planted in the 1st week of November at a spacing of row to row 60 cm and plant to plant 45 cm. The crop was fertilized with 85:50:30 kg NPK/ha. Altogether 5 sprays (started at 60 days after planting) of tobacco soaked water @ 60 kg tobacco stalk/ha alongwith 40 g/ha of detergent powder was used in 600 litres of water. Similarly endosulphan @ 1.0 l/ha was sprayed at the same intervals. Thus altogether 5 sprays of insecticides was also done starting at 60 days after planting.

RESULTS AND DISCUSSION

PRA and field study

The farmers informed that tobacco stalkwas easily available at cheaper rate in the market. It is eco-friendly and has no side effects either on soil or on human health. In most of the houses people use tobacco for chewing purpose and the waste product is utilized in controlling the insect pest in brinjal. Hence, no additional monetary involvement was there. Hence they use this practice in control of insect pest.

Results given in Table 1 reveal that application of tobacco soaked water to control shoot and fruit borer in brinjal is as good as use of chemical insecticide (endosulphan). Further, tobacco-soaked water had no adverse effect on human health and soil like chemical pesticides, as reported by the respondents.

Experiment

The experimental results obtained are presented in Table 2.

Data presented in Table 2 reveal that the lowest number of shoots (1.2/m2) and fruits (0.85/m2) were found to be infected by the insects due to application of endosulphan @ 1.0 litre/ha the number of infected shoot and fruit was 1.4 and 1.05/m2 when tobacco soaked water was applied to brinjal. Data further indicate that by application of endosulphan 89% less infestation was recorded in shoot and 92% in fruit than control. Similarly, by spray of tobacco soaked water 88% and 91% less infestation were recorded in shoot and fruit respectively than the control.

The higher fruit yield (365 q/ha) was recorded where chemical insecticide (endosulphan) was sprayed which was at par with the yield (354 q/ha) obtained by spraying of tobacco soaked water. Thus, use of endosulphan and tobacco soaked water gave 33 and 31% more fruit yield in comparison to the control, respectively.

Highest net return (Rs 1,39,886/ha) was recorded when the brinjal crop was sprayed with

Table 1. Matrix scoring for assessment of performance of tobacco-soaked water and endosulphan in control of brinjal shoot and fruit borers

Prameter	Tobacco soaked water	Chemical pesticide (Endosulphan)
Extent of control	8	9
Effect on quality	8	-8
Effect on human health and environment	2	-8
Availability	10	4
Cost effectiveness	8	6
Liking of the farmer	10	6
Yield	7	8

Table 2. Number of infected brinjal shoots and fruits/m2, yield (q/ha) and economics under field experimentation

Treatment	No. of infected shoots/m2	No. of infected fruits/m2	Yield (q/ha)	Net return (Rs/ha)	Return/Rupee spent (Rs/Re)
Control	11.2	10.6	245.0	33,086.00	1.84
Use of tobacco-soaked water	1.4	1.05	354.0	1,35,906.00	4.31
Use of endosulphan	1.2	0.85	365.0	1,39,886.00	4.28
CD (P=0.05)	0.32	0.57	17.4	1,245.00	0.43

endosulphan than rest of the treatments with a net return of Rs 1,35,906/ha and Rs 33,086/ha obtained by spraying tobacco soaked water and control, respectively. The data show that about 3.0% more net return was obtained by use of endosulphan over tobacco soaked water. Further, it is revealed from Table 2 that about 75% more net return could be obtained through use of ITK practice and improved practice over control. However, the highest return/rupee spent (Rs 4.31/Re) was recorded when tobacco soaked water was used to control shoot and fruit borer in brinjal which was Rs 4.28/Re in case of use of endosulphan. The net return when no treatment was given (control) was 1.84 Rs/Re.

CONCLUSION

On the basis of results of the field experiment, it may be concluded that for controlling shoot and fruit borer in brinjal, spraying of tobacco soaked water is equally effective as that of using endosulphan.

Code : **366**

Title of the ITK : **Use of kochila *(Strichnos nuxvomica)*-mixed cowdung compost in brinjal for controlling fruit and shoot borer**

Description of the ITK : Cowdung, 10 kg *kochila (Struchnos nux-vomica)* seed powder and 25 kg *kochila* leaf are put in a compost pit of 10 × 3 × 3 feet by mixing thoroughly. Then 10 litre cow urine is added to the pit for 10 consecutive days and covered with soil. After 2 months the compost becomes ready. This compost (5 g) is added to each plant once at the time of sowing and at 45 days after planting. Due to its repellent action, incidence of shoot and fruit borer is reduced.

Name and address of the discloser : Shri Bivision Pradhan, Badakodanda, Bhanjanagar, Ganjam (Orissa) 761 126

Location of use of the ITK : Badakodanda, Bhanjanagar, Ganjam (Orissa) 761126

Geographical indicator

Struchnos nux-vomica Linn.:An evergreen or deciduous tree usually 13 m high, founds throughout tropical India up to an altitude of 360 m. The tree occurs to a considerable extent in Uttar Pradesh, Bihar and Orissa. The coromandes coast Arunachal Pradesh and Masoor and is most common in the monsoonal forest along the western coast.

Experimenters : Dr A.K. Das, Associate Professor, Department of Horticulture, Orissa University of Agriculture and Technology, Bhubaneswar 751 003 (Orissa), Shri N.Nayak, Training Organiser, Krishi Vigyan Kendra, Bhanjanagar (Orissa) and Shri D. Mohapatra, Training Associate, Krishi Vigyan Kendra, Barachana (Orissa).

METHODOLOGY

Location

The efficacy of *kochila*-mixed cowdung compost for controlling fruit and shoot borer was evaluated by participatory rural appraisal (PRA), field survey and experimental methods. These were conducted at village Badakodanda, Bhanjanagar, Dist. Ganjam (Orissa).

Fruit and shoot borer is the major insect in brinjal. Borer causes harm to shoot as well as to fruits, reducing the market value of brinjal.



Fig. 1. *Kochila* seeds

Table 1. Matrix table for evaluation of performance of kochila-mixed cowdung compost vis-à-vis plant protection measures in controlling fruit and shoot borer of brinjal

Parameter	Tratment		
	Use of kochila mixed cowdung compost	Use of plant protction mesures	Without control
Plant growth	Vigorous	Moderate	Poor
Fruit bore incidence	8%	10%	20%
Fruit set	70%	60%	50%
Fruit weight (g/fruit)	250	200	150
No. of fruits/plant	8	6	3
Average yeild of fruit/plant (kg)	1.75	1.10	0.75
Taste of health fruits	Good	Good	Good



Fig. 2. Healthy crop of brinjal after the treatment

The PRA was conducted to determine the efficacy of *kochila* -mixed cowdung compost as compared to plant protection method by use of pesticide. The survey was done on 10 farmers of village Badakodanda. The following parameters were taken for study, i.e. growth of plant, fruit borer incidence, fruit setting, fruit size, number of fruits/plant, fruit yield/plant and taste of healthy fruits.



Fig. 3. Treatments under experimentation on use of kochila mixed with compost (left) and use of pesticide (right) for control of fruit and shoot borer in brinjal

Experiment

The experiment was conducted at two sites at (i) Badakodanda village, and (ii) KVK, Bhanjanagar, with three treatments: (i) kochila mixed cowdung compost applied @ 5 g/plant at planting and @ 10 g/plant after 45 days of transplanting (ITK method), (ii) chemical pesticide: granular pesticide at planting @ 10 kg ai/ha, monocrotophos 15 days after transplanting, endosulfan 15 days after transplanting, Nukil 60 days after transplanting and Sevin- 75 days after transplanting, and (iii) without any treatment control.

Table 2. Efficacy of *kochila*-mixed cowdung compost in controlling brinjal fruit and shoot borer

Parameter	Treatment			
	Application of *kochila* cowdung compost (ITK method)	Use of recommended Pesticide	Without any control	C.D.(P=0.05)
Shoot borer infestation (%)	4.99	4.50	17.71	1.17
Fruit borer infestation (%)	6.00	4.68	18.48	1.05
Average fruit weight (g/fruit)	132.52	135.08	126.48	5.27
No. of fruits/plant	11.74	11.08	7.80	0.48
Yield of fruits/plant (kg)	1.55	1.57	1.02	0.14
Fruit taste	Palatable	Palatable	Palatable	-
Total fruit yield (q/ha)	270.81	272.54	181.61	0.31
Marketable fruit yield (q/ha)	253.66	262.54	150.61	21.17

The experiment was laid out in CRD with 15 replications. The variety used was Bhanjanagar Local. Observations were taken on (i) percentage of shoot infestation, (ii) percentage of fruit infestation, (iii) fruit weight, (iv) number of fruits/plant, (v) Yield of fruits/plant, (vi) fruit taste, (vii) fruit yield/ha, and (viii) Marketable fruit yield

Data given in Table 1 show that ITK method (use of *kochila* mixed cowdung compost) was superior to other two methods. Application of kochila mixed cowdung compost resulted in better plant stand with lesser pest incidence, which helped realize higher yield of brinjal.

Experiment

Results of the experiment conducted at Badakodanda village revealed that with use of *kochila*-enriched cowdung, the incidence of shoot and fruit borer was much lower (4.9_6.0%) as compared to that of untreated plot (17.71 and 18.48%). Use of pesticides also reduced the pest incidence which is similar to the application of kochila-mixed cowdung. Effect of kochila compost was also at par with the use of pesticides in terms of fruit weight and number of fruit yield per plant. Yield of fruits per plant, total fruit yield and marketable fruit yield (Table 2).

CONCLUSION

Use of *kochila* mixed cowdung compost reduces the incidence of fruit and shoot borer in brinjal up to considerably, which also matches with the claim of the discloser.

Code : **701**

Title of the ITK : **Protection of cabbage from pests**

Description of the ITK : Cabbage is one of the important cash crops of Shimla district. In the cabbage plants a special type of pest spoils the inner portion of cabbage, the cabbage remains loose, and ultimately plants fall down. Ash and cow urine are used to protect the cabbage plant from insect pests. This ITK is useful to check insect pests and also to enhance cabbage productivity. Cow urine may have certain chemical, which may have insecticidal properties.

Name and address of the discloser : Shri Devkant Prakash, Village Bhagheog, Tehsil and P/O Theog, Shimla (Himachal Pradesh) 171 201

Location of use of the ITK : This ITK is prevalent in Theog area of Shimla district in Himachal Pradesh. This area forms a part of high hills temperate wet Himalayan region and lies between the longitudes 77° - 0" and 78° - 19" east and latitudes 30° - 45" and 31° - 44". This zone is physio-graphically a mountainous trait with terraces. Mainly dry farming is practised and soil is shallow, silt to loam in texture and acidic in nature. This zone at present contribute to about 96% of the total temperate fruit production. Apple is the most pre-dominant fruit grown in the zone.

Experimenters : Dr L.R. Verma, Department of Bio-Sciences, and Shri Sanjeev Noel, Scientific Assistant, Himachal Pradesh University, Summer Hill, Shimla 171 005, Himachal Pradesh, and Shri Devkant Prakash, village- Bhagheog, Tehsil and P. O. Theog, Shimla- 171 201 (Himachal Pradesh)

METHODOLOGY

PRA and field study

The PRA exercise was carried out in Theog area of Shimla district in Himachal Pradesh. More than 50 farmers belonging to different villages, viz. Deorighat, Jadeog, Batog, Nelaha, Tikkar and Baloa, were interviewed through a questionnaire.

Experiment

Field trials were conducted at experimental field of Mountain Research and Development Associates (MRDA) in village Gawai, tehsil Theog, dist. Shimla, during 2002. Different concentrations of cattle (cow, buffalo, sheep) urine and cowdung ash were used against the cabbage aphid (Brevicoryne brassicae). The effects of urine and ash were studied separately. The first application of urine and ash was done when the cabbage plants were at 4-5 leaf stage. Second spray was done after 2 weeks following the first spray. Cattle urine was used both fresh and aged. Aging of urine was done by keeping it in airtight earthen container for 10 days. Different plots were used for each treatment, where each plot had 25 cabbage plants. A gap of 12 feet was

kept between two adjacent plots. The experiment was laid out in complete randomised design (CRD) in a plot size of 2 m × 2 m with 25 replications. Each cabbage plant was treated as a replicate. The cabbage was planted in 40 cm × 30 cm geometry.

Five concentrations, viz. 0, 10, 20, 30 and 100%, of cow and buffalo urine with water were sprayed to observe their aphicidal properties as well as their effect on growth of cabbage. For sheep urine, two concentrations, viz. 0 and 100%, were used. Volume of urine mixture applied per plant was 20 ml. To compare these results with chemical pesticides, a commonly used insecticide, monocrotophos 0.05% was used.

Cowdung cakes were dried and collected in a heap. The heap of cowdung was burnt in the open field and the ash was collected. The quantity of ash dusted was 0, 50, 100 and 150 g/plant.

Observations on the incidence of aphids, number of leaves per plant and plant height were taken at 5 days interval up to 60 days of plant growth.

Final observations were statistically analysed by applying Student `t' test and F test to find out the level of significance.

RESULTS AND DISCUSSION

PRA and field study

The results of the study are summarized below:

- About 40% farmers revealed that spray of cow urine on cabbage foliage reduces the incidence of insect pest especially aphids.
- About 20% farmers reported that dusting cowdung ash on foliage is effective for controlling aphid population on cabbage plant.
- About 30% farmers revealed that sowing of cabbage seed in a mixture of cowdung ash and soil (100 g ash/plant) results in very good (80%) seed germination and the remaining farmers informed that such a treatment did not help much (10-15% germination).
- About 15% farmers reported that by dipping of cabbage seed in cow urine, about 60_80% germination occurred; the other farmers did not practice this method.
- About 20% farmers use aged cow urine for control of insect pests in cabbage and they felt that it is an effective method.
- Both cowdung ash and burnt crop residue ensure better growth of the plant in terms of number of leaves, thicker stem and plant height.
- Cowdung ash helps in controlling the weeds in cabbage crop.
- Mixing cowdung ash makes the soil porous and more fertile.
- Germination of cabbage seed is advanced by about 10 days by treating the seeds with cow urine.
- A majority of the farmers revealed that the method of control of insects in cabbage using cow urine is now declining, as the farmers are now adopting modern method of chemical application for insect-pest control.
- Aged cow urine is prepared by storing the fresh urine underground in the earthern pot for about a week.

Experiment

Comparative effect of different concentrations of aged cow urine spray on aphid population and growth of cabbage.

The results obtained are given in Tables 1,2 and 3 and depicted in Fig 1. Unsprayed (control) cabbage showed an initial increase in aphid population, followed by a plateau. This plateau observed may be due to a balance in the rate of loss (migration and death) and gain (birth).

In the treated cabbage with aged cow urine, significant decline in aphid population was observed after 10 days, showing very effective eradication of aphids. The initial rise in number of aphids in treated cabbage plants up to day 10th

Table 1. Effect of aged cow urine spray on number of aphids per cabbage plant

Treatment (urine concen-tration in %)	Aphid population at different intervals (in days) after treatment imposition												
	5	10	15	20	25	30	35	40	45	50	55	60	Mean
0	0.0	5.0	15.0	30.0	35.0	36.0	39.0	38.0	38.0	38.0	38.0	36.80	29.07
10	0.0	10.0	5.0	5.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
20	8.0	5.0	3.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.83
30	5.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.10
100	7.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.92
Mean	7.0	6.04	7.60	7.60	7.40	8.00	7.60	7.60	7.60	7.60	7.60	7.36	6.98
SE-diff	0.77	1.15	1.08	1.83	1.74	1.51	0.89	1.69	1.46	1.26	0.66	1.17	0.38
CD 5%	1.62	2.40	2.26	3.82	3.64	3.15	1.87	3.52	3.04	2.64	1.38	2.45	0.75
Sig	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

SE _ diff (dates) 0.59; CD (P=0.05) 1.15

may be due to the presence of more resistant adult stages, which reproduced and increased the aphid population subsequently.

After 10 days, the number of aphids declined significantly under all urine concentration treatments. But significant effect could be observed either on the number of leaves or plant height, indicating that these parameters remained almost indifferent to all the treatments. The observed final plant height showed no significant difference between treated and untreated cabbage plants. Full control of aphid population was obtained after day 35 in urine treatments. This phenomenon was observed much earlier with higher concentrations. There was a consistent positive effect in controlling the aphid population and the differences were significant.

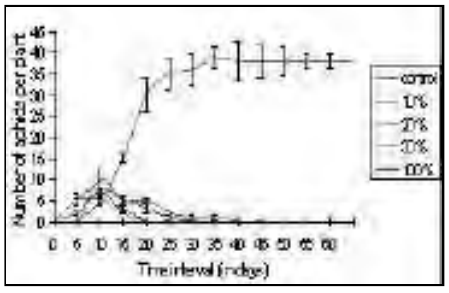


Fig. 1. Effect of different concentrations of aged cow urine spray on the number of aphids per plant

Comparative effect of different concen-trations of fresh cow urine on the aphid population and growth of cabbage

The results of this experiment are given in

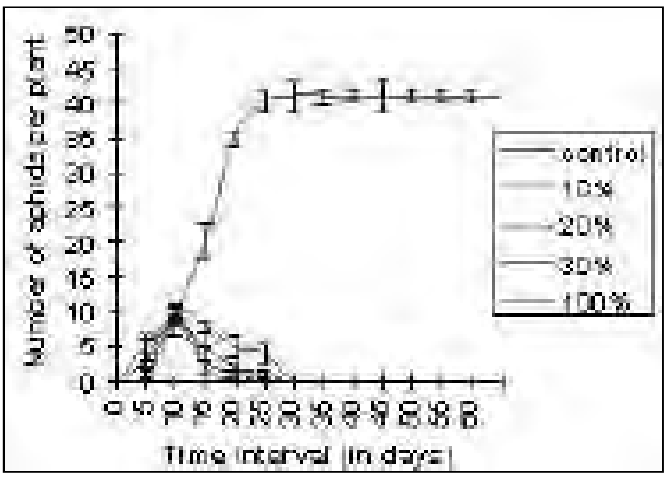


Fig. 2. Effect of different concentrations of fresh cow urine spray on the number of aphids per plant

Table 2. Effect of aged and fresh cow urine spray on growth of cabbage

Day	Urine conc. (%)	No. of leaves/plant		Plant height (cm)	
		Aged	Fresh	Aged	Fresh
5	0	6 ± 0.58	8 ± 0.99	15.2 ± 1.45	8.7 ± 0.69
	10	6 ± 1.52	7 ± 1.52	14.0 ± 0.81	9.8 ± 0.29
	20	7 ± 1.52	8 ± 2.08	14.8 ± 2.20	8.7 ± 0.65
	30	6 ± 0.58	7 ± 1.15	14.9 ± 2.20	8.6 ± 0.69
	100*	6 ± 1.52	8 ± 2.08	15.0 ± 2.01	8.5 ± 0.50
10	0	11 ± 0.58	12 ± 2.64	16.5 ± 1.39	13.8 ± 0.79
	10	9 ± 0.58	11 ± 1.15	16.7 ± 1.81	12.9 ± 0.75
	20	10 ± 0.99	13 ± 3.46	15.3 ± 0.90	12.8 ± 0.62
	30	10 ± 0.58	11 ± 1.52	15.4 ± 1.50	12.7 ± 0.70
	100	10 ± 1.52	10 ± 1.99	15.5 ± 1.53	12.8 ± 0.62
15*	0	12 ± 2.30	13 ± 1.15	17.7 ± 1.28	14.2 ± 0.88
	10	12 ± 0.58	12 ± 0.58	17.3 ± 1.42	13.8 ± 0.45
	20	12 ± 0.99	14 ± 2.64	18.6 ± 2.25	13.6 ± 0.60
	30	11 ± 0.58	12 ± 0.99	17.6 ± 1.00	12.9 ± 0.85
	100	12 ± 1.52	12 ± 1.52	17.8 ± 1.10	12.8 ± 0.62
20	0	14 ± 1.52	16 ± 1.52	19.9 ± 0.53	16.3 ± 0.89
	10	16 ± 0.58	15 ± 1.15	20.1 ± 1.58	16.5 ± 0.72
	20	14 ± 1.52	15 ± 2.64	19.2 ± 1.22	14.3 ± 0.58
	30	15 ± 1.20	14 ± 0.99	18.7 ± 1.02	12.9 ± 0.85
	100	14 ± 1.52	14 ± 0.58	18.5 ± 1.95	12.8 ± 0.62
25	0	16 ± 1.73	17 ± 1.15	20.5 ± 1.87	18.9 ± 1.20
	10	17 ± 1.58	18 ± 1.15	20.8 ± 1.41	18.7 ± 1.48
	20	17 ± 1.52	17 ± 2.30	20.1 ± 1.88	16.0 ± 0.20
	30	17 ± 0.99	18 ± 1.52	19.4 ± 1.24	17.4 ± 0.40
	100	16 ± 1.52	18 ± 2.08	19.3 ± 1.42	17.7 ± 0.70
30	0	21 ± 0.58	21 ± 1.52	21.6 ± 1.76	19.2 ± 1.05
	10	22 ± 1.51	21± 1.15	21.4 ± 1.65	19.3 ± 1.27
	20	21 ± 1.15	21 ± 2.08	21.5 ± 1.27	18.2 ± 0.32
	30	21 ± 1.15	22 ± 1.52	21.3 ± 2.13	18.5 ± 0.36
	100	22 ± 1.15	22 ± 1.52	21.2 ± 0.80	18.4 ± 0.51
35	0	23 ± 0.58	24 ± 2.64	22.9 ± 1.83	22.5 ± 0.52
	10	24 ± 1.52	24 ± 1.52	22.7 ± 0.70	22.3 ± 0.30
	20	24 ± 0.58	24 ± 3.21	22.7 ± 2.80	22.3 ± 0.47
	30	24 ± 2.64	24 ± 1.52	22.5 ± 1.90	22.1 ± 0.11
	100	23 ± 1.52	24 ± 0.99	22.3 ± 1.84	22.2 ± 0.40
40	0	25 ± 1.52	26 ± 2.51	24.8 ± 0.75	24.3 ± 0.45
	10	26 ± 2.08	26 ± 0.57	24.3 ± 1.87	24.1 ± 0.26
	20	26 ± 0.58	26 ± 2.64	24.1 ± 1.15	23.8 ± 0.55
	30	24 ± 2.64	26 ± 1.15	24.1 ± 0.90	23.7 ± 0.32
	100	26 ± 0.58	26 ± 0.99	23.9 ± 1.66	23.5 ± 0.65

(Contd...)

1	2	3	4	5	6
45	0	27 ± 2.64	28 ± 2.64	24.9 ± 1.86	24.7 ± 0.75
	10	28 ± 0.58	28 ± 1.15	24.5 ± 1.01	24.3 ± 0.45
	20	28 ± 1.73	28 ± 1.52	24.2 ± 0.75	24.0 ± 0.64
	30	27 ± 2.08	28 ± 0.57	24.2 ± 1.08	24.0 ± 0.32
	100	28 ± 0.58	28 ± 0.58	24.0 ± 1.49	23.8 ± 0.58
50	0	28 ± 1.52	28 ± 2.64	24.9 ± 1.38	24.8 ± 0.70
	10	28 ± 0.58	29 ± 0.58	24.6 ± 1.53	24.3 ± 0.45
	20	29 ± 1.52	28 ± 1.52	24.3 ± 2.24	24.1 ± 0.60
	30	28 ± 0.58	29 ± 0.58	24.2 ± 2.19	24.0 ± 0.32
	100	28 ± 0.58	28 ± 0.58	24.1 ± 0.91	23.9 ± 0.55
55	0	29 ± 1.52	30 ± 1.52	24.9 ± 1.00	24.9 ± 0.70
	10	30 ± 1.15	29 ± 0.58	24.6 ± 1.53	24.4 ± 0.45
	20	30 ± 1.15	30 ± 0.58	24.4 ± 2.18	24.1 ± 0.60
	30	29 ± 0.99	30 ± 0.58	24.2 ± 1.73	24.0 ± 0.32
	100	28 ± 0.58	29 ± 0.58	24.2 ± 1.49	24.0 ± 0.64
60	0	30 ± 1.52	30 ± 1.52	25.1 ± 0.54	25.0 ± 0.75
	10	30 ± 1.15	30 ± 1.52	24.7 ± 1.11	24.6 ± 0.48
	20	30 ± 1.15	30 ± 0.58	24.4 ± 1.15	24.2 ± 0.58
	30	30 ± 1.52	30 ± 0.58	24.2 ± 1.65	24.0 ± 0.32
	100	30 ± 0.58	30 ± 0.58	24.2 ± 1.07	24.0 ± 0.64

Aged , `t' value insignificant at 0.05 level; Fresh , `t' value insignificant at 0.05 level.

Table 3. Effect of fresh cow urine spray on number of aphids per cabbage plant

Treatment (urine concen-tration in %)	Aphid population at different intervals (in days) after treatment imposition												
	5	10	15	20	25	30	35	40	45	50	55	60	Mean
0	5.00	9.80	19.80	35.00	40.00	43.00	45.00	45.00	45.00	45.00	45.00	45.00	43.80
10	1.60	9.80	15.00	8.00	6.00	4.00	3.00	1.00	0.0	0.0	0.00	0.0	0.00
20	1.00	5.00	10.00	7.00	3.00	1.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0
30	0.0	5.00	5.00	3.00	1.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.00
100	0.0	5.00	5.00	2.00	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0
Mean	1.52	6.92	10.96	11.00	10.00	9.60	9.60	9.20	9.00	9.00	9.00	9.00	8.76
SE-diff	0.71	1.31	1.87	1.50	1.80	2.41	2.06	1.73	1.72	1.00	1.10	0.93	0.38
CD 5%	1.48	2.73	3.90	3.12	3.75	5.02	4.30	3.61	3.59	2.09	2.29	1.93	0.75
Sig	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

SE -diff (dates) 0.50 CD (P=0.05) 0.97

Tables 2, 3 and Fig. 2. The cabbage crop showed similar trend, as was observed in the aged cow urine treatments. The aphid population under control conditions first increased steadily till day 35 and stabilized later on. The number of aphids on treated plants declined significantly after day 15 due to the controlling effect of cow urine.

The insignificant difference observed in the number of leaves and plant height, under all concentrations of fresh cow urine shows that these urine treatments have no appreciable effect on the growth of cabbage. The differences are during later stages, though prominent during the earlier stages of crop growth.

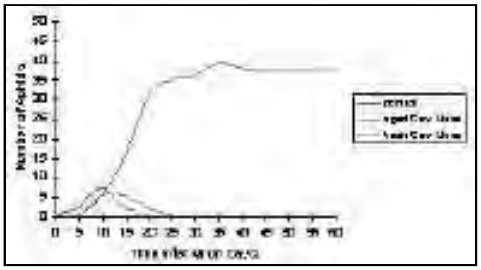


Fig. 3. Comparative effect of aged and fresh cow urine spray on the number of aphids per plant

A comparison of effects between aged and fresh urine treatments indicates that former is more effective than the latter in terms of time taken for complete eradication of the aphid. Eradication under aged cow urine is achieved at day 20, whereas, under fresh cow urine it is effective at day 25. (Fig. 3).

Comparative effect of different concentrations of aged buffalo urine spray on aphid population and growth of cabbage

The results of this experiment are given in Tables 4 and 5 and Fig. 4. In this case also the

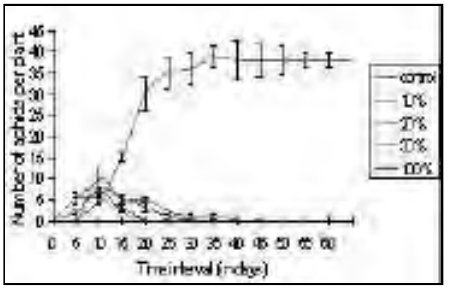


Fig. 4. Effect of diferent concentrations of aged, buffalo urine spray, on the number of aphids per plant

Table 4. Effect of aged buffalo urine spray on number of aphids per cabbage plant

Treatment (urine concen-tration in %)	Aphid population at different intervals (in days) after treatment imposition												
	5	10	15	20	25	30	35	40	45	50	55	60	Mean
0	0.00	10.00	20.00	35.00	40.00	41.00	41.00	41.00	41.00	40.60	41.00	41.00	29.07
10	1.00	10.00	8.00	5.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	5.00	8.00	5.00	2.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	5.00	9.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	3.00	10.00	3.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	2.80	9.40	7.60	8.60	9.00	8.20	8.20	8.20	8.20	8.20	8.12	8.20	8.20
SE-diff	1.02	1.37	1.72	1.06	1.37	1.13	0.72	0.53	1.18	1.34	0.82	0.57	0.38
CD 5%	2.13	2.86	3.59	2.21	2.86	2.36	1.50	1.10	2.47	2.79	1.72	1.18	0.75
Sig	1%	NS	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

SE -diff (dates) 0.50 CD (P=0.05) 0.97

Table 5. Effect of aged and fresh buffalo urine spray on growth of cabbage

Day	Urine conc. (%)	No. of leaves/plant		Plant height (cm)	
		Aged	Fresh	Aged	Fresh
5	0	5 ± 0.58	5 ± 0.58	8.3 ± 0.64	9.1 ± 0.66
	10	6 ± 1.15	5 ± 1.73	8.7 ± 0.43	8.5 ± 0.80
	20	5 ± 1.15	6 ± 0.99	9.8 ± 0.45	9.0 ± 0.36
	30	5 ± 1.99	5 ± 1.99	8.5 ± 1.01	8.7 ± 0.89
	100	6 ± 0.58	5 ± 0.99	8.6 ± 0.95	8.9 ± 1.22
10	0	8 ± 1.03	7 ± 0.58	13.4 ± 0.85	12.8 ± 1.82
	10	9 ± 1.15	8 ± 0.99	9.6 ± 0.30	10.4 ± 0.55
	20*	10 ± 2.08	8 ± 1.52	12.4 ± 0.66	11.9 ± 1.75
	30	9 ± 1.15	9 ± 1.15	12.3 ± 1.82	13.0 ± 0.83
	100	10 ± 2.64	8 ± 1.52	12.1 ± 0.91	12.7 ± 1.92
15*	0	12 ± 1.52	12 ± 0.58	18.7 ± 1.73	17.7 ± 0.56
	10	12 ± 0.58	12 ± 0.99	15.2 ± 0.60	14.9 ± 0.96
	20	11 ± 2.08	13 ± 1.52	15.1 ± 1.08	15.2 ± 1.42
	30*	12 ± 0.58	15 ± 0.99	14.9 ± 0.72	14.3 ± 0.30
	100*	11 ± 1.15	12 ± 0.57	14.9 ± 1.00	14.5 ± 1.02
20	0	16 ± 1.52	15 ± 1.15	22.5 ± 0.58	20.2 ± 0.65
	10	16 ± 1.52	16 ± 1.15	18.5 ± 1.12	17.9 ± 1.50
	20	13 ±1.73	15 ± 1.15	17.8 ± 0.73	17.7 ± 0.80
	30	16 ± 0.99	16 ± 0.57	17.7 ± 0.52	17.3 ± 1.01
	100*	14 ± 1.15	16 ± 1.15	17.5 ± 0.30	17.5 ± 0.56
25	0	18 ± 0.58	18 ± 0.57	22.9 ± 0.49	21.4 ± 0.56
	10	18 ± 1.52	18 ± 0.99	19.6 ± 0.87	18.6 ± 1.33
	20	16 ± 1.52	18 ± 0.99	18.7 ± 0.75	18.4 ± 0.69
	30	18 ± 0.58	19 ± 0.99	18.5 ± 0.15	18.1 ± 1.06
	100	16 ± 0.99	18 ± 0.99	18.3 ± 0.40	18.1 ± 0.34
30	0	22 ± 1.52	21 ± 1.73	23.1 ± 0.51	21.6 ± 0.37
	10	23 ± 2.08	22 ± 0.99	22.8 ± 0.90	19.3 ± 0.88
	20	22 ± 2.64	22 ± 0.99	22.5 ± 1.38	19.0 ± 0.66
	30	22 ± 0.58	22 ± 0.99	22.1 ± 1.36	18.9 ± 1.00
	100	22 ± 1.52	22 ± 0.57	21.9 ± 0.90	18.9 ± 0.36
35	0	23 ± 0.58	24 ± 1.52	24.0 ± 0.20	21.9 ± 0.45
	10	24 ± 1.52	24 ± 0.58	23.9 ± 0.75	21.7 ± 1.74
	20	24 ± 1.52	23 ± 1.15	23.8 ± 1.00	21.3 ± 1.47
	30	24 ± 0.58	24 ± 0.58	23.7 ± 0.70	21.0 ± 1.33
	100	25 ± 1.52	24 ± 0.58	23.7 ± 1.15	19.8 ± 0.55
40	0	26 ± 0.58	26 ± 0.58	24.6 ± 0.45	22.7 ± 0.49
	10	27± 2.08	26 ± 0.58	24.2 ± 0.68	22.2 ± 1.44
	20	26 ± 0.99	26 ± 0.58	24.1 ± 1.15	21.8 ± 1.18
	30	26 ± 0.66	26 ± 0.33	23.9 ± 1.20	21.6 ± 1.58
	100	26 ± 1.52	26 ± 0.58	23.8 ± 1.15	21.2 ± 1.12

(Contd...)

1	2	3	4	5	6
45	0	27 ą 2.64	28 ą 2.64	24.9 ą 1.86	24.7 ą 0.75
	10	28 ą 0.58	28 ą 1.15	24.5 ą 1.01	24.3 ą 0.45
	20	28 ą 1.73	28 ą 1.52	24.2 ą 0.75	24.0 ą 0.64
	30	27 ą 2.08	28 ą 0.57	24.2 ą 1.08	24.0 ą 0.32
	100	28 ą 0.58	28 ą 0.58	24.0 ą 1.49	23.8 ą 0.58
50	0	28 ą 1.52	28 ą 2.64	24.9 ą 1.38	24.8 ą 0.70
	10	28 ą 0.58	29 ą 0.58	24.6 ą 1.53	24.3 ą 0.45
	20	29 ą 1.52	28 ą 1.52	24.3 ą 2.24	24.1 ą 0.60
	30	28 ą 0.58	29 ą 0.58	24.2 ą 2.19	24.0 ą 0.32
	100	28 ą 0.58	28 ą 0.58	24.1 ą 0.91	23.9 ą 0.55
55	0	29 ą 1.52	30 ą 1.52	24.9 ą 1.00	24.9 ą 0.70
	10	30 ą 1.15	29 ą 0.58	24.6 ą 1.53	24.4 ą 0.45
	20	30 ą 1.15	30 ą 0.58	24.4 ą 2.18	24.1 ą 0.60
	30	29 ą 0.99	30 ą 0.58	24.2 ą 1.73	24.0 ą 0.32
	100	28 ą 0.58	29 ą 0.58	24.2 ą 1.49	24.0 ą 0.64
60	0	30 ą 1.52	30 ą 1.52	25.1 ą 0.54	25.0 ą 0.75
	10	30 ą 1.15	30 ą 1.52	24.7 ą 1.11	24.6 ą 0.48
	20	30 ą 1.15	30 ą 0.58	24.4 ą 1.15	24.2 ą 0.58
	30	30 ą 1.52	30 ą 0.58	24.2 ą 1.65	24.0 ą 0.32
	100	30 ą 0.58	30 ą 0.58	24.2 ą 1.07	24.0 ą 0.64

Aged , `t' value insignificant at 0.05 level; Fresh , `t' value insignificant at 0.05 level.

control (unsprayed) cabbage showed an initial increase in the aphid population followed by a plateau, for which similar explanation can be given as in the cases of cow urine treatments.

Significant (p > 1.10 level of significance) decline in aphid population was observed after day 10 for all the concentrations of aged buffalo urine treatments. Initial upsurge in aphid population may be due to the presence of more resistant adult stages, which subsequently added to the aphid population. The higher concentration, particularly 30% and 100% aged buffalo urine, were most effective in eradicating the aphid. The full control of aphid population was achieved after day 25 in all the urine treatments. The control of aphid population with higher concentration was achieved as early as after day 20 in concentration >30%. The decline in effectiveness of these urine concentrations of higher dilution may probably be due to overdilution of certain insecticidal constituents of urine.

Comparative effect of different concentrations of fresh buffalo urine spray on aphid population and growth of cabbage

The results of this experiment are given in Tables 5 and 6 and Fig. 5. The cabbage in control treatment initially showed a continuous increase

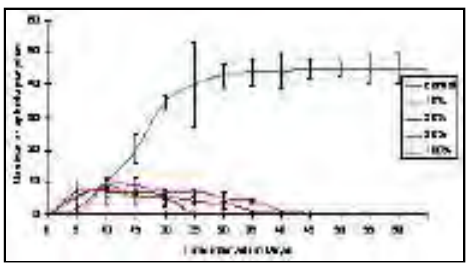


Fig. 5. Effect of different concentrations of fresh, buffalo urine spray, on the number of aphids per plant

Table 6. Effect of fresh buffalo urine spray on number of aphid per cabbage plant

Treatment (urine con -centration in %)	Aphid population at different intervals (in days) after treatment imposition											
	5	10	15	20	25	30	35	40	45	50	55	60 Mean
0	0.0	10.00	20.00	35.00	40.00	43.00	44.00	45.00	45.00	45.00	45.00	45.00
10	2.00	9.00	9.00	7.00	7.20	5.00	4.00	1.00	0.0	0.0	0.0	0.0
20	7.00	7.00	7.00	6.00	4.00	3.40	1.00	0.0	0.0	0.0	0.0	0.0
30	5.00	9.00	6.00	5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100	6.00	7.60	5.00	5.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean	4.00	8.52	9.40	11.64	10.24	10.28	9.80	9.00	9.00	9.00	9.00	9.00
SE-diff	1.79	2.22	2.08	2.14	5.16	1.61	1.94	2.09	1.22	1.06	2.01	2.09
CD 5%	3.73	4.64	4.34	4.46	10.77	3.35	4.04	4.36	2.54	2.21	4.19	4.36
Sig	1%	NS	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

SE _ diff (dates) 1.04; CD (P=0.05) 2.03.

in the number of aphids, but later the aphid population became stable. The stability in aphid population may be due to a balance in birth, migration and death.

A significant decline in aphid population was observed for all treatments with fresh buffalo urine. Sprays of both 30% and 100% urine concentrations were most effective and were faster in eradicating the aphids. Though, 10% and20% fresh buffalo urine treatments also reduced the aphid number after day 10, the total eradication of aphids took longer time (40-43 days) than by 30% and 100% urine concentration treatments, and significant decline was observed on day 20 with the treatments > 20%. This may be due to overdilution of certain insecticidal chemicals present in the fresh buffalo urine.

The effect of fresh buffalo urine treatment on the number of leaves and plant height remained insignificant, in each case the final observations showed no appreciable difference between the treated and untreated cabbage, through the same lag in plant height was present in this case. It too diminished at later stages of development, as in previously observed results.

Both pure aged and pure fresh buffalo urine were found equally effective against *Brevecoryne brassicae* and were able to eradicate it before day 25. It indicated that both are equally effective against cabbage aphid (Fig. 6).

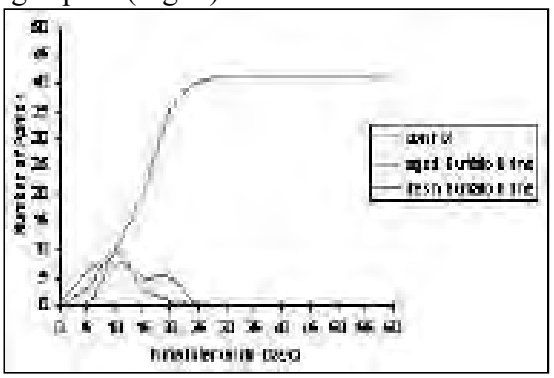


Fig. 6. Comparative effect of aged and fresh buffalo urine spray on the number of aphids per plant

Effect of aged sheep urine on aphid popula-tion and growth of cabbage

The results of this experiment are given in Tables 7 and 8 and Fig.7. Control (unsprayed) cabbage showed a continuous increase in the number of aphids per plant and later on achieved a balance in aphid population due to birth,

Table 7. Effect of aged sheep urine spray on number of aphids per cabbage plant

Treatment (urine con -centration in %)	Aphid population at different intervals (in days) after treatment imposition											
	5	10	15	20	25	30	35	40	45	50	55	60	Mean
0	4.00	12.00	18.00	27.20	36.00	43.00	44.00	44.80	44.00	44.00	44.00	44.00
100	6.00	13.00	9.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	5.00	12.50	13.50	14.10	18.00	21.50	22.00	22.40	22.00	22.00	22.00	24.00
SE-diff	1.38	2.65	2.14	1.80	2.35	2.00	3.11	0.80	4.75	3.97	0.89	4.47
CD 5% (P=0.05)	3.73	4.64	4.34	4.46	10.77	3.35	4.04	4.36	2.54	2.21	4.19	4.36
Sig	NS	Ns	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

SE _ diff (dates) 1.04; CD (P=0.05) 2.03.

Table 8. Effect of aged and fresh, sheep urine spray on growth of cabbage

Day	Urine conc. (%)	NO. of leaves/plant		Plant height (cm)	
		Aged	Fresh	Aged	Fresh
5	0	5 ± 1.52	4 ± 1.52	8.5 ± 0.87	8.3 ± 1.10
	100	6 ± 0.99	5 ± 1.73	6.1 ± 1.80	8.2 ± 0.72
10	0	8 ± 0.99	6 ± 1.52	12.3 ± 2.29	9.1 ± 0.75
	100	10 ± 0.58	6 ± 1.52	12.6 ± 2.31	8.9 ± 0.85
15*	0	12 ± 0.58	10 ± 1.55	15.1 ± 2.30	12.7 ± 0.43
	100	11 ± 0.58	9 ± 1.15	12.8 ± 2.42	12.8 ± 0.78
20*	0	16 ± 0.58	13 ± 1.52	17.4 ± 3.06	15.6 ± 1.15
	100*	14 ± 1.52	14 ± 0.99	15.9 ± 1.57	15.8 ± 1.48
25	0	18 ± 0.58	17 ± 1.52	19.3 ± 1.68	17.4 ± 1.94
	100	17 ± 0.99	18 ± 2.08	16.7 ± 1.55	16.9 ± 1.83
30	0	22 ± 0.99	22 ± 2.08	19.3 ± 1.13	19.3 ± 1.83
	100	22 ± 1.52	22 ± 1.52	19.6 ± 3.52	18.7 ± 1.78
35	0	24 ± 1.15	25 ± 0.99	21.4 ± 2.27	21.7 ± 1.61
	100	25 ± 0.99	24 ± 0.99	22.5 ± 2.82	21.1 ± 2.15
40	0	26 ± 0.99	26 ± 0.58	23.3 ± 1.50	23.1 ± 2.10
	100	26 ± 0.66	26 ± 0.58	23.1 ± 3.01	23.0 ± 1.68
45	0	28 ± 0.58	28 ± 0.58	23.9 ± 1.28	23.8 ± 2.02
	100	28 ± 0.66	28 ± 0.99	23.6 ± 3.13	23.9 ± 1.70
50	0	29 ± 0.33	29 ± 0.58	24.2 ± 1.68	24.2 ± 1.83
	100	29 ± 0.88	30 ± 0.99	23.9 ± 2.79	24.4 ± 1.53
55	0	30 ± 0.58	30 ± 0.58	24.3 ± 1.68	26.1 ± 1.95
	100	30 ± 0.58	30 ± 0.99	23.9 ± 2.79	25.9 ± 2.05
60	0	30 ± 0.58	30 ± 0.58	24.3 ± 1.68	26.1 ± 1.95
	100	30 ± 0.58	30 ± 0.99	23.9 ± 2.79	25.9 ± 2.05

Aged, `t' value significant at 0.05 level; Fresh, `t' value significant at 0.05 level.

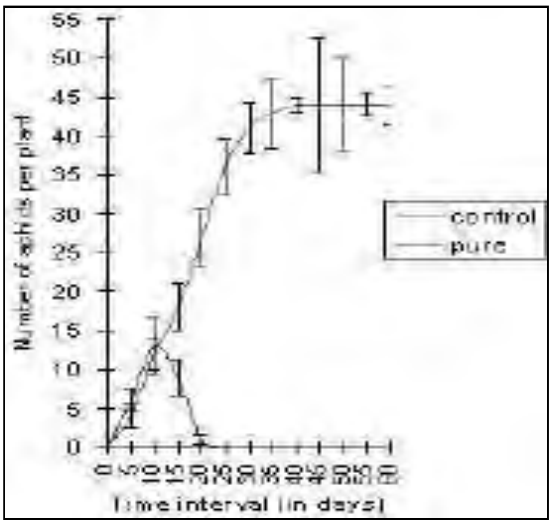


Fig. 7. Effect of aged, sheep urine spray, on the number of aphids per plant

Migration and death.

Undiluted aged sheep urine spray was effective as insecticide and eradicated the aphid population by day 20.

No effect on the number of leaves and plant height was observed.

Effect of different concentrations of fresh sheep urine spray on aphid population and growth of cabbage

The results of this experiment are given in Tables 8 and 9 and Fig. 8. Control (unsprayed) cabbage showed a continuous increase, followed by plateau in aphid population. The balance achieved may be due to gain through birth and loss through migration and death. Undiluted fresh sheep urine spray eradicated the aphid population completely by day 30.

Undiluted fresh sheep urine treatment also showedno significant effect on the number of leaves and plant height. Against aged and fresh sheep urine, the former appears to more effective than the latter in controlling aphids though only

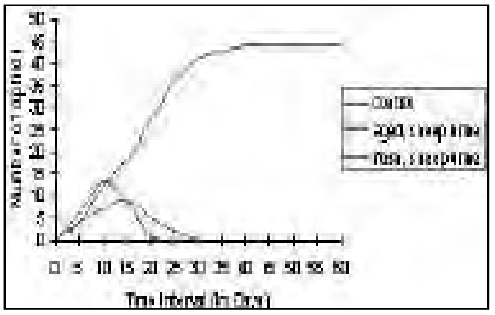


Fig. 8. Comparative effect of aged and fresh, sheep urine spray, on number of aphids per plant

Table 9. Effect of fresh sheep urine spray on number of aphids/cabbage plant

Treatment (urine con -centration in %)	Aphid population at different intervals (in days) after treatment imposition											
	5	10	15	20	25	30	35	40	45	50	55	60	Mean
0	5.40	17.20	22.40	38.80	40.00	42.0	40.80	40.8	44.80	40.8	41.60	40.8
100	4.00	7.00	9.00	2.00	0.00	0.0	0.0	0.0	0.00	0.0	0.0	0.0
Mean	4.70	12.10	15.70	20.40	20.00	21.0	20.40	20.40	22.40	20.4	20.8	20.4
SE-diff	1.29	2.40	4.09	2.54	2.19	1.67	1.16	3.17	3.20	3.20	1.03	1.77
CD 5% (P=0.05)	2.97	5.52	9.44	5.85	5.05	3.86	2.67	7.31	7.38	7.38	2.37	4.09
Sig	NS	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

SE _ diff (dates) 1.76; CD (P=0.05) 3.50

Table 10. Effect of different quantities of cow dung ash on number of aphids per cabbage plant

Treatmnet (cowdung ash , mg)	Aphid population at different intervals (days) after treatment imposition							
	5	10	15	20	25	30	35	40
0	35.00	24.00	17.00	10.00	10.00	10.00	10.00	10.00
50	22.00	16.00	4.00	2.00	1.00	0.00	0.00	0.00
100	16.00	11.00	2.00	0.00	0.00	0.00	0.00	0.00
150	14.00	6.00	1.00	0.00	0.00	0.00	0.00	0.00
Mean	21.75	14.25	6.00	3.00	2.75	2.50	2.50	2.50
SE-diff	4.47	4.47	1.86	2.18	0.67	1.00	0.89	0.81
CD (P=0.05)	9.47	9.48	3.94	4.62	1.42	2.12	1.90	1.71
Sig.	1%	1%	1%	1%	1%	1%	1%	1%

SE, diff (dates) 1.78; CD (P=0.05) 3.52.

slight significance was observed statistically. (Fig. 10)

Comparative effect of different quantities of cowdung ash on aphid population and growth of cabbage

The results of this experiment are given in Tables 10, 11 and Fig. 9. In the control (untreated) cabbage, the number of aphids increased initially and then declined substantially, before stabilizing finally. This decline may be due to the drought conditions, which resulted in the unfavorable conditions for aphid survival. The balance in aphid population at later stages may be due to the return of favorable conditions. Results obtained include the following:

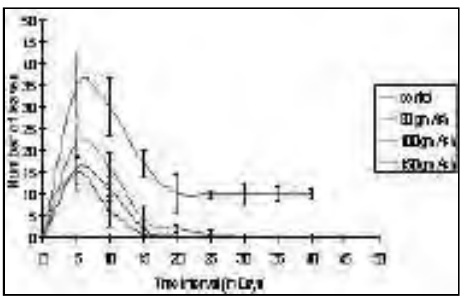


Fig. 9. Effect of cow-dung ash on number of aphids

- The treatment with 50 g ash per plant was found to be effective against aphids as it eradicated aphids completely in 34 days after-treatment.
- The treatment with 100 g ash per plant was more effective than with 50 g ash per plant, as it was able to eradicate the aphid in 16 days.
- The treatment with 150 g ash per plant was most effective, as it was able to eradicate the aphid in 16 days.
- Though treatment of cabbage with 150 g ash per plant seems to be the most effective; there was no significant different between 100 g and 150 g ash treatments.

The effect of different quantities of ash on the number of leaves and plant height did not show any difference amongst themselves. This may similarly be due to the lack of rain and subsequent non-availability of nutrients from the soil under dry climatic conditions.

In the present study both cowdung and cattle urine have been found to posses marked aphicidal property. The application of both urine and ash was made when the cabbage plants were at 4 to 5 leaf stage and approximately 500 ml of each urine

Table 11. Effect of dfferent quantities of cow-dung ash on growth of cabbage

Day	Quantity of ash/plant (mg)	No. of leaves /plant	Plant height (cm)
5*	0	10 ą 1.15	11.70 ą 0.49
	50*	12 ą 2.64	10.20 ą 1.19
	100*	13ą 0.40	10.14 ą 0.44
	150*	11 ą 2.08	10.40 ą 0.52
10*	0	20 ą 1.52	13.54 ą 0.33
	50*	16 ą 1.52	12.34 ą 0.27
	100*	18 ą 2.51	11.38 ą 1.92
	150*	15 ą 0.81	12.10 ą 0.43
15	0	24 ą 0.58	17.12 ą 1.47
	50*	19 ą 0.99	14.62 ą 1.39
	100*	20 ą 1.99	14.56 ą 1.75
	150*	17 ą 1.52	14.78 ą 0.81
20	0	27 ą 0.58	17.40 ą 1.55
	50	20 ą 0.58	15.72 ą 0.56
	100	24 ą 0.58	15.54 ą 1.54
	150	20 ą 0.58	15.16 ą 0.73
25	0	27 ą 0.58	17.40 ą 1.55
	50	20 ą 0.58	15.72 ą 0.56
	100	24 ą 0.58	15.54 ą 1.54
	150	20 ą 0.58	15.16 ą 0.73
30	0	27 ą 0.58	17.40 ą 1.55
	50	20 ą 0.58	15.72 ą 0.56
	100	24 ą 0.58	15.54 ą 1.54
	150	20 ą 0.58	15.16 ą 0.73
35	0	27 ą 0.58	17.40 ą 1.55
	50	20 ą 0.58	15.72 ą 0.56
	100	24 ą 0.58	15.54 ą 1.54
	150	20 ą 0.58	15.16 ą 0.73
40	0	27 ą 0.58	17.40 ą 1.55
	50	20 ą 0.58	15.72 ą 0.56
	100	24 ą 0.58	15.54 ą 1.54
	150	20 ą 0.58	15.16 ą 0.73

`t' value insignificant at 0.05 level.

type or concentration was sprayed per 25 plants. These treatments were thought to affect both aphid population and growth of cabbage (Fig. 10).

Though the aged urine treatments were more effective than the fresh urine treatments, this difference in effectiveness was not very significant, as both aged and fresh urine treatments reduced the number of aphids substantially with almost same time. Again, 30% and 100% concentration treatments were more effective than 10% and 20% urine concentration treatments. There was no significant difference in the effectiveness of 30% and 100% urine concentration treatments. Hence, it is better to use 30%urine concentration for the practical use. All the urine types (cow urine, buffalo urine and sheep urine), whether fresh or

Table 12. Comparative efficacy of different concentrations of aged cow urine and monocrotophos against cabbage
aphid (*Brevicornye brassicae*)

Treatment	Number of cabbage aphid/plant on different days after treatment							
	Day 1	Day 10	Day 20	Day 30	Day 40	Day 50	Day 60	Mean
C	11.80	15.20	21.40	27.20	28.20	23.60	24.20	21.6
ACU 25%	1.40	13.60	19.20	11.20	11.20	5.00	6.00	10.94
ACU 50%	6.80	11.00	15.00	7.60	4.20	1.00	0.00	6.51
ACU 100%	9.20	10.60	10.80	4.00	0.00	0.00	0.00	4.94
MC	0.00	5.40	9.60	0.00	0.00	0.00	0.00	2.14
Mean	7.64	11.16	15.20	10.00	8.72	5.92	6.04	9.24
SE-diff	1.95	2.30	2.71	1.54	1.22	1.21	1.14	0.69
CD (P=0.05)	4.06	4.80	5.66	3.22	2.54	2.52	2.37	1.34
Sig.	1%	1%	1%	1%	1%	1%	1%	1%

SE-diff (dates) 0.81; CD (P=0.05) 1.60; C, Control; ACU, aged cow urine; MC, monocrotophos.

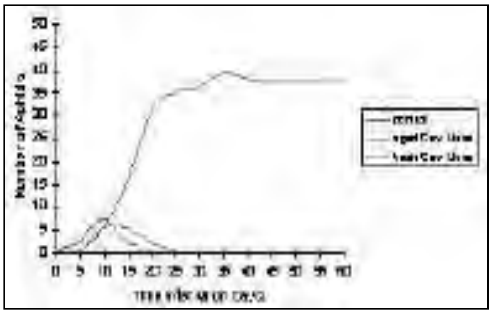


Fig. 10. Comparative effect of different urine types and cow-dung ash on number of aphids per plant

aged, showed nearly similar effects for similar concentration levels without any significant difference. None of the treatments, i.e. cattle urine and cowdung ash, showed any marked effect on the number of leaves per plant and on the height of cabbage plant. Though there is slight difference in the initial stages after the spray for these parameters but they all become insignificant in the later stages.

Comparative effects of monocrotophos and aged cow urine spray on cabbage aphid

Monocrotophos provided complete control of aphid populations on day I after treatment and was the best. The aged cow urine on first day of treatment were satisfactory at par with control. On day 10 and onwards the treatment effects were significant. Aged cow urine 100%, aged cow urine 50% and ACU 25% provided aphid control, decreasing with the concentration of bio-pesticides. On day 40, aged cow urine 100% provided full control followed by aged cow urine 50% and 25%. All the treatments were superior to the control (Table 12).

CONCLUSION

Results of the study showed that cattle urine treatment is effective in controlling aphids in cabbage. Therefore in application of cowdung ash, fresh urine treatments took a little longer time for pest eradication than aged urine. The 30% and 100% concentration treatments were of cow urine more effective than 10% and 20%. All the urine types (cow, buffalo and sheep) whether fresh or aged showed nearly similar effects for similar concentration levels without any significant difference; the treatments with 150 g ash per plant was most effective as compared to other quantities used and neither cattle urine nor cowdung ash showed any marked effect on the growth of cabbage plant.









a) and (b): Cabbage showing heavy infestation with *Brevecoryne brassicae*; (c) and (d): cabbage showing attack of cabbage caterpillar







(a, b, c) Eggs of cabbage butterfly subsequently hatching into larvae









(a, b, c, d) Untreated cabbage without heads (showing heavy infestation)









(a, b, c, d) Urine treated cabbage with healthy heads

Code : **1475**

Title of the ITK : **Control of insect-pest and reducing bitterness in sweet potato tubers through use of dry *mahua* (*Madhuca indica*) flowers during planting**

Description of the ITK : **Mahua** flowers have some characteristics to minimize the bitterness and make soil sterile to keep away the insects. During planting of shoot of sweet potato, flowers of *mahua* (*Madhuca indica*) are placed in the furrow of soil at an interval of about 30cm. The practice is followed in the villages of Patna and Ranchi districts of Bihar and Jharkhand, respectively and has potentiality for its further spread where *mahua* plants are available. About 80% problem is solved in checking the bitterness of sweet potato and insect pest attack. Cost: benefit of this practice is 1: 3.

Name and address of the discloser : Shri Vishwesh Kumar, C/o Shri Satyendra Prasad Singh, Village Kataiya, P.O. Dostiyan, Sheohar (Bihar) and Sri Kailash Singh, Village Jariagarh, Block Ratu, Ranchi (Jharkhand)

Location of use of the ITK : Village Fatuha, Block Fatuha, Patna (Bihar) and Village-Jariagarh, Block Ratu, Ranchi (Jharkhand)

Geographical indicators : *Madhuca indica* is a large evergreen tree, 10_40 m high, dome-shaped crown and straight, stout bole. It has been found wild and also cultivated in India for at least 2000 years.

Experimenters : Dr B.M.Chowdhary, Associate Professor, Department of Horticulture and Dr R. P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand) 834 006.

Methodology

Location

Village Jariagarh, Block Ratu, Ranchi (Jharkhand)

PRA and field study

PRA tools were used to find out the effects of application of *mahua* flowers in controlling insect pests and reducing bitterness in sweet potato involving 20 respondents. The referred ITK was compared with chemical control measure, i.e. monocrotophos on parameters like number of unaffected tubers, number of tubers/plant, crop growth, efficacy, yield, cost effectiveness, taste, bitterness, taste after cooking and duration of storage.

Experiment

The field experiment was conducted at Jariagarh village of Ratu Block of Ranchi district. The plants were multiplied in the Horticulture



Control of insect-pest and reducing bitterness in sweet potato tubers through use of dry *mahua* flowers during planting

Department (Tuber Section). The variety used was Kalmegh. The experiment was conducted in randomized block design in 15 replications with three treatments, viz., T1-Control, T2- ITK practice and T3-Spraying of monocrotophos (2 ml/litre of water) at an interval of 15 days for two times. Size of each treatment plot was 500 sq.m. Observations were taken on yield attributes, number of weevils/m2, bitterness and taste of tubers.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 reveal that the ITK was perceived to be superior to improved practice in terms of reducing bitterness, yield, taste after cooking, duration of storage and availability of materials. However, the improved practice was found to be more effective in control of insect-pests and crop growth than the ITK practice.

Experiment

Results obtained from field experimentation have been presented in Table 2.

Data presented in Table 2 reveal that maximum vine length (180 cm) was found in T2 (application of dried *mahua* flowers) while minimum in T1 (control). The fresh weight of vine was also found to be higher in T2 (320 g/vine). The effect of application of *mahua* flowers was also observed to be substantial in terms of number of weevils/m2. While the number of weevils was 20 in control, it was low (4) in T2 (*mahua* flower treatment) and 6 in T3 (chemical insecticide treatment).

Table 1. Matrix scoring for assessment of mahua flowers (ITK) and monocrotophos (improved practice) in controlling weevil and reducing bitterness in sweet potato N=20

Parameter	ITK practice	Improved practice
Crop growth	3	5
No. of unaffected tubers	3	4
No. of tubers/plant	4	3
Efficacy	5	4
Yield	5	4
Availability of materials	5	2
Cost effectiveness	5	4
Taste	5	4
Bitterness	5	4
Taste after cooking	5	4
Duration of storage	5	4

Table 2. Vine length, fresh weight per vine and number of weevils in sweet potato as affected by application of mahua flowers and monocrotophos

Treatment	Vine length (cm)	Fresh Weight/ vine (g)	No. of weevils/ m2
T1 Control	109	210	20
T2 ITK practice	180	320	4
T3 Monocrotophos	140	270	6

Table 3. Extent of bitterness of sweet potato and taste after cooking

Treatment	Bitterness	Taste after Cooking
T1 Control	High	Good
T2 ITK practice	Low	Better
T3 Monocrotophos	Medium	Good

Sample plants were uprooted for testing the bitterness and taste after cooking. Data given in Table 3 reveal that on testing, the bitterness and taste after cooking in tubers of T_2 were found to be low and better while in T_1 it was high and good, and in T_3 medium and good, respectively.

CONCLUSION

Use of *mahua* flowers during planting of sweet potato was found to be superior to the use of chemical pesticide (monocrotophos) in controlling weevil and reducing bitterness in sweet potato.

Code :370

Title of the ITK :Sprouting in yam by cowdung slurry

Description of the ITK :Tuberous roots of yam (Dioscorea alota) are divided into many pieces, weighing about 150 to 200 g, dipped in freshly prepared cowdung slurry, dried in shade and kept in sand for sprouting. This results in sprouting within 5–6 days, giving 100% germination. Application of cowdung slurry prevents the entry of microorganisms, loss of moisture from the cut ends and supply the nitrogen at the during initial stages. By this practice the farmers get additional income of Rs 10,000 per acre over planting only tops of the tuber. It is being followed by almost all the yam-growing farmers in Benakunda village of Ganjam district in Orissa.

Extent and coverage

The greater yam (Dioscorea alata) is propagated mainly through setts. Traditionally the farmers use whole tuber or proximal setts (with bud) for planting in the field after sprouting. In this method the yam is cut into setts (1 sett/ corm) and kept in shade for sprouting or whole tuber is used as sett. After20–30 days the sprouted setts areplanted in the field. In this method only terminal buds sprout, for which a large number of setts as well as large quantity of seed tubers are required for large-scale cultivation. As a result , the cost of cultivation is increased due to cost involved for the seed material. Moreover it is very difficult to set laarge quantity of raw material for large- scale cultivation.

Name and address of the discloser **:Shri Narendra Bisoyi, C/o Binayak Bisoyi, Bhanjanagar,** Ganjam (Orissa) 761 126

Location of use of the ITK :Benakunda, Bhanjanagar, Ganjam, (Orissa) 761 126

Experimenters :Dr S. K. Naskar, Principal Scientist, Shri P. Sethuraman Sivakumar, Scientist (Agril. Extension), and Dr R. C. Ray, Principal Scientist, Regional Tuber Crops Research Centre, Bhubaneswar (Orissa) 761 126

METHODOLOGY

Location

The efficacy of cowdung slurry in inducing sprouting in yam was evaluated by participatory rural appraisal (PRA), field survey and experimental methods. Participatory rural appraisal and field survey were done at village Benakunda, Bhanjanagar, dist. Ganjam (Orissa)

and the experiment was conducted at (a) Regional Centre of Central Tuber Crops Research Institute, Bhubaneshwar (Orissa), and (b) village Benakunda, Bhanjanagar, dist. Ganjam (Orissa).

PRA and field study

The method was applied to determine the efficacy of cowdung slurry in inducing sprouting in yam. It was compared with recommended practice (treating with 0.05% Bavistin and ash/ cowdung slurry) with a control treatment. The study was done on 10 farmers of village Benakunda in terms of quick sprouting, good field establishment, less disease incidence, number of planting material required ease for of operation, low cost, high yield and good taste.

Experiment

The experiments were conducted at Regional Centre of Central Tuber Crops Research Institute farm and in the farmers' field during 2002 – 2003 with three treatments , viz. (i) ITK method (treatment with fresh cowdung slurry) , (ii) recommended practice (treating with 0.05 % Bavistin and ash or cowdung slurry), and (iii) control (no treatment).The experiment was laid out in randomized block design with 10 replications.

RESULTS AND DISCUSSION

PRA and field survey

It was found that sprouting was higher when 200 g yam setts were treated with fresh cowdung slurry, followed by recommended (treating with 0.05% Bavistin and ash or cowdung slurry) practice and control methods (Table 1). Efficacy of cowdung slurry was also found to be superior in terms of good field establishment, less disease incidence, obtaining more number of planting materials, ease in operation, low cost, high yield and good taste as compared to treatment with 0.05% Bavistin+ash or cowdung slurry and control practice.

Experiment

Sprouting of yam setts was determined at Research Station and also under on-farm conditions. The efficacy of indigenous knowledge (treating with fresh cowdung slurry) was compared with the recommended practice (treating with 0.05% Bavistin + ash or cowdung slurry) with a control treatment. Cowdung used contained 0.30–0.45% nitrogen, 0.15–0.25% phosphorus, 0.05–0.15% potassium with 14.6% total organic material and 82–85% moisture. Results obtained are presented in Table 2. It

Table 1. Matrix ranking for assessing efficacy of cowdung slurry in inducing sprouting in yam setts as compared to recommended practice and control

Parameter	Treatment		
	Fresh cowdung slurry	0.05% Bavistin+ash/ cowdung slurry	Control
Quick sprouting	8	1	1
Good field establishment	6	2	2
Less disease incidence	5	4	1
No. of planting materials required	7	2	1
Ease of operation	7	1	2
Low cost	6	3	1
High yield	5	4	1
Good taste	6	2	2

Table 2. Effect of fresh cowdung slurry on sprouting of yam setts under research station and on-farm conditions

Treatment	Sprouting (%)	
	On-farm	Research station
Treatment with fresh cowdung slurry	100	92
Treatment with 0.05% Bavistin and ash slurry	78	84
Control (no treatment)	76	62

was observed that sprouting of yam setts was higher when treated with fresh cowdung slurry both under on-farm conditions and research station.

Germination studies using isolated organisms

Germination studies were conducted with fresh and sterilized cowdung, and treated with the isolated organisms.

The results presented in Table 3 indicate that cumulative effect of all micro-organisms present in unsterlised fresh cowdung facilitate improvement in germination of yam, particularly after 25 days.

Table 3. Germination of tubers

Treatment	Germination (%) after		
	15 days	20 days	25 days
Unsterlized fresh cowdung	33.33	66.66	100.00
Sterilized fresh dung	40.00	80.00	86.66
Culture S1O1	20.00	53.33	86.66
Culture S1O2	0.00	33.33	73.33
Culture S1O4	6.66	40.00	73.33
Culture S1O5	0.00	33.33	80.00
Untreated cowdung	0.00	26.66	73.33

Phenol content

Phenol content of the tubers generally reduces the rate of germination due to toxicity. During the experiment, the phenol content of non-germinated tubers and sprouts were studied and results are presented in Table 4. It is indicative that lower phenol content in fresh cowdung might have promoted higher generation in tubers. No definite trend could be seen between germination and phenol content in sprout.

Protein content in sprouted and dormant tubers

The protein content of sprouted and dormant yam tubers was studied. Two samples were collected from the tissues adjacent to sprout and the lower portion of the seed tubers. One gram tissue was taken and extracted for protein estimation. The protein content in different treatments is presented in Table 5.

Protein content in dormant tuber was found to be lower than in the sprouted tuber. However, when sprouting started, the protein content was

higher (except T_4) in the treated tubers as compared to the untreated tubers. The phenol content was found to be inversely proportional to protein content, (Tables 4 and 5).

Table 4. Phenol content of tubers and sprouts

Treatment	Phenol content (痢/g)	
	Tuber	Sprout
Unsterilised fresh cowdung	12	6
Sterilized fresh dung	13	7
Culture S1O1	11	1
Culture S1O2	22	12
Culture S1O4	10	4
Culture S1O5	17	5
Untreated cowdung	31	8

Post-harvest tuber rot

The Dioscorea (yam) tubers were subjected to storage and natural rotting. The rotted tubers were plated on petri-plates on potato dextrose agar medium under aseptic conditions. The causal organisms were transferred to PDA slants. The cultures were again plated and re-isolated. The pathogenicity of the rotting organisms was confirmed by inoculation in healthy tubers, for identical symptoms.

Five major pathogens that caused post-harvest rotting of Dioscorea (yam) were identified. Of the five, four fungal pathogens, viz. Sclerotium *rolfsii, Botryodiplodia theobromae, Fusarium and Rhizopus species caused considerable damage to* seed tubers of yam. One bacterial pathogen *Erwinia carotovora was also found to cause* damage to yam tubers.

Table 5. Protein content of sprouted and dormant tuber

Treatments	Protein content in 痢/g tuber			
	Fresh cowdung treated		Decomposed cowdung treated	
	Dormant tuber	Sprouted tuber	Dormant tuber	Sprouted tuber
Unsterlized fresh cow dung	187	278	173	248
Sterilized fresh cow dung	172	252	183	234
CultureS101	169	249	168	221
CultureS102	182	222	172	218
CultureS104	186	218	180	222
CultureS105	159	238	172	223
Untreated cow dung	180	212	163	196

Table 6. Reduction (%) in growth of rotting fungus in dual plate over control

Pathogens	Reduction over control (%)							
	Culture S101		Culture S102		Culture S104		Culture S105	
	Day 3	Day 5	Day 3	Day 5	3 Day	Day 5	Day 3	Day 5
Sclerotium rolfisii	31.3	53.1	25.0	46.9	18.8	36.7	34.4	40.8
Botryodiplodia theobromae	*44.7*	*62.1*	*39.5*	*36.2*	*31.6*	*41.4*	*23.7*	*56.9*
Fusarium sp.	58.6	59.2	31.0	30.6	55.2	32.7	20.7	28.6
Rhizopus sp.	36.8	45.8	34.2	56.9	42.1	54.2	26.3	56.9

Antagonistic effect of actinomycetes against rotting pathogens

To know the presence of the rotting pathogens in soil, the soil samples were subjected to serial-dilution agar plating. All of the above rotting pathogens were also isolated from the seed buds or soil samples.

To study the inhibitory effect of actinomycetes isolated from the cowdung against the rotting pathogens, one antagonistic experiment was conducted. The test organisms were inoculated along with the individual rotting fungus in PDA petri-plates. Again, the rotting fungus alone was inoculated in separate petri-plates as control. The reduction in growth over control was calculated on days 3 and 5 and the results obtained are presented in Table 6.

All the four actinomycetes cultures studied were found to inhibit the growth of the pathogens tested *in vitro,* showing the antagonistic effect against the four pathogens studied.

CONCLUSION

Application of fresh cowdung to the cut tubers enhanced early sprouting. Results of the study indicate that enhancement of sprouting time is due to nutrient, organic matter content of cowdung as well as cumulative effect of micro-flora present in it. The micro-flora present in the cow dung and inoculation with actinomycetes, isolated from cowdung, reduced the phenol content in the tubers, thereby indirectly enhancing the sprouting. It is known that sprouting is inversely related to phenol content. Further, protein content was higher in the treated tubers which increased enzymatic activity resulting in early sprouting. The additional nutrients in the cowdung accelerated the sprouting processes, and the organic matter present in the cowdung absorbed more moisture and prevented water loss, thereby helping in maintaining moisture status in the tuber that is required for the sprouting.

❑

Code : **141**

Title of the ITK : **Control of rhinocerous beetle in coconut by using cowdung slurry**

Description of the ITK : Cowdung slurry in wide-mouthed vessel is kept at ground level under coconut plantations to trap the rhinoceros beetle (*Oryctes rhinoceros*). This practice is in use for the last 5 years by the coconut growers of Thummanayakkanpatty Madurai district, Tamil Nadu

Name and address of the discloser : Mr. M. Jagadeesan, S/o. Shri C. Muniyandi, South Street, Chelaimalaipatty, Thumbanayakkampatty, Peraiyur, Madurai (Tamil Nadu) 625 703

Location of use of the ITK : Thumbanayakkampatty Post, Peraiyur Taluk, Madurai (Tamil Nadu) 625 703

Experimenters : Dr K. Koodalingam, Professor (Breeder Seeds), Centre for Plant Breeding and Genetics, Dr K. Rajamanickam, Associate Professor of Entomology, Coconut Research Station, Tamil Nadu Agricultural University, Aliyar Nagar, Coimbatore 642 101 and Dr P. Karuppuchamy, Professor, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore 641 003

METHODOLOGY

Location

In Pollachi location selected in Aliyar Nagar, Nanj equoundanpdur and Thensangam Palayam where infestation is more than 15 per cent.

PRA and field study

The performance of cowdung slurry and chemical in controlling Oryctes rhinocerous beetle in coconut was evaluated by taking unstructured interview with nine farmers. The interview was conducted to gather information on pest control, time control, yield and adverse effect of chemical treatments.

Experiments

Six on-farm trials were conducted (two each in three blocks) with the following five treatments: T1, cowdung slurry 2.5 kg in 1 litres water, T2, cowdung slurry 2.5 kg in 2 litres water, T3, cowdung slurry 2.5 kg dried fish powder 50 g in 1 litre water; T4, castor cake 2.5 kg in 1 litre water; and T5, untreated check.

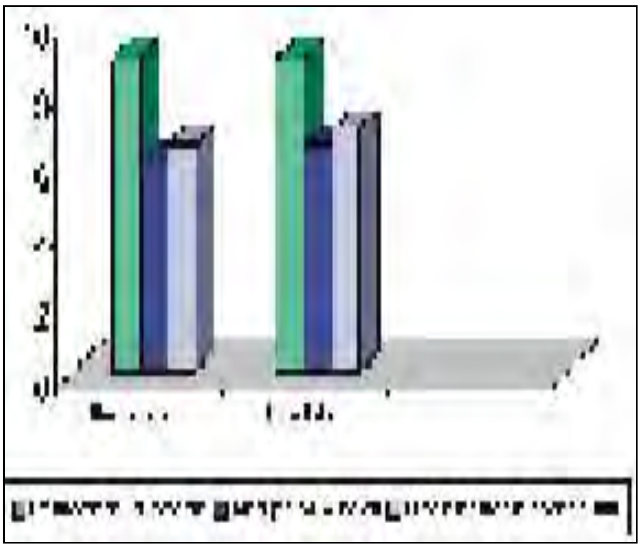


Fig. 1. Relative performance of cowdung slurry on coconut pest control

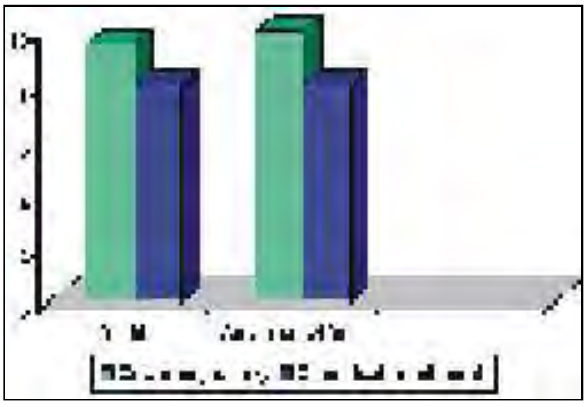


Fig. 2. Relative performance of cowdung slurry on coconut yield

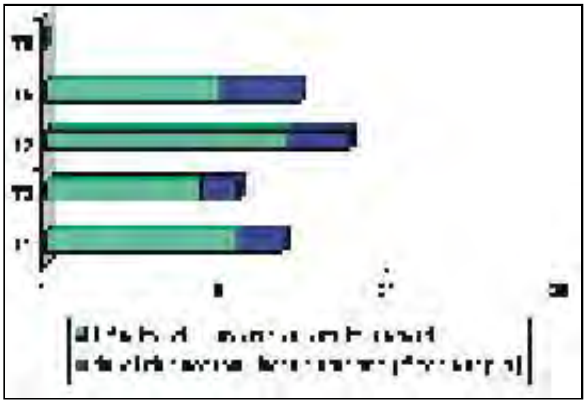


Fig. 3. Effect of cowdung and other attractants on Oryctes rhinocerous beetle (15.09.2002 to 25.11.2002) Location: Aliyanagar

First experimental trial on ITK on *Oryctes rhinocerous* beetle management in coconut by using cowdung slurry was initiated in September 2002 at Aliyar Nagar. The second one at Nanjegoundanpudur during October 2002 and the third one at Thensangampalayam during February 2003. All five treatments were imposed and replicated for four times. Periodical observations on the weekly collection of trapped adult Oryctes rhinocerous beetles in the wide mouthed mud pots with width 24 cm, height 30 cm and bottom width 27 cm were taken and recorded it three locations, viz. Aliyarnagar, Nanjegoundanpudur and Thensangampalayam.

RESULTS AND DISCUSSION

PRA and field study

The results of PRA are presented in Figures 1 and 2.

Experiment

Intensive survey on the infestation of *Oryctes rhinocerous* beetle on coconut palms in selected villages of Anaimalai, Pollachi and Udumalpet blocks was carried out from September 2002 to February 2003. The results are presented in Tables 1 to 5.

Effect of cowdung slurry and other attractants used in wide mouthed mud pots at Aliyarnagar location revealed that among the cowdung slurry treatments tried, cowdung slurry 2.5 kg + 1 litre

Table 1. Effect of cowdung and other attractants on Oryctes rhinocerous beetle at Aliyarnagar (15.9.2002 to 25.11.2002)

Treatment	Particulars	No. of *Oryctes rhinocerous* beetle trapped	
		Total	Mean of(4 replications)
T1	Cowdung slurry 2.5 kg + 1 litre water	6	1.5
T2	Cowdung slurry 2.5 kg + 2 litres water	4	1.0
T3	Cowdung slurry 2.5 kg + dried fish powder 50 g + 1 litre water	8	2.0
T4	Castor cake 2.5 kg + 1 litre of water	12	3.0
T5	Untreated Check	-	-

Table 2. Effect of cowdung and other attractants on Oryctes rhinocerous beetle at Aliyarnagar (26.11.2002 to 28.2.2003)

Treatment	Particulars	No. of *Oryctes rhinocerous* beetle trapped	
		Total	Mean of(4 replications)
T1	Cowdung slurry 2.5 kg + 1 litre water	11	2.75
T2	Cowdung slurry 2.5 kg + 2 litres water	9	2.25
T3	Cowdung slurry 2.5 kg + dried fish powder 50 g + 1 litre water	14	3.50
T4	Castor cake 2.5 kg + 1 litre of water	10	4.75
T5	Untreated Check	-	-

Table 3. Effect of cowdung and other attractants on Oryctes rhinocerous beetle at Nanjegoundanpudur _ (26.10.2002 to 22.01.2003)

Treatment	Particulars	No. of *Oryctes rhinocerous* beetle trapped	
		Total	Mean of(4 replications)
T1	Cowdung slurry 2.5 kg + 1 litre water	15	3.75
T2	Cowdung slurry 2.5 kg + 2 litres water	12	3.00
T3	Cowdung slurry 2.5 kg + dried fish powder 50 g + 1 litre water	18	4.50
T4	Castor cake 2.5 kg + 1 litre of water	27	6.75
T5	Untreated Check	-	-

Table 4. Effect of cowdung and other attractants on Oryctes rhinocerous beetle at Nanjegoundanpudur (23.1.2003 to 28.2.2003)

Treatment	Particulars	No. of *Oryctes rhinocerous* beetle trapped	
		Total	Mean of(4 replications)
T1	Cowdung slurry 2.5 kg + 1 litre water	8	2.00
T2	Cowdung slurry 2.5 kg + 2 litres water	5	1.25
T3	Cowdung slurry 2.5 kg + dried fish powder 50 g + 1 litre water	10	2.50
T4	Castor cake 2.5 kg + 1 litre of water	13	3.25
T5	Untreated Check	-	-

Table 5. Effect of cowdung and other attractants on Oryctes rhinocerous beetle at Thensangampalayam (01.2.2003 to 28.2.2003)

Treatment	Particulars	No. of *Oryctes rhinocerous* beetle trapped	
		Total	Mean of(4 replications)
T1	Cowdung slurry 2.5 kg + 1 litre water	10	2.50
T2	Cowdung slurry 2.5 kg + 2 litres water	8	2.00
T3	Cowdung slurry 2.5 kg + dried fish powder 50 g + 1 litre water	13	3.25
T4	Castor cake 2.5 kg + 1 litre of water	16	4.00
T5	Untreated Check	-	-

water + 50 g dried fish powder kept in wide-mouthed pots attracted and captured more number of *Oryctes rhinocerous* beetles (up to 8) during 15 September 2002 to 25 November 2002 (Fig.3) and 14 during 26 November 2002 to 28 February 2003. The other treatments viz., cowdung slurry 2.5 kg with 1 litre and 2 litres water were also fairly effective in attracting the *Oryctes rhinocerous* beetles, i.e. 4 to 6 and 9 to 4 respectively during the periods mentioned above.



Slurry pot placement in the field

Cowdung in semi-solid form (with little liquid consistency) was effective in emanating the odour rather than when it was in watery form. However, castor (*Ricineus communis* L.) cake suspension



Trapped beetles in cowdung slurry



Trapped beetles in castor cake slurry

2.5 kg in 1 litre of water was found significantly superior in attracting the black beetle *Oryctes*

rhinocerous than all other treatments.

It was also observed that the beetles began to be attracted to mud pots only 7 days after initiation of experiments. Water was added for every 2 days once and new cowdung once every week, which led to emanations of strong odour from the mud pots.

Similar trend of attracting more *Oryctes rhinocerous* beetle by cowdung slurry + fish powder was also noticed at Nanjegoundanpudur (18 beetles during 26 October 2002 to 28 February 2003 and 10 during 23 January 2003 to 28 February 2003), and Thensangampalayam (13 beetles during February 2003 alone). Castor cake suspension significantly attracted maximum number of beetles ranging from 13 to 27 in the above-mentioned two places. Cowdung slurry with 1 litre water combination is better than with 2 litre water in attracting the beetles.

Based on the size and shape of wide mouthed mud pots. Capacity, it is felt that quantity of cowdung and castor cake 1 kg may be increased for effective attraction and strong odour emanating from the mud pots.

CONCLUSION

Castor cake 2.5 kg + 1 litre water kept in wide- mouthed mud pots (mouth width 24 cm × height 30 cm × bottom width 27 cm) attracted significantly maximum number of *Oryctes rhinocerous* beetles (up to 27). Among the cowdung-slurry treatments, cowdung-slurry 2.5 kg + 50 g dried fish powder in wide-mouthed mud pots also attracted more number of *Oryctes rhinocerous* beetles (up to 18), followed by other treatments of cowdung slurry with + litre of water (up to 15) and 2 litres water (up to 12). The other coconut pests viz. redpalm weevil, and black-headed caterpillar were not attracted to castor cake suspension and cowdung slurry. Since the castor cake suspension and cowdung slurry were plant and animal waste products, ecological safer and that too kept separately in mud pot traps, there won't be any adverse effect to the plant and soil in the coconut plantations.

Thus the ITK was found to be good and effective, in controlling rhinocerous beetle in coconut. ❑

Code : **240**

Title of the ITK : **Effect of soaking of Solanaceous vegetable seeds in butter milk on germination**

Description of the ITK : The germination percentage of solanaceous tropical vegetables such as tomato, brinjal and chilli is increased by the application of this practice. A mixture of 10 ml of 3 days old buttermilk is mixed with 40 ml water and kept aside for 3 days. The mixture is ready for use. Seeds of solanaceous vegetables are soaked in this mixture for 6 hours and the treated seeds are dried under shade to remove excess moisture. Germination percentage may be 80%. Local variety of tomato Co 3 is best suited to the treatment. The practice is applicable only for 6 to 12 months old seeds. If seeds are treated by this method, germination percentage is increased to 80% under laboratory condition and 60% under field condition. If the seeds are not treated, the germination percentage under laboratory condition may be 20% and under the field condition 5%.Sometimes coconut or palmyra toddy is used as a substitute to buttermilk.

Name and address of the discloser : Dr. S. Sendur Kumaran, Asst. Professor (Horticulture), Krishi Vigyan Kendra, Tamil Nadu Veterinary and Animal Science University, Kundrakudi, Sivagangai (Tamil Nadu) 630 206

Location of use of the ITK : Paras/Devakottai, Sivagangai (Tamil Nadu)

Geographical indicators : *Common name* : Chilli



Botanical name : *Capsicum frutescens*

Family : Solanaceae

Description

Numerous varieties of chillies exist. The primary separating characteristics are based upon flower and seed colour, shape of the calyx, the number of flowers per node and their orientation.

Country

Latin America, India, Indonesia, Africa, China



Common name : Tomato

Botanical name : *Lycopersicon esculentum*

Family : Solanaceae









Description

Growth varies between the so-called "indeterminate" and "determinate" habits. Cultivars with "determinate" (bush type) growth are the most commonly grown field crops for processing or fresh market. The maximum possible height at harvest is 2 m, but usually the crop stops at a height of 1.50_1.80 m. The "indeterminate" (or vine type) cultivars are used mainly in greenhouses but are grown in the field as a "staked" crop. In the field, the final height does not exceed 2 m and depends on weather conditions and cultural techniques. These cultivars can, however, under protection grow to more than 10 m in a year.

Tomato leaves are produced regularly and grow initially with parallel log

growth curves. Between about 7 and 11 leaves are formed before the apex is transformed into a terminal inflorescence. Further growth is from the leaf axils. The size of the compound leaf is variable. The leaves are typically 0.5 meters long, slightly less wide, with a large terminal leaflet and 6, 8 or usually 10 large lateral leaflets.

The primary tap or seminal root may grow deeper than 0,5 m while the

root zone extends to a diameter of more than 1.5 m. The roots of transplanted tomato plants extend wider but has a shallower root system than the direct seeded plants. When the plants are fertigated, the root system is limited within the wet zone of the soil. The scheme and size of the wet bulb is mainly dependant on soil texture and discharge of emitters. Adventitious roots similar in structure to the laterals develop in favourable conditions from the stem near the base.

Origin

Tomatoes originated on the dry west coast of tropical South America,

extending from Ecuador to Chile between the Andes and the sea. The original site of domestication of Lycopersicon esculentum Mill. is uncertain although the balance of evidence suggests Mexico. The cherry tomato (L. esculentum var. cerasiforme) is almost certainly the direct ancestor of the modern cultivated forms.

Common name : Brinjal

Botanical name : *Solanum melongena*

Family : Solanaceae

Description

Experimenters : Green-yellow to purple-black, up to 6 inches long, angeled, round, teardrop,
or lobed.
A small tropical perennial, native to Africa and Asia, growing up to a height
of 80 inches with purple flowers.
The purple fruits grow to 25" and can weigh up to 2½ lb. and has numerous
seeds.

Origin
Egypt, Ghana, Iran, Israel, Jordan, Nigeria, South America, Syria, Thailand, Vietnam

Dr. S. Ganeshan, Principal Scientist, Dr. K. Bhanuprakash, Scientist, and Dr. H.S. Yogeesha, Senior Scientist, Section of Seed Science and Technology, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore (Karnataka) 560 089.

METHODOLOGY

Location

Indian Institute of Horticultural Research, Bangalore

PRA and field study

Unstructured interview was conducted and all the details on the use and methods of ITK were obtained.

Experiment

Crops: Tomato, chillies and brinjal

Varieties: Different varieties of tomato, brinjal and chilli were
taken for the study which are as follows:

Tomato _ Arka vikas and Arka alok

Brinjal _ Arka navneeth and PPL

Chilli _ Arka lohit and Pusa jwala

Treatments: The following 6 treatments were imposed to evaluate the effect of seed soaking in butter milk on germination
of the test crops and its varieties.

T1 _ Dry seeds (control-1)

T2 _ Soaking seeds in distilled water for 6 hours (control-2)

T3 _ Soaking seeds in fresh buttermilk for 6 hours

T4 _ Soaking seeds in one day old buttermilk for 6 hours

T5 _ Soaking seeds in three day old buttermilk for 6 hours

T6 _ Soaking seeds in six days old buttermilk for 6 hours

The experiment was conducted under controlled conditions with
10 replications. Number of seeds per replication was 50. The performance was evaluated by observing germination percentage and seedling emergence.

RESULTS AND DISCUSSION

PRA and field study

Matrix scores determined by PRA exercise on germination percentage and yield of tomato, brinjal and chillies have been depicted in Fig. 1 and 2.

Experiment

Soaking tomato seeds in fresh buttermilk has improved percent
germination to the extent of 20 and 11% in varieties Arka vikas and Arka alok

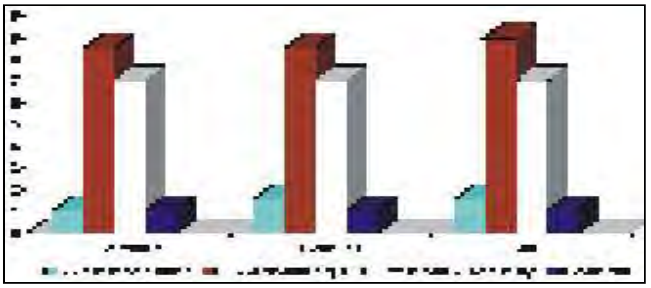


Fig. 1. Relative performance on different treatments

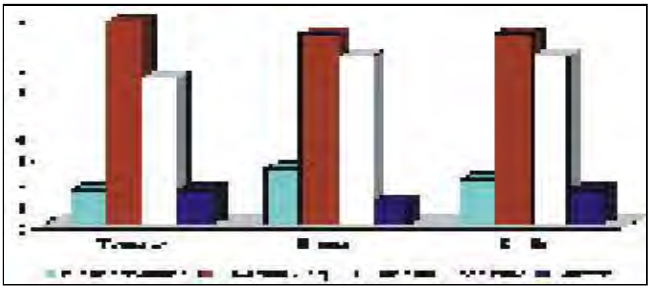
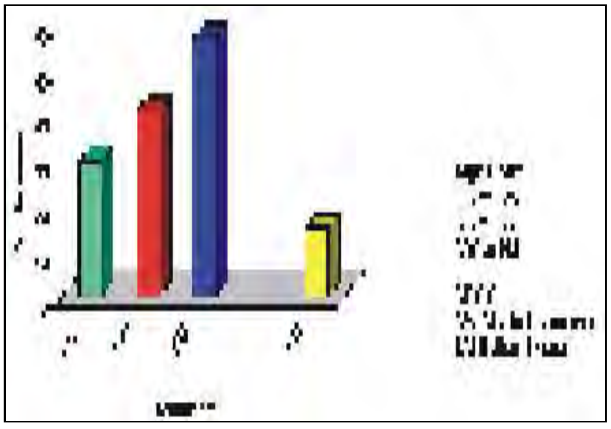
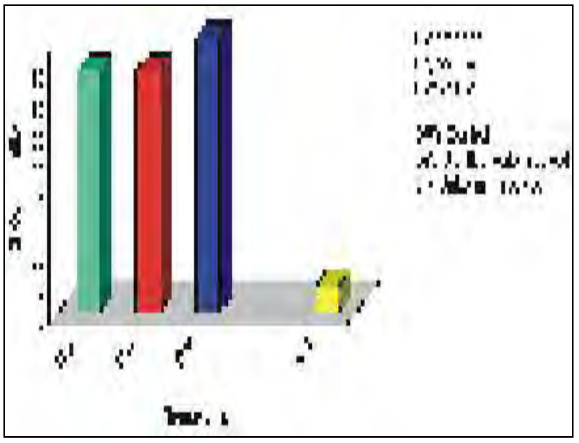


Fig. 2. Relative performance of different treatments on yield



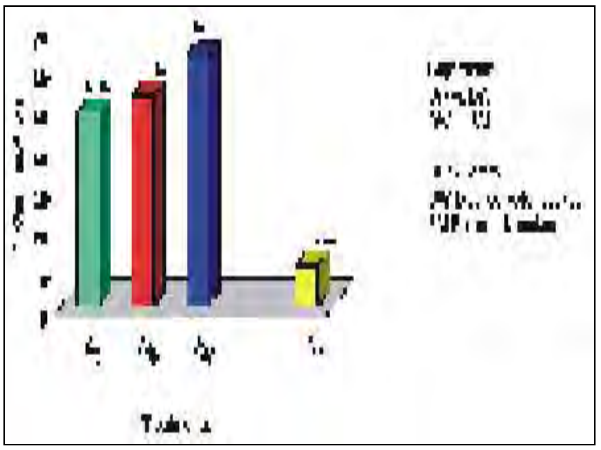
Significant: Dry vs DW; Dry vs BM; DW vs BM; DRY-Control; DW-Distilled water soaked; BM-Buttermilk soaked

Fig. 3. Effect of fresh buttermilk on final germination (%) of tomato (IIHR)



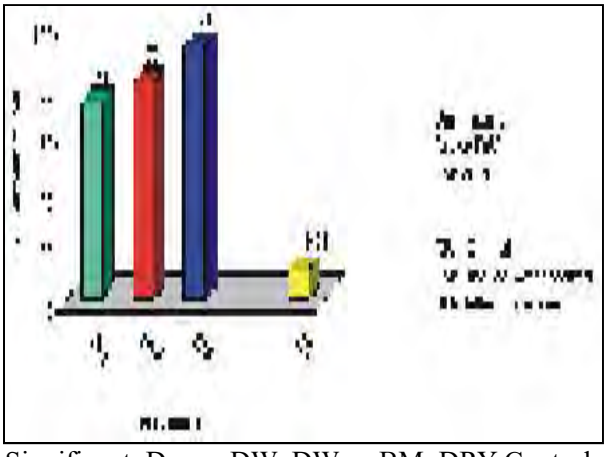
Significant: Dry vs DW; DW vs BM; DRY-Control; DW-Distilled water soaked; BM-Buttermilk soaked

Fig. 4. Effect of fresh buttermilk on final germination (%) of tomato (NSC)



Significant: Dry vs DW; DW vs BM; DRY-Control; DW-Distilled water soaked; BM-Buttermilk soaked

Fig. 5. Effect of fresh buttermilk on final germination (%) of chillies (IIHR)



Significant: Dry vs DW; DW vs BM; DRY-Control; DW-Distilled water soaked; BM-Buttermilk soaked

Fig. 6. Effect of fresh buttermilk on final germination (%) of chillies (IIHR)

respectively (Fig.3 and Fig. 4).

However, no significant effect of fresh buttermilk in case of brinjal was noticed (Table1).

20% higher seed germination in *arka lohit* and *pusa jwala,* respectively. Similar beneficial effect was also noticed in these crops by using 3 day

Table 1. Effect of fresh buttermilk on final germination (%) of brinjal

Variety	Final germination percentage		
	Dry (control)	Distilled water treated	Butter milk treated
Arka navneeth	0	0	0
Pusa purple long	35.7	35.3	42.3

Soaked chilli seeds in fresh buttermilk had germination percent in both the varieties tested higher. (Fig 5 and Fig.6) compared to control.

Soaking in fresh buttermilk resulted in 15 and

Table 2 and Table 3) and 6-days old buttermilk, under laboratory (Table 4) as well as field conditions (Table 5).

Except in brinjal variety Arka naveenth, the

Table 2. Effect of 3-day old buttermilk on final percent germination (laboratory condition)

Crop	Variety	Percent germination		
		Dry	Dw	BM
Tomato	Arka Vikas	42.7	35.3	44.7
	Arka alok	79.3	80.0	90.6
Brinjal	A. navneeth	0	0	0
	Pusa purple long	71.4	74.6	80.7
Chillies	Arka lohit	48.7	50.7	64.0
	Pusa jwala	72.0	78.7	88.0

Table 3. Effect of 3-day old buttermilk on final percent germination (field condition)

Crop	Variety	Percent Germination		
		Dry	Dw	BM
Tomato	Arka vikas	30	36.7	43.3
	Arka alok	58	76	79.3
Brinjal	A. navneeth	0	0	0
	Pusa purple long	29.3	34.7	44.7
Chillies	Arka lohit	18.7	20.0	32.7
	Pusa jwala	30.0	34.7	49.3

Table 4. Effect of 6-day old buttermilk on final percent germination (laboratory condition)

Crop	Variety	Percent Germination		
		Dry	Dw	BM
Tomato	Arka Vikas	38	35.3	46.7
	Arka alok	80	80.0	85.3
Brinjal	A. navneeth	0	0	0
	Pusa purple long	83.3	87.3	97.3
Chillies	Arka lohit	46	54	64.7
	Pusa jwala	82.0	82.7	91.3

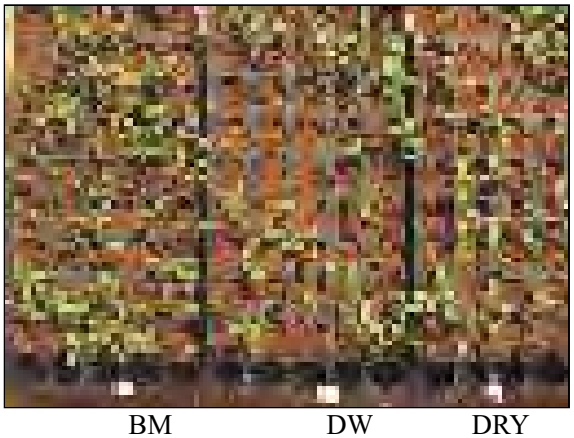
DW, Distilled water soaked; BM, buttermilk soaked

Table 5. Effect of 6-day old buttermilk on final percent germination (field condition)

Crop	Variety	Percent Germination		
		Dry	Dw	BM
Tomato	Arka vikas	40	45.3	53.3
	Arka alok	72	76	82.7
Brinjal	A. navneeth	0	0	0
	Pusa purple long	43.3	56.7	64.0
Chillies	Arka lohit	16.7	30.7	36.0
	Pusa jwala	38.0	46.7	54.7

DW, Distilled water soaked; BM, buttermilk soaked

effect of 3 and 6-days-old buttermilk was conspicuous in increasing germination in all the varieties tested. An attempt was made to study the effect of soaking in buttermilk on revival of seed germination using dead seeds of brinjal cv. A. Navneeth. However, no such effect of butter milk was observed. In general when compared to field conditions, the germination percent of all the crops was more under laboratory conditions in control as well as in other treatments. Soaking



BM DW DRY

Plate 1. Effect of seed treatment on field emergence of tomato



Plate 2. Effect of seed treatment on field emergence of chillies



Plate 3. Effect of seed treatment on field emergence of brinjal

in old buttermilk improved germination percentage of tomato,
chilli and brinjal (Plates 1, 2 and 3).

As compared to fresh buttermilk, 3 and 6 days old buttermilk
performed better. Different varieties responded differently to the treatments imposed. Seeds having different initial germination potential responded differently to the same treatment.

CONCLUSION

Soaking in 3-day and 6-day old buttermilk improved the germination percent in tomato, chilli and brinjal as per the discloser

Code : **380**

Title of the ITK : **Seed extraction in tomato by use of rice bran**

Description of the ITK : Ripened tomatoes of elite varieties are squeezed by hand on well- spread rice bran @ 1 kg rice bran for 1 kg seed extraction. After thorough mixing and drying for 24-48 hours, the bran is separated from the mixture by hand winnower. Healthy and clean tomato seeds are preserved. All 100% tomato-growing farmers are adopting this practice in Khairmal and Dumal villages of Kalahandi district in Orissa. Tomato covers around 50 ha area in winter *(rabi)* season in Sanakhairimal and Dhumal villages, which requires at least 25 kg good tomato seeds costing Rs 20,000. Moreover, availability of tomato seeds having tolerance to wilt complex and high yield potential is not certain. The conventional process of tomato seed extraction through fermentation process was not compatible to the socio-cultural system of the community, especially women of farm families who abhored the work to be done by hand in fermentation process.

Name and address of the discloser : Shri Dilip Kumar Basatia, Scientist, RRTTS, Orissa University of Agriculture and Technology, Bhawanipatna (Orissa) 766 001

Location of use of the ITK : Sanakhairimal and Dumal, Bhawanipatna, Kalahandi, (Orissa) 766 001

Experimenters : Dr A.K. Das, Associate Professor, Department of Horticulture Orissa University of Agriculture and Technology, Bhubaneswar (Orissa) 751 003, Dr M.M. Hossain, Training Organiser and Shri A.M. Prusti, Training Associate, Krishi Vigyan Kendra, Bhawanipatna, Kalahandi (Orissa)

METHODOLOGY

Location

Evaluation of efficacy of rice bran for extracting tomato seeds was done by participatory rural appraisal (PRA), field survey and experimental methods. Participatory rural appraisal and field survey were done in village Sanakhairimal, Bhawanipatna, dist. Kalahandi (Orissa) and experiment was conducted at Department of Horticulture, Orissa University of Agriculture and Technology, Bhubaneshwar, Orissa and village Sanakhairimal, P.O. Karlaguda, Bhawanipatna, Kalahandi (Orissa).

PRA and field study

The survey to determine the performance of the ITK method as compared to fermentation method. The survey was done with 15 farmers of village Sanakhairimal on different parameters, i.e. seed quality, time consumption, seed germination and plant growth.

Experiment

Experiments were conducted at two sites. The main site comprised the village Sanakhairimal, where breeder seeds of variety BT-10 (wilt tolerant variety) was provided. The second site was at Horticulture Department, OUAT where only ripe fruits of tomato were purchased and seed extraction was taken up as per the treatments.

Three treatments, i.e. (i) seed extraction by use of rice bran ITK), (ii) seed extraction by use of fermentation method, and (iii) seed extraction by dilute hydrochloric acid method, were taken for experiment. The experiment was laid out in CRD design to study (i) seed colour, (ii) germination percentage, (iii) seed recovery and (iv) duration required for seed extraction.

PRA and field study

It is revealed from the data presented in Table1 that ITK method (use of rice bran) is less time consuming, having good seed quality with higher germination percentage than fermentation method; whereas both the methods were found to be easy and having similar plant-growth characteristics.

Experiment

It was found that seed extracted by rice bran method was quite superior in seed colour and germination percentage with better recovery of seeds than fermentation and HCl methods. Dilute HCl method consumed lesser time than the ITK method.

Table 1. Matrix table for assessment of efficacy of rice bran vis-à-vis fermentation method for extraction of tomato seeds

Parameter	Mean Value	
	Fermentation method	ITK method
Colour of seeds	Dull brown	Yellowish brown
Seed texture	Hairy	Plain (non hairy)
Seed yield/kg fruit (g)	7_8	8_10
Time consumption (hour)	48 and more	Less than 24 hours
Germination percentage (%)	75	85
Growth of plant	Same as rice bran method	Same as fermentation method

Table 2. Comparative performance of different methods of seed extraction

Treatment	Character				
	Seed yield/kg fruit (g)	Duration of seed extraction (hours)	Seed recovery (%)	Germination (%)	Seed colour
Fermentation method	7.53	47.0	0.80	78.40	Dull Brown
Dilute HCl method	7.80	4.26	0.78	81.26	Light Brown
Rice bran method	8.64	10.6	0.86	89.60	Yellowish Brown
C.D. @ 5%	0.34	0.62	0.02	3.31	-

CONCLUSION

The extraction of tomato seeds by rice bran method was found more effective as compared

to other (fermentation method and dilute hydrochloric acid method) methods. As in case of ITK method, the seeds are devoid of hair, the general market preference is greatly affected, although it gives better results regarding seed yield and germination

Code : **391**

Title of the ITK : **Lemon juice as a substitute of hydrochloric acid for tomato-seed extraction**

Description of the ITK : For 100 g manually-extracted wet seed of tomato, lemon juice of 2 fruits is added and is kept for 2_3 hours. Later the seed is washed properly and dried under shade for 4_5 hours. Lemon juice works as a substitute of hydrochloric acid, which results in 100% germination and cost is also low. Almost all the tomato-growing farmers of Benakunda village of Ganjam district in Orissa follow this practice. Tomato seed is extracted by two methods, viz. acid and fermentation methods. In acid method, hydrochloric acid is used, which is very strong, costly and beyond the reach of the poor farmers. It is also hazardous and risky to use. The fermented method takes more time (40_48 hr) and the colour of the seeds is not so good.

Name and address of the discloser : Shri Ramesh Chandra Bisoyi, C/o Shri Udayanath Bisoyi, village-Benakunda, Dihapadal, Bhanjanagar, Ganjam (Orissa) 761 126

Location of use of the ITK : Benakunda, Bhanjanagar, Ganjam 761 126 (Orissa)

Experimenters : Dr A. K. Das, Associate Professor,Department of Horticulture,Orissa University of Agriculture and Technology, Bhubaneswar (Orissa) 751 003, Shri N. Nayak, Training Organiser and Dr (Ms) B. P. Mishra, Training Associate, Krishi Vigyan Kendra, Bhanjanagar (Orissa).

METHODOLOGY

Location

The efficacy of lemon juice for extracting tomato seeds was evaluated by participatory rural appraisal (PRA), field survey and experimental methods. Participatory rural appraisal and field survey were done at village Benakunda, Bhanjanagar, dist. Ganjam (Orissa) 761 126 and experimental method was conducted at the village Benakunda, Bhanjanagar, Ganjam (Orissa).

PRA and field study

The PRA and field study were done to determine the performance of lemon juice for extraction of tomato seeds. The survey was done with 15 farmers of village Benakunda in terms of seed colour, seed germination, ease in preparation, time consumption, plant growth, fruit yield and cost effectiveness.

Experiment

The experiment on extraction of seeds by different methods was carried out at the Department of Horticulture, Orissa University of Agriculture and Technology, Bhubaneshwar with the following three methods: (i) fermentation method, (ii) dilute HCl method and (iii) lemon juice method.

Seed extraction by fermentation

The ripe tomatofruits were collected and

weighed. Ten kg fruits were taken for seed extraction per treatment each time. The pulp was scooped out and placed in the bucket provided for the purpose. Then water was added and kept for fermentation. After 36 hours the seeds were checked at regular intervals for removal of sliminess. When the seeds were found fully free from mucilaginous material, they were separated, washed, dried and stored.

Seed extraction by use of dilute hydrochloric acid

The pulp of taomato was collected in a plastic bucket in the in the
same way as mentioned above and dilute (10%) HCl was added at the rate of 10 ml/ kg of pulp. When the action of acid pulp was completed, the seeds were separated, washed thoroughly, dried and stored.

The experiment was laid out in CRD design with 15 replications.
The seeds were extracted from 10 kg fruits of BT-10 variety in each treatment. The crop was sown on 2 November 2002 and transplanted on 4 December 2002. Observations were taken on (i) seed colour, (ii) germination percentage, (iii) seed recovery, (iv) duration of seed extraction, and (v) seed yield.

RESULTS AND DISCUSSION

PRA and field study

The PRA conducted in village Benakunda revealed that ITK
method (lemon juice) was found to be superior to fermentation method is colour, seed germination (85%) and time consumption for seed extraction. Lemon juice method was found to be easy and was completed within 12 hours as compared to fermentation method, which takes more than 48 hours (Table1). Fruit yield and plant growth were found to be similar in both the methods.

Table 1. Matrix table for assessing performance of lemon juice method vis-à-vis fermentation method for tomato seed extraction

Parameter	Mean value	
	Fermentation method	Lemon juice method
Seed quality	Average	Good
Ease of operation	Easy	Easy
Time consumption (hours)	48	Less than 24
Seed germination (%)	75	85
Plant growth	Good	Good
Yield of fruits (q/ha)	200	200

Table 2. Comparative performance of different methods of tomato seed extraction

Method of seed extraction	Parameter				
	Seed colour	Duration of seed extraction (hour)	Seed recovery (%)	Germination (%)	Seed yield/kg of fruit (g)
Fermentation method	Dull brown	46.86	0.82	88.6	8.25
Dilute HCl method	Light brown	4.28	0.78	87.0	7.84
Lemon juice method	Sparkling brown	8.30	0.85	91.6	8.50
CD (P=0.05)	-	0.599	0.028	1.91	0.39

Experiment

Results presented in Table 2 reveal that seed colour is sparkling brown when extracted using lemon juice. Seeds were dull brown and light brown in fermentation and dilute HCl method respectively.

Time taken for extraction of seeds was least (4.28 hour) when HCl was used. Seed extraction by lemon juice took 8.30 hr, which was 46.86 hr by fermentation method. Recovery of seed was higher in lemon juice and fermentation method as compared to hydrochloric acid method.

Germination percentage of the extracted seed was significantly higher when the seeds were extracted by using lemon juice. Seed yield was similar in fermentation and lemon juice methods (8.25 to 8.50 g/kg fruit) which was higher than is dilute HCl method (7.84 g/kg fruit).

CONCLUSION

Lemon juice was found to be superior to other methods in maintaining quality of tomato seeds which is desired by the farmers. ❑

Code : **403**

Title of the ITK : **Off-season flowering in guava**

Description of the ITK : On the basis of expectation, the farmers bend down the branches of guava about 45 to 60 days before flowering in 3 to 8 years old plants. The branches are bent towards outer periphery to open the centre and allow penetration of sunlight. After 25 to 30 days, new shoots emerge from the bent portion, which bears profuse flowers. This practice results in 39% increase in flowering in early summer and 28% increase in late autumn. Off-season flowering fetches Rs 590 to Rs 600 per plant, instead of Rs 150 to Rs 180 per plant in the normal season.

Name and address of the discloser : Dr Dipankar Saha, Training Organiser, Ramakrishna Ashram KVK, Nimpith Ashram, South 24_Parganas, (West Bengal) 743 338

Location of use of the ITK : Twenty-six villages in 4 blocks: block Baripur-I and Baripur II Joynagar-I and Jaynagar-II, South 24 Parganas (West Bengal)

Experimenters : Dr Bikas Ghosh, Reader, Department of Orchard Management, Faculty of Horticulture, and Dr Premasis Sukul, Reader, Department of Agriculture Bio-Chemistry, Faculty of Agriculture, Bidhan Chandra Krishi Vishwa Vidyalaya, Mohanpur, Nadia (West Bengal) 741 252

METHODOLOGY

Location

Evaluation of effectiveness of autumn bending of guava branches for profuse flowering was done by Participatory Rural Appraisal (PRA) and field study and experiment was conducted at Baruipur, South 24 Parganas (West Bengal).

PRA and field study

The PRA tools were used and field study was done to determine the efficacy of autumn bending as compared to summer bending and without bending practices. It was done on 12 farmers of village Baruipur. The study had the following parameters to observe: production of new shoots, flower in the new shoots, number of fruits/plant, size of the fruit, improvement in quality of fruit (sweetness), production of off-season flowering, market price of fruits, (sweetness), production of off-season flowering, market price of fruits, harmful effect on longevity of plant, if any, and cost effectiveness.

Experiment

Experiments were conducted in seven different guava orchards belonging to farmers of Baruipur. The experimental design was Complete Randomized Design (CRD) and the treatments were: (i) summer bending (April_June), (ii) autumn bending (September_November), (iii) complete removal of leaves from the shoot and decapitation, and (iv) control (without any treatment). The number of plants per treatment and per season was three.

Uniformly growing 3 years old trees of the varieties Allahabad Safeda and Khaja were


Emergence of new shoots due to bending


Full bloom due to bending of branches


Good fruit set after 120 days of operation

selected and all the trees were given uniform cultural practices. Each plant received 450 g N, 300 g P2 O5 and 450 g K2O in two equal split doses, once during 12_15 days before bending operation, and again during marble stage of the fruit growth. The control plants were fertilized during August_September and January. Irrigation was given as and when required. Adequate plant-protection measures were taken. The observations taken were on days required to emerge new shoot, number of new shootlets/branch, days required to initiate flowering, days required for fruit setting, length of new shootlets at flowering time (cm), pair of new leaves produced per shootlet at flowering time, number of shootlets with flower buds per branch, number of fruits/branch at fruit set stage, number of fruits per shootlet at fruits set stage, number of fruits retained up to harvest/branch, number of fruits/plant, average weight of the fruits (g), colour of the fruits, sweetness of the fruits, market price, and cost effectiveness.

RESULTS AND DISCUSSION

PRA and field study

It is gathered from discussion made with the practising farmers that bending is practiced in two seasons, i.e. during summer (April_May) to produce fruits during autumn to winter, and during autumn (September _ October) to produce fruits during early summer. The farmers followed mostly the autumn bending, which produces profuse flowering and fruiting that fetches higher market price. This off-season flowering fetches Rs 600 to 800 per plant instead of Rs 150_180 per plant in mid-summer for rainy season fruiting (in 5 years plant).

The practice of bending of shoot is followed in the third year after planting of the trees. It is continued up to 10_12 years of age of the plant. During bending the leaves and small shoots are removed from the branch, keeping 8_10 inch terminal portion of the twig intact. It is also observed that when bending is done during summer (April_May), the new shoots start emerging within 8_10 days of bending and fruit set occurs within 30_45 days. After emergence, the shoots grow for two to three weeks, which is followed by appearance of flower bud in leaf axil. Setting of fruits takes another three weeks. In

Table 1. Matrix scoring of the result

Parameter	Summer bending (April-May)	Autumn bending (September_October)	Without bending
Production of new shoots	00000000	0000000	0
Flower in the new shoots	0000000	000000000	0
Number of fruits/plant	000000	000000000	0
Size of the fruit	00000	0000000	0
Improvement in quality of fruit (sweetness)	000	00000000	Nil
Production of off- season flowering	0000000	000000000	0
Market price of fruits	000000	000000000	0
Harmful effect on longevity of plant	00	00	Nil
Cost effectiveness	000000	000000000	0

autumn, new shoots appear after 25_30 days of bending and fruit set occurs after 60_65 days of bending.

Within 2_3 days after bending, planofix @ 5 ml/10 litres water

and metacid @ 10 ml/10 litres are applied. Manures and fertilizers are applied and the field is irrigated 15 days before the bending operation. When the new shoots start emerging from the naked bent portion of the branch, the tying is removed. Twelve respondents were selected randomly among the orchard owners. During discussion it was revealed that most of the orchard owners followed the same practice. The varieties which are grown in Baruipur are: (i) Baruipur Local, (ii) Teli, (iii) Bhagalpur, (iv) Allahabad Safeda, (v) Khaja, and (vi) Kabri.

The ITK is practised in all the above-

mentioned varieties except kabri, and is very much effective and produces profuse flowering. Kabri is a small-fruited tree with good fruit colour and taste. It has good market value, irrespective of the size of the fruits.

Results obtained indicated that the practice is very much effective

and produces profuse flowering (Tables 1 and 2). Bending in autumn was more effective than when done in summer.

Experiment

The investigation was carried out on two cultivars, viz. Allahabad

Safeda and khaja.

Allahabad safeda

Days required to emerge new shoot

The data presented in Table 3 show that season of bending has a profound effect on morphological changes and fruit yield of the plant.

Table 2. Yield of guava (during off-season)

Treatments	Number of fruits/plant			Yeild (kg/plant)		
	3 year old plant	4year old plant	5 year old plant	3 year old plant	4 year old plant	5 year old plant
Summer bending of shoots (25%)	80	140	200	20	35	50
Autumn bending of shoots (75%)	160	240	320	40	60	80
Without bending	20	40	60	5	10	15

It was found that summer bending of branches caused early emergence of new shootlets (10.2 days) than autumn bending of branches (23.0 days). Earliness in shoot emergence was also noted in other treatments during summer bending. Warm humid condition during summer probably favoured the early emergence of new shootlets.

Number of new shootlets per branch

The summer season of bending increased number of new shotlets per branch (21.4) than autumn season of bending (13.9). The same trend of increment in number of new shootlets per brahch was noted in other treatments during summer season (Table 3).

Days required to initiate flowering

The summer bending of branches (Table 4) produced early initiation of flowering (33.6 days) than autumn bending (41.5 days). Early initiation of flowers was also recorded with other treatments during summer season of bending.

Days required for fruit set

Fruit set was also advanced by 20 days during summer season of bending (46.6 days) than autumn bending (64.1 days). Earliness in fruit setting was also noticed in other treatments during summer season of bending (Table 3).

Pair of new leaves produced per shootlet at Flowering time the

data presented in Table 3 show

Table 3. Morphological changes and fruit yield of guava (cv. Allahabad Safeda) as affected by re-structuring of canopies

Parameter	Treatment					
	Autumn bending of branch (T1)		Complete removal of leaves from the shoot and decapitation (T2)		Control (normal plants) (T3)	
	Autumn 2002	Summer 2003	Autumn 2002	Summer 2003	Autumn 2002	Summer 2003
Days required to emerge new shoots	23.0	10.2	29.0	14.8	44.0	-
Number of new shootlets/branch	13.9	21.4	6.90	12.0	1.83	5.0
Days required to initiate flowering	41.5	33.6	47.7	42.4	26.8	23.2
Days required for fruit set	64.1	46.6	70.3	52.4	45.4	38.2
Pair of new leaves produced shootlet at flowering time	4.8	5.8	5.0	6.2	5.5	7.6
No. of shootlets with flower buds/branch	11.4	10	5.5	6.0	1.7	4.0
No. of flowers shootlet	7.5	7.2	6.9	7.2	5.8	6.8
Number of fruits/branch at fruit set stage	65.0	43.0	27.2	21.8	6.6	12.4
Number of fruits/shootlet at fruit set stage.	5.9	4.6	5.0	3.8	4.0	3.9
Number of fruits retained upto harvest/branch	22.6	-	9.8	-	3.3	-
Number of fruits/plant at harvest	258.8	-	117.2	-	22.6	-
Average weight of fruits (g/fruit)	187.9	-	177.9	-	168.7	-

that the pair of leaves/shootlet varied from 4.8 to 7.6 among the treatments during the season of experiment. Control plants produced the maximum pair of leaves/shootlet at flowering time (7.6) during summer season. Least pair of leaves was produced in autumn bending of branches (T1=4.8).

Number of shootlets with flower buds/branch

Inspite of having more number of shootlets/branch in plants

(Table 3) with summer bending recorded less number of shootlets with flower buds per branch. During summer bending of branch, many newly emerged shoots become vegetative instead of reproductive. High temperature with high humidity during summer has a deleterious effect on the production of reproductive shoots. It was also noticed that if rainy days continued for 2 to 3 days after bending operation, the newly emerged shootlet made excess growth and became vegetative in nature. These vegetative shoots should be removed.

Number of flowers per shootlet

The autumn bending of branches produced maximum number

of flowers/shootlet (7.5), followed by T2 (6.9) and T3 (5.8) during the same season (Table 3). Variation was not conspicuous in respect of number of flowers/shootlet among the treatments, which ranged from 6.8 to 7.2 during summer season of bending.

Number of fruits/branch at fruit set stage

The maximum number of fruit set/branch at fruit set stage

(Table 3) occurred during autumn bending of branch (65.0) than summer bending (43.0). The summer bending of branches produced maximum number of new shootlets/branch but fruit set was reduced due to excessive fruit drop during summer season. Production of reproductive shoots was also reduced during summer months, which caused lesser fruit set/branch.

Number of fruit per shootlet

Number of fruits per shootlet at initial stage

was also higher during autumn bending of branches than during summer bending. Other treatments also showed similar trend in results in this regard. At present the fruits of summer bending of branches are in marble stage of growth. Therefore rest of the observations like number of fruits retained up to harvest/branch, number of fruit/plant at harvest and average fruit weight (g/fruit) were incorporated, for which the finding of autumn bending branch in year 2002 is given.

Number of furits retained up to harvest per branch

Maximum number of fruits retained up to harvest per branch was with autumn bending of branch (22.6).

Number of fruits per plant at harvest

Highest number of fruits per plant at harvest was recorded in bending of branch in autumn (258.0) whereas T2 and T3 produced 117.0 and 22.0 fruits/plant, respectively.

Average fruit weight (g/fruit)

In spite of having maximum number of fruits/plant, T1

(bending of branches during autumn) produced highest fruit weight (187.0 g/fruit).

Khaja

Days required to emerge new shoot

The data presented in Table 4 show that summer bending of branch (T1) caused early emergence of new shootlet (11.5 days) as compared to autumn bending of branch (26.3 days). Earliness in new shoot emergence during summer bending was also recorded in T2, i.e. complete removal of leaves from the shoot and decapitation. The control plants did not have new shoots, as the plants were in bearing stage (at pre-harvest stage) at the time of bending in summer.

Number of new shootlets per branch

Production of new shootlets/branch was also increased in summer

bending of branch (19.0) as compared to autumn bending (10.8). In other treatments summer season produced more

Table 4. Morphological changes and fruit yield of guava (cv. Khaja) as affected by re-structuring canopies

Parameter	Treatment					
	Autumn bending of branch (T1)		Complete removal of leaves from the shoot and decapitation (T2)		Control (normal plants) (T3)	
	Autumn 2002	Summer 2003	Autumn 2002	Summer 2003	Autumn 2002	Summer 2003
Days required to emerge new shoots	26.3	11.5	31.0	17.0	46.4	0
Number of new shootlets/branch	10.8	19.0	6.4	8.5	1.9	4.8
Days required to initiate flowering	45.2	36.4	49.7	45.4	28.9	23.4
Days required for fruit set	64.8	51.8	69.7	55.0	46.9	38.0
Pair of new leaves produced shootlet at flowering time	5.1	5.9	5.2	6.6	5.7	8.1
No. of shootlets with flower buds/branch	9.0	9.2	4.9	5.5	1.9	4.6
No. of flowers shootlet	8.3	6.8	7.7	6.4	6.8	6.4
Number of fruits/branch at fruit set stage	56.5	39.6	27.2	18.6	8.6	10.4
Number of fruits/shootlet at fruit set stage.	6.7	4.2	6.0	3.8	5.0	3.5
Number of fruits retained upto harvest/branch	18.7	-	9.0	-	3.6	-
Number of fruits/plant at harvest	225.0	-	110.0	-	21.0	-
Average weight of fruits (g/fruit)	289.0	-	277.0	-	269.0	-

number of shootlet per branch than those in autumn season (Table 4).

Days required to initiate flowering

Early initiation of flowering in new shootlets was also recorded in summer bending of branch (36.4 days) than autumn bending (45.2 days). Earliness in initiation of flowering was also observed in other treatments in summer season (Table 4).

Days required for fruit set

The fruit set was also advanced by 9 days during bending summer season as compared to bending in autumn season (Table 4). Other treatments also showed similar trend of variation

Pair of new leaves produced per shootlet at flowering time

The maximum pair of leaves was produced at flowering time with control plants (8.1) during summer season. However, other treatments also showed slight increment in pair of leaves/shootlet during summer season of bending than autumn season.

Number of shootlets with flower buds per branch

About 83% of the newly emerged shoots produced flower buds during autumn bending (Table 4) whereas only 48.42% of the newly

emerged shoot produced flower buds during bending in summer season. During summer season due to warm and humid condition the newly emerged shoot made excess growth, having more than 5_6 pairs of leaves at flowering time and became vegetative shoot instead of producing flowers in them.

Number of flowers per shootlet

The number of flowers/shootlet was found to increase in autumn season of bending (8.3) as compared to summer bending (6.8). Similar change of variation was recorded in other two treatments (Table 4).

Number of fruits per branch at fruit-set stage

The maximum fruitset/branch (56.5) was observed in autumn season of bending at fruit set stage than summer bending (39.6) during autumn season (Table 4). Increased fruit set was also recorded in all the treatments. The increment of fruit set in autumn season was due to number of shootlet with flower buds as well suitable environmental condition reduced fruit drop at fruit set stage.

Number of fruits per shootlet

The number of fruits per shootlet was also higher in autumn season of bending (6.7) than summer bending (4.2). Other treatments followed the same trend of variation in this regard (Table4).

Number of fruits retained up to harvest per branch

It was found that bending of branches during autumn produced maximum number of fruits retention (18.7) at harvest than the other two treatments (Table 4).

Number of fruits per plant at harvest

Maximum number of fruits was recorded in bending of branches in autumn (225.0) as compared to other treatments, whereas T2 and T3 produced 110 and 21.0 fruits per plant at harvest respectively (Table 4).

Average weight of fruit (g/fruit)

T1 (bending of branches during autumn) produced highest fruit weight of 289.0 g/fruit.

CONCLUSION

It was concluded that summer bending of branches produced early emergence of more number of shootlets/branch, which caused flowering and fruit set in them. But the number of reproductive shoot/branch and fruit set is reduced during summer bending was compared to autumn season of bending, which proved superior in respect of production with quality fruits. Bending of branches I both the seasons produced more fruits during off-season than normal plants. This ITK is remunerative and cost effective, as the rainy-season crop was sold @ Rs 1.80 to 2.0/kg fruit, whereas production during November_January fetched Rs 12_15/kg fruit and the fruits during February_May fetched Rs 10_12/kg fruit from the farmers' fields. The guava is now available almost all the year round due to this innovative technique.

Code : **527**

Title of the ITK : **Use of fine yellow soil for treatment of stem disease in apple**

Description of the ITK : Locally available yellow soil is used in this indigenous technology-based practice for controlling stem diseases of apple. The diseased part of the stem is scraped and a paste of fine yellow soil is applied. Then, a piece of cloth is tied over this portion of the stem. The disease is claimed to be controlled by this treatment. The stem disease is most destructive and widely prevalent disease of apple in the hilly areas of Uttaranchal. The disease affects the apple trees by killing the branches directly and later reducing the plant vigour. This adversely affects the productivity of apple trees. The whole tree may also die due to severe infection.

Stem diseases of apple are caused by fungi and have been chiefly categorized into following types:

Stem black: caused by *Coniothecium chomatosporum.*Corda

Stem brown: caused by *Botryosphaeria ribis* Gross and Dugg

Pink disease: caused by *Corticium salmonicolor* Berk and Br.

Stem canker: caused by *Monochaetia mali* Sacc.

The different types of stem diseases are depicted in Figs. 1 to 4.

Name and address of the discloser : Shri Shambhu Prasad Semwal, Village-Triyugi Narayan, Post Office-Triyugi Narayan, District-Rudraprayag (Uttaranchal) 246 477

Location of use of the ITK : Triyugi Narayan, Guptkashi, Rudraprayag (Uttaranchal)

Experimenter : Shri Ratan Kumar, Physiologist, Horticultural Experiments and Training Centre, Chaubatia, Ranikhet, Almora (Uttaranchal)

METHODOLOGY

Location

The efficacy of the technology was evaluated by PRA and field survey in village Triyugi Narayan, Rudraprayag (Uttaranchal) and Horticultural Experiments and conducting trials at Training Centre, Chaubatia, Ranikhet, Almora.



Fig. 1. Stem-black disease



Fig. 2. Stem-brown disease



Fig. 3. Stem canker



Fig. 4. Severely affected dead apple tree



Fig. 5. Application of yellow soil paste



Fig. 6. Application of *chaubatia* paste

Extent and coverage

PRA and field study

PRA technique was used to gather background information about the performance and other facts of the technology.

Experiment

The effectiveness of the indigenous practice was compared with the scientifically standardized known method for stem disease control with the following 7 treatments.

1. Chaubatia paste (copper carbonate + red lead + raw linseed oil = 1:1:1.25)
2. Lime - sulphur
3. Lime -sulphur + kerosene (3:1)
4. Yellow soil paste (IT practice)
5. Yellow soil + kerosene
6. Yellow soil + lime _ sulphur
7. Control

The experiment has been laid out in the existing orchard with 4 replications for each treatment. Locally available yellow soil is used for this practice. Samples of the yellow soil were collected from the site for the purpose of physico-chemical analysis. Apple trees having 10_15 affected branches were selected for the study. First application of the treatment has been done during dormant stage (January 2003) after scraping the surface of infected bark of the affected branches of apple trees (Plate 1 and 2). Second application

Table 1. Present status of use of the technology

Present status	Number	Percentage
Persons using fine yellow soil	38	78
Persons using Chaubatia paste	-	-
Persons not using any measure	11	22

of the treatments was done during May_June 2003.

RESULTS AND DISCUSSION

PRA and field study

Results presented in Table 1 indicate that 78% of the orchard growers use fine yellow soil to control stem disease in apple. No one was using Chaubatia paste due to lack of its availability. About 70% orchardists preferred use of Chaubatia paste, if made available (Table 2).

Experiment

The experiment was laid out during October, 2002 and the initial percentage of infection was recorded (Table 3) by carefully observing the length of the cankered portions of affected branches during dormant stage in December 2002. The process has been depicted in Figs 5 and 6. Final observation were taken in the month of August, 2003 and per cent recovery was calculated (Table3).

Data presented in Table 3 indicate that among all the treatments, chaubatia paste was found to be more effective in reducing the stem disease of apple. There was a recovery of 62.1% by using chaubatia paste which was followed by the treatments lime + sulphur + kerosene (59.9%) and lime + sulphur (53.1%). Among the yellow soil treatments, yellow soil alone showed a recovery of 11.0%, followed by yellow soil+ kerosene (19.6%). However, there was a recovery of 50.9% when yellow soil was used in combination with lime and sulphur. Figure 5 and 6 show the protion of the disease and its treatment at experiment station, Chaubatia.

Results of the chemical analysis of the yellow soil used in the study show that content of DTPA extractable Cu is only 0.50ppm. Copper which is an important ingredient of fungicide was not found in sufficient quantity in this soil to show any sort of fungicidal action. The other soil properties were pH 5.3, EC 0.059, Carbon

Table 2. Preference of individuals for the ITK vs chaubatia paste

Criterion	Preference for ITK (yellow soil paste)	Preference for chaubatia paste
Number	14	35
Percentage	29	71

Table 3. Percentage of infection under different sets of treatments

Treatment	Percentage of infection		
	Before treatment imposition (December 2002)	After treatment imposition (August 2003)	Recovery (%)
T1 Chaubatia paste	44.50	16.86	62.1
T2 Lime + sulphur	28.75	13.47	53.1
T3 Lime + sulphur + kerosene	27.50	11.02	59.9
T4 Yellow soil paste (ITK practice)	48.75	43.37	11.0
T5 Yellow soil + kerosene	32.50	26.13	19.6
T6 Yellow soil + lime + sulphur	36.25	17.78	50.9
T7 Control	35.00	57.12	-

CD for recovery (P=0.05).

0.162%, N 0.048%, DTPA-Zn 0.09%, DTPA-Fe 13.4 ppm and DTPA-Mn 3.24%.

CONCLUSION

The results of the experiment indicate that yellow soil provides a sort of protective layer around the wound, which may prevent the entry of the pathogen as only 11.0% recovery was observed by using paste of yellow soil.

Code : **1162**

Title of the ITK : **Raising of cucurbitaceous crop in sand dunes under water scarcity conditions**

Description of the ITK : In south western districts of Punjab, specially in Muktsar and Faridkot, a number of sand dunes are prevalent which are uncultivable and there is no facility of irrigation water. The underground water in brackish is natural. About 100 families, mostly muslim, utilize these sand dunes for raising cucurbits (long melon, water melon, musk,melon and pumpkin) taking the lands on lease from the land lords. The farmers dig trenches on sand dunes, which are 6 feet deep and 3 feet wide. The trenches are dug apart at a distance of 4 feet. In some cases the depth of the trenches is at the point where moisture is available. Two to three seeds of cucurbits are sown at a distance of 1 foot in October_November. Farm-yard manure @ 12 tonnes/acre is applied before sowing. The seeds are covered with soil after sowing. The farmers go on putting soil with the germinating seedlings and bring the plants up to the surface of the soil, leaving the roots at a depth of about 6 feet below in moist zone. During February, sponge gourd is sown in the trenches by dibbling. The cucurbits, sown in October_November, come to bearing in March and the vines are dried up in the month of June). eanwhile fruiting starts on sponge gourd, which continues up to October. The process thus restarts.



Prepared trench for cultivation of cucurbit in sand dunes

Name and address of the discloser : Shri Mohammad Amir Kadri C/o Malkit Auto Service Bus Stand Bhange Wali P.O. Sir Wali, Muktsar (Punjab).

Location of use of the ITK : Villages of Muktsar district of Punjab and Villages of Garh Mukteshwar, Jyotibaphule Nagar (Uttar Pradesh).
The disclosure states that ITK was followed by the farmers of Sher Wali of Muktsar district, Punjab. However, the survey revealed that vegetable cultivation system as practised by them was different from the reported ITK Though they cultivated cucurbits particularly the bottle gourd and melons in sandy soil, they did not go in for trenches of reported dimension (6' × 3' × 4'). Also the cultivation was successful due to assured irrigation. However, the vegetable cultivation system as per the ITK could be observed along the major river banks. Hence on-farm trials were conducted in the Ganges river bed near Garh Mukteshwar as farmers from this region are the leading cultivators of vegetables in sands. Their conviction

and reasoning helped in validation of the ITK during PRA.

Experimenters : Dr Baldeo Singh, Principal Scientist, Division of Agril. Extension; Dr A. D. Munshi, Sr. Scientist, Division of Vegetable Crops; Dr R.N.Padaria, Sr. Scientist, and Dr Poonam Sharma, Scientist (S.S.) Division of Agril. Extension, Indian Agricultural Research Institute, New Delhi 110 012

METHODOLOGY

Location

Field study through PRA matrix ranking as well as on-farm trials were conducted in the villages near Garh Mukteashwar, Jyotibaphule-nagar district of Uttar Pradesh

PRA and field study

Twenty farmers were interviewed using PRA matrix, ranking with four treatments (upland, lowland, mid course and river bank) on nine criteria (soil status, irrigation, seed germination, plant growth, insect pest, yield, cost of inputs, labour and net profit). Matrix ranking for the relative performance of the options with respect to each criterion was done with scoring pattern of 0-10.

Extensive cultivation of cucurbit vegetables in riverbeds in South Asia has been reported by More *et al*. (1998). The main riverbed consists of sand. It is available for cultivation from December to June. The vegetables grown are watermelon, muskmelon, pumpkin, bottle gourd and bitter gourd.

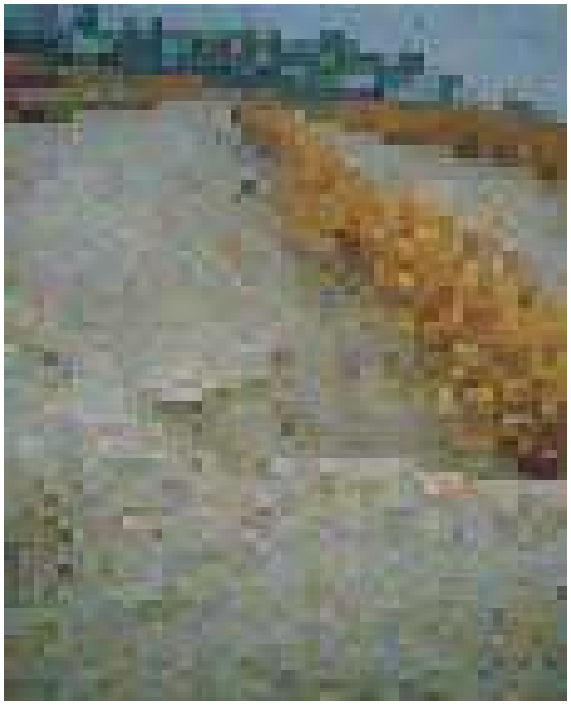
Riverbed cultivation started possibly during the Mughal period. Various vegetables and cucurbits were grown in sandy riverbeds after the water level had receded. Though several vegetables are grown, cucurbits have adapted themselves best to riverbed cultivation.

In India the main riverbeds where cucurbits are grown occur on the rivers Sabarmati, Vatrat, Panam, Orusung, Mahi, Bans and Tapti in Gujarat; Narmada, Tapti, Tawa and Mohan in Madhya Pradesh; Markheda Ghat and Banas in Rajasthan; Yamuna, Hindon, Sarayu, Ganga, Ghaghra, Tank beds, Sharada, Ramganga and Gomati in Uttar Pradesh. Tungabhdra, Krishna, Pennar, Papagni, Hundri and Sagileru in Andhra Pradesh; Channapatna, Hanganoor and Shinsha in Karnataka; Tapi, Buri, Purna, Vagur, Girna, Mais Bhuikkund, Nirguna, and Kanhan in Maharashtra; Pumba in Kerala; and Ganga, Gandak, Sone, Kosi and Burhi Ganga in Bihar (Anonymous, 1974).

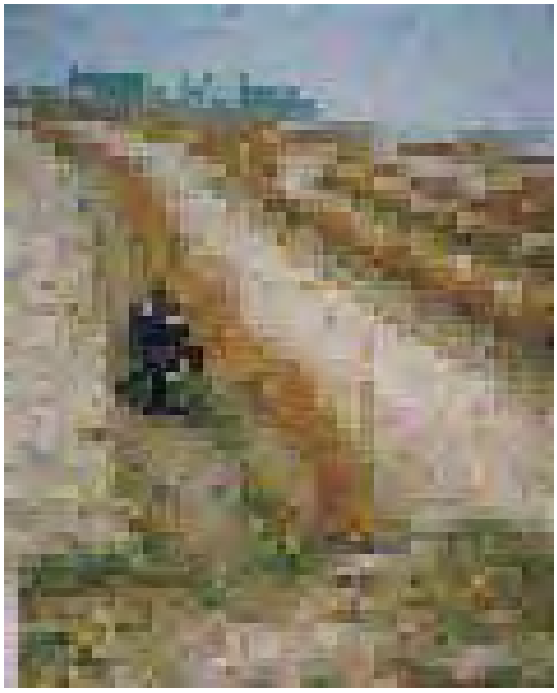
Singh (1983) described the cultivation of dessert melons in shifting sand dunes of Rajasthan.

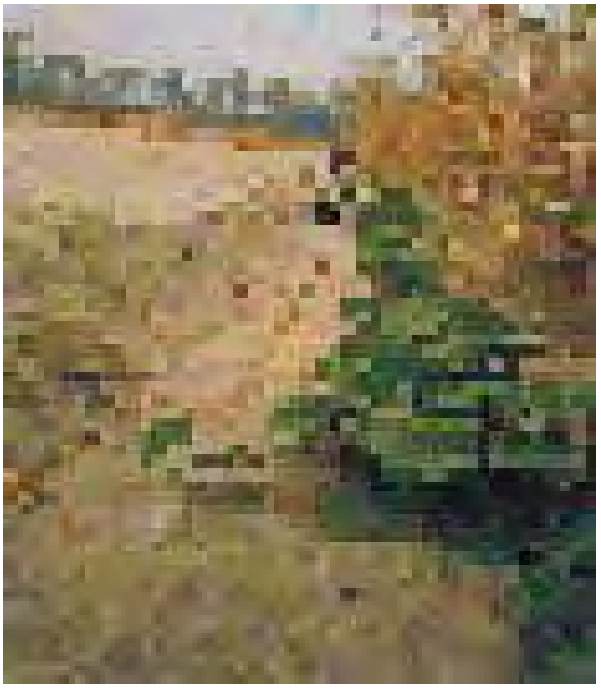
The main diara land is located on the beds of rivers. It is frequently inundated by swollen flood waters. Upland *diara* is the result of continuous decomposition. It is an elevated land. It is less frequently flooded and not much different from non-*diara* lands.

Cultivation in riverbeds starts after the cessation of the southwest monsoon and recession of floods in the rivers, around late October. Most of the cucurbits are sown from November to January. Young plants are protected in the early stages against low temperature and frosty winds, especially in northwest India, by Saccharum grass screens (Nandpuri and Lal, 1978). Later in February this grass is spread over the sand as a mulch and bedding, and the vines are allowed to grow over it. This helps protect the young and tender plants from the heat of the scorching sand during summer and also avoids drifting of the vines during strong winds. Usually some organic matter is the only basal manuring given to the crop. The seedlings are ideally first raised in









Bed preparation, germination and plant growth on sand dunes

polyethylene bags of 10 × 15 cm size made of 100–gauge thickness. Misra (1962), while describing the cultivation of melons on bare new sand dunes, has recommended mulching with *Crotalaria burthia.*

No systematic work has been done on the fertilizer requirements of riverbed- grown cucurbitaceous crops. Purewal (1957) recommended the applivation of 30–60 g. ammonium sulphate per pit at the time of thinning.

In a survey on muskmelon cultivation (Anonymous, 1980), it was observed that farmers apply basal dose of manure before sowing or planting. This consists usually of an organic manure such as FYM, compost or castor cake in Gujarat, and groundnut cake or bat guano in Andhra Pradesh. These organic manures provide some kind of warmth to the germinating seedlings. In some areas superphosphate, ammonium sulphate, or any standard fertilizer mixture is also given as basal application, but it is not known whether all the nitrogen is fully available or some is leached away. After 30–40 days of sowing, top-dressing is usually done in two split doses with chemical fertilizers at varying doses in different regions ranging from 250 kg/ ha ammonium sulphate to 125 kg/ha urea or calcium ammonium nitrate (CAN). Use of bentonite clay at the rate of 2 kg/pit followed by 0.75 kg FYM/pit increases the yield in Rajasthan by improving moisture use efficiency and moisture content in round melon, (kakri) or serpent melon and water melon (Singh and Singh, 1975; Singh et al. 1975).

No scientific information is available on nutrient requirements of riverbed- growing cucurbitaceous crops. One indirect report is available on nitrogen nutrition of cucurbits. Sen *et al. (1980) found that nitrogen content in the* leaves of many cucurbits was often much higher than of the sandy soils on which they grow. Investigations revealed the presence of active N-fixing bacteria in the phyllosphere of most cucurbits. It appears that during the association, N-fixing microorganisms have been incorporated in the leaf cells of cucurbits. Nitrogen requirements of cucurbits is met partly by N-fixing through the activity of the nif gene and largely by the N-fixing microorganisms that inhabit their leaf surfaces.

Mixed cropping is usually practised in riverbeds. Muskmelon and watermelon generally go together. Other cucurbits usually grown together are bottle gourd, cucumber, summer squash, bitter gourd, Indian squash or round melon (tinda), and long melon (kakri) in north India, ridge gourd in Rajasthan, Madhya Pradesh, and Uttar Pradesh (Anonymous, 1980), and *parwal in Bihar (Dubey and Pandey, 1973).* Sometimes cowpea and tomato are also grown as intercrops. This mixed cropping has some advantages in that it gives the riverbed farmers continuos income from March to June and makes up for the failure of any one crop. But if diseases such as mildews and viruses occur, they can spread from one crop to another, and their control mat then becomes difficult.

Riverbed cultivation continues to be carried out in the traditional manner. Many improved varieties of bottle gourd, muskmelon, watermelon, pumpkin and bitter gourd have been developed by various research institutes, but they have yet to be evaluated and adopted in diara lands. There is tremendous scope for demonstration in the potato, in which the riverbed cultivators get average yields of 67–70 t/ha, whereas the national yield level is less than 20 t/ ha and world levels are about 37 t/ha. This is being achieved by use of improved cultivars, application of nutrients and most important, judicious management of water.

The effects of improved cultivars and modern cultivation practices on production of cauliflower, radish and bitter gourd (Momordica *charantia) in the riverbed areas of Birbhum* district of west Bengal, were investigated during 1995–1998. The use of new technology increased

the production and yields, with percentage returns of 30% more than in the conventional system. Cauliflower cultivation was more suitable for farmers with moderate resources, and bitter gourd production, being the least cost intensive, was more suitable for resource-poor farmers (Nayak *et al. 1999).*

of the options with respect to each criterion was done with scoring pattern of 0–10. The data obtained from key informants (20) are presented in Table 1.

Cultivation of cucurbits in sandy condition, i.e. riverbed near the bank, was ranked higher by farmers in comparison to other conditions of

Table 1. Matrix ranking for vegetable crops

Criterion	Upland	Lowland	Mid-course	River bank
Soil status	7.00	4.90	7.10	8.10
Irrigation	3.70	6.00	6.90	8.40
Seed germination	7.00	6.20	7.10	7.80
Plant growth	7.60	6.60	7.20	8.20
Insect-pests	6.10	6.10	6.50	6.70
Yield	6.90	6.30	6.80	8.60
Cost of inputs	6.80	6.60	7.00	8.20
Labour	7.30	5.80	6.20	6.40
Net profit	7.60	6.60	7.40	8.60

Experiment

The technical parameters considered for observations:

(i)land and seed bed preparation, (ii) seed rate, (iii) method of sowing, (iv) irrigation, nutrients and plant protection management, (v) mulching, (vi) efficacy, (vii) rationality and perception (farmers and scientist); and the economic parameters were yield and cost benefit analysis.

RESULT AND DISCUSSION

PRA and field study

Matrix ranking for the relative performance

cultivation.

Experiment

On-farm trials were laid out in the riverbeds of the Ganges near Garh Mukteshwar. It was observed that cultivation of cucurbits was practised as reported by the disclosure, though with some variations. The observations recorded for germination and plant growth indicated that cucurbits performed well in riverbed system. Comparative study of cultivation of cucurbits in different conditions of riverbed (river bank, mid-course) and low-land adjoining the river was offset as inundation of river washed away the

Table 2. Crop wise net profit per hectare from vegetable cultivation in riverbeds

Items	Bottlegourd	Pumpkin	Watermelon	Muskmelon
Total cost	1,19,650	1,15,150	1,25,150	1,08,275
Total income	1,80,000	1,80,000	1,80,000	1,25,000
Net profit	60,350	64,850	54,850	16,725

crops of the plots. Economics of the riverbed cultivation revealed that farmers earned profits Rs 50,000 to 60,000 in watermelon, bottle gourd and pumpkin, and Rs 17,000 in muskmelon (Table2). The trials need to be replicated on larger scale for proper understanding of the cultivation system.

CONCLUSION

The trend of findings showed that indigenously developed method of cucurbit cultivation in riverbed during off-season without irrigation was technically feasible and economically viable.

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Code : **1476**

Title of the ITK : **To make cucurbit plants resistant to drought and to increase its fruiting capacity (productivity) in the river-bed of Bagmati river**

Description of the ITK : In the riverbed areas of Bagmati, pits of 1.2 m в 0.6 to 0.9 m are made. Pits are filled with mixture of sand and compost in 6:4 ratio. The seeds of cucurbits are planted after 2-3 days and covered with thin layer of soil and flooded with water. After 2 or 3 days again the sown seeds are covered with a thin layer of soil and flooded with water. This practice is continued till the germination of seeds. Along with the pit another pit is dug at about 5-6 depth till water comes from underground. The cucurbits planted with this method gave good yield. The practice is adopted in the villages of Dostiyan Panchayat of Purnahiya block of Sheohar district in riverbed of Bagmati river. Almost 100% plants become resistant to use of this practice and give 60% more yield compared to common practice. About 50-60% more income is generated through this technology compared to other practice.

Name and address of the discloser : Shri Viswesh Kumar, C/o Shri Satyendra Prasad Singh, Kataiyan, Dostiya, Sheohar (Bihar)

Location of use of the ITK : Dostiyan, Purnaihya, Sheohar (Bihar)

Experimenters : Dr B.M. Choudhary, Associate Professor, Department of Horticulture, Shri R. K. Singh, Research Associate (IVLP) and Dr R. P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand) 834 006.

METHODOLOGY

Location

The experiment was conducted in village Dostiyan, block Purnahiya, dist. Sheoher (Bihar).

PRA and field study

Evaluation of efficacy of the ITK in terms of germination percentage, incidence of weeds, insect pest infestation and yield was done by the PRA methods. The PRA tools were applied to determine the efficacy of the ITK as compared to general cucurbit cultivation. Twenty vegetable (cucurbit) growers were selected randomly as respondents from the village.

Experiment

Field trials were conducted in Dostiyan Village of Sheohar district of Bihar during 2002-2003 in 10 replications with two treatments, viz. T1-control (common practice of cucurbit cultivation), and T2-ITK.

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METHODOLOGY

Location

The experiment was conducted in village Dostiyan, block Purnahiya, dist. Sheoher (Bihar).

PRA and field study

Evaluation of efficacy of the ITK in terms of germination percentage, incidence of weeds, insect pest infestation and yield was done by the PRA methods. The PRA tools were applied to determine the efficacy of the ITK as compared to general cucurbit cultivation. Twenty vegetable (cucurbit) growers were selected randomly as respondents from the village.

Experiment

Field trials were conducted in Dostiyan Village of Sheohar district of Bihar during 2002–2003 in 10 replications with two treatments, viz. T_1 – control (common practice of cucurbit cultivation), and T_2 –ITK.

Table 1. Performance assessment of ITK on cucurbit cultivation and common methods on related parameters

Parameter	Cucurbit cultivation in riverbed of Bagmati	Common practice of cucurbit cultivation
Germination (%)	10	8
Cropping period	6	10
Crop growth	10	6
Non-incidence of weed	10	4
Drought resistance	10	2
Manuring		
FYM	10	6
Chemical fertilizer	8	6
Plant protection		
Insect infestation	8	8
Disease incidence	6	6
Yield	8	6
Expenditure	8	6
Income	10	6



Fig. 1. Shaping of sand dune for seeding in ridges

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 show that the reported ITK was rated high in comparison to the common practices of cucurbit cultivation on 8 out of the 10 selected parameters. The common practices of cucurbit cultivation excelled over the ITK in case of only one parameter, i.e. cropping period. The data further reveal that the practices related to use of chemical fertilizer, insect infestation and disease incidence, were same for both the methods of cultivation.

Table 2. Assessment of performance of cucurbit cultivation on selected parameters

Parameter	T_1 (common practice of cucurbit cultivation)	T_2 (ITK method)
Germination (%)	85	98
Incidence of weed (%)	40	10
Insect-pest infestation (%)	52	20
Yield (q/ha)	80	202

Table 3. Economics of the two practices of cucurbit cultivation

Parameters	Treatment	
	T_1	T_2
Net income/ha (Rs./ha)	24,000	75,000
Cost : benefit ratio	1 : 2.6	1 : 4
Unit cost of treatment (Rs/ha)	15,000	32,000

Experiment

Data presented in Table 2 reveal the following on the selected parameters:

1. Germination percentage**:** Germination percentage was calculated after 10 days of sowing. Findings indicate that 85% germination was found in common method of cucurbit cultivation, which was 98% in the ITK method.
2. Incidence of weeds*:* Only 10% weeds were seen in the ITK method which was 40% in common practices of cucurbit cultivation.
3. Insect pest infestation: Insect pest infestation was observed to an extent of 20% in the ITK method, whereas it was 52% in common practice.
4. Yield: In common practices 80q/ha yield was recorded, whereas 202 q/ha was recorded in the ITK method

Net income was about three times more in the ITK method than the common practice (Table 3). As such the cost : benefit ratio was also higher (1 : 4) in the ITK method. However, the unit cost of treatment was more than two times in the ITK method than the common practice of cucurbit cultivation.

CONCLUSION

The reported ITK was found superior in all respects compared to the common method of cultivation. It was also found that the lands that remain unused due to sands could be utilized in better way. However, this ITK is capital intensive. ❑

Code : **100**

Title of the ITK : **Evaluation of *birani badi* in cultivation of cucurbits in Bikaner district of Western Rajasthan**

Description of the ITK : *Birani badi* is the practice of cultivation of summer cucurbits (watermelon; muskmelon) with the use of limited water in sandy soils of Bikaner district of Rajasthan. In this practice there are components of soil and water conservation, moisture preservation and water management. For the cultivation of summer cucurbits, field preparation is done during the rainy season. Just after the rains, the fields are ploughed twice and planker is given. During the winter if there are rains, field is ploughed with cultivator and *pata* is given. In December-January, micro windbreaks are prepared from the locally available material at a distance of 1 m against the south- west wind direction by using local bushes, so that hot wind during summer may not disturb the creepers and the sands spreads on them. *Thala* (*koreas*) is prepared along the rows at a distance of 1 m. Soil is pulverized in *these thalas*. Seed sowing is done around *Maha Shiva Ratri*, giving seed treatment. Seeds are kept in wet gunny bag and buried in 1 to 1.5 feet deep pit for 2 to 3 days. One *lota* (approx 1 litre) water is poured in each *thala*. Wet soil is removed up to the depth of 6 inches and *korea* is made. In each *korea*, 6 to 10 germinated seeds are put. These small pits are closed with wet soil, which was taken out, and thin layer of dry sand is spread. Germinated seeds come out after 8-10 days. Only 4-6 plants are kept in each pit. The soil around each plants is pressed with foot. After 60 days of sowing, watering is done, if needed. For this purpose, a ring is prepared around the creepers in each *thala* and 1 *lota* water is given. Flowering on creepers starts after 2 months of sowing and fruiting starts after 75-90 days (*Akshya tritiya*). Picking of muskmelon (*kakri*) is done in evening and of watermelon early morning. Fruiting continues up to October. Thus with the use of about 25,000 to 50,000 litres of water in 1 acre, farmer can raise the cucurbits in sandy tract. There is earning of Rs 40,000 /ha with an investment of Rs 22,380.



View of the *birani badi*

Name and address of the discloser : Shri Shive Lal Mali, Chorya Police Line, Bikaner, Rajasthan

Location of use of the ITK : Villages Sagar and Napasar, Tehsil Bikaner, Block Kolayat, Bikaner (Rajasthan)

Experimenters : Dr. N. D. Yadava, Senior Scientist (Agronomy) and Ms Preeti Nauriyal, Scientist (Home Science), Regional Research Station, Central Arid Zone Research Institute, Bikaner (Rajasthan).

METHODOLOGY

Location

Village Sagar and Napasar, Tehsil Bikaner, Block Kolayat Bikaner (Rajasthan)

Extent and coverage

Birani badi practice is very important for arid tract where rainfall is very erratic and ground water availability is very limited in quantity and poor in quality. It provides the self-employment to the farm families and income generation where no cropping could be done by the farmers.

PRA and field study

Field survey on birani badi was conducted in 2000 by observation with the discloser and other cultivators in Sagar and Napasar villages of Bikaner district in Rajasthan. The cultivation practices of watermelon and muskmelon have been documented pictorially.

Experimental field study was conducted in village Napasar in 2002 where observations were taken in 2 spots on standing crops. Drought conditions that prevailed in Rajasthan during 2000, 2001 and 2002 restricted cultivation in birani badi. Therefore, the data collection was restricted in 2 sites of Shri Bhawar Lal (Site 1) and Shri Jitendra Mali (Site 2). Due to poor soil moisture availability conditions, the regular birani badi growers did not cultivate watermelon and muskmelon in 2003.

RESULTS AND DISCUSSION

PRA and field study

Different stages in raising *birani badi* have been recorded in 2002 which are shown in figures 1 to 6.

Experiments

Experimental study carried on *birani badi* to study the growth and yield performance of musk melon and water melon, moisture distribution pattern in soil, women participation in birani badi and economics of the practice.

Growth and yield performance of watermelon and muskmelon



Fig. 1. Creation of micro windbreaks while using local bushes and herbs



Fig. 2. Erection of micro wind break chequer board systems



Fig. 3. 60 days-old-spreading creepers in *birani badi*



Fig. 4. Dust cleaning in developing badi of melons



Fig. 5. Flowering starts after 60 days of sowing while fruiting begins after 75_90 days. Farmers removes minor bearings from *badi*



Fig. 6. Insects damage in developing creepers. Root damage by mites



Fig. 7. Fruiting and harvesting continues till October

Crop growth

During the experimentation at farmers field in 2002 it was found that the growth at the early stages of the crop after the plantation in the month of March was good as it was due to better availability of moisture just after sowing and less water requirement of the crop.

Later on due to the failure of expected rainfall in the month of May 2002, the crop growth was poor. The infestation of insect prevailed in the root system which damaged the crop. The traditional system of insect control was followed by intercultural practices.

Moisture availability in soil profile

Observations on moisture distribution in musk melon and water melon were taken from the

Table 1. Quantity of water applied at the time of seeding in birani badi

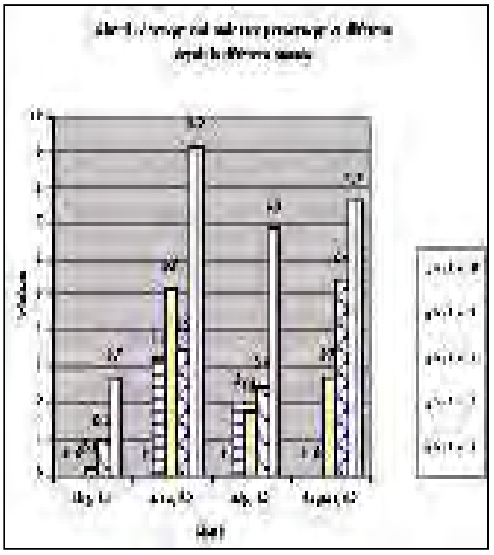
Site	Name of the farmer raised birani badi	Area (ha)	Number of camel water applied	Total quantity of water tankers applied (litres)
I	Sh. Bhawar Lal	3	60	6000
II	Sh. Jitendra Mali	2	35	35000

Table 2. Average soil moisture content at different depth in different months (%)

Month	Solid Depth (cm)				
Site 1	15	30	45	60	90
May, 2002	1.10	00	1.30	5.40	7.30
June, 2002	1.50	0.60	1.40	5.80	7.60
July, 2002	00	00	1.40	5.60	6.40
August, 2002	1.10	00	1.60	5.40	8.40



Site 1. Average soil moisture percentage at different depth in different months



Site 2. Average soil moisture content at different depths in different months (%)

Table 3. Average soil moisture content at different depths in different months (%)

Month	Solid Depth (cm)				
Site-2	15	30	45	60	90
May, 2002	00	00	0.10	0.90	2.70
JUne, 2002	00	3.20	5.20	3.50	9.20
July, 2002	00	0.20	1.80	2.50	6.90
August, 2002	00	00	2.70	5.40	7.70

Table 4. Average yield of muskmelon in different pickings (kg/ha

Period (picking)	Yield/day (kg/ha)	No. of days in a month	Total (kg/ha)
Early	6.5	30	195
Middle	8.0	20	160
Maturity	120.0	20	2400

Table 5. Average yield of watermelon in different pickings (kg/ha)

Period (Picking)	Yield/day (kg/ha)	No. of days in a month	Total (kg/ha)
Early	5.0	30	150
Middle	10.5	20	210
Maturity	25	20	500

month of May. During the cropping season about 60000 lit of water was added for 60 times @ 3.0 lit water per pit in Site I and 35000 lit water in Site II in 35 times (Table 1.)

On an average 2-3 litres of waters was applied per pit at the time of sowing. Data presented in Tables 2 and 3 indicate moisture content in different depths of soil profile in Site I and II, respectively. The observations were taken once a month in the months of May, June, July and August during 2002. As shown in Figures 1 and 2, moisture is very low, which increased generally with increase in soil depth.

Yield

The data on yield of musk melon and water melon were collected from different pickings of the crop.The fruits were picked at three stages: at early and middle stage for vegetable purposes and at maturity stage for consumption as fruits. First stage was daily picking for 30 days in a month giving an average yield of 6.5 kg/day where as in middle period for 20 days it was 8.0 kg/day. At fruiting stage the average yield was 120 kg/day (Table 4)

Watermelon was picked for 30 days at early stage for vegetable purpose with as average of 5 kg/day. Pickings were re to 20 days at both middle and maturity stages, giving yield of 10.5 and 25. respectively.

Data on yield obtained during May to September, 2002 for muskmelon and watermelon along with income are shown in Ta

Table 6. Month-wise average yield (kg/ha) of muskmelon (kakri) and watermelon (mateera) pickings in birani badi at Bikaner

Month and year	Yield/ day (kg)		Total yield/month			
	Muskmelon	Watermelon	No. of days	Muskmelon	Watermelon	Total Income (Rs)
May, 2002	8	5	30	240	150	2,340
June, 2002	7	8	30	210	240	2,700
July, 2002	9	11	20	180	220	2,400
Aug, 2002	40	85	25	1000	2125	18,750
Sept, 2002	70	50	15	1050	750	10,800.00
Total	134	159	120	2680	3485	36,990.00

Economic analysis of *birani badi*

Cost of cultivation

Cost of cultivation of watermelon and musk

Code	:	**1595**
Title of the ITK	:	**Use of bantulsi *(Ocimum gratessimum)* leaf paste for treatment of *khurha* (FMD) in cattle and buffalo**
Description of the ITK	:	*Bantulsi* has medicinal properties against FMD. Paste of *bantulsi* leaves is prepared after grinding it along with water and the paste is applied on the infected foot of cattle and buffalo at least twice daily for 3-4 days. The practice is prevalent in Barmasa village of Jarmundi Block in Dumka district (Jharkhand) and has potentials for spread in the areas where *bantulsi* is available. Success has been reported in more than 75% of the cases.
Name and address of the discloser	:	Shri Varun Lal, C/o Lok Jagriti Kendra, 52 Bigha, Madhupur, Deoghar (Jharkhand)
Location of use of the ITK	:	Barmasa, Jarmundi, Dumka (Jharkhand)
Geographical indicators	:	*Bantulsi (Ocimum gratessimum)* is a bushy plant, 4-6 feet in height. The flowers are bluish and the plant is available on mountains of Jharkhand.
Experimenter	:	Dr B.K.Roy, Associate Professor, Department of Pharmacology and Toxicology, Birsa Agricultural University, Ranchi (Jharkhand) 834 006.

METHODOLOGY

Location

The study was carried out in village Barmasa, block Jarmundi, dist. Dumka (Jharkhand)

PRA and field study

Field study was conducted following PRA methodology with 20 respondents. The parameters or factors included were; extent of cure, duration of treatment (days), cost effectiveness, safety, increase in milk yield, effect on reproduction and draught capacity. The ITK was compared on these factors with the recommended allopathic treatment.

Experiment

Field experiment was conducted in 10 replications with two treatments, viz. T1 ITK (the wound in the hooves was washed and the paste of *bantulsi* leaves was applied over the wound once daily for 6-7 days); and T2, recommended practice, i.e. potassium permanganate lotion was applied over the wound, analgesic tablet was given once or twice and ointment (himax) was applied once daily over the affected hooves for 6-7 days.



Fig. 1. Use of *bantulsi* leaf paste for treatment of *khurha in cattle and buffalo*

Veterinary Science and Animal Husbandry

results and discussion

PRA and field study

Data on PRA and field study are presented in Table 1

Table 1. Matrix scoring for assessing performance of *bantulsi* in treatment of FMD in cattle and buffalo against the recommended allopathic medicine

Criteria	Application of paste of leaves of *bantulsi*	Allopathic medicine
Extent of cure	6	8
Duration of treatment	5	7
Cost effectiveness	10	2
Safety	10	5
Effect on milk yield	6	8
Effect on reproduction	4	5
Draft capacity	4	4

Data show that the farmers or users perceived *bantulsi* leaves as highly cost effective and safer than the recommended allopathic medicine. However, extent of cure was reported more in the allopathic treatment. On other parameters both the treatments were found to be at par.

Experiment

Data on the cure of hoof wound after treatment with paste of *bantulsi* and allopathic treatment are given in Table 2. The *bantulsi* paste could cure only 20% animals suffering from hoof wound of FMD, whereas the allopathic treatment could cure

Table 2. Effect of paste of *bantulsi* in treatment of FMD in cattle against the recommended allopathic medicine (potassium permanganate, oxalgin bolus and himax ointment)

Days after treatment	Extent of cure (%)	
	Paste of *bantulsi*	Allopathic medicine
1	0.00	0.00
2	0.00	0.00
3	0.00	1/5 (20)
4	0.00	1/5 (20)
5	1/10 (10)	3/5 (20)
6	1/10 (10)	3/5 (60)
7	2/10 (20)	3/5 (60)
8	2/10 (20)	3/5 (60)

Figures in parentheses indicate percentages

60% of animals after 8 days of treatment. The hoof wounds if treated at the start of disease could be cured at the earliest. However, if the wound was infested with maggots and treated late, the cure was delayed. The complicated hoof wounds took much time and were cured in 2 months, and in some cases the hoof was deformed due to muscular growth. In this experiment the cases were treated just after the report by the farmers and no complication was observed.

CONCLUSION

It was concluded that *bantulsi* leaf paste is slightly effective in treatment of hoof wound of FMD in cattle

Code	:	1588
Title of the ITK	:	**Control of FMD in cattle with camphor**
Description of the ITK	:	Mouth wounds and hoove wounds are common disease in cattle/animals. Farmers of Bagraisai village of Saraikela Kharsawan district in Jharkhand use following practice for treatment of hooves and mouth wounds. 1.For hooves: Cattle are made to walk in sandy soils along the river bed. The coarse sand helps to clean the wound by friction. Hooves are washed with hot water; then 2 pieces of camphor and 10 ml coconut oil mixed together are applied on the wounds, which acts as an antiseptic. 2. For mouth: Paste of roasted brinjal and pure ghee is scrubbed on the tongue to clean as well as treat the lesions. The cost of above two treatments is very less, i.e. almost Rs 3 to Rs 5 per animal, which is successful in more than 95% of cases. All the farmers in the village use these age-old practices. In February and March, or October and November 20% cattle and buffaloes suffer from FMD disease in Jharkhand region.
Name and address of the discloser	:	Ms Chami Murmu, Sahyogi Mahila, Bagraisai, Govindpur, Rajnagar, Saraikala, Kharsawan (Jharkhand) 831 002
Location of use of the ITK	:	Village Bargaisai, Block Rajnagar, Saraikela (Jharkhand)
Experimenters	:	Dr B.K. Roy, Associate Professor, Department of Pharmacology, Ranchi Veterinary College and Dr (Ms) Niva Bara, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

Methodology

Location

The experiment was conducted village Bargaisai, block Rajnagar, dist. Saraikela (Jharkhand).

PRA and field study

The field study was carried out using PRA methods with a total number of 20 respondents. The parameters or factors studied included the extent of cure, duration of treatment, cost effectiveness, regaining milk yield and draught power affected.

Experiment

Twenty FMD affected animals were selected and divided into two groups. Each group comprised of 10 animals. In group 1, 10 FMD affected animals were treated with ITK. Hooves of the animals were washed with water. Coconut oil and two pieces of camphor were mixed thoroughly and applied once on hooves daily for 15 days. The mouth of lesions was treated with roasted brinjal (one brinjal of 100 g mixed with 50 g of ghee) was applied once daily for 10 to 11 days.Ten animals of group 2 were treated with allopathic medicine. The hoof and mouth were

washed with potassium permanganate (0.01%) once daily for 15 days.

Results and discussion

PRA and field study

Farmers indicated that 60% cases are being cured by ITK method, which is marginally less than the cases cured (80%) by the recommended practice. However, in both ITK and allopathic medicine the duration of treatment is similar. Use of ITK, was advantageous over allopathic medicine for regaining milk yield. Cost effectiveness and duration of treatment was similar in both the methods of treatment.

Experiment

It was observed (Table 2) that application of roasted brinjal with ghee on the mouth lesions cured only 30% cases in 6 days. However, after application for 10 days, all mouth lesions were

Table 1. Matrix scoring for assessing performance of ITK vis-□-vis allopathic medicine

Criterion	ITK method	Allopathic medicine
Extent of cure (full)	6	8
Duration of treatment (days)	5	5
Cost effectiveness	4	4
Regaining milk yield	7	6
Draught power affected	8	9

Table 2. Influence of ITK and allopathic medicine on mouth and hooves lesion in cattle

Days	Mouth lesion (% recovered)		Hoof lesions (% recovered)	
	Brinjal + ghee	Potassium permanganate	Camphor + coconut oil	Potassium permanganate + Himax + Phenyl
1	0	0	0	0
2	10	10	10	10
3	10	20	10	20
4	20	20	20	20
5	30	30	30	30
6	30	50	50	50
7	60	60	50	50
8	60	70	50	70
9	80	100	50	70
0	90	-	50	80
11	100	-	50	80
12	-	-	60	80
13	-	-	60	90
14	-	-	70	90
15	-	-	70	90

cured in 90% animals. But allopathic medicine cured 50% cases in 6 days and all the animals were within 9 days. The hoof lesions were cured in 70% animals in 15 days as compared to 90% by allopathic medicine. Hoof lesions of FMD are more complicated and the recovery by ITK method (70%) is less than by the allopathic medicine (90%). Thus the ITK method reported by farmers for the treatment of FMD is suitable for mouth lesions only. The hoof lesions will take more time for its recovery.

Phytochemical analysis

The preliminary phytochemical screening of the brinjal dry leaves residue showed the presence of flavonoids, alkaloids, tannins and steroids.] In acute toxicity study the dry residue of leaf juice was found to be safe and no mortality was observed in mice up to a dose level of 4 g/kg. *S. melogana* produced antipyretic effect in a dose dependent manner. An appreciable antipyretic effect was noticed in mice which was comparable to paracetamol. The dry residue of *S. melongana* leaf produced analgesic activity.

The use of *S. melongana* by farmers especially for tongue lesions of animals is meant for analgesic activity. Because in FMD the tongue lesions are painful. The analgesic activity of *S. melongana* may be due to the presence of flavonoids (Mutalic et al. 2003). In many earlier studies, flavanoids have been reported to exhibit antipyretic effects (Brasseur, 1989; Vimal et al. 1997). The antioxidant activity of *S. melongana* has also been reported due to presence of flavanoids and an anthocynin (Sudhees et al. 1998). Hence antioxidant activity of *S. melongana* may be one of the possible mechanism by which it reduces the pain and elevated body temperature of animals affected with FMD.

CONCLUSION

Treatment with camphor, brinjal, coconut and **ghee** in cattle is effective to cure mouth lesion totally and hoof lesion partially.

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Code	:	1279
Title of the ITK	:	**Evaluation of peach (*Prunus persica*) leaves with fresh milk in the treatment of FMD lesions/wounds**
Description of the ITK	:	To treat the lesions of mouth and hooves of the animals suffering from FMD, extract of peach leaves mixed with fresh milk is applied three times daily on the lesions of FMD-affected parts of the animals. This is followed in many villages of Budaun, Shahjahanpur and Bareilly districts of Uttar Pradesh.
Name and address of the discloser	:	Shri Syed Musawwir Ali, Mohalla Furshori Tola, Bund Gali, Badaun (Uttar Pradesh) 243 601
Location of use of the ITK	:	Farmers in villages of Bareilly and Badaun districts use peach leaves for wounds both on family members and animals.
Experimenters	:	Dr D. Swarup, Head, Division of Medicine, Dr Naveen Kumar, Senior Scientist, Division of Surgery, Dr A. K. Sharma, Senior Scientist, Division of Surgery: Dr Mahesh Chander, Senior Scientist, Division of Extension Education and Dr Ram Naresh, Scientist, Division of Medicine, Indian Veterinary Research Institute, Izatanagar (Uttar Pradesh) 243 122

Methodology

PRA and field study

PRA and Field Study: PRA and field survey was conducted. A matrix as case sheet for evaluation of the efficacy of the practice using PRA methods was used.

The leaves, flowers, bark, flowers, bark and kernel of peach have medicinal properties. They have sedative, diuretic and expectorant action. An infusion of □ oz (14 g) of the bark or 1 oz (28 g) of the leaves in a pint of boiling water has been found almost a specific treatment for irritation and congestion of the gastric surfaces. It is used in whooping cough, ordinary cough and bronchitis. The fresh leaves possess the power of expelling worms, if applied outwardly to the body as a poultice. An infusion of the dried leaves has also been recommended for the same purpose. The powder of the leaves strewed on fresh bleeding wounds checks bleeding and heals them.

Experiment

Animal Experimentation

The experimentation on animal was done on different types of wounds in LPR (C and B), Indian Veterinary Research Institute, Izatnagar. A total of 14 wounds were treated with the paste of peach leaves. Eight wounds had maggots and 6 wounds no maggots. The wounds were evaluated on day 0, 3, 7, 10, 14 and 21, or till the healing occurred on the basis of the following parameters:

1. Exudation: Type of exudates was scored and graded as: 0=dry casts; 1=serous;

Evaluation of peach (*Prunus persica*) leaves with fresh milk in the treatment of wounds

Case No. ..... Owner's name..... Address ..... Species ..... Breed ..... Age ..... Sex ..... General condition: good/fair/poor/very poor ..... Duration of illness ..... Previous treatment .....

Score sheet

Observation	Days								
	0	1	2	3	5	7	10	14	15
Type of exudation									
Quantity of exudation									
Peripheral swelling									
Warmth									
Pain									
Colour of wound									
Granulation tissue									
Scab formation									
Other information									

2=fibrinous; 3=seropurulent; 4=purulent.

2. Quantity of exudates: Quantity of exudates was scored as per the method of Bigbie *et al.* (1991): 0=none (apparently dry wound); 1=slight (wound is moist but no oozing on pressing the wounds); 2=moderate (wound is moist and slight oozing on pressing the wound); and 3=extreme (exudate is visible and pressure leads to excessive exudation).
3. Peripheral swelling: Peripheral swelling was recorded as follows at weekly intervals: 0=nil; 1=moderate; and 2=marked
4. Warmth and pain: Warmth around the affected area was compared with that of the normal area by touching with palm. This was done by the same person at 10.30 am. The warmth was graded as per the



1a. Maggoted wound in foot



1b. Application of peach leaves on maggot wound



1c. Completely cured foot



2a. View of non-magotted wound



2b. Application of peach leaves on non-maggoted wound



2c. Completely cured foot

following order: 1=normal warmth; 2=mildly warm; 3=moderately warm; and 4=hot.

5. Pain on manipulation of the area was recorded as: 0=no pain on extensive manipulation; 1=pain on extensive manipulation; 2=pain on moderate manipulation; and 3=pain on slight manipulation.
6. Colour of wounds: Colour of wounds grossly depicts the status of healing and was scored as follows: 1=pale yellow, 2=pale red; and 3=pink
7. Area of wound: Area of wound was recorded at 7_day intervals as per the method described by Kumar and Tyagi (1972). Margins of wound, area of granulation and area of epithelialization was marked and the percentage of healing was calculated. Finally time taken for complete healing was recorded.
8. Granulation tissue evaluation: At each dressing change the granulation tissue was categorized according to the standards (Bigbie *et al.* 1991): 1=grade I (granulation tissue depressed below skin edges); 2=grade II (granulation tissue proliferated to the level of skin edges); 3=grade III (granulation tissue elevated above skin edges); and 4=grade IV (elevated above skin edges, projecting over the advancing border of epithelium).
9. Scab formation: Scab formation was evaluated according to the scheme suggested by Jean *et al.* (1985).

RESULTS AND DISCUSSION

PRA and field study

Field survey using PRA matrix was conducted in the villages of Bareilly district. The results (scores out of 10) on different criteria both for ITK as well as for allopathic medicine are given in Table 1.

Table 1. PRA matrix score for treatment of dog bite in animals by peach leaves + fresh milk

Criterion	Treatment	
	Peach leaves+ fresh milk	Allopathic medicine
High efficacy/ cure rate	7	8
Less duration (6-8 days)	7	8
Low cost	10	6
Easy availability	10	7
Convenience for use	10	9
Side effects (none)	10	9

Table 2. Scores obtained on different parameters as recovery from FMD by applying peach-leaf extract with milk

Observation	Days					
	0	3	7	10	14	21
Type of exudation	2.4	2.0	1.2	0.4	0.0	0.0
Quantity of exudation	1.8	1.2	0.6	0.2	0.0	0.0
Peripheral swelling	1.0	0.8	0.2	0.2	0.0	0.0
Warmth	1.8	1.2	1.0	1.0	1.0	1.0
Pain	1.8	1.4	0.6	0.4	0.0	0.0
Colour of wound	2.0	2.4	2.8	3.0	3.0	0.0

Experiments

A total number of 14 wounds were treated with the paste of peach leaves. Eight wounds had maggots and 6 wounds had nomaggots. The mean scores of different parameters are presented in Table 2.

The paste of peach leaves was found to be very effective in the treatment of wounds affected by maggots. One or two applications were required to kill or expel of the maggots. The paste was applied on the affected part and bandaged. The wounds without maggots also showed improvement in healing. After 2_3 applications the type and quantity of exudates decreased. The wounds appeared dried and the peripheral swelling subsided. There was concomitant decrease in pain and warmth scores. As the healing progressed, the colour of wounds changed from pale red to pink. All the wounds were healed by day 14 to day 21.

CONCLUSION

The peach leaves were found to be effective for the treatment of maggoted wounds as well as not affected with maggots

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Code : **416**

Title of the ITK : **Treatment of foot-and-mouth disease in cattle by using *harida* (*Terminalia chebula*) and *bahada* (*Terminalia ballarica*)**

Description of the ITK : Foot-and-mouth disease (FMD) in cattle is controlled by applying the affected parts by using 500 g each of *harida* and *behada* powder mixed with 2,500 ml water, applied twice a day after boiling. It is being used extensively by the cattle-growing farmers in Makarbili village of Nawapada district in Orissa.

Foot-and-mouth disease of cattle is a severe problem in village Makarbili. FMD is a deadly viral disease of cattle, causing severe mouth and foot lesions. The oral mucosa and dorsum of the tongue are severely affected and there is sloughing of the mucous layer of oral cavity as well as dorsal aspect of the tongue, for which animal cannot eat. Similarly, development of severe lesions in the interdigital clefts of the four legs are seen, due to which, the affected animals cannot walk properly. Ultimately, milk yield in cattle decreases abruptly and the bullocks cannot perform properly. There is severe deterioration of health and body conditions.

Name and address of the discloser : Ms Bhanumati Behera, Plot No 64, Surva Nagar, Unit 7, Bhubaneshwar (Orissa)

Location of use of the ITK : Makarbili, Boden, Nawapada (Orissa) 766 107

Geographical indicators : *Terminalia chebula* Retz.: A tree 15-24 m in height and 1.5-2.4 m in girth with a cylindrical bole of 4-9 m, a rounded crown and spreading branches founds through out India. Flowers are yellowish white, terminal spikes. It is found in the sub Himalayan tracts from Ravi east ward to West Bengal and Assam, ascending upto an altitude of 1,500 m in the Himalayas.

Experimenter : Dr N. R. Pradhan, Professor, Department of Veterinary Medicine, Ethics and Jurisprudence, West Bengal University of Animal and Fishery Sciences, Kolkata (West Bengal), and Dr C. Lodh, Lecturer, Department of Veterinary Medicine, Ethics and Jurisprudence,West Bengal University of Animal and Fishery Sciences, Kolkata (West Bengal) and Dr M.M.Hossain, Training Organiser, KVK, Kalahandi, Bhawanipatna (Orissa).

METHODOLOGY

Location

Efficacy of *harida* (*Terminalia chebula*) and *bahada* (*Terminalia ballarica*) in controlling FMD in cattle was evaluated by participatory rural appraisal (PRA), field survey and experimental methods. Participatory rural appraisal and experiment were done in village Makarbili, Boden, dist. Nawapada (Orissa) 766 107.

PRA and field study

The PRA tools were applied to evaluate the performance of harida and baheda as compared to kareala root bark, neem oil and veterinary medicines in controlling FMD in cattle. The study



Fig. 1. FMD lesion at posterior side of the foot



Fig. 2. Crushing of *harida* and *bahada* fruits on grinding stone at Makarbirli village

was conducted at Makarbili village covering 10 farmers who use harida and baheda in controlling FMD in cattle. The parameters studied were: (i) effectiveness in controlling the disease, (ii) recovery period, (iii) improvement of milk yield, (iv) improvement of health, (v) ease in preparation and application, (vi) acceptability by the farmers, and (vii) preference.

Experiment

An experiment was conducted at Makarbili village with the following five treatments:

1. The first group or T1 group comprising seven cows as untreated control. They were not treated with any medicine except washing the lesions with saline water. These animals were kept for observing the pathogenesis of the disease.
2. The second group or T2 group comprising 12 cows were treated with the ITK method of treatment, i.e. with *harida* and *baheda* @ 500 g each.
3. The third group or T3 group comprised nine cows. These animals were treated with the paste of herbal preparation of the root barks of the *karala* tree, a local forest plant. The root barks of the *karala* were collected and dried in sunlight for several days. After drying, the bark was crushed thoroughly in the grinding stones and made into powder. Thereafter 500 g of this powder was mixed with 1 litre water and kept overnight. On the next day, the paste was used in the FMD lesions of the foot of cattle @ 15 g twice daily, consecutively for 5 days.
4. The fourth group or T4 group comprised 10 cows, which were treated with neem oil applied twice daily on the foot lesions for 5 days.
5. The fifth group or T5 group, comprising 10 cows, were treated with the conventional therapy, which includes Baxivet - 2.5 g daily for 3 days

(antibiotic), Zobid 10 ml daily for 3 days (analgesic), Cadistin 10 ml daily for 3 days (antihistamin) and Hivit 10 ml daily for 3 days (vitamin B complex). Besides, potassium permanganate (0.5%) was used for washing the foot-and- mouth lesions of the animals and thereafter Himax ointment (antiseptic) was applied on the foot lesions, twice daily for 4 days. Boric powder (5 g), mixed with 30 ml glycerine was applied on the mouth lesions, twice daily for 4 days.

Observations were taken on recovery period, clinical improvement, cost effectiveness, health improvement, milk yield improvement, farmers' reaction and preference.

RESULTS AND DISCUSSION

PRA and field study

It is evident from Table 1 that use of harida and baheda in controlling FMD in cattle is more effective, takes lesser time to recover, improved the heath of cattle and milk yield and the farmers accept the technology as compared to using root bark of karala and neem oil.

Table 1. Matrix scores on erformance of ITK in controlling FMD as compared to other possible options

Parameter	ITK method (harida and bahada)	Root bark of karala	Neem oil
Effectiveness in controlling the disease	00000000	0000000	00000
Recovery period	0000000	000000	00000
Improvement in milk yield	0000000	000000	00000
Improvement of Health	00000000	000000	0000
Easy preparation and application	00000	00000	00000
Acceptability by the farmers	00000000	0000000	0000
Preference	1	2	3

Table 2. Treatment effect and opinion of animal owners

Parameter	Untreated control (T_1)	ITK method of treatment (T_2)	Karala treatment (T_3)	Neem oil treatment (T_4)	Veterinary medicine (T_5)
Recovery period	Suffered more than 2 weeks	5-6 days	6-7 days	8-9 days	4-5 days
Clinical improvement	Marked detori-ation of health	Marked	Moderate	Slow	Marked
Cost effectiveness	-	Best	Moderate	Poor	Poor
Health improvement	No	Moderate	Moderate	Poor	Best
Milk-yield improvement	No	Moderate	Poor	Poor	Maximum
Farmers' reactions	-	Best acceptable	Moderate acceptable	Less acceptable	Less acceptable
Preference	-	Best	Moderate	Poor	Moderate

Experiment

Recovery period

The animals of the untreated control group (T_1) suffered more than 2 weeks. The animals of T_2 or ITK treatment group recovered within 5 – 6 days, whereas T_3 group (karala treatment) took 6 – 7 days to recover. The animals of T_4 (neem oil treatment) recovered after 8–9 days, but in T_5 or conventional treated group with veterinary medicine, the animals recovered within 4–5 days.

Clinical improvement

The clinical improvement was marked both in ITK treated group (T_2) and in conventional treated group (T_5), but moderate and slow in T_3 and T_4 groups respectively, when no improvement was noted in T_1 or untreated control group. Rather the T_1 animals showed marked detoriation of health.

Health improvement

ITK and karala treatment showed moderate, and neem oil treatment was found to be poor for health improvement. Conventional method achieved the highest score in this regard.

Milk yield

Maximum improvement was observed in conventional treatment, followed by ITK method, whereas other methods showed poor improvements in milk yield. Significant ($P<0.1$)

Table 3. Average milk yield (litre) per day in treated animals

Groups	Before FMD	Before treatment of FMD (day 0)	Day 4 (after treatment)	Day 8 (after treatment)	Day 12 (after treatment)
T_1 (Control)	2.56±0.13	0.82**±0.02	0.58±.001	0.66±0.01	0.68±0.01
T_2 (ITK)	2.75±0.11	0.74**±0.03	1.12*±0.02	1.85*±0.08	2.43**±0.12
T_3 (Karala)	2.85±0.15	0.81**±0.02	1.05±0.02	1.46**±0.09	1.88**±0.06
T_4 (Neem oil)	2.68±0.13	0.76**±0.01	0.93±0.01	1.22*±0.05	1.62**±0.67
T_5 (Conventional)	2.66±0.16	0.68**±0.01	1.28**±0.02	2.16**±0.07	2.45**±0.13

*Significant at P=0.05; **significant at P=0.01.

Cost effectiveness

It is indicated that the cost of the conventional treatment is very high, whereas the karala and neem oil treatment involves moderate costs. The ITK is highly cost effective.



Fig 3 Paste of harida and bahada



Fig 4 Healing of FMD lesions after treatment with harida and bahada

improvement of milk yield was noted in the ITK treated group and conventionally treated group. In other groups less improvement was observed (Table 3).

Data presented in Table 3 show that there was decrease in milk yield in all five groups after the infection of FMD from their early healthy conditions. But following treatment with different herbal or non-herbal medicines in different groups, there was improvement in all the treated groups on 12 days after treatment, whereas no improvement was noticed in the control group.

However amongst the treated groups the best improvement of milk yield was noticed in T5, followed by T2, T3 and T4 groups.

Farmer's reaction

Although the farmers are utilizing the ITK-based practice for controlling FMD in cattle, the experiment provided options to evaluate the efficacy of other means of treatment. Considering the cost, recovery and improvement in milk yield, body conditions and other parameters studied, the farmers appreciated their own practices. Other methods of treatment for FMD were less acceptable to them.

The results of this study show that ITK method is the best cost effective for treatment of FMD in cattle. The tribal villagers of the village Makarbirli are very poor and so they prefer this treatment against this deadly malady. Though the conventional treatment is highly effective, they do not prefer, it because of its high cost. Other treatments like application of root barks of *karala* or neem oil are also sometimes used by them, but are not preferred above the ITK method of treatment, since they are less effective and take more time to cure.

CONCLUSION

Use of *harida* and *baheda* was found to be effective in controlling FMD in cattle (cow and buffalo). While the animals took 5-6 days to recover by using ITK method, it was 4-5 days using veterinary medicine.

Out of 10 virus samples collected, 9 samples were "O" positive and one sample was "Asia 1"positive. The bacterial isolates from FMD lesions were Staphylococus spp, *Streptococcus* spp, *Corynebacterium* spp and *E. coli.*

Code : **280**

Title of the ITK : **Effect of gingelly (*Sesamum indicum* Linn.) oil, pig fat and banana (*Musa paradisiaca* Linn.) mixture and *Gloriosa superba* and neem (*Azadirachta indica* A. Juss.) oil paste to control foot-and-mouth disease in cattle**

Description of the ITK : Foot and mouth disease is controlled by the application of a mixture by both oral dose as well as external application on the wound. About 250 ml gingelly (*Sesamum indicum*) oil is mixed with 4 banana and 5-10 drops of pig fat, and the mixture is given as a oral dose to the cattle. Then 250ml kannu vali kelangu (*Gloriosa superba*) mixed with 250 ml neem oil and boiled well for half an hour. After boiling, this extract could be applied on the wound. Oral dose twice, for 3 days is best suited for animals suffering from foot-and-mouth disease. External application of the extract should be continued for 3 days each twice daily till recovery. This is in practice for more than 5 years. About 2000 farmers are practicing it. It costs Rs 100 per animal.

Name and address of the discloser : Dr M. Subramaniyan, Assistant Professor (Dairy Science and Animal Husbandry Extension), Tamil Nadu Veterinary and Animal Sciences University, Krishi Vigyan Kendra, Kundrakudi, Sivagangai (Tamil Nadu) 630 206

Location of use of the ITK : Aandi Orrani, Kalayarkoil, Sivagangai (Tamil Nadu) 630 551

Geographical indicators : *Azadirachta indica*

Common name : Neem

Botanical name : *Azadirachta indica*

Family : Meliaceae

Description
It is grown throughout India. The parts are used medicinally as follows:

Fruit - Antiperiodic, anthelmintic, astringent, emollient, purgative and tonic.

Seed oil - Antiseptic, locally used in eczema and leprosy, in common dermatosis and in rheumatism.

Kernal oil is known as neem oil. Possesses antifertility, antifungal, antimicrobial and antiseptic properties. Active against both gram positive and gramnegative organisms.

External application for rheumatism and sprain.

Flowers - Stomachic and tonic

Leaves - Antifungal, antiperiodic, antiseptic and antiviral. Applied in the form of poultice in boils, abscesses, eczema and ulcers.

Bark - Antiemetic, antiperiodic, anthelmintic, astringent.

Twigs - Used as toothbrush for anti pyrorrhoeal.

Kernels - Oil of Margosa contains tocopherol, arachidic, linoleic, margosic myristic, oleic, palmitic and stearic acids, azadirone, azadiradione, epixyazodiradine (nimbinin).

Nimbidin is the bitter principle of the oil.

Sesamum indicum

Common name : Gingelly

Botanical name : *Sesamum indicum*

Family : Pedaliaceae

Seeds - Demulcent, diuretic, emollient, lactagogue laxative and tonic. Seeds contains tocopherol.

Poultice - applied to burns, scalds and ulcers.

Oil (from seeds) used as a base for many perfumed oil meant for hair. Equal parts of sesame oil and limewater find useful application as dressing for burns, scald and suppurating wounds.

Leaves - External applied in cutaneous and ophthalmic complaints demulcent and emollient. Leaves contains pedaliin.

Flowers - Arginine, cystine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine threonine, tryptophane, tyrosine, valine a and ß globulin, P-amino benzoic acid ascorbic acid, biotin, choline, folic acid inositol, niacin, nicotinic acid pantothenic acid, pyridoxine, riboflavin sesamol, thiamin, a and ß tocophenols galactose, glucose, lychnin, plantiose raffinose, sesamose, sucrose and pentosans.

Seeds - oil (from seeds) used as a base for many perfumed oil meant for hair, equal parts of sesame oil and lime water find useful application as dressing for burns, scald and suppurating wounds. Seeds contain a tocopheriol poultice

applied to burns, scalds and ulcers.

Flowers - contains essential amino acids, B groups of vitamins and carbohydrates.

Liquid paraffin - emollient and laxative in action.

Boric acid - weak germicidal, more bacteriostatic in action Antiseptic

Glycerin - glycerol, Glycerium; emollient, demulcent, antiseptic, solvent and vehicle externally.

Lorexane - contains gamma benzene hexachloride I.P. 0.1% W/W. proflavine hemisulphate 0.1% W/W strong cetrimide solution B.P. equivalent to cetrimide I.P. 0.45% W.W. bactericidal, antiseptic inaction.

Gloriosa superba

Common name : *Kalappaikkilanku, Kal Nabhikhodai*

Botanical name : *Gloriosa superba*

Family : *Liliaceae*

Seeds - colchicine (0.9%) identified in corn extract, cornigerine - ß-sitosterol, a long chained fatty acid.

Tuber - ß and g lumicolchicines

Flowers - luteolin, colchicine, N-formyldeacetyl colchicine, ß and g lumi colchicines, 3 dimethyl colchicines, 2 - dimethyl colchicine

Glycosides of 3-dimethyl colchicine and luteolin

Colchicine increased basal release of growth hormone from anterior pituitary gland.

Tuber - regarded as tonic, stomachic and anthelmintic, Intensely, poisonous in large doses. Promote labour pain and as an abortifacient.

Externally used for neuralgic pains and skin troubles. Also used in inflammation ulcer and haemorrhoids.

Colchicine - an alkaloid used in treatment of gout and rheumatism and to induce polyploidy.

Musa paradisiaca
Common name : Banana
Botanical name : *Musa paradisiaca*
Family : Musaceae

A rich source of carbohydrates and a fair source of calcium, phosphour and iron and contains vitamin A, B and C. Vitamins particular of B group. Banana fruit laxative used in intestinal disorders, uraemia, nephritis hypertension and other vascular diseases.

Pig Fat - It has an emollient in action.

Experimenters : Dr F.R. Sheriff, Director of Extension Education, Tamil Nadu Veterinary and Animal Sciences University, Madhavaram Milk Colony Post, Chennai (Tamil Nadu) 600 051, Dr R.V. Suresh, Associate Professor, and Dr S. Thilagar, Professor and Head, Department of Clinics, Madras Veterinary College, Chennai (Tamil Nadu) 600 007.

METHODOLOGY

Location

Clinical cases were attended in the Department of Clinics, Madras Veterinary College, Chennai and Veterinary Hospital, Mayiladuthurai.

PRA and field study

Unstructured interview was conducted and all the details were obtained on the use and methods of ITK.

Experiment

Clinical trial

Sixty animals showing clinical symptoms such as anorexia, profused salivation and lameness formed the subject of this study.



Fig. 1. Foot lesion before treatment

Of the 30 apparently healthy cattle aged 6 months to 4 years, 15 cattle were stationed at the Krishna Dairy Farm and 15 from private milkman's holding were selected and used as healthy controls for standardisation of various parameters of this study. The animals were subjected to routine physical and laboratory examinations.

The 60 sick cattle aged 6 months to 4 years exhibiting signs of anorexia, profuse salivation



Fig. 2. Healed foot after treatment by gloriosa and neem oil



Fig. 3. Ulcer in tongue before treatment



Fig. 4. Healed tongue after treatment by gingelly oil + pig fat + banana

and lameness that were brought for treatment to Large Animal Clinic, Madras Veterinary College Hospital and Veterinary Hospital, Mayiladuthurai were used for this study (Fig. 1a-d).

Based on the history, physical examination and laboratory examination, it was tentatively diagnosed as foot-and mouth-disease.

Sixty foot-and-mouth disease-affected cattle were divided into two groups (I and II) of 30 each. The animals (9 calves, 17 heifers, 3 cows and 1 bullock) in first group (Group I) were treated with *gingelly* oil, pig fat and banana mixture for oral application twice a day for 7 days. The Group I was further divided into 3 subgroups A, B and C of 10 animals each. For subgroup A, *neem* oil alone was applied to the foot lesions for 7 days. For subgroup B a mixture of *Gloriosa superba* and liquid paraffin was applied to the foot lesion for 7 days and for subgroup C a mixture of *Gloriosa superba* and *neem* oil paste was applied to the foot lesions for 7 days. The application was done twice a day and the results were studied.

The second group (Group II) (7 calves, 13 heifers, 8 cows and 2 bullocks) of animals were treated twice a day for 7 days with boroglycerine and Lorexane ointment for oral and foot lesions respectively.

The clinical symptoms and haematology were studied in sick groups before and after the treatment.

Group I: For oral lesion, *gingelly* oil, pig fat and banana mixture in under mentioned composition were used.

Gingelly oil	-	250 ml
Pig fat	-	10 drops
Banana	-	4 fruits

Its ground mixture was used for oral application, twice a day for 7 days.

For foot lesion 3 subgroups (each group 10 animals), were formed: (i) *neem* oil alone, (ii) *Gloriosa superba* and liquid paraffin, and (iii) *Gloriosa superba* and *neem* oil. These substances were applied twice a day for 7 days.

Group II: For oral lesions, boric acid and glycerin paste for oral application twice a day for 7 days. For foot lesions, Lorexane cream twice a day for 7 days.

RESULTS AND DISCUSSION

PRA and field study

Results of the field study obtained on foot-and-mouth disease management, time taken to control, amount spent and adverse effect are shown in Fig.1.

Experiment

Foot-and-mouth disease is a contagious, acute viral disease of all cloven-footed animals, causing great economic loss to the cattle owners.

The clinical parameters such as clinical signs and complete blood count were studied in

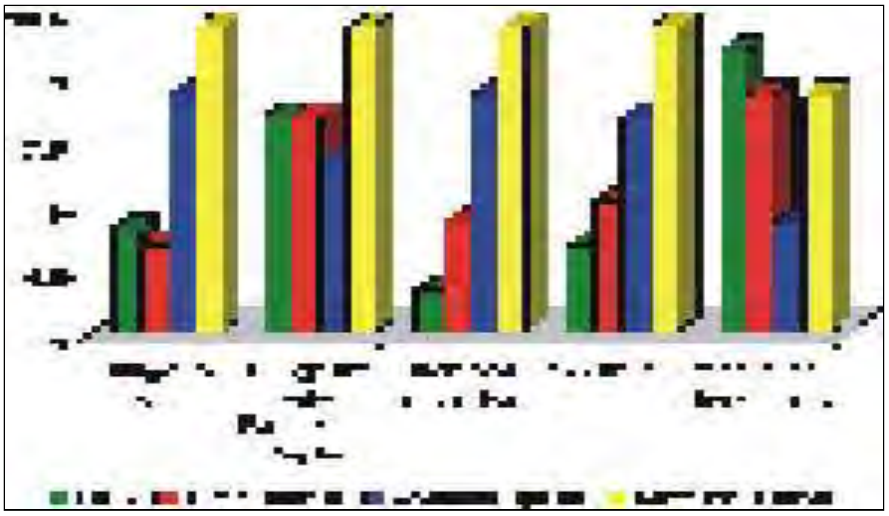


Fig. 1. Relative performance of different types of treatments for controlling FMD

apparently healthy group only once and in sick cattle before and after the treatment.

Clinical examination

The clinical examination was carried out both in apparently healthy and sick animals.

In apparently healthy animals, all the 30 animals were bright, alert and had good appetite. Their eyes were bright and prominent and the visible mucous membrane was pale pink and moist. They had normal body temperature.

In sick animals, all the 60 cattle were dull in behaviour, showed profused salivation, anorexia and had lameness. Their eyes were dull and slightly sunken. Their visible mucous membrane was bright red and dry. Mouth examination revealed ulcered tongue, lesion in dental pad and congested oral mucosa (Fig. 2a&b). Examination of foot revealed lesions in interdigital of the heal and coronet.

Temperature: The mean body temperature of apparently healthy cattle was 38.32 ± 0.03°C. and of sick animals in treatment Groups I and II was 39.34 ± 0.03°C and 39.39 ± 0.02°C respectively (Table 1). The body temperature of the animals (Group II) after the treatment reached normal level.

Analysis of variance showed that there was a significant difference in mean body temperature between the pre-and-post treatment stages (P>0.01). However, there was no significant difference between apparently healthy and Group II animals.

Haematology: In haemogram, the mean values of haemoglobin (Hb), packed cell volume (PCV) and total erythrocyte count (TEC) in apparently healthy cattle were 11.18 ± 0.04 g/dl, 35.23 ± 0.20% and 6.01 ± 0.04 millions/ml respetively (Table 2).

Table 1. Mean temperature (0^{c}) in cattle affected with foot-and-mouth disease in different treatment groups

Parameter	Apparently healthy attle	Group I		Group II	
		Pre- treatment	Post- treatment	Pre- treatment	Post-treatment
Temperature	38.32 ± 0.03	39.34 ± 0.03	39.05 ± 0.04	39.39 ± 0.02	38.37 ± 0.02



A. Profuse salivation



B. Ulcered dental pad



C. Ulcered tongue





Interdigital foot lesion

Table 2. Mean values of haemogram in cattle affected with foot-and-mouth disease in different treatment groups

Parameter	Apparently healthy cattle	Group I		Group II	
		Pre- Treatment	Post- Treatment	Pre- Treatment	Post- Treatment
Hb gm/dl	11.18 ± 0.04	13.18 ± 0.04	11.20 ± 0.05	13.23 ± 0.05	11.23 ± 0.05
PCV (%)	35.23 ± 0.20	42.73 ± 0.18	35.23 ± 0.23	43.00 ± 0.15	35.30 ± 0.15
TEC (million/µl)	6.01 ± 0.04	7.46 ± 0.03	5.98 ± 0.04	7.47 ± 0.03	6.02 ± 0.03

Post-treatment means were compared with mean of healthy cattle; The respective means with same superscript do not differ significantly (P > 0.01); Samples size in each group comprises 30 cattle

Table 3. Mean values of leucogram (number/mm ^{3}) in cattle affected with foot-and-mouth disease in different treatment groups

Parameter	Apparently healthy cattle	Group I		Group II	
		Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
TLC(/īl)	5350.00 ą 38.88 [a]	8870.00 ą 66.12	7361.66 ą 99.70 [c]	8820.00 ą 160.99	5670.00 ą 25.44 [b]
Neutrophils (/īl)	1703.23 ą 16.52 [a]	4001.17 ą 36.49	3084.17 ą 49.64 [c]	3988.17 ą 77.48	1824.33 ą 16.26 [b]
Lymphocytes (/īl)	3491.73 ą 24.49 [a]	4606.47 ą 37.04	4160.82 ą 54.95 [c]	4573.40 ą 87.67	3734.43 ą 20.21 [b]
Monocytes (/īl)	98.13 ą 6.75 [c]	149.47 ą 9.73	87.87 ą 7.77 [b]	143.23 ą 9.78	73.60 ą 5.56 [a]
Ecosinophils (/īl)	76.87 ą 5.55 [b]	115.90 ą 7.9	28.55 ą 6.52 [a]	115.83 ą 6.81	37.63 ą 4.95 [a]

Post-treatment means were compared with mean of healthy cattle; The respective means with same superscript do not differ significantly (P > 0.01); Samples size in each group comprises 30 cattle.

The pre-treatment mean values of Hb, PCV and TEC in sick cattle of treatment Group I were 13.18 ą 0.04 g/dl, 42.73 ą 0.18% and 7.46 ą 0.03 millions/ml; whereas those Group II were 13.23 ą 0.05 g / dl, 43.00 ą 0.15 % and 7.47 ą 0.03 millions/ml respectively. The post -treatments mean values of Hb, PCV and TEC reached normal.

Analysis of variance showed that there was a significant difference in haemogram in sick groups(P>0.01) in pre-and post treatment stages. However, there was no significant difference in treatment groups.

In leucogram, the total leucocyte count was made and absolute count was derived for differential leucocyte count.

The mean value of total leucocyte count (Tlc) in apparently healthy cattle was 5,350.00 ą 38.88 per ml.The pretreatment means of total leucocyte count in foot-and- mouth disease-affected animals of treatment Groups I and II were 8,870 ą 66.12 and 8,820.00 ą 160.99 per ml respectively . The post- treatment mean values of total leucocyte count in sick animals of treatment Groups I and I I were 7,361.66 ą 99.70 and 5,670.00 ą 25.44 per ml respectively (Table 3).

Analysis of variance showed that there was significant difference in mean total leucocyte count in pre-and post-treatment stages (P>0.01). However, there was no significant difference between treatment groups.

The mean values of neutrophils, lymphocytes, monocytes and eosinophils ofapparently healthy cattle were 1,703.23 ą 16.52, 3, 491.73 ą 24.49, 98.13 ą 6.75 and 76.87 ą 5.55 per ml respectively. Their pre-treatment mean values of sick animals in Group I were 4,001. 17 ą 36. 49 , 4,606. 47 ą 37.04 , 149.47 ą 9.73 and 115.90 ą 7.99 per ml respectively, and the post-treatment mean values of sick animals in Group-I were 3,084.17 ą 49.64, 4,160.82 ą 54. 95, 87.87 ą 7.77, 28.55 ą 6.52 per ml respectively , whereas there pre- treatment values of sick animals in Group II were 3,988.17 ą 77.48, 4,573. 40 ą 87.67 , 143.23 ą 9. 78 and 115. 83 ą 6. 81 per ml respectively . The post-treatment values of neutrophils , lymphocytes , monocytes and eosinophils decreased and there was an increase in lymphocyte count in both sick groups. Analysis of variance showed that there was a significant difference in mean neutrophils

and lymphocytes count between pre-and-post treatment stages. However, there was no significant difference between treatment groups.

Sixty foot-and-mouth disease-affected animals were divided into two groups (Groups I and II) of 30 animals each. Group I was further divided into 3 subgroups A, B and C of 10 animals each.

The oral lesions in all the 30 animals (9 calves, 17 heifers, 3 cows and 1 bullock) of Group I were treated with mixture of *gingelly* oil, pig fat and banana twice a day for 7 days. Reduction of salivation in these animals was observed on the fifth day and healing of tongue and oral lesion following application of mixture of *gingelly*, pig fat and banana. They also started taking drinking water and succulent grass (Fig. 3).

In subgroup A, which was treated for foot lesion by application of *neem* oil alone, all the animals did not show any improvement even after 7 days of treatment (Fig. 4).

In subgroup B, a mixture of *Gloriosa superba* and liquid paraffin was applied to the foot lesion for 7 days and no healing was observed in any of these animals.Animals in subgroup C were treated for foot lesion with a mixture *Gloriosa superba* and *neem* oil for 7 days and the healing of lesion was appreciable. Animals exhibited lameness. A delay in healing of foot-and-mouth lesions was observed in Group I C.

In Group II of 30 animals (7 calves, 13 heifer, 8 cows and 2 bullock), which received an application of buroglycerin for oral lesion twice a day for a period of 7 days, there was a remarkable reduction of salivation on the third day itself, and from the fourth day onwards the animal showed some interest in nibbling succulent grass and drinking water (Fig. 5).

Further, Lorexone ointment was applied twice a day for 7 days to the foot lesions for all the animals in Group II. The healing was visible on the third day of application of the ointment and was almost complete by 7 days of treatment, although the animal showed slight lameness.

Clinical signs

All the 30 apparently healthy animals selected were bright, alert and had good appetite. Their eyes were bright and prominent and the visible mucous membrane was pale pink and moist. The body temperature was normal. All the 60 cattle (cow calves, bull calves, heifers cows, bulls and bullock) were dull in behaviour, showed anorexia, profused salivation, fever and lameness. Their eyes were dull and slightly sunken. Physical examination revealed lesions on the dorsum of the tongue, dental pad, interdigital space, bulb of the heals and coronet. In milch animal, there was drop in milk yield. These observations are in full accordance with these of Singh and Gupta (1987), *Radostits et al.* (1994); Smith (1996) and Remond *et al.* (2002).

Temperature: The normal body temperature of cattle ranged from 38.0 to 39.0°C. In the present study the mean body temperature of cattle was 38.32 ± 0.03°C (Table 1) and it was within the normal range as stated by Rosenberger (1979). In foot-and-mouth disease-affected animals the body temperature ranged from 40 to 41°C. The pre-treatment mean body temperature of cattle in treatment Groups I and II was 39.34 ± 0.03°C and 39.39 ± 0.02°C respectively (Table 1). The elevation of body temperature might be due to involvement of infectious agent. Animals in the state of dehydration are prone to hyperthermia, because heat loss by evaporation of tissue fluids is reduced (Kelly, 1984; Radostits et al. 1994). All the sick animals had mild degree of dehydration due to anorexia and hyperthermia, which might have resulted due to reduction of heat loss by evaporation.

The mean body temperature of animals in Group II reached normal levels after treatment, perhaps due to control of bacterial infection and correction of dehydration, as the sick animals started consuming drinking water much earlier than the animal in Group I.

Interpretation

Complete blood count

Regarding haemogram, Rosenberger (1979) reported the normal values of haemoglobin (Hb) packed cell volume (PCV) and total erythrocyte count (TLC) were 10 (8-12) g/dl, 36 (30-40)% and 7 (5-8) million/ml.

The mean values of haemoglobin (11.18 ± 0.04 g/dl), packed cell volume (35.23± 0.20%) and total erythrocyte count (6.01 ± 0.04 million/ml) of apparently healthy cattle observed in this study were within the normal range (Rosenberger, 1979).

The pre-treatment mean values of haemoglobin, packed cell volume and total erythrocyte count in sick animals of treatment Groups I and II are presented in Table 2. Their mean values in sick animal group showed significant elevation when compared with that in normal animals. This is apparently due to haemoconcentration, which is always associated with dehydration (Benjamin, 1985). In the present study, the increase in haemoglobin content, packed cell volume and total erythrocyte count might be due to reduction of blood plasma volume and haemoconcentration.

The post-treatment mean values of haemoglobin (Hb), packed cell volume (PCV) and total erythrocyte count (TEC) reached the normal level (Table 2). But their values were found to be marginally higher than the normal values of apparently healthy cattle. This could be attributed to the normal physiological variation between individual animals before the onset of foot-and-mouth disease. Probably these sick animals had higher haemoglobin, packed cell volume and total erythrocyte count before the onset of the disease, and the treatment adopted have restored it to its original normal values.

Fig. 2 leucogram, Rosenberger (1979) reported that the total leucocyte count of the cattle ranged between 5,000 and 10,000 (7,500)/ml. The mean value of total leucocyte count in apparently healthy cattle was 5,350.00 ± 38.88/mm3 and it was within the normal range as stated by Rosenberger (1979).

The pre-treatment mean values of total leucocyte count of sick animals in treatment Groups I and II were 8,870.00 ± 66.12 and 8,820.00 ± 160.99/ml (Table 3). These values of sick animals significantly increased when compared to that of apparently healthy cattle. The leucocytosis observed in the present study might have occurred due to normal reaction of body defence mechanism against infection (Doxy, 1983). Leucocytosis is the reactive response to an acute viral disease (Rosenberger, 1979).

The post-treatment mean values of total leucocytes count of sick animals in treatment Groups I and II were 7,361.66 ± 99.70 and 5,670.00 ± 25.44/ml (Table 3). The mean values of total leucocyte count of sick animals showed no significant decrease when compared to apparently healthy group.

For differential leucocyte count, Rosenberger (1979) stated that the normal absolute number of neutrophils, lymphocytes, monocytes and eosinophils in cattle were 1,250 to 4,500, 2,250 to 6,500, 50-800 and 50 to 1,000/ml respectively.

Their mean values of apparently healthy cattle in absolute number were 1,703.23 ± 16.52, 3,491.73 ± 24.49, 98.13 ± 6.75 and 76.87 ± 5.55/ml (Table 3).

The pre-treatment mean values of neutrophils in sick animals of Groups I and II were 4,001.17 ± 36.49 and 3,988.17 ± 77.48/ml respectively (Table 3). The pre-treatment mean values of lymphocytes in sick animals of Groups I and II were 4,606.47 ± 37.04 and 4,573.40 ± 87.67/ml respectively (Table 3).

The pre-treatment mean values of neutrophils and lymphocytes of foot and mouth disease affected cattle varied significantly from the mean of apparently healthy group. There was a marked response to neutrophils with lymphopenia in all the sick animals. These observations with increased total leucocyte count of all sick cattle indicate inflammatory reaction (Rosenberger, 1979).

The post-treatment mean values of the total leucocyte (TLC), neutrophils and lymphocyte of sick animal in Groups I and II were found to be marginally higher than the normal values of apparently healthy cattle. The sick animals showed clinical recovery from the disease, but their haematological examination indicated the persistence of infection.

All the 30 sick animals were treated for oral lesion in Group I with *gingelly oil,* pig fat and banana fruit mixture, twice a day for 7 days. Reduction of salivation in these animals was observed on the fifth day and healing oral and tongue lesions following its application. The animals in this group started consuming water and succulent grasses. There was no improvement in healing of foot lesion in animals treated with *neem* oil alone. There was no healing of foot lesion in animals treated with *Gloriosa superba* and liquid paraffin. Animals in subgroup C were treated for foot lesion with a mixture *Gloriosa superba* and neem oil for 7 days and the healing of lesion was appreciable and they exhibited lameness.

In Group II of 30 animals, which received an application of boroglycerin for oral lesion twice a day for a period of 7 days, there was a remarkable reduction of salivation on the third day itself, and from the fourth day onwards the animal showed some interest in nibbling succulent grass and drinking water. Further, Lorexone ointment was applied twice a day for 7 days to the foot lesions for all the animals in Group II. The healing was visible on the third day of application and was almost complete by 7 days of treatment, although the animal showed slight lameness.

The hematological examination of sick animals in Groups I and II revealed presence of infection, though the animals showed clinical recovery.

As per economics, the treatment of animal in Group I C with *gingelly,* pig-fat and banana mixture and *Gloriosa superba* and *neem* oil paste was cheaper than that of animals treated with boroglycerin and Lorexone of Group II.

CONCLUSION

The ITK method of controlling FMD is the cheapest treatment, which is in agreement with that of the discloser. Delayed healing of the foot-and-mouth lesions in animals occured, which were treated with a mixture of *gingelly oil,* pig-fat and banana for oral lesions and *Gloriosa superba* and *neem* oil paste for foot lesions. .

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Code	**:**	**1288**
Title of the ITK	**:**	**Use of *babool (Acacia nilotica)* and *jamun (Syzygiune cumini)* bark extract to cure foot-and-mouth disease in animals**
Description of the ITK	:	A paste of *babool* bark and *jamun* is applied on the hooves of the FMD-affected animal thrice daily, costing Rs 2_5 per animal. In this method the disease is cured up to 70%.
Name and address of the discloser	:	Shri Syed Musawwir Ali, Mohalla Furshori Tola, Bund gali, Badaun, District- Bareilly
Location of use of the ITK	:	This is practised in many villages of Baduan and Bareilly districts of Uttar Pradesh.
Experimenters	:	Dr D Swarup, Head, Dr D B Mondal Scientist (SS), Division of Medicine, and Dr Mahesh Chander, Scientist (SS), Extension Division, Indian Veterinary Research Institute, Izatnagar, Dr Ram Naresh and Dr Madhuri Gautam, Scientist, Indian Veterinary Research Institute Campus, Mukteswar

METHODOLOGY

PRA and field study

The PRA was conducted in several villages of Bareilly, Badaun and Bulandshahar districts of Uttar Pradesh. Experimental work and clinical trial were done in the Division of Medicine, Indian Veterinary Research Institute, Izatnagar and villages of Farrukhabad district of Uttar Pradesh.

PRA and field study

A matrix was developed to assess the performance of the ITK and standard veterinary treatment (SVT) by PRA method to cover the aspects of efficiency, duration, cost, availability, convenience and side effects. A scoring pattern of 0_10 was used. The number of informants was 20. Mandal and Chauhan (2000) have reported that bark of *babool (Acacia nilotica),* boiled in water, is used as an ethno-veterinary practice by the farmers of West Bengal for washing mouth lesions of FMD. However, there were no reports on the scientific validity of this practice.

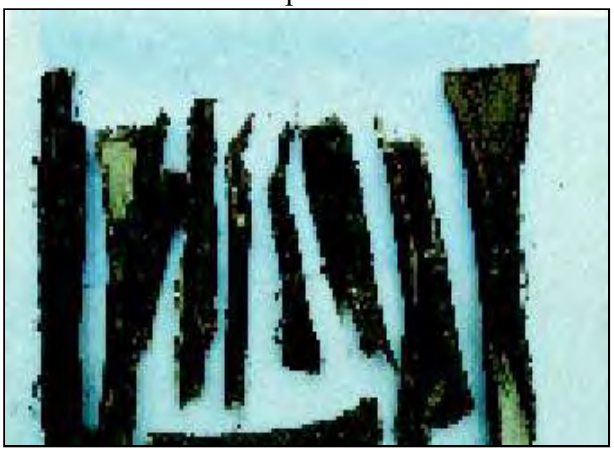


Fig. 1. Bark of babool

Experiment

The trial was conducted in clinical cases following outbreak of FMD in certain villages of district Farrukkhabad in Uttar Pradesh. Most cases were 5_7 days old and had severe foot lesions. The decoction was prepared from fresh bark of *babool* and *jamun* by boiling 250 g bark of each tree in 1 litre water till the volume became half. Thereafter the decoction was filtered through muslin cloth. The foot lesions were washed by

decoction and farmers were advised to repeat the washing in the similar manner twice daily. They were also advised to follow some precautions like restriction of animals for grazing and entry in to dirty and hard places. The animals were examined for healing of the lesions after 7 days. The information to decide recovery rate was collected from the farmers. In another group of 10 animals, parenteral antibiotic together with diclofenac sodium was given once a day for 3 consecutive days.

RESULTS AND DISCUSSION

PRA and field study

Tables 1 and 2 depict the results of PRA method.

Table 1. Matrix for ITK validation

Criterion	Treatment	
	SVTITK practice	
High efficacy	8.4	8.3
Less duration (6–8 days)8.0		7.6
Low cost	6.3	10.0
Easy availability	8.0	10.0
Convenience for use	8.7	10.0
Side effects (none)	9.6	10.0

These findings indicated that ITK was highly popular amongst farmers for treatment of FMD lesions. Farmers considered treatment by ITK to be highly economic.

Experiment

Data (Table 3) on spontaneous cases of FMD consisting of 4 cattle and 15 buffaloes having foot lesions showed that decoction of babool and *jamun has good efficacy to hasten healing of the* FMD hoof lesions both in cattle and buffaloes. Majority of the farmers were very happy with the use of ITK , as their animals showed high recovery . Most of them wanted to store the medicine to treat their animals in future. The recovery rate in cases treated with antibiotic and analgesic was lower than that with ITK, perhaps due to lack of local antiseptic application. Two cases treated with antibiotic did not respond to the treatment and developed maggot wound. Oil of turpentine was recommended for their treatment.

FMD is a highly contagious viral disease of farm animals , with high morbidity rate and economic losses due to inimical effects on production. There is no specific treatment against causative organism. The standard treatment includes foot and mouth wash by antiseptic solution, anti- inflammatory drugs for treatment of fever and antibiotics to check secondary bacterial infection. In the present experimentation an ITK comprising of application of decoction of babool (Acacia sp.) and jamun bark on hooves, thrice a day showed good efficacy to cure FMD lesions in cattle and buffaloes.

CONCLUSION

The ITK was found highly cost effective on

Table 2. Farmers' opinion about two different approaches (mean ± SE) for controlling FMD in animals

Treatment	Efficacy	Duration	Cost	Availability	Application convenience	Side-effects
SVT	8.45±0.68	8.05±0.05	6.3±3.37	8.±0.73	8.75±1.46	9.6±0.67
BJ (ITK)	8.35±1.607	7.65±0.34	10±0	10±0	10±0	10±0
t value	0.295	2.847	–9.001	–10.419	–4.625	–2.179

Table 3. Effect of babool and jamun bark decoction on recovery from FMD

Treatment	Animal	No. of cases treated	Dose regimen	Frequency of application	Duration (days)	No. of cases cured	Efficacy (%)
Decoction of *babool and jamun bark*	Cattle *Buffalo*	14 + *15*	Washing of hoof lesions	Twice daily	4-6	28	96.5
Ampicillin 3 g + Diclofenac sodium 15 ml	Cattle	10	I/M I/M	Once daily	3	8	80.0

clinical trial to treat foot lesion in FMD. The cure rate with ITK was better than with costly allopathic treatment including antibiotic and analgesic. The material used in ITK is readily available almost at no cost. The shelf life of the decoction is also quite satisfactory.

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Code :1589

Title of the ITK :Treatment of diarrhoea in animals (goat and sheep)

Description of the ITK :Goat and sheep which are suffering from diarrhoea are treated by pojo plant. Paste is prepared by crushing the pojo plant. It is and fed to animal @ ½ cup of pojo paste daily for 3 days. Villagers believe that pojo plant has medicinal value, controls diarrhoea and prevents dehydration. This wisdom is being used for the ancient times without modification. About 40% goats suffer from diarrhoea in the village from where the ITK is reported. Out of these, 30% cases of diarrhoea are treated by the method of ITK, and 5% remains untreated and equally are treated by some other medicines.

Name and address of the discloser **:Shri Veeresh Kumar, Department of Extension Education,** Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006.

Location of use of the ITK :Sose, Kanke, Ranchi (Jharkhand)

Experimenters :Dr B. K. Roy, Associate Professor, Department of Pharmacology, Ranchi Veterinary College, and Shri S. K. Sawaiyan, SRF (ITK-NATP), Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

The experiment was conducted in village Sose, block Kanke, Ranchi (Jharkhand).

PRA and field study

A field study was carried out using PRA tools with a total number of 20 respondents. The parameters or factors studied included the extent of cure, duration of treatment, cost effectiveness, safety and regaining milk yield.

Experiment

Twenty goats, suffering from diarrhoea were made into two groups, 10 in each group. Group 1 received treatments following ITK method, i.e. half cup of pojo bark paste was fed orally twice daily for 3 days. The other 10 animals in Group 2 received anti-diarrhoeal drug (Svifta) orally twice daily for 3 days.

Faecal examination was done for examining the presence of helminths. The goats found positive with worms were given ½ bolus of panacur under allopathic treatment.

RESULTS AND DISCUSSION

PRA and field study

The results obtained from field study are given

Table 1. Performance of pojo bark paste in control of diarrhoea in goats and sheep

Criterion	Paste of pojo bark	Allopathic medicine
Extent of cure	8	8
Duration of treatment (days)3		5
Cost effectiveness	10	4
Safety	10	4
Regaining in milk yield	4	2

Table 2. Effect of pojo bark paste and allopathic medicine in control of worm +ve and worm –ve diarrhoea in goats

Duration of treatment (days)	Paste of pojo bark (%cured) (Panacur ½ boles) once only + Svifta		Recommended practice (% cured) Svifta (½ bolus BID*)	
	With worm (+ve)	Without worm (–ve)	With worm (+ve)	Without worm (–ve)
1	0	0	0	0
2	0	30	50	50
3	0	50	80	100
4	0	60	100	-
5	0	60	-	-
6	0	60	-	-

*BID.

in Table 1. Farmers were of the opinion that pojo is as efficient as an allopathic drug for the treatment of diarrhoea. They expressed that the allopathic drugs are not available to them, which are also costly. Therefore they have a higher ranking for ITK as compared to allopathic drugs. They consider that after allopathic treatment milk yield of goat is decreased.If the treatment is done with pojo bark the goats regain milking earlier than by the use of allopathic drugs.



Fig. 1. Removing barks from a portion of the trunk of pojo tree for treatment of diarrhoea in goats

Experiment

After faecal examination it was found that the majority of diarrhoea cases in goats were due to nematode (Haemonchus contortus), trematode (Amphistomes), cestode (Moniezia) and protozoa (Coccidia). It is observed from the data presented in Table 2 that pojo paste is effective for control of diarrhoea in worm negative cases only. Fifty

Table 3. Effect of paste of pojo bark and allopathic medicine in control of diarrhoea of goats

Criterion	Paste of pojo bark	Svifta	Panacur + Svifta
Duration of treatment (days)	6	3	4
Extent of cure (%)	60	100	100
Effect on G.I. parasites (%)	Nil	Nil	80
Cost of each unit treatment (Rs)	2.0	24	34
Cost : benefit ratio	2 : 998	24 : 976	34 : 966
Safety (%)	100	80	80

per cent of diarrhoea could be cured within 3 days of treating the goats with pojo paste. In contrast, 100 % diarrhoea could be cured by using allopathic medicine in worm negative cases within 3 days. If the therapy was prolonged for 6 days , 60 % of the problem was cured. The percentage of cure in 4 to 6 days was stagnant up to 60 % with pojo paste. On the contrary, the recommended practice could cure 80% of cases within 3 days.

The paste of pojo could not cure diarrhoea where the causative agents were gastrointestinal parasites. The administration of anthelmintic (panacur) was very effective in the cure of diarrhoea associatedwith helminthes.The ranking of other criteria is given in Table 3. Pojo bark treatment is safer as compared to allopathic medicine.

Phytochemical evaluation

(i) The bark was crushed into fine powder and dried to remove any moisture.

(ii) Sohxlet apparatus was used for successive extraction. The extraction was done with the help of solvents in increasing polarity viz.

(a) petroleum ether (60°–80°C)

(b) Chloroform

(c)Ethyl acetate

(d)Methanol

(iii) TLC patterns of the individual extract was taken.

Petroleum2 spots (both fluorescent)

Chloroform2 spots (fluorescent) + 1 spot

Ethyl acetate2 spots

Methanol2 spots (F)

(iv) PTLC (Preparative TLC) was done to isolate the individual components.

•Quantity in sufficient for IR/Mass /NMR (Analytical/Spectral grade)

•Column is yet to done

Pharmacology

LD_{50} = < 500 mg/kg (Methanolic extract)

It has been observed that it is a potent drug. The other pharmacological study is still being conducted.

CONCLUSION

It is evident from the results obtained from the study that the paste of pojo bark is beneficial in the treatment of diarrhoea in goats that is not associated with helminthes. It is very cheap medicinal agent and has no ill effect on the animals.

References available also supports the view that pojo bark is beneficial in treatment of diarrhoea. The bark is also applied to the body for pains arising from blows or bruises or from hard work. It is also beneficial for fractured bones. However, it is very unfortunate that by damaging the tree its bark is removed for making candle or for medicinal purpose. The plant needs protection in Jharkhand. The pharmacological studies being carried out in collaboration with the Department of Pharmacology, BIT, Mesera, Ranchi. Many important pharmacological findings are expected to come out of this plant.

❑

Code :1585

Title of the ITK :Treatment of diarrhoea by juice of urhul (Hibiscus ***sinensis) flowers in goats***

Description of the ITK :Diarrhoea is common in goats in Samtoli village of Simdega district in Jharkhand and is controlled by extract of urhul flower. Juice of urhul flowers (2–3 flowers) is orally administered twice a day for 3 days. The cost of the treatment is Rs 30 per animal. Majority of the farmers use this ITK in the referred village. About 20% of goats suffer from diarrhoea in this village and 50% are treated by the reported ITK.

Name and address of the discloser **:Shri Babulal Horo, Pathalkudwa, Church Lane, Ranchi** (Jharkhand)

Location of use of the ITK :Samtoli, Simdega, Simdega (Jharkhand)

Geographical indicators :An evergreen, woody glabrous, showy shrub, 5–8 feet high. The flowers solitary, axillary and bell shaped. It is native of China. It is grown as an ornamental plant in gardens through out India and often planted as hedge or fence plant.

Experimenters :Dr B. K. Roy, Associate Professor, Department. of Pharmacology and Toxicology and Dr R. P. Singh 'Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

The experiment was conducted in village Samtoli, Block Simdega, Simdega (Jharkhand).

PRA and field study

The field study was conducted following the PRA methodology with 20 respondents. The parameters or factors included were extent of cure in adults, extent of cure in kids, potency, duration

Table 1. Matrix scoring for comparing the performance of juice of urhul flower and allopathic medicine in treatment of diarrhea in goats

Criterion	Juice of urhul flower	Allopathic medicine
Extent of cure in adults	6	8
Extent of cure in kids	8	7
Potency	4	5
Duration of treatment	3	3
Frequency of oral administration	2	2
Cost effectiveness	10	1
Regain in milking	5	2
Safety	10	5



Fig. 1. Treatment of diarrhoea by juice of urhul flowers in goat

of treatment, frequency of oral administration, cost effectiveness, and regain in milking and safety. The ITK was compared on the basis of these factors with the recommended allopathic treatment.

Experiment

An experiment was conducted in 5 replications with two treatments, viz. T_1, ITK, i.e. extract of 3 flowers of urhul twice daily for 3 days to each animal; and T_2, Svifta bolus (one bolus twice daily for 2 – 3 days to each animal). In each set of treatment there were 5 goats. The experiment was conducted at the place from where it was reported.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 show that duration of treatment and frequency of drug administration were similar in both the methods of treatment. The ITK reported by farmers proved much cheaper and the goats regained milking earlier as compared to allopathic treatment.

Experiment

The results of the effect of administering the extract of urhul flower and allopathic medicine (Svifta) are shown in Table 2. The urhul flower could cure 80 % of animals affected from diarrhoea after 6 days of the treatment. On the other hand the oral administration of Svifta bolus could cure 100% of animals after 3 days of the treatment. The potency of ITK material compared to allopathic medicine was very mild. The goats affected with diarrhoea were negative for the presence of helminths.

Table 2. Effect of urhul flower (ITK) and Svifta *bolus (allopathic) in treatment of diarrhoea in goats*

Days after treatment	Extent of cure (%)	
	Extract of *urhul flower*	*Svifta bolus*
1	0.00	2/5 (40)
2	1/5 (20)	4/5 (80)
3	2/5 (40)	5/5 (100)
4	2/5 (40)	-
5	4/5 (80)	-
6	4/5 (80)	-

Data in parentheses are in percentage.

CONCLUSION

It was concluded that use of urhul is effective in treatment of diarrhoea in goats, which takes more time to cure than allopathic medicine. ❑

Code :1967

Title of the ITK :Curing of diarrhoea in goats by using takala (Cassia ***tora) flower juice***

Description of the ITK :Diarrhoea is a commonly observed health disorder in goats. The reason may be eating of tender grasses in rainy season, excess intake of tubers and grains. To control diarrhoea, *takala flower juice and ½ cup of tea is orally administered* to the goat for 2–3 days. Farmers of Solapur district in Maharastra are adopting this practice since several years.

Name and address of the discloser **:Shri B.B.Khatal, At./PO: Solapur, Maharashtra**

Location of the use of the ITK **:Solapur, parts of Sangli, Ahmednagar and Pune** (Maharashtra)

Geographical indicators :Botanical name:Cassia tora
Local name :Takala
Family :Leguminoseae

A small weed plant, an annual herb 30–90 cm high. It is widely spread, growing on dry soil. It occurs in wasteland during rainy season. Leaves and seeds of takala are laxative, antipyretic, anthelmintic, ophthalmic and expectorant. The leaves and seeds are useful in cough, constipation and stomach disorder.

Experimenter :Dr N.P.Dakshinkar, Associate Professor of Clinical Veterinary Medicine, Nagpur (Maharashtra) 440 006

METHODOLOGY

PRA and field study

Randomly selected goat raisers of five districts of Vidarbha region were interviewed using PRA tools. Three villages from each taluka of every district were selected and five goat raisers from every village were interviewed by preparing a standard questionnaire. Parameters or factors studied were recorded on a questionnaire sheet and the data were analysed to draw inferences.

Experiment

The study was conducted from 60 goats suffering from diarrhoea . These goats were subjected to detailed clinical and parasitological examination and were divided into parasitic and non-parasitic groups. Each group was equally divided into 5 sub groups comprising 6 goats each.

Table 1. District-wise distribution of respondents

District	No. of respondents
Wardha	15 (6.27)
Chandrapur	24 (10.05)
Nagpur	85 (35.56)
Bhandara	85 (35.56)
Akola	30 (12.56)
Total	239 (100.00)

Figures in parentheses indicate percentage

Table 2. Number of respondents treating diarrhoea in goat with takala flower and/ or leaves

District	*Takala* flower (%)	*Takala* leaves	*Takala* flower and leaves	No. of goats without treatment
Wardha	-	-	5 (33.34)	10 (66.66)
Nagpur	8 (9.42)	3 (3.52)	7 (8.24)	67 (78.82)
Akola	29 (96.66)	-	-	1 (3.34)

Figures in parentheses indicate percentage.

RESULTS AND DISCUSSION

PRA and field study

In the study 35.56% of goat keepers were consulted from Nagpur and Bhandara districts regarding traditional treatments of diarrhoea in goats with takala flower or leaves. Wardha district represents the lowest percentage of respondents (6.27 %). Overall 239 goat raisers of Vidarbha region participated in the summer study (Table1).

Of 239 respondents, 166 (66.45%) goat raisers were found to treat diarrhoea at home. The same proportion of personnel were under-taking traditional treatments for effective control of goat diarrhoea. It indicated that hardly 30% of goat raisers rely on other types of treatments, which include role of veterinarian. In Akola district, almost all goat keepers treat diarrhoea at home using traditional medicine (Table 2). On the other hand, in Wardha district, hardly 46.66 % goat raisers treat their animal at home using this age-old practice.

Experiment

The therapeutic regimen adapted in the animals is detailed in Table 3.

Faecal samples of goats sufferings from diarrhoea were collected before treatment and then on day 6 after treatment. Freshly collected faecal samples were examined by concentrated method for detection of endoparasitic ova. Efficacy of drug was evaluated on the basis of reduction in EPG at day 0 and on day 6 after treatment.

Table 3. Design of treatment of drugs on diarrhoeic goats

Type of diarrhoea	Group	No. of animals	Treatment given	Dose	Route
Parasitic Non parasitic	T1A TIB	6	Astringent mixture (Kaolin,Creta, Katechu)	30 g b.i.d	Oral
Parasitic Non-parasitic	T2A T2B	6	Tab. Fenbendazole (Pancur)	7.5 mg/kg b.w (single dose)	Oral
Parasitic Non-parasitic	T3A T3B	6	Powdered seeds of Cassia tora	1–3 g b.i.d	Oral
Parasitic Non-parasitic	T4A T4B	6	Flower juice of Cassia *tora*	15 ml b.i.d	Oral
Parasitic Non-parasitic	T5A T5B	6	Combination of flower juice and powdered seeds of *Cassia tora*	3g b.i.d and 15 ml of flower juice	Oral

b.i.d., Two times a day.

Table 4. Mean ą S.E and `t' values for number of days in treatment for non-parasitic diarrhoea group

Treatment group	Mean ą S.E for days in treatment	`t' calculated
T1B	2.83ą0.83	T1B_T2B= 1.96
T2B	1.17ą0.16	T1B_T2B= 1.54
T3B	1.5ą0.22	T1B_T4B= 0
T4B	2.83ą0.30	T2B_T3B=1.19
		T2B_T4B= 4.76**
		T3B_T4B= 3.5*

*Significant at (P=0.01); **Significant at (P=0.05).

Clinical examination for degree of dehydration, body temperature, heart rate, pulse rate, body weight of the individual animals was undertaken both before treatment and on day 6 after treatment.

For hematological examination, blood samples were collected before and day 60 after treatment. Serum was prepared for estimation of local serum protein.

The effect of various treatments on heart rate, pulse rate, body temperature, degree of dehydration, heamoglobin, serum protein and packed cell volume, total erythrocyte count, eggs per gram feaces was statistically analysed.

For non-parasitic diarrhoea, four treatments were considered on the basis of number of days required for effecting complete cure. In group T1B, 2_7 days are required with an average of 2.83**ą**0.83 days. Group T2B required 1_2 days with an average of 1.17**ą**0.16 days. Group T3B required 1_2 days with an average of 1.5**ą**0.22 days. Group T4B required 2_4 days with an average of 2.83**ą** 0.30 days (Table 4).

Parasitic diarrhoea was attributed mainly to roundworm infestation with *Trichuris* spp, *Strongyles* spp. and *Haemonchus* spp. Number of days required for complete recovery in animal of group T1A was 5.33ą1.05 days, group T2A 1.17ą0.16 days, group T3A 2.67ą0.88 days and group T4A 2.17ą0.47 days.

Conclusion

Takla flower juice and showed moderate degree of effectiveness against parasitic diarrhoea in goats without any anthelmentic action.

Code	:	**1287**
Title of the ITK	:	**Control of diarrhoea in cattle and buffalo by a paste made from leaves of *shisham* (*Dalbergia sissoo*)**
Description of the ITK	:	*Dulbergia sissoo* leaves might be having anti-diarrhoea medicinal value. This ITK is highly compatible with the existing resources. About 500 g of *shisham* leaves are ground into paste and are mixed with 1 litre water and drenched 2-3 times a day per adult cow or buffalo. It costs Rs 1-2 per animal. The animal is cured in 2-3 days. This is in vougue in many villages of Shahjhanpur, Bulandshar and Bareilly districts of Uttar Pradesh.
Name and address of the discloser	:	Shri. Syed Musawir Ali, Mohalla - Furshoori Tola, Bund Gali, Baduan, Bareilly (Uttar Pradesh)
Location of use of the ITK	:	Villages in the district of Shahjhanpur, Bulandshar and Bareilly (Uttar Pradesh).
Experimenters	:	Dr. D. Swarup; Head, Dr. N. N. Pandey, Principal Scientist and Dr. D. B. Mondal, Scientist, Division of Medicine, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122

Methodology

Location

Field study was conducted in Shahjahanpur, Bulandshar and Bareilly districts in Uttar Pradesh. Experimental work was done in the Division of Medicine and LPR (C&B), Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh)

PRA and field study

Participatory Rural Appraisal (PRA) tools were used in number of villages of Shahjhanpur, Bulandshar and Bareilly districts in Uttar Pradesh. A total of 20 key informants were discussed to collect information on a 10 score ranking by PRA matrix method.

Experiment

Toxicity trial study

The trial was conducted at the Division of Medicine, Indian Veterinary Research Institute (IVRI). Green leaves of *shisham* were collected from trees and were dried under shed. The dried leaves were powdered with the help of an electric grinder and stored under plastic containers for use.

In order to study any toxic effect by the use of *shisham* leaf paste, the leaf powder was given orally to 5 healthy goats @ 105 g/ 100 kg body weight daily for 7 days. A group of 5 healthy goats, which did not receive the leaves, served as control.

Blood samples were collected on 0, 3, 5 and 7 days after feeding *shisham* leaves for biochemical estimations. The animals were observed daily for recession of clinical signs.

Therapeutic trail study

The study was undertaken as per the following experimental design, detailed in Table 1.

Results and discussion

PRA and field study

Results of PRA and field study revealed that *shisham* leaf treatment had 70% cure rate, as compared to 90% each for allopathic treatment



Fig. 1. A view of *shisham* tree, leaves and powder

and allopathic along with *shisham* leaf treatment recovery in 3 days as compared to allopathic (Table 2). *Shisham* leaves when mixed with treatment, which took as long as 5 days for full allopathic treatment were able to bring faster recovery. In terms of cost effectiveness,

Table 1. Experimental design for therapeutic study

Therapeutic agents	Group (n=5)	Dose regimen	Duration (3 days)
Standard therapy (Cotrimazine)	I	15 mg / kg b. wt.	Twice daily
Shisham leave I	II	70 g / 100 kg b. wt.	Twice daily
Shisham leave II	III	105 g / 100 kg b. wt.	Twice daily
Standard therapy + *shisham* leave I	IV	15 mg / kg b. wt.+ 70 g / 100 kg b. wt.	Twice daily
Standard therapy + *shisham* leave II	V	15 mg / kg b. wt.+ 105 g / 100 kg b. wt.	Twice daily

Table 2. PRA matrix scores for treatment of cattle against diarrhoea

Criteria	Paste of shisham leaves	Allopathic medicine + paste of shisham leaves	Allopathic medicine
Extent of cure (fully)	07	09	09
Duration of treatment (days)	03	03	03
Time taken for full recovery (days)	07	03	05
Cost effectiveness	10	04	04
Availability	10	–	05
Safety	10	07	07

availability and safety, shisham leaf treatment was found to be better.

Experiment

Toxicity trial study

The results of biochemical estimations done at different time intervals in goats are presented in Table 3 and Fig. 3 and 4. The data obtained in both the groups (experimental and control) were found comparable indicating that feeding of *shisham leaf paste even at higher dose rate was* not toxic to animals. The study shows that

Table 3. Serum biochemical profile (Mean ±S.E.) in experimental (5) and healthy control (5) goats

Parameter	Day	Experimental group	Control group
Urea nitrogen (mg%)	0	12.16±0.50	11.82±0.42
	3	12.76±0.27	12.30±0.49
	5	12.44±0.54	12.13±0.55
	7	12.32±0.44	12.01±0.07
Creatinine (mg%)	0	1.48±0.09	1.70±0.09
	3	1.55±0.08	1.70±0.09
	5	1.51±0.08	1.73±0.06
	7	1.046±0.10	1.68±0.10
Bilirubin (mg%)	0	0.05±0.008	0.06±0.007
	3	0.058±0.007	0.08±0.007
	5	0.064±0.011	0.06±0.007
	7	0.052±0.007	0.06±0.009
SGOT (U/L)	0	190.2±5.97	170.3±2.30
	3	170.6±6.03	171.3±4.91
	5	171.4±6.02	172.3±4.40
	7	170.0±5.18	171.6±5.00
SGPT (U/L)	0	6.64±0.16	6.5±0.07
	3	6.76±0.08	6.56±0.06
	5	6.58±0.19	6.63±0.06
	7	6.64±0.13	6.56±0.02



Fig. 2. Shisham leaf powder being drenched to a goat

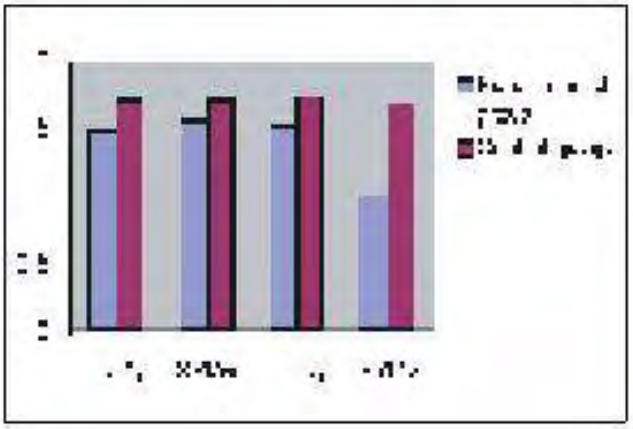


Fig. 3. Serum creatinine (mg %) in goats treated with shisham leaf powder @ 105 g/100 kg b. wt.

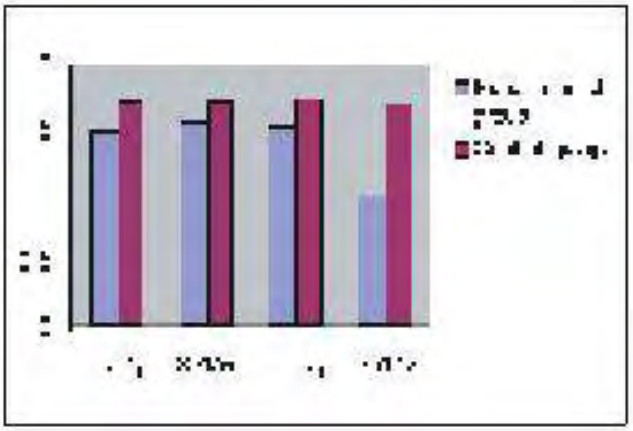


Fig. 4. Serum urea nitrogen (mg %) in goats treated with shisham leaf powder @ 105 g/100 kg b. wt.

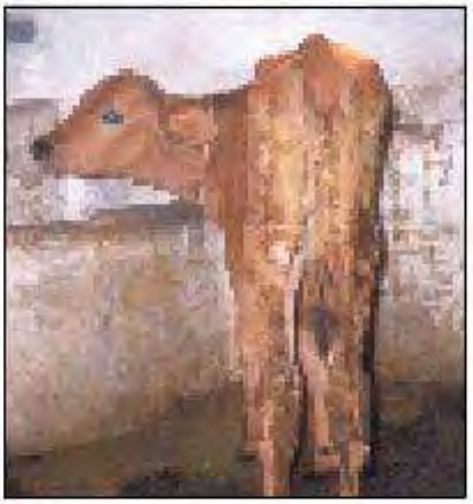


Fig. 5. A diarrhoeic calf



Fig. 6. A dull and depressed diarrhoeic calf



Fig. 7. Shisham leaf powder being fed to a diarrhoeic calf

Table 4. Mean clinical response of diarrhoeic calves of group I (Cotrimazine alone), II (Cotrimazine + *shisham leaf @105g/100 kg b. wt) and III (@ shisham leaf @105g/100 kg b. wt alone)*

(MeanąS.E.)

Parameter	Group	Day 0	Day 3	Day 7
Faecal consistency Score	I	2.2ą0.20	1.0ą0.31	0.0ą0.0
	II	2.6ą0.24	0.0ą0.0	0.0ą0.0
	III	2.4ą0.20	0.0ą 0.0	0.0ą 0.0
Depression Score	I	1.4ą0.25	0.8ą0.49	0.4ą0.25
	II	2.0ą0.00	0.2ą0.20	0.0ą0.0
	III	2.2ą0.20	1.2ą0.20	0.4ą0.24
Dehydration Score	I	1.8ą0.20	0.8ą0.20	0.4ą0.25
	II	2.0ą0.00	0.2ą0.20	0.0ą0.00
	III	2.0ą0.00	1.2ą0.20	0.2ą0.20

Table 5. Mean haemato-biochemical changes in group I (5) calves (Cotrimazine @ 15 mg / kg b. wt.)

(MeanąS.E.)

Parameter	Day 0	Day 3	Day 7
Glucose (mg/dl)	44.21ą1.42	46.13ą1.45	51.05ą0.83
Total protein (g/dl)	6.97ą0.13	6.51ą0.14	6.26ą0.16
Albumins (g/dl)	3.15ą0.08	2.92ą0.06	2.75ą0.09
Globulins (g/dl)	3.81ą0.05	3.61ą0.07	3.51ą0.07
A: G ratio	0.81ą0.013	0.79ą0.012	0.78ą0.010
Sodium (mmol/L)	115.2ą2.13	120.0ą1.30	123.2ą1.07
Potassium (mmol/L)	5.44ą0.16	5.22ą0.18	4.76ą0.17
Chloride (mmol/L)	96.91ą0.75	98.41ą0.54	99.54ą0.35

shisham leaf may be used safely to treat diarrhoea in animals.

Therapeutic study

Diarrhoeic calves were subjected to close clinical examination. They were dull, depressed, dehy-drated and after recumbent (Fig 5 and 6). *Shisham leaf powder was fed to them after mixing* with water (Fig 7).The data presented in Tables 4 to 7 indicate that shisham leaf powder given orally @ 105g/ 100 kg b. wt. with or without antibiotic therapy was effective for treatment of diarrhoea and recovery in terms of faecal consistency which was better in shisham leaf treatment group as compared to standard antibiotic.

CONCLUSION

The efficacy of paste of shisham leaves in the treatment of diarrhoea is very good with 70% cure, as judged by PRA method. The efficacy was, though, slightly less than allopathic medication,

Table 6. Mean haemato-biochemical changes in group II (5) calves
(Cotrimazine + shisham leaf @105g/100 kg b. wt.)

(Mean±S.E.)

Parameter	Day 0	Day 3	Day 7
PCV (%)	46.00±1.09	38.0±0.63	35.20±0.49
Glucose (mg/dl)	42.92±3.99	51.27±3.59	55.12±3.35
Total protein (g/dl)	6.33±0.19	5.91±0.22	5.69±0.19
A: G ratio	0.83±0.02	0.79±0.02	0.79±0.02
Sodium (mmol/L)	114.2±1.74	122.0±1.82	127.6±1.17
Potassium (mmol/L)	6.30±0.19	5.78±0.10	5.26±0.14
Chloride (mmol/L)	94.34±1.36	97.13±0.81	99.56±1.05

Table 7. Mean haemato-biochemical changes in group III (5) calves
(shisham leaf @105g/100 kg b. wt. alone)

(Mean±S.E.)

Parameter	Day 0	Day 3	Day 7
PCV (%)	46.00±0.63	43.20±1.36	40.40±1.33
Glucose (mg/dl)	47.97±2.18	51.01±1.96	53.67±1.76
Total protein (g/dl)	6.50±0.18	6.25±0.14	5.99±0.12
A: G ratio	0.87±0.03	0.83±0.03	0.82±0.03
Sodium (mmol/L)	114.00±1.67	116.40±1.50	121.40±1.29
Potassium (mmol/L)	6.08±0.11	5.84±0.15	5.52±0.18
Chloride (mmol/L)	92.26±1.59	95.30±0.91	98.17±1.99

but considering other parameters such as cost-effectiveness , availability, and safety, it's use seems to be promising especially when given along with allopathic treatment. Experimental toxic study results also showed that shisham leaves is safe to the animals for use as oral drench even at higher dose than that used for treatment of diarrhoea. Further studies involving clinical trial on various types of diarrhoeic animals and active ingredient identification / analysis are required to confirm the findings.

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Code :281

Title of the ITK :Diarrhoea control in cow

Description of the ITK :Use of sapota fruit and jackfruit leaves to control diarrhoea in livestock particularly cow is under practice in a village in West Bengal. About 4–5 unripe sapota (Achras zapota) fruits are crushed with one teaspoonful of common salt. This mixture is placed on a banana leaf and fed to the cattle to stop diarrhoea. Another practice to stop diarrhoea is the use of jackfruit (Atrocarpus heterophyllus) leaves instead of sapota fruits. For four doses, the cost of sapota is Rs 4 and salt is Re 1.

Name and address of the discloser **:Ms. Saroja Bala Manna, Bahichard, Naikuri, Midnapore** (West Bengal) 721 627

Location of use of the ITK :Bahichard, Naikuri, Midnapore (West Bengal) 721 627

Geographical indicators :Common name : Jack fruit

Botanical name : Artocarpus heterophyllus

Family : Moraceae

Description

Tree 50 feet or more, trunk straight; leaves elliptic to obovate, 4 to 8 inches long, stiff and glossy, entire; flowers borne on trunk and thick branches, male spikes cylindrical or club-shaped, 2 to 4 inches long; fruit oblong, 1 to 2 feet long, greenish-yellow, turning brownish, covered with hard points.

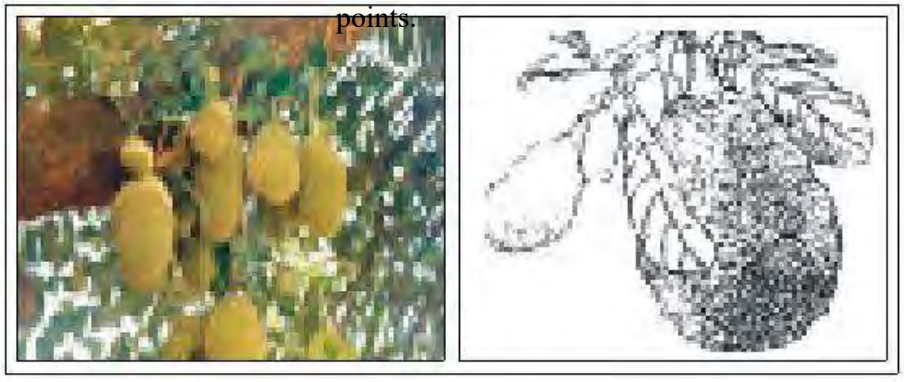


Fig. 1. View of jack fruit

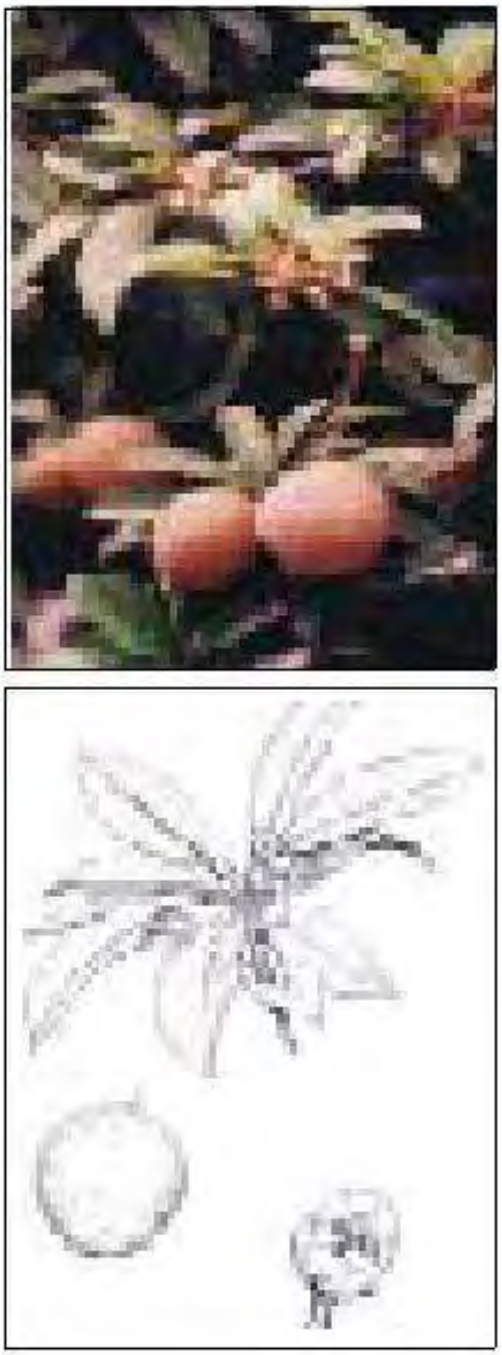


Fig. 3. View of sapota A & B

Origin

India or Malaysia.

Growth habits:Evergreen tree, 60 feet tall (18 m) or more

Common name : Sapota

Botanical name : Achras zapota

Family : Sapotaceae

Description

The sapodilla is a fairly slow- growing, long-lived tree, upright and elegant, distinctly pyramidal when young; to 60 feet (18 m) high in the open but reaching 100 feet (30m) when crowded in a forest. It is strong and wind-resistant, rich in white, gummy latex. Its leaves are highly ornamental, evergreen, glossy, alternate, spirally clustered at the tips of the forked twigs; elliptic, pointed at both ends, firm, 3 to 4½ inch (7.5 – 11.25 cm) long and 1 to 1½ inch (2.5–4 cm) wide. Flowers are small and bell - like, with 3 brown - hairy outer sepals and 3 inner sepals enclosing the pale-green corolla and 6 stamens. They are borne on slender stalks at the leaf bases. The fruit may be nearly round, oblate, oval, ellipsoidal, or conical; varies from 2 to 4 in (5–10 cm) in width . When immature it is hard, gummy and very astringent. Though smooth - skinned it is coated with the sandy brown scurf until fully ripe. The flesh ranges in color from yellowish to light - or dark - brown or sometimes reddish - brown ; may be coarse and somewhat grainy or smooth ; becomes soft and very juicy, with a sweet flavor resembling that of a pear. Some fruits are seedless, but normally there may be from 3 to 12 seeds, which are easily removed as they are loosely held in a whorl of slots in the center of the fruit. They are brown or black, with one white margin ; hard, glossy; long oval, flat, with usually a distinct curved hook on one margin; and about ¼ inch (2 cm) long.

Origin and distribution

The sapodilla is believed native to Yucatan and possibly other nearby parts of southern Mexico, as well as northern Belize and Northeastern Guatemala. In this region there were once 10,00,00,000 trees. The species is found in forests throughout Central America where it has apparently been cultivated since ancient times. It was introduced long ago throughout tropical America and the West Indies, the

Bahamas, Bermuda, the Florida Keys and the southern part of the Florida mainland. Early in colonial times, it was carried to the Philippines and later was adopted everywhere in the Old World tropics. It reached Ceylon in 1802. Cultivation is most extensive in coastal India (Maharastra, Gujarat, Andhra Pradesh, Madras and Bengal States), where plantations are estimated to cover 4,942 acres (2,000 ha), while Mexico has 3,733.5 acres (1,511 ha) devoted to the production of fruit (mainly in the states of Campeche and Veracruz) and 8,192 acres (4,000 ha) primarily for extraction of Chicle as well as many dooryard and wild trees. Commercial plantings prosper in Sri Lanka, the Philippines , the interior valleys of Palestine, as well as in various countries of South and Central America, including Venezuela and Guatemala.

Experimenters :Dr F. R. Sheriff, Director of Extension Education, Tamil Nadu Veterinary and Animal Sciences University, Madhavaram Milk Colony Post, Chennai (Tamil Nadu) 600 051, Dr S .R. Srinivasan, Professor and Head, and Dr S. Thilagar, Professor and Head, Department of Clinics, Madras Veterinary College, Chennai (Tamil Nadu) 600 007

METHODOLOGY

Location

The experiment was conducted in the Department of Clinics, Madras Veterinary College, Chennai to study the use of jackfruit leaf and sapota fruit in controlling diarrhoea in cattle.

Experiment

The diarrhoeic animals (cattle, calf and goat) were subjected to a routine physical and laboratory examination to recognize other signs of illness and eliminate the cases that require treatment other than astringents and intra-venous fluids, wherever necessary. The unripe sapota fruit was smashed with 15 – 30 g salt on a banana leaf and administered orally. Jackfruit tree leaves were collected, shade dried and powdered for oral administration with jaggary . The t reatment schedule was followed for 3 days with oral administration once a day. Blood samples were collected before treatment and on day 3 after the treatment for hemotobio chemical estimation. Sapota fruit as jackfruit leaves were given to calves (n=6) @ 30–60 g/calf and to adults cattle @ 100–150 g each. The doses administered are indicated below.

Dose in g Sapota Jackfruit l eaves: Calves (n-6) 30–60 30–60 Adult cattle (n=18) 100–150 100–150 Clinical signs.

Duration of illness, feed intake, temperature and consistency of dung

Laboratory studies: Leucogram (TC and DC), serum biochemistry (Na, K, and Cl), and culture of dung.

The clinical materials were collected from cases of cattle before and after treatment, wherever feasible . Thus laboratory values for leucogram are available for 14 animals each of



A. Sapota tree



B. Sapota unripe



C. Sapota (unripe) smashed and mix



D. Jackfruit tree



E, F. Jack leaf powder

sapota group and jack group. Serum biochemistry dung culture were undertaken only in jackfruit-leaf group. Values of serum biochemistry are available for 13 cases before and after treatment.

A preliminary study with culture o f dung samples was undertaken for three animals each of normal and diarrhoeic animals. As the growth pattern was uniform in both the cases, the



Fig. 5. Diarrhoeic cow

Table 1. Leucogram in control and treatment groups after therapy

Parameter	Control (n=8)	Sapota (n=14)	Jackfruit (n=14)
Total leucocyte (/ml)	9838 ± 658	12023 ± 1828	10,500 ± 617
Neutrophil (/ml)	3920 ± 351	4988 ± 706	4550 ± 322
Lymphocytes (/ml)	5445 ± 382	6309 ± 887	5476 ± 317
Monocytes (/ml)	230 ± 56	501 ± 399	308 ± 73
Eosinophil (/ml)	242 ± 56	103 ± 51	166 ± 77

parameter was dropped from the study.

The study also included a control group of six healthy animals for comparison of quantitative data.

The study was conducted in 50 cases of diarrhoea in ruminant animals comprising of two treatments groups viz. sapota (unripe) and jackfruit leaves with 25 animals each. Sapota

Table 2. Serum electrolyte value of control and diarrhoeic animals in jackfruit group

Parameter	Control group	Jackfruit group
Sodium (mmol/litre)	114.36 ± 4.25	97.81 ±7.52
Potassium (mmol/litre)	3.96 ± 0.13	3.49 ± 0.13 *
Chloride (mmol/litre)	94.95 ± 2.40	92.62 ± 2.38

group comprised 13 cows, 2 bullocks, 1 buffalo, 4 cow calves and 5 goat /kids. Jackfruit leaves group comprised 15 cows, 6 bullocks and 4 cow calves.

The clinical efficacy of sapota (unripe fruit) and jackfruit leaves in the treatment of diarrhoea was determined. Observations on clinical signs like feed intake and dung characteristics were recorded in all the 25 animals of each group.

The temperature was within the normal range in all animals of this study.

Leucogram was studied in 14 cattle (including cow, bullock, buffalo, and calves) of each group (Table 1). Serum electrolytes were studied in 13 animals of jack leaves group only (Table 2). In these 13 animals of jack group, leucogram and serum electrolyte changes between before and after treatment were also studied.

All the quantitative data were subjected to appropriate statistical analysis viz.CRD or paired 't' test.

RESULTS AND DISCUSSION

Experiment

Treatmentefficacy: The treatment efficacies of sapota (unripe) and jackfruit tree leaves in the cure for diarrhoea were 84% and 88% respectively (Fig. 7). No side - effects were observed in either trials.

Duration of therapeutic response: In sapota group (Fig. 7), 57% animals were cured in 2 days and 29% animals in 1 day only. The other 14% animals required 3 days treatment (Fig. 7). In the jack group, 50% cases each required 1 day and 2 days treatment only.

Clinical signs

Feed intake: In animals treated with sapota (Fig. 3), inappetance, anorexia and normal feeding habits were recorded in 48%, 36% and 16% cases respectively. In the jackfruit group, 76% of the animals had normal feeding habits. The remaining 24% cases had either anorexia (12%) or inappetance (12%) (Fig. 8).

Dung Characteristics: In sapota group (Fig. 4) the dung was loose in 32% cases and watery in 68% cases. It was foul smelling in 36% cases. In jackfruit group, the dung was loose in 60% cases and watery in 40% cases. Foul smelling was observed in 12% cases (Fig. 9.).

Leucogram and serum electrolytes: The total leucocyte count in healthy animals of the control group was 9838 ± 658/ ml. The differential leucocytic counts, viz. neutrophil, lymphocyte,

Table 3. Leucogram and serum electrolyte values before and after treatment in jackfruit group and their comparison with control values

Parameter	Jack fruit group		Control
	Before treatment	After treatment	
Total leucocyte (/µl)	11125 ± 576	10,013 ± 469	9838 ± 658
DC Neutrophil (/µl)	4690 ± 364	3797 ± 238	3920 ± 351
Lymphocyte (/µl)	5793 ± 308	5632 ± 297	5445 ± 382
Monocyte (/µl)	388 ± 111	318 ± 52	230 ± 56
Eosinophil (/µl)	255 ± 115	293 ± 72	242 ± 56
Sodium (mmol/l)	90.59 ± 11.47	109.88 ± 3.65	114.36 ± 4.25
Potassium (mmol/l)	3.34 ± 0.18	3.73 ± 0.15	396 ± 0.13
Chloride (mmol/l)	89.38 ± 2.73	97.95 ± 1.53	94.95 ± 2.40

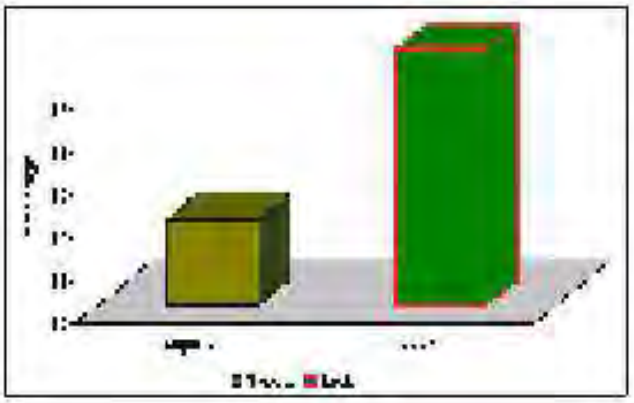


Fig. 6. Treatment efficacy

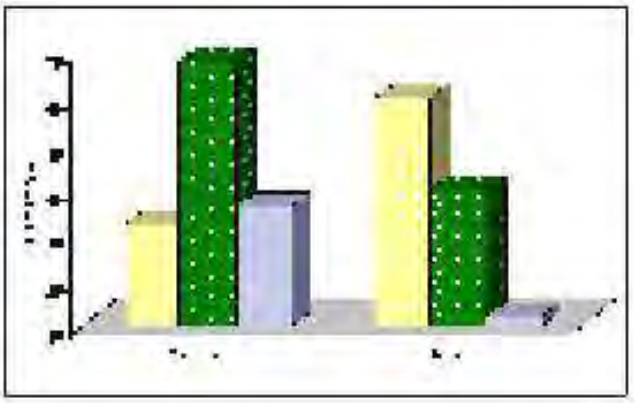


Fig. 9. Dung characteristics

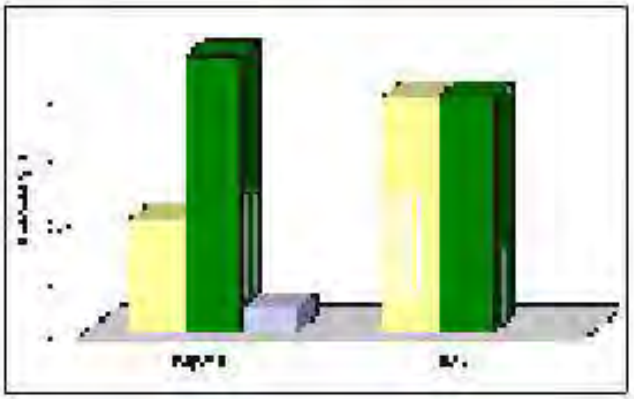


Fig. 7. Speed of therapeutic responses (per cent losses)

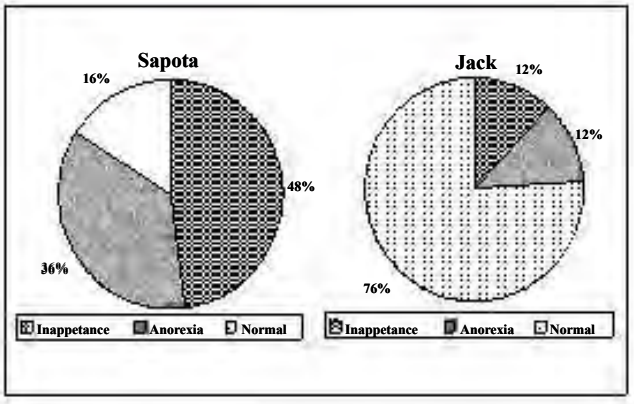


Fig. 8. Pattern of feed intake

monocyte and eosinophil were 3920 ą 351/ ml 5445 ą 382 / ml , 230 ą 56 / ml and 242 ą 56 /ml , respectively. The total and absolute differential leucocyte counts of diarrhoeic animals of sapota and jack did not differ significantly from normal values of control group (Table 1).

The serum electrolytes like sodium, potassium and chloride in the Jack group were 97.81ą7.52 mmolitre, 3.49 ą 0.13 mmolitre and 92.62 ą 2.38 mmolitre respectively. Though the levels were decreased than normal values of control group, there was no significant difference except with potassium (Table 2).

The leucogram and serum electrolytes recorded before and after treatment of jackfruit leaves group did not differ significantly.However, the decreased serum electrolyte levels (when compared with normal values of control group) noted during diarrhoea were found to have raised and approached normal value, recorded in the control group (Table 3).

Though astringent action for the ITKs used in this validation trial could not be traced though the literature, the action could be attributed to the availability of latex or gum in the plants, sapota or jackfruit tree. The dried exudates from the root of jack tree was reported to possessing astringent property may be considered as a supporting point for the efficacy of ITKs used in this validation trial.

A slightly higher efficacy and speed of response observed with jackfruit leaves trial could be related to a lesser degree of digestive dysfunction noted in this group than in sapota group. The normal feeding habits, loose instead of watery dung and non - smelly faeces are considered as evidences of lesser degree of digestive dysfunction.

A non-significant difference between the leucogram of diarrheic animals and healthy,

animals was indicative of non-infective diarrhoea. Absence of pyrexia can supports this inference. The decrease in the serum levels of sodium, potassium and chloride in diarrhoeic animals before treatment and their rise to normal value after recovery from diarrhoea suggested that there was loss of electrolytes in diarrhoeic faeces, which is a usual pathogenesis in diarrhoea. The non-significant decrease of serum electrolyte (except potassium) could be attributed to the short duration of illness (1-3 days) before the time of presentation to veterinary aid.

CONCLUSION

The claim of the ITK discloser and the results of the validation trial are in total agreement. The cost of one dose of sapota was Rs 10 and the total cost for the course of the treatment was Rs 20-45. The cost of one dose of jackfruit leaves was Rs 30 and the total cost for the course of the treatment was Rs 30-75.

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Code	**:**	**1280**
Title of the ITK	**:**	**Use of wood fruit (bael) to check diarrhoea in animals**
Description of the ITK	:	Wood apple (bael) might be having anti-diarrhoea ingredient. Juice of wood apple is mixed with water and is drenched to the animals suffering from diarrhoea, 2-3 times a day. Treatment per animal costs Rs 15 to 20. The animal is cured in 2-3 days. This practice is in use in many villages of Budaun, Shahjahanpur and Bareilly of Uttar Pradesh.
Name and address of the discloser	:	Ms. Husan Afjal, Primary School Teacher, C/o Late Ilyas Fatima, Mohalla Vedon Tola, Bund Gali, Baduan (Uttar Pradesh).
Location of use of the ITK	:	Animal owners of many villagers of district Budaun Shahjahanpur and Bareilly (Uttar Pradesh) use juice of wood apple in animals with drenching them with good results. Treatment cost per animals is Rs 15 to 20.
Experimenters	:	Dr. D. Swarup, Head, Dr. N. N. Pandey, Principal Scientist and Dr. D. B. Mondal, Scientist, Division of Medicine, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122

METHODOLOGY

Location

Field survey was done in villages of Badaun, Shahjahanpur and Bareilly, and experimental studies were conducted in Division of Medicine and LPR (C&B), Indian Veterinary Research Institute, Izatnagar and with the help of Grameen evam Krishi Vikas Samiti, Haldwani.

PRA and field study

By making visits to a number of villages of District of Budaun, Shahjanpur and Bareilly (Uttar Pradesh) a total of 20 key informants were contacted and the information collected were analysed on a 10 score ranking by PRA matrix method.

Bael (wood apple) is used extensively in human medicine. The medicinal virtues of bael are described in the Charaka Samhita, written in 700 bc. The half-ripe fruit is known to have astringent property, which reduces irritation in the digestive tract and is excellent for diarrhoea and dysentery. The full-grown fruit (when it just begins to ripen) is best for medicinal purposes (Kindersley, 1996). Liquid extract of bael prepared from dried slices of unripe fruit is given @ 1-2 drachms. Powder of dried pulp, kept in airtight bottles is administered 20 grains - 2 drachms. Bael is useful as an adjunct after treatment of bacillary dysentery. The unripe fruit is cut in slices and sun dried or roasted and made into powder to be given in chronic diarrhoea and dysentery in children when there is no fever (Nadkarni, 2000).

Experiment

The un-ripped bael fruits of medium size just before ripening were collected, its hard covering removed and fruit was sliced. The fruit slices were shade dried. The dried slices were powdered using



Fig. 1. Bael tree



Fig. 1. Bael tree



Fig. 1. Bael tree

electric grinder. The powder was stored in a plastic container for use (Fig. 1, 2 and 3). The schedule adopted in diarrhoea animals for validation of ITK in clinical cases is given in Table 1. The blood samples were collected before (day

TABLE 1. DESIGN OF THERAPEUTIC TRIAL

Location

Field survey was done in villages of Badaun, Shahjahanpur and Bareilly, and experimental studies were conducted in Division of Medicine and LPR (C&B), Indian Veterinary Research Institute, Izatnagar and with the help of Grameen evam Krishi Vikas Samiti, Haldwani.

Therapeutic agent	Group(n=5)	Dose regimen	Duration (3 days)
Standard therapy (Cotrimazine)	I	15 mg/kg b.wt.	Twice daily
Standard therapy + bael fruit powder	II	15 mg/kg b.wt. + 24 g/100 kg b.wt.	Twice daily
Bael fruit powder	III	24 g/100kg b.wt.	Twice daily
Standard therapy + bael fruit powder	IV	15 mg/kg b.wt. + 16 g/100 kg b.wt.	Twice daily
Bael fruit powder	V	16 g/100 kg b.wt.	Twice daily

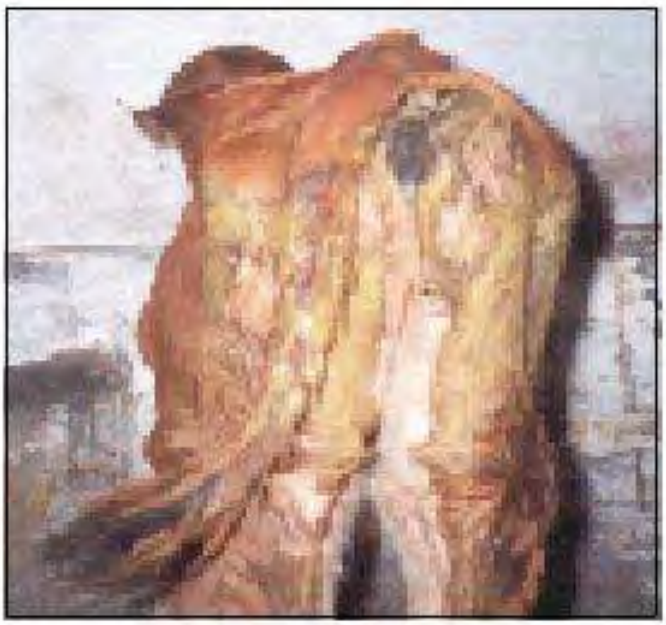


Fig. 4. A calf with soiled back due to diarrhoea



Fig. 5. Dull and depressed diarrhoeic calf in recumbency

Criteria	*Bael* fruit juice	*Allopathic* medicine
Extent of cure (fully)	08	09
Duration of treatment (days)	04	03
Time taken for full recovery (days)	07	05
Cost effectiveness	07	04
Availability	09	05
Safety	10	06

0) and after administration of the treatment (day 3 & 7) and analyzed for different biochemical parameters. The diarrhoeic animals were kept under close observations and their clinical signs were recorded (Fig. 4 and 5).

RESULTS AND DISCUSSION

PRA and field study

Based on PRA exercice it was observed that the treatment with bael juice was efficacious

Table 2. Mean haemato-biochemical changes in group I (5) calves (Cotrimazine @ 15 mg / kg b. wt.)

(MeanąS.E.)

Parameter	Day 0	Day 3	Day 7
Glucose (mg/dl)	44.21ą1.42	46.13ą1.45	51.05ą0.83
Total protein (g/dl)	6.97ą0.13	6.51ą0.14	6.26ą0.16
Albumins (g/dl)	3.15ą0.08	2.92ą0.06	2.75ą0.09
Globulins (g/dl)	3.81ą0.05	3.61ą0.07	3.51ą0.07
A: G ratio	0.81ą0.013	0.79ą0.012	0.78ą0.010
Sodium (mmol/L)	115.2ą2.13	120.0ą1.30	123.2ą1.07
Potassium (mmol/L)	5.44ą0.16	5.22ą0.18	4.76ą0.17
Chloride (mmol/L)	96.91ą0.75	98.41ą0.54	99.54ą0.35

Table 3. Mean haemato-biochemical changes in group II (5) calves (Cotrimazine @ 15 mg / kg b. wt. and *bael @ 24 g / 100 kg b. wt.)*

(MeanąS.E.)

Parameter	Day 0	Day 3	Day 7
PCV (%)	44.0ą1.41	37.6ą0.75	34.8ą0.49
Glucose (mg/dl)	45.53ą2.02	55.15ą1.69	61.56ą0.81
Total protein (g/dl)	7.13ą0.31	6.39ą0.09	6.17ą0.08
Albumins (g/dl)	3.21ą0.13	2.85ą0.02	2.72ą0.04
Globulins (g/dl)	3.92ą0.17	3.53ą0.07	3.49ą0.06
A: G ratio	0.81ą0.005	0.80ą0.013	0.77ą0.018
Sodium (mmol/L)	113.8ą2.42	122.8ą0.97	128.2ą1.11
Potassium (mmol/L)	5.04ą0.17	4.72ą0.17	4.22ą0.12
Chloride (mmol/L)	96.19ą1.80	98.61ą1.41	101.49ą1.01

Table 4. Mean haemato-biochemical changes in group III (5) calves (Bael powder @ 24 g/100 kg b. wt.)

(MeanąS.E.)

Parameter	Day 0	Day 3	Day 7
PCV (%)	46.0ą2.10	40.0ą1.55	35.6ą1.16
Glucose (mg/dl)	47.77ą1.72	54.77ą0.92	58.02ą1.29
Total protein (g/dl)	6.82ą0.33	6.57ą0.26	6.23ą0.11
Albumins (g/dl)	3.16ą0.14	3.00ą0.11	2.75ą0.06
Globulins (g/dl)	3.66ą0.19	3.55ą0.14	3.47ą0.06
A: G ratio	0.86ą0.010	0.83ą0.007	0.79ą0.013
Sodium (mmol/L)	113.6ą2.21	119.0ą1.00	124.4ą1.16
Potassium (mmol/L)	4.92ą0.16	4.62ą0.15	4.28ą0.11
Chloride (mmol/L)	95.37ą1.52	97.87ą0.98	99.74ą0.68

Table 5. Mean haemato-biochemical changes in group IV (5) calves (Cotrimazine @ 15 mg/kg b. wt. and bael @ 16 g/100 kg b. wt.)

(MeanąS.E.)

Parameter	Day 0	Day 3	Day 7
PCV (%)	46.20 ą 1.48	43.20ą1.02	38.40ą0.75
Glucose (mg/dl)	46.90ą1.28	50.12ą1.22	55.67ą1.52
Total protein (g/dl)	7.14 ą0.20	6.64ą0.15	6.25ą0.16
A: G ratio	0.85ą0.05	0.82ą0.01	0.80ą0.02
Sodium (mmol/L)	113.20ą1.36	117.80ą1.28	122.40ą1.21
Potassium (mmol/L)	5.46ą0.15	4.96ą0.10	4.60ą0.11
Chloride (mmol/L)	93.31ą2.45	97.21ą0.80	99.16ą0.32

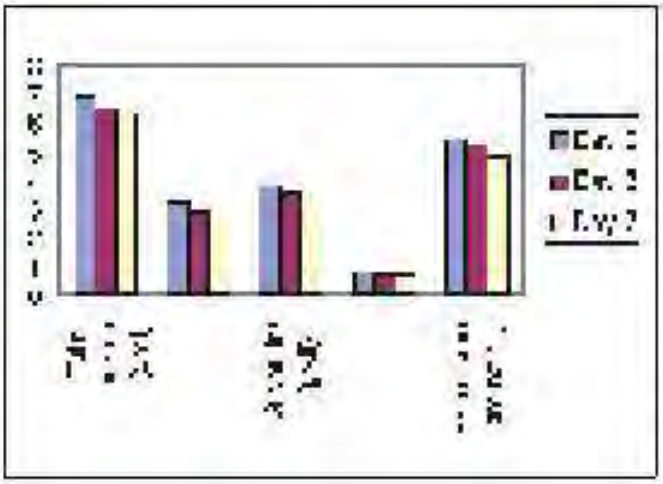


Fig. 6. Haemato-biochemical changes calves treated with bael powder

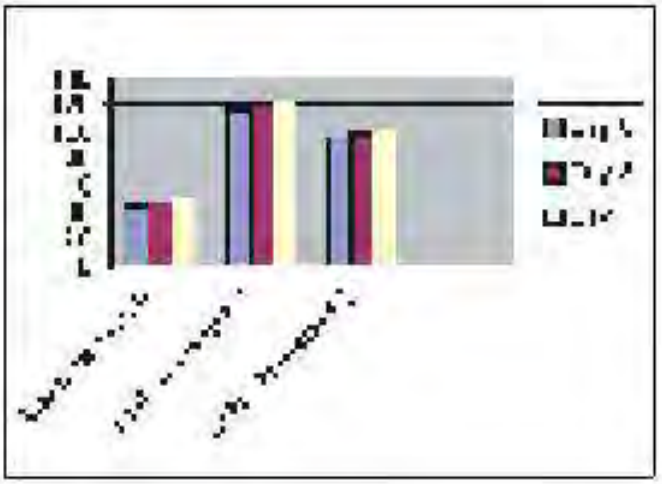


Fig. 7. Biochemical changes after treating with bael powder @ 24 g/100 kg b. wt.

Table 6. Mean clinical profile of group I, II, III, IV and V diarrhoeic calves

(Mean±S.E.)

Parameter	Group	Day 0	Day 3	Day 7
Faecal consistency score	I	2.2±0.20	1.0±0.31	0.0±0.0
	II	2.0±0.31	0.0±0.0	0.0±0.0
	III	2.6±0.25	1.2±0.2	0.0± 0.0
	IV	2.2±0.37	0.8±0.58	0.0±0.0
Depression score	I	1.4±0.25	0.8±0.49	0.4±0.25
	II	1.4±0.24	0.4±0.25	0.0±0.0
	III	2.0±0.00	0.8±0.37	0.2±0.2
	IV	2.0±0.32	1.0±0.32	0.2±0.2
Dehydration score	I	1.8±0.20	0.8±0.20	0.4±0.25
	II	1.4±0.24	0.2±0.20	0.0±0.0
	III	1.80±0.37	0.2±0.20	0.0±0.00
	IV	1.8±0.2	0.8±0.2	0.2±0.2

(80%) in treatment of diarrhoea in animals. The allopathic treatment was, however, more effective (90%) in bringing faster recovery. In terms of cost effectiveness, availability and safety, bael has superiority over allopathic treatment.

Experiment

Data of the trial in respect of validation study of ITK in diarrhoeic calves are shown in Tables 2–6 and Figs 6 and 7. It was observed that clinical recovery based on faecal consistency, depression and dehydration score was more prominent in calves of group II, which showed (near normal health) by day 3 of treatment. Similar recovery rate was noticed in this group in respect to parameters like PCV, blood glucose, total protein, A/G ratio, sodium, potassium and chloride. Considering clinical and haemato-biochemical

profile, observed in experimental method of validation, bael given along with standard allopathic treatment was found effective in hastening the recovery in diarrhoeic calves as compared to bael or allopathic treatment given alone.

CONCLUSION

Juice of bael fruit is highly effective (80%) in treatment of diarrhoea as judged by PRA tools. It is less effective as compared to allopathic treatment but it is easily available locally, less costly and does not have any adverse effect. No knowledge is available for its use, if given along with allopathic treatment as supportive therapy.

Results of the experiment on ITK in diarrhoeic calf undertaken so far indicate that bael powder used along with allopathic treatment was efficacious. Validation of the ITK, undertaken so far relates to bacterial diarrhoea only.

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Code : 1596

Title of the ITK : Root of daydhapara as an anthelmintic agent

Description of the ITK : Roots of daydhapara is used as an anthelmintic agent in animals. In this practice, the roots of daydhapara are dug out from earth and washed. It is then pressed and minced and given to the animals after mixing with salt and water orally for 2–3 days. This is century old practice which is having 70% success rate, and is adopted by some farmers in the Banpur village of Lohardaga district in Jharkhand. About 50% animals are affected with gastro-intestinal worms in this village.

Name and address of the discloser : **Shri R.K.Jha,Research Associate,Department of Fisheries** Ranchi Veterinary College, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

Location of use of the ITK : Banpur, Jori, Kisko, Lohardaga (Jharkhand)

Experimenter : Dr B. K. Roy, Associate Professor, Department of Pharmacology and Toxicology, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

The experiment was conducted in village Banpur, P.O. Jori, block Kisko, dist. Lohardaga (Jharkhand).

PRA and field study

PRA tools were used in Banpur village of Lohardaga district in Jharkhand, having 20

Table 1. Performance assessment of root of *daydhapara as anthelmintic agent for cattle, buffalo,* goats and pigs in comparison to allopathicmedicine

Criterion	Paste of root of *daydhapara*	Allopathic *medicine*
Extent of cure	6	8
Cost effectiveness	10	2
Safety	10	6
Influence on milk yield	4	2
Improvement of health	3	4



Fig. 1. Use of root of daydhapara as an anthemintic agent for cattle

respondents to study the effectiveness of practice. The parameters or factors included in the study were: extent of cure, cost effectiveness, safety, influence on milk yield and improvement of health.

Experiment

An experiment was carried out in 20 replicates having two groups of cattle. In the first group of 10 animals, 250 g of root of daydhapara was mixed with 2 spoon salt was administered orally once for 3 days. The stool was examined before and after administration of the paste. In the second group one bolus of panacur to each of 10 affected animals was given once only. The stool was examined after 24 hr of anthelmintic administration. The technical parameters included; extent of worm removal, duration of treatment and milk yield.

RESULTS AND DISCUSSION

PRA and field study

The results given in Table 1 show that the ITK adopted by farmers is very cheap, for which they have scored 10 out of 10. However, they consider that it is less effective as compared to allopathic medicine, and is 100% safe. However, they scored 3 for its effect on milk yield as compared to 4 for allopathic treatment.

Table 2. Effect of paste of root of daydhapara mixed with salt and allopathic medicine in worm elimination in cattle

Days after Treatment	Paste of daydhapara (% effectiveness)	Panacur (% elimination)
1	10	80
2	15	-
3	20	-

Experiment

Result presented in Table 2 show that the ITK material removed 10% of helminthes after 1 day treatment which increased to 20% after three days of the treatment. However, the allopathic medicine after single dose removed 80% of the helminthes from gastrointestinal tract. In fact, 100% of elimination of helminthes is not desirable by an anthelmintic; only 80% removal of helminthes is ranked excellent and below 60% elimination by an anthelmintic agent is ranked poor.

CONCLUSION

The juice of daydhapara mixed with salt removed only 20% helminthes after 3 days of treatment, indicating its low effectiveness corroborating the finding of the field study. ❑

Code	:	**1182**
Title of the ITK	:	**Use of *amaltas (Cassia fistula)* fruits in flatulence in animals**
Description of the ITK	:	Flatulence is a serious disease of the animals occurring during rainy season, generally by heavy grazing and overeating of grasses. To control the disease the farmers of Uttar Pradesh prepare a mixture of madar and amaltas fruits with garlic, ajwain, black pepper and mustard oil and give this mixture to the suffering animal. To prepare the mixture, *madar and amaltas* fruits, garlic, *ajwain* and black pepper are crushed and then fried in the mustard oil. After cooling, 200 ml per dose is given to the suffering animal. The dose is repeated thrice a day as per the need.
Name and address of the discloser	:	Shri Ranjay Kumar Singh, C/o Dr C. B. Singh, Dean, College of Agriculture, JNKVV, Adhartal, Jabalpur (Madhya Pradesh) 482 004
Location of use of the ITK	:	This ITK is in use in Bundelkhand region of Banda district in Uttar Pradesh
Experimenters	:	Dr D. Swarup, Head and Dr Reena Mukherjee, Scientist (SS), Division of Medicine; Dr Mahesh Chander, Sr Scientist, Division of EE, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122

METHODOLOGY

Experimental study was conducted at Indian Veterinary Research Institute, Izatnagar. Field study was carried out in Terahi and Sonrahi villages of Tindwari block in Banda district of Uttar Pradesh, from where it was reported to be in use.

PRA and field study

The information was obtained from three key informants, viz. Gram Pradhan, Veterinary Officer and Forest Guard. These key informants conveyed that the *amaltas* known as *kilwar* and none in the villages was aware it by name *amaltas*. Twenty farmers were enquired about its use (knowledge and practice) in flatulence. The ITK was known by 12 farmers and practised by 3. The use of



Fig. 1. *Amaltas* tree

amaltas in flatulence was reported effective by 2 farmers.

The technology is not much in use nowadays, perhaps due to declining number of amaltas trees and also improved availability of allopathic alternatives for the ailment. The farmers belonging to very poor economic conditions were found to be using it.

Table 1. Anthelmintic potential of amaltas fruit in calves: mean eggs per gram in buffalo calves

Days PT	Gr I	Gr II	Gr III
0	826	880	790
7	785	659	591
15	802	592	480

Experiment

Pods were collected from the institute campus. Shed–dried seeds and shade-dried pulp were weighed. Anthelmintic activity of the seeds and pulp was evaluated by of faeces in 36 calves at LPM section of cattle and buffalo farm, Indian Veterinary Research Institute, Izatnagar, before and after treatment. The clinical trial was conducted by taking standard treatment as control.

RESULTS AND DISCUSSION

The results obtained are presented in Tables 1 and 2.

Gr I: Positive control, not given any treatment; Gr II: negative control given standard conventional anthelmintic drug as per the standard schedule; and

Gr III: Calves given amaltas fruit or seeds @ 20 g/calf/day for 21 days.

The reduction of EPG was 32% in standard conventional therapy and 41% in amaltas-treated calves.

The standard conventional treatment gave 100% recovery within 3 hours of drench. The herb was not effective in reducing the flatulence or bloat in animals.

Table 2. Efficacy of amaltas fruits against flatulence or bloat in animals

Treatment	No of animals	Quantity of product used	Duration of treatment	Remarks
Conventional treatment	6	As per the standard schedule	-	Effective in reducing the bloat
Amaltas fruit or seeds drenched along with hot water	*5*	*150–170 g/animal*	Drenched twice at an hour/interval	The therapy is not effective

CONCLUSION

Amaltas was effective as anthelmintic in calves. However, it was not effective in reducing flatulence or bloat in animals. ❑

Code : **1581**

Title of the ITK : ***Garkati* disease in animals and its treatment**

Description of the ITK : *In garkati* disease, inner part of the tongue gets swollen and the cattle do not take feed and drinking water, that results into death of cattle. For its treatment, farmers of village Asanbera of Thethaitangar block in Simdega district of Jharkhand use *olekand*, tamarind, salt, carbon, fat of pig and sindur. First, swollen tongue is touched by the hot iron rod, then 200 g *olekand*, 20 g tamarind and salt each and 10 g carbon are powdered, mixed, and fed to the affected animals. After that pig fat and *sindur* (vermilion) is rubbed on the tongue. Then water is given to drink. One treatment is enough to cure *garkati*. This indigenous treatment is being used by the farmers for the last several years without any modification. The disease generally prevails in June and July in 5% of the cattle. The traditional method cures 40% of cases.

Name and address of the discloser : Shri Anjelus Kerketta, Asanbera Kathartoli, Simdega (Jharkhand) 835 235

Location of use of the ITK : Village Asanbera, Post Thethai Tangar, Simdega (Jharkhand)

Geographical indicators : *Amorphophallus campanulatus* is a stout herbaceous plant with an underground corn, which is hemispherical.

Experimenter : Dr B.K. Roy, Associate Professor, Department of Pharmacology, Veterinary College, Birsa Agricultural University, Ranchi (Jharkahand) 834 006

METHODOLOGY

Location

The experiment was conducted village Asanbera, P.O. Thethai Tangar, dist. Simdega (Jharkhand).

PRA and field study

Field study was conducted using PRA tools with 20 respondents. The reported ITK was compared with recommended allopathic medicine on selected parameters/factors, viz. extent of cure, duration of treatment, cost effectiveness, regaining in milk yield, draught power, and safety.

Experiment

The experiment had 20 replications with two



Fig. 1. Treatment of *garkati/simla* with olekand

treatments, viz. T_1= mixture of *olekand* (200 g), *imali* (20 g), salt and carbon, prepared and fed once daily to the affected animals for 2 days; and T_2=analgesic (oxalgin bolus), one bolus once daily for 3 days was given to the affected animals with tetracycline (one bolus twice daily for 3 days) and Vitamin- B complex (10 ml) once daily for 3 days. In each treatment there were 10 animals.

RESULTS AND DISCUSSION

PRA and field study

Data given in Table 1 show that the extent of cure by ITK method was less as compared to with that by allopathic medicine. The ITK adopted by the farmers was safer and cheap as compared to allopathic medicine. However, the farmers believed that the draught power after treatment with ITK method was marginally decreased as compared to allopathic medicine. These data also showed that farmers were confident with their own method of treatment.

Table 1. Matrix scoring for assessment of effects of olekand, imli, salt and carbon (ITK) vis-à-vis allopathic medicine in treatment of *garkati/simla* in cattle.

Criterion	Olekand + *imali* + salt and carbon	Allopathic medicine
Extent of cure	7	9
Duration of treatment	2	4
Cost effectiveness	10	4
regaining in milk yield	6	4
Draught power affected	3	6
Safety	8	4

Experiment

The cases were identified in the village from where the ITK was reported. Data in Table 2 show that 80% cases of *simla*-affected animals recovered within 3 days after treatment with ITK materials. However, after allopathic treatment 90% of cases were cured and 10% of animals died, most probably due to suffocation because there was huge swelling around the neck. It was very interesting to note that before adopting the ITK some of the veins below tongue were broken by farmers with needle. An animal developed *surra* after being affected with *simla* and died even after proper treatment during the experiment.

Table 2. Effect of methods of treatment on cure of *garkati/simla* in cattle

Days after treatment	ITK method (% cured)	Allopathic method (% cured)
1	1/10 (10)	2/10 (20)
2	2/10 (20)	4/10 (40)
3	8/10 (80)	9/10 (90)

CONCLUSION

The ITK was found to be effective by 80% which was 90% for allopathic treatment. In both the systems of treatment some of the animals died either due to development of *surra* or haemorrhagic septicaemia.

Code	:	**1285**
Title of the ITK	:	**Treatment of hemorrhagic septicaemia by *kala jeera***
Name and address of the discloser	:	Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia, Jamia Nagar, New Delhi 110 025
Description of the ITK	:	This method which is practiced in many villages of Badaun and Bareilly districts of Uttar Pradesh is very effective to cure the disease, if the treatment is done at the initial stage of disease. Paste of ***kala jeera*** is applied on the throat of HS affected animal.
Location of use of the ITK	:	Badaun district is located in western Uttar Pradesh India. The climate is semi-arid, hot and sub- humid type, suitable to occurrence of Hemorrhagic septicemia in large ruminant. Animal husbandry is a supporting business to native farmers along with agricultural farming, by keeping 3-6 buffaloes. They were fully aware about the disease Hemorrhagic septicaemia in large animals, its clinical symptoms, fate and conventional therapy. The farmers were having education of metric to high school level.
Experimenters	:	Dr V.S. Vihan, Head, Dr Ashok Kumar, Senior Scientist and Dr Rajneesh Rana, Senior Scientist, Animal Health Division, Central Institute for Research on Goats, Makhdoom, Farah, Mathura (Uttar Pradesh)

METHODOLOGY

Location

Field survey was done through PRA in 11 villages of Badaun district. Experimental studus were done at the Animal Health Division of Central Institute for Research on Goats, Makhdoom (Mathura).

PRA and field study

Total 11 villages of Badaun district were visited for this study, viz. Binavar, Silhary, Ghatpuri, Malgaon, Ikram Nagar, Ajhauli, Giddharpur, Ivahe, Naushera, Rasoolpur and Natoi. In these villages total 40 farmers were interviewed thoroughly over various aspect of the disease, i.e. disease occurrence, symptomatology, stage for treatment, efficacy of different combination of therapy including herbal drugs, method of local formulation, drug administration convenience, supportive therapy practised, accessibility, availability and sustainability of the treatment approach. Only 27 farmers responded to our questionnaire. The scoring pattern was kept from 0 to 10 as applicable to each parameter. The seven major criteria were selected for analysis were efficacy, treatment stage, cost effectiveness, application convenience, accessibility, avail-ability, sustainability using different treatment approaches such as *kala jeera,* veterinary drugs, and veterinary drugs and *kala jeera* (Table1).

Experiment

Experiments were conducted to find out

Table 1. Criteria for assessment of different treatment approaches

Criterion	Treatment approach
Efficacy	*Kala jeera*
Treatment stage	Veterinary drugs
Cost effectiveness	Veterinary drugs + kala jeera
Application convenience	
Accessibility	
Availability	
Sustainability	

antibacterial property of *kala jeera* against causative agent of haemorrhagic septicaemia. Methonolic and ether extracts of seed were prepared by Soxhlet extraction method with yield of 17.98% and 5.40% respectively. These extracts were further tested for the presence of active principal, which revealed that both types of extract were positive for phenol only and negative for glycoside and alkaloid. *Pasteurella multocida* B: 2 culture was procured from Division of Standardization, IVRI, Izatnagar and was regularly maintained at Goat Health Division, CIRG. On initial experimentation, both types of extract were tested at lower concentration, viz. 2 mg, 1 mg, 0.5 mg, 0.25 mg per disc. The *in vitro* results revealed that only in ether extract the concentration of 2 mg and 1 mg had inhibition zone of 13 mm and 12 mm respectively.

In second phase, antibiogram profile study was conducted on alcohol and ether extract of *kala jeera* along with several other antibiotics. For this study Mueller Hinton (MH) medium was used with slight modifications. *Pasteurella multocida* P_{52} strain was used. Sterile discs were adsorbed with 32 mg, 16 mg, 8 mg, 4 mg and 2 mg of methanol and ether extract of *kala jeera*. One disc for each methanol and ether was prepared separately as a control. The MH plates, streaked with *P. multocida* and all those discs that were adsorbed with different concentrations of *kala jeera* extract and control disc were placed over media. Plates were kept at 37°C for 14 hr incubation.

RESULTS AND DISCUSSION

PRA and field study

The results of matrix ranking are given in Table 2. This ITK is in practice in opinion of 55% farmers, infrequently used in 19% and not in practice in opinion of 26%. Local practitioners and animal owners use only this ITK, however, it is not practised by trained pharmacists and qualified veterinary officers. The respondent's opinion regarding the three different treatments on efficacy had no difference. Treatment efficacy with veterinary drugs (VD), and veterinary drugs and *kala jeera* (VD+KJ) was found significantly better than local application of *kala jeera* (KJ) alone. Efficacy between veterinary drugs (VD), veterinary drugs + *kala jeera* (VD+KJ) was not significantly different. In all cases the treatment was effective only in early stage of the disease. *Kala jeera* application was cheaper as compared to veterinary drugs. Application convenience of *kala jeera* was better than veterinary drugs.

Table 2. Matrix ranking of farmer's opinion about three different treatment approaches (t-test, mean ±SE)

Treatment	Efficacy	Treatment stage	Cost effiectiveness	Application con -venience	Accessibility	Availability	Sustainability
KJ	2.59±1.10^{a}	1.93±1.05^{a}	9.19±1.01^{a}	8.82±1.02^{a}	9.12±1.02^{a}	9.30±1.02^{a}	3.92±1.06^{a}
VD	7.2±1.08^{b}	2.54±1.04^{ac}	5.32±1.05^{ac}	5.33±1.05^{ac}	3.20±1.00^{b}	6.66±1.04^{ac}	7.71±1.03^{ac}
VD+KJ	8.44±1.03^{b}	2.78±1.04^{c}	5.38±1.04^{c}	5.16±1.04^{c}	5.20±1.04^{b}	6.77±1.04^{c}	8.39±1.06^{c}

KJ, *Kala jeera*; VD, veterinary drugs.



Fig. 1. Seeds of *kala jeera*



Fig. 2. Antibiogram study of *Kala jeera* ether extract (A1- 2mg, A2-1mg, A3-0.5 mg, A4-0.25mg per disc) and Methonolic extract (B1, B2, B3, B4) in similar concentration, with standard antibiotic

Accessibility and availability of *kala jeera* was easier than of veterinary drugs. Treatment with veterinary drugs, and veterinary drugs and *kala jeera* was sustainable than with *kala jeera* alone.

In the *in-vitro* study, the zone of inhibition was recorded, as given in Table 3.

Except sulphadizine and oxytetracycline, all the antibiotics were found to be sensitive for *Pasteurella multocida* P_{52} culture (Table 4, Fig 2). In first trial, the methanolic extract of KJ, at higher concentration (32, 16 and 8 mg) exhibited lesser inhibitory zone, viz. 12, 11 and 9 mm, respectively as compared to lower concentration (4 mg), which exhibited 32 mm inhibitory zone. Ether extract at 32 and 16 mg exhibited lesser zone of inhibition i.e. of 6 and 9 mm respectively. However, 2 mg concentration showed higher inhibitory zone of 37 mm (Table 4, Fig. 2). In second trial, (Table 5) the inhibitory zone at higher concentration of

Table 3. Antibiogram profile of standard antibiotics using *Pasteurella multocida* P_{52} strain

Standard antibiotics	Zone of inhibition (mm)
Sulphadiazine	0
Oxytetracycline	6
Gentamycin	30
Kanamycin	24
Ampicloxacillin	34
Amoxyclav	24
Chloramphenicol	30
Enrofloxacin	32
Ofloxacin	35
Lincomycin	36
Cefuroxime	37
Erythromycin	24

Table 4. Antibiogram profile of various extracts using *Pasteurella multocida* P_{52} strain in first trial.

Concentration of extract/disc	Zone of inhibition (mm)	
	Mentholic extract	Ehter extract
Control (absorbed with 20 micro ltr solvent)	0	0
32 mg	12	6
16 mg	11	9
8 mg	9	0
4 mg	32	0
2 mg	0	37

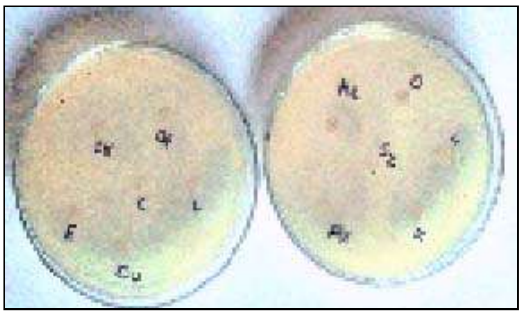


Fig. 3. Antibiogram profile of standard antibiotics using *Pasteurella multocida* P_{52} strain

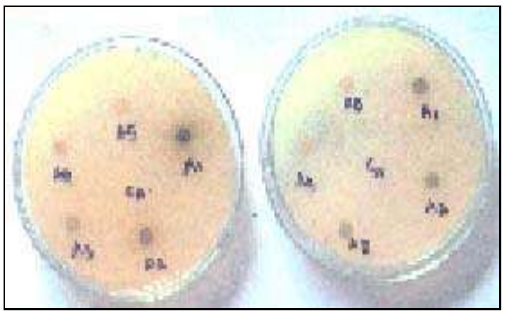


Fig. 4. Antibiogram profile of various methonolic extracts using *Pasteurella multocida* P_{52} strain

methanolic extract (32, 16, 8 and 4 mg) ranged from 16 to 14 mm; however, 2 mg concentration

Table 5. Antibiogram profile of various extracts using *Pasteurella multocida* P_{52} strain in second trial.

Concentration of extract/disc	Zone of inhibition (mm)	
	Methnolic extract	Ehter extract
Control (adsorbed with 20 micro ltr solvent)	0	0
32 mg	16	15
16 mg	15	14
8 mg	15	12
4 mg	14	18
2 mg	10	18

showed 10 mm inhibitory zone. Ether extract at higher concentration (32, 16 and 8 mg) showed lesser inhibitory zone (15, 14 and 12 mm), as compared to lower concentration (4 and 2 mg), which showed higher zone of inhibition (18 mm each).

The *in vitro* study revealed that both methanol and ether extract of *kala jeera* have antibacterial activity. The overall antibacterial effect of both the extracts was exhibited better in lower concentration (4 mg/< 4 mg/disc) than that of higher concentration (> 4 mg/disc). It seems that extracts of lower concentration works better than of higher concentration.

The clinical study was conducted over 5 clinical cases (Table 6), which were precipitated during current mansoon season, in buffaloes suffering with pneumonic pasteurellosis and exhibiting all pathognomic signs of disease, including high rise of temperature respiratory distress, nasal discharge, swelling on throat and

Table 6. Results of clinical study

Clinical diagnosis	Treatment	Outcome
Pneumonic pasteurellosis	Enrofloxacin, Avil, Paracetamol + paste of kala jeera X 3 days	Recovered after 3 days
Pneumonic pasteurellosis	Terramycin, Avil, Paracetamol + paste of *kala jeera* × 3 days	Recovered after 3 days
Pneumonic pasteurellosis	Enrofloxacin, no *kala jeera* paste	Recovered after 5 days
Pneumonic pasteurellosis	Enrofloxacin, Avil, Paracetamol × 5 days, no *kala jeera* paste	Died
Pneumonic pasteurellosis	Terramycin + *kala jeera* paste × 2 days	Recovered after 3 days

complete off fed.

CONCLUSION

In-vitro antibiogram study and limited clinical trial showed that the application of paste of *kala jeera (Veronina anthelmintica)* on swelled throat area in haemorrhagic septicaemia in cattle and buffaloes act as adjunct therapy along with conventionally antibacterial therapy.

Code : **1966**

Title of the ITK : **Use of *bhangariya (Eclipta alba)* to cure blain in animals**

Description of the ITK : To cure the animals from blain, farmers of Sonapur village in Azamgarh district of Uttar Pradesh use paste of *bhangariya*. About 200-250 g of *bhangariya* plant (leaf and stem) is collected from the field and washed before crushing. The paste is fried in 50-60 ml mustard oil. The fried paste is divided into three parts which are used in 3 days after changing the old doses. By this practice, 80-90% of the problem is controlled for cattle, buffaloes and goats. Out of 1200 farmers, 400-500 farmers follow this practice.

Name and address of the discloser : Shri Ranjay Kumar Singh, S/o Shri Haribansh Singh, Village Sonapur, P.O.: Sewta, Azamgarh (Uttar Pradesh) 276 128

Location of use of the ITK : Sonapur, Johanaganj, Azamgarh (Uttar Pradesh) 276 128

Geographical indicators : Botanical name: *Eclipta alba*

English name : Bhringaraj

Family : Asteraceae

Bhringaraj is an annual herb. It is a hardy crop and can be grown in any type of soil. The plant prefers warm climate with a temperature range of 25-35ºC. Bhringaraj contains alkaloid ecliptene. It also contains nicotine and resin. The plant is considered as an astringent and is used for cure of many diseases. Decoction of leaves is used in treatment of hemorrhages.

Experimenter : Dr C.R.Jangde, Associate Professor, Department of Pharmacology and Toxicology, Nagpur Veterinary College, Nagpur (Maharashtra)

METHODOLOGY

Location

The field study was done in Gondiya, Amarawati, Bhandara, Cochiroli, Akola, Chandrapur districts of Vidarbha region in Maharashtra.

PRA and field study

Survey on the knowledge about the use of *bhangariya* in animals was initiated using questionnaire for amongst cattle owners and the farmers.

Experiment

The plant *bhangariya* was collected from some

possible sources and its paste was fried with mustard oil for application on inflammatory swelling in animals.

RESULT AND DISCUSSION

PRA and field study

The survey report indicated that 40-84% of the cattle owners and the farmers of different districts of Vidarbha region had the knowledge about the use of *bhangariya* as a medicinal remedy for animals.

Experiment

Out of 20 animals including cattle, buffaloes and goats, treated with ITK, 9 were cured within 3-10 days of the treatment, indicating the anti-inflammatory effects of the ITK to reduce swelling.

CONCLUSION

Results of limited study indicated that the use of paste of *bhangariya* is effective in controlling inflammatory swelling in animals. ❑

Code : **1281**

Title of the ITK : **Control of bovine mastitis using fermented leaves of *bathua (Chenopodium album)* as topical application**

Description of the ITK : Mastitis is a common ailment especially in high-yielding cattle and buffaloes. It is not only injurious to the animal but also spoils the milk produced by the diseased animal. To control mastitis a few grams of green *Chenopodium album* is boiled in one litre water and the fermentation is used to wash the teats and udder of diseased cattle and buffalo 1-2 times a day. The animal gets relief by this practice, which involves almost no cost. This treatment is followed by the farmers of many villages of Badaun and Bareilly districts of Uttar Pradesh.

Uses

Chenopodium is a plant with multiple uses

As food it is consumed in a number of foodstuffs. The tender shoots are eaten raw as salad or cooked as green vegetable. *Batua ka parantha* is a delicacy in north west India. A sample of 100 g leaves contains 3.7 g protein, 0.4 g fat, 2.9 g carbohydrate, 150 mg calcium, 80 mg phosphorus, 1.74 mg vitamin A, 0.4 mg vitamin B2 (riboflavin), 0.5 mg niacin and 3.5 mg vitamin C. The seeds are cooked like rice or oatmeal or sometime with *dal*. It is also an important source of food for livestock and poultry. As such, it is used in variety of preparations depending on the local taste and preferences.

In medicinal properties it has antiscorbutic, diuretic and nutritive properties. It has been used to treat various symptoms attributable to nutritional deficiencies like anaemia. It is also said to have sedative and anti-refrigerant properties, thus the leaves are also used to soothe burns. Poultice is used as topical application in headache or sunburn. However, no literature was available on use of *Chenopodium* to control mastitis.

Name and address of the discloser : Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education and Extension, Jamia Milia Islamia University, Jamia Nagar, New Delhi 110 025

Location of use of the ITK : This ITK is in use in many villages of Badaun and Bareilly districts of Uttar Pradesh

Geographical indicator

Commonly known as *bathua,* wild spinach, Lamb's-quarters and pigweed, it is a nutritious leafy vegetable of the beetroot and palak family i.e. Chenopodiaceae. *Chenopodium* is a polymorphous, mealy white, erect herb, growing wild up to an altitude of 4,700 m and found throughout India. The herb is common in agricultural field. In the wild, the plant is low growing, but when cultivated, it is tall growing and leafy. The plant has a stem, rarely slender, often angled and striped green, red or purple. The leaves are dull green with a pale pink center. The leaf lamina possesses a waxy coating. Flowers are borne in clusters, forming compact or loosely panicled spikes in axils. The black seeds are slightly smaller than mustard seeds and have sharp margins.

Experimenters : Dr Devendra Swarup, Head, Division of Medicine; Dr Reena Mukherjee, Scientist (SS), Division of Medicine; Dr Mahesh Chander, Senior Scientist, Division of Extension Education; Dr R.S.Rathore, Senior Scientist, VPH Division, Indian Veterinary Research Institute, Izatnagar and Dr Ram Naresh, Scientist, Division of Medicine, Indian Veterinary Research Institute Campus, Mukteshwar (Kumaun)

METHODOLOGY

Location

Field survey was conducted through PRA in nine villages of Bareilly district (Uttar Pradesh). Experimental study including clinical trial was done in the Division of Medicine and LPR (C and B) of Indian Veterinary Research Institute, Izatnagar.

PRA and field study

Nine villages, viz. Khata, Bhandsar, Mudia, Mohanpur, Rithora, Kalapur, Purenatal, Dupeharia, and Manda, were surveyed. However, the use of *Chenopodium* to control mastitis was found only in Purenatal village. Thus the study was restricted to this village only. Out of the 55 farmers contacted across the villages, 15 farmers from Purenatal village were chosen for the PRA study as the rest were not aware or had not used ITK, as they believed that it is effective only in early stages of mastitis and its role is limited to only reduction in swelling. The farmers had good access to veterinary hospital and allopathic and homeopathic medicine in nearby town; thus their dependence on ITK was not much. The use of *bathua* was restricted to only a few farmers with only 2-3 animals.

Experiment

Protocol

In phase I, 9 cows and 6 buffaloes were taken from commercial dairy farms around Rajendranagar and household backyard cattle



Fig. 1. *Chenopodium album*

rearing (Bareilly).

In phase II, 15 lactating cows (5 clinical cases, 9 subclinical cases) were studied at LPR (C and B), IVRI, Izatnagar.

The herb was collected from the local market.

For preparation of the fermented paste, leaves were washed under running water and made to a fine paste in the mechanical grinder. The paste was then put in a closed container for 48_72 hr for fermentation.

About 900 g of leaf paste/cow was thoroughly applied over the quarters and teats of the diseased udder once daily for 7 to 9 days depending upon the clinical recovery. About 10 ml milk was collected in sterile tubes before initiation of the treatment and 10 days after treatment

The parameters studied were:

1. California Mastitis Test (CMT) was carried out before treatment and 10 days after treatment (PT). (Schalm *et al.* 1971). CMT was carried out immediately by the side of the cattle at the time of milking, by mixing equal quantity of milk and CMT reagent.

2. Somatic Cell Count (SCC) was done before treatment and 10 days PT. (Schalm *et al.* 1971). SCC was done by preparing milk smear over the clean microscopic slide and stained by New Man's Lampert stain.

3. Bacterial isolation was done before treatment and 10 days PT (Griffin *et al.* 1974). it was done in bovine blood agar and on Tryticase agar.

Table 1. Comparative performance of the ITK practice, homoeopathy and allopathy therapy in controlling mastitis in animals

Treatments	Swelling control			Recovery		
	24 hr	24-36 hr	36-48 hr	Day 3	Day 4	Day 5
C.album	3	5	6	2	4	6
Homeopathy	4	6	8	4	6	7
Allopathy	6	7	8	6	7	8

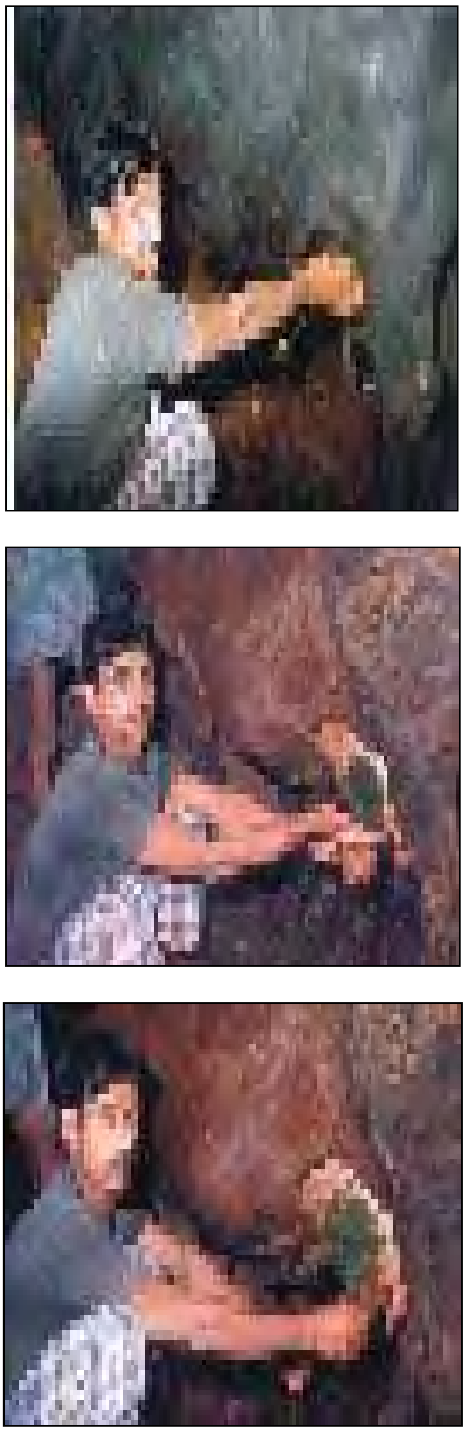


Fig. 2. Application of *C. album* paste on mastitic quarters

Table 2. CMT score in response to the application of *C album* in clinical / subclinical mastitis (cattle)

S. no.	CMT point score	
	day 0	day 10
1*	3+	2+
2*	3+	1+
3**	4+	0
4**	3+	0
5*	2+	1+
6	1+	1+
7	1+	1+
8	1+	0
9	1+	0

CMT(3+& 4+)=clinical mastitis; CMT (1+& 2 +) = subclinical mastitis; *cows treated with vit E/selenium and lime; **cows treated with enrofloxacin, CMT point scores reduced to normal in 50% cases in response to treatment with *bathua* leaves paste.

Table 3. Somatic cell count in response to *C. album* treatment in clinical or subclinical mastitis (cattle)

S. no.	SCC X 10^5 cells/ml of milk	
	Day 0	Day 10
1	48	31
2	46	19
3*	57	-
4*	53	-
5	26	17
6	13	14
7	17	11
8	21	9
9	19	12

*Clinical mastitis cases shifted to standard antibiotic treatment. Significant reduction in SCC was observed on 10 days after treatment with *bathua* leaves application in inflamed udder.

RESULTS AND DISCUSSION

PRA and field study

Matrix was developed to compare the efficacy of *C. album* in terms of reduction in swelling of affected quarters (hours after treatment), as also in terms of recovery in days after treatment (PT) in comparison to homoeopathic and allopathic treatments with which farmers were well acquainted. The farmers were asked to assign scores out of 10 to represent the utility of *C. album* as compared to allopathic and homoeopathic

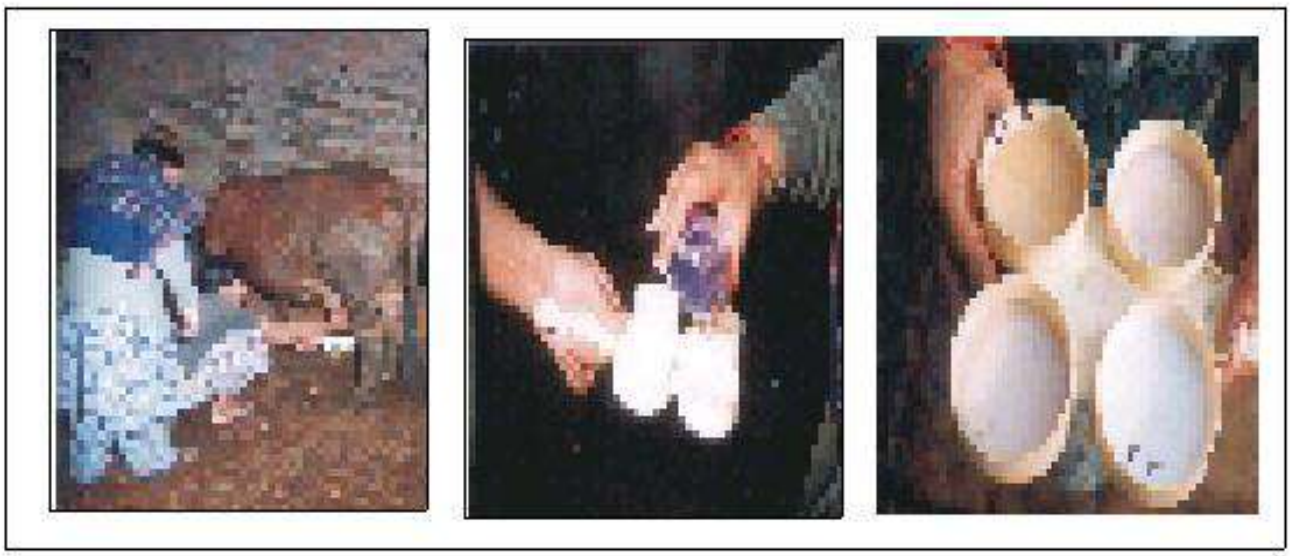


Fig. 3. CMT for screening mastitic quarters

Table 4. Bacterial isolation from the mastitic milk samples (cattle)

S. No.	Isolation of microorganism from milk samples (day 0)
1	*Streptococcal sp.*
2	*Staphylococcus sp.*
3	*Staphylococcus sp.*
4	*Collibacilli*
5*	-
6*	-
7	*Collibacilli*
8	*Micrococci*
9	*Streptococcus sp.*

* Not done.

Table 5. CMT point score in response to the application of C. album in clinical/subclinical mastitis (buffalo)

S.No.	CMT point score	
	Day 0	Day 10
1*	4+	0
2*	4+	0
3*	4+	0
4**	2+	0
5***	1+	0
6***	1+	0

CMT 4 (+)–clinical mastitis; CMT (1+ & 2 +)–subclinical mastitis; *buffalo treated with enrofloxacin; **buffalo treated with E care; ***buffalo treated with lime (6–7 limes fed orally per animal for 3 days); CMT score returned to normal 10 days after treatment with bathua leaves paste.

Table 6. Somatic cell count in response to C. album treatment in clinical / subclinical mastitis (buffalo)

	SCC × 10^5 cells / ml of milk	
S. No.	0 day	10 days
1*	42	-
2*	39	-
3*	35	-
4**	27	12
5***	21	9
6***	19	7.5

*Clinical mastitis case shifted to standard antibiotic treatment. Significant reduction in SCC was observed 10 days PT.

Table 7. Bacterial isolation from the mastitic milk samples (buffalo)

N	Isolation of microorganism from milk samples (day 0)
1	*Streptococcal sp.*
2	*Staphylococcus sp.*
3	*Collibacilli*
4	*Streptococcus sp.*
5	*Collibacilli*
6	*Collibacilli*

Table 8. Phase II (IVRI, cattle and buffalo Farm, LPM Section)
55 crossbred cattle were shortlisted

Parameters studied	Day 0	Day 10
CMT point scores 0 = normal milk 1_2 = subclinical mastitis 3_4 = clinical mastitis	3_4 point score	1_2 point score
SCC/ml milk (<500,000 cells/ml of milk normal) (> 6×10^5 subclinical mastitis) (> 25×10^5 million cells/ml of milk-clinical mastitis)	17_46 lacs cells/ml milk	12_32 lacs cells/ml milk

Significant reduction in CMT point scores was observed 10 days after treatment. Significant reduction in SCC was observed 10 days after treatment, with the application of *bathua* leaves paste on the mastitic udder.

treatments. The results are presented in Table 1, which indicate that use of *bathua* leaves is less effective than homoeopathic and allopathic treatments in controlling swelling and time taken to recover.

Experiment

In phase I, the CMT point score, SCC and bacterial isolation in response to *C. album* treatment in lactating cows are presented in Tables 2, 3 and 4.

Significant reduction in CMT point scores was observed 10 days after treatment. Significant reduction in SCC was observed 10 days post-treatment, with the application of *bathua* leaves paste on the mastitic udder.

CONCLUSION

It was concluded that the *bathua*-leaf paste (ITK) is not effective singly in clinical mastitis, but can be given as on adjunct therapy along with vitamin C and E. The application of *Chenopodium* paste reduces the swelling and pain in the inflamed udder. It also cured blood in milk, indicating its anti-inflammatory potential. Further studies for immunomodulatory potential and active ingredient identification or analysis are required to confirm the findings.

Code : **1278**

Title of the ITK : **Determination of efficacy of pigeon waste to induce estrum in the post-partum anestrus animals**

Description of the ITK : Pigeon waste might have the property to control anoestrous in animal. To induce oestrus, pigeon waste is given orally in raw form without mixing any thing by farmers of Bhujia village in Bareilly district of Uttar Pradesh.

Name and address of the discloser : Shri Om Prakash S/o Shri Manohar Lal, Village- Bhujia, Bhaujipura, Barielly (Uttar Pradesh).

Location of use of the ITK : Many villages in Bareilly and Budaun districts of Uttar Pradesh. The ITK is being used in the village Purenatal and Pandari-Halwa of Bhaujipura block of Bareilly district.

Experimenters : Dr. D. Swarup, Head, Division of Medicine; Dr. Satish Kumar, Senior Scientist, A.R. Division and Dr. Mahesh Chander, Senior Scientist, Division of Extension Education, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122

METHODOLOGY

Location

Field study was done in villages of Bareilly district and clinical trial was undertaken in villages of Nainital district in Haldwani block with the help of *grameen aud krishi vikas samiti*, Haldwani.

PRA and field study

Farmers of 4 villages in Bareilly district of Uttar Pradesh were contacted to elucidate information on the use and efficacy of the ITK practice.

Experiment

Experiment was conducted with 36 animals in villages around Haldwani, almost raised under identical feeding and managemental raising. These animals had subactive ovaries without any palpable CL or folicle on its surface. Pigeon waste (droppings) were collected from the local habitat of the birds. It was cleaned from debris, dried and powdered. A dose rate of 100 g of this powder per day for 3 consecutive days were fed to post-partum anoestrus bovines, and the following follow up was done: did animal show heat? if animal showed heat then on what day? whether the animal received insemination? duration of heat? nature of heat? if inseminated the result? The pregnancy diagnosis was done after 60 days of insemination/ mating.

Simultaneously in another group of post-partum anoestrus bovines the recommended therapy of allopathic medicine consisting of hormonal preparation and mineral mixture was administered. Basic studies on determination of chemical in pigeon waste was done at the Indian Veterinary Research Institute, Izatnagar.

RESULT AND DISCUSSION

PRA and field study

Response of farmers about the use of pigeon waste for treatment of post-partum anestrus in animals are indicated below.

About technology		Number of respondents	
		Number	Percentage
Whether they know about this technology	Yes	20	71.4
	No	08	28.5
Have they ever tried this technology for their animals	Yes	12	42.8
	No	16	57.1
Are they still using this technology	Yes	10	35.7
	No	18	64.2
Does this technology really works these days	Yes	06	21.4
	No	10	35.7
	Can't say	12	42.8

Experiment

Clinical trial was conducted in 36 animals out of which, results of 27 animals are available that are presented in Table1.

Table 1. Effect of pigeon droppings for treatment of post-partum anestrus in bovines

Group	No. of animals treated	No. of animals came in heat	No. of animals conceived
ITK (pigeon droppings)	17	7	5
Allopathic medicine	10	4	2

The results obtained indicate that feeding of pigeon waste to the post-partum animals have a good effect in bringing them to normal heat. With use of pigeon waste, the animals came in heat within 10–18 days of end of treatment with an average of 15.5 days. The effect of pigeon waste is similar to allopathic medicine where both the treatments resulted in bringing about 40% animals to heat. About 71% animals conceived by treating with pigeon waste which was 40% for allopathic medicine.

Basic study

Results of the estimation of pigeon waste indicate that it is rich in iron, zinc and fluorine (Table 2). Substantial amount of copper, cobalt, lead and cadmium are also present in the pigeon waste.

Table 2. Content of micro-nutrients in pigeon waste

Nutrient	Concentration (ppm)
Lead	0.833
Cadmium	0.750
Copper	19.087
Cobalt	4.582
Zinc	295.455
Iron	6571.429
Fluorine	167.500

CONCLUSION

It is indicative from the results of the study that feeding of pigeon waste is effective in bringing the bovines in heat and may be better than allopathic medicine, particularly if the feeding of pigeon waste is supplement with mineral mixture. ❑

Code : **1284**

Title of the ITK : **Determination of efficacy of pigeon waste in showing estrus symptoms in heifers**

Description of the ITK : To induce oestrus and for showing heat symptoms in heifers, pigeon waste, mixed with jaggery, is fed to heifers 2-3 times a day. The disease is cured up to 60%. Treatment cost per animal is Rs. 10-15. This is practised by the farmers of many villages in Badaun and Bareilly districts of Uttar Pradesh.

Name and address of the discloser : Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education, Jamia Millia Islamia, Jamia Nagar, New Delhi 110 025

Location of use of the ITK : The ITK is being used in many parts of Bareilly and Budaun districts of Uttar Pradesh.

Experimenters : Dr D. Swarup, Head, Division of Medicine. Dr Satish Kumar, Senior Scientist, A.R. Division, and Dr Mahesh Chander, Senior Scientist, Extension Division, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122

METHODOLOGY

Location

Field study was done in 4 villages of Bareilly district of Uttar Pradesh. Clinical trial was conducted in villages of district Nainital in Haldwani block with the cooperation of *gamin evem krishi vikas samiti.*

PRA and field study

PRA and field survey was done in 4 villages of Bareilly district of Uttar Pradesh. Information were collected from 12 key informants which have been arranged in a 10 score matrix ranking.



Fig. 1. Pigeon waste

Experiment

Experiments were conducted to study the effect of pigeon waste on 38 bovine heifers with almost similar feeding and management systems. These heifers had inactive/ subactive ovaries with no palpable CL or follicle in villages around Haldwani. Pigeon waste (droppings) were collected from the local habitat of the birds. It was clean of debris, dried and powdered. A dose rate of 100 g of this powder was fed to the heifers for 3 days.



Fig. 2. Processed pigeon waste



Fig. 3. Processed pigeon waste in polypack

In another group of bovine heifers the recommended therapy of allopathic medicine consisting of hormonal preparation and mineral mixture was administered. All these animals were followed up for proper treatment schedule and when came in heat and received insemination examined for P.D. 60 days of artificial insemination.

RESULTS AND DISCUSSION

PRA and field study

PRA was conducted and response of farmers about the use of pigeon waste for treatment of post-partum anestrus in animals is as follows:

Experiment

Till July. 2003 clinical trial on 38 heifers were taken up using pigeon waste, out of which results of 26 animals are available that are presented in Table 2.

Out of 38 animals treated with the pigeon waste the results of 26 animals indicated that the feeding of pigeon waste to the anestrus animals have a good effect in bringing them to heat.

Table 1. PRA matrix for determination of efficacy of pigeon waste

About technology		Number of respondent	
	Response	Number	Percentage
Whether they know about this technology	Yes	10	83.3
	No	02	16.7
Have they ever tried this technology for their animals	Yes	09	75.0
	No	03	25.0
Are they still using this technology	Yes	08	66.6
	No	04	33.3
Does this technology really work these days	Yes	06	50.0
	No	03	25.0
	Can't say	03	25.0

Table 2. Effect of pigeon waste for treatment of anestrus in bovine heifers

Group	Animals treated	Animals came in heat	Animals conceived
ITK (pigeon waste)	18	8	4
Allopathic medicine	8	3	2

Feeding of pigeon waste helped 44% of the treated bovines to come to heat and 50% of them conceived. In contrast, allopathic medicine had effect on 38% treated animals in bringing to heat and 66% of them conceived. With use of pigeon waste, heifers showed weak to normal heat within 18–24 days of treatment completion.

CONCLUSION

The use of pigeon waste for inducing estrus in heifers have been found to have encouraging results.

Code : **863**

Title of the ITK : **Treatment for removal of placenta in cattle**

Description of the ITK : Farmers of Mendi village of Mandi district in Himachal Pradesh are adopting this practice for removal of placenta in cattle. Banana inflorescence is cut into small pieces and 0.5 kg is orally administered to the cattle effected by this problem. Bayuhal twigs (10-20) are ground and 200 ml of the extract is orally administered to the affected cattle, which helps release the placenta safely within 30 minutes.

Name and address of the discloser : Shri Sita Ram, Village Mendi, Tehsil Karsog, Mandi (Himachal Pradesh)

Location of use of the ITK : Karsog area in Mandi distt. of Himachal Pradesh lies in mid-hills sub-humid zone with an altitudinal range from 651-1,800 metres above sea level. The soil types are loam to clay-loam with erratic distribution of rainfall. Traditionally mixed farming is practiced in this zone. Cropping pattern is dominated by maize, wheat, paddy and millets. In some parts, fruits and vegetables are substituting cereal crops.

Experimenters : Dr Navneet Kumar Vasishta, Associate Professor and Head, Dr Madhumeet Singh, Associate Professor and Dr Pankaj Sood, Assistant Professor, Department of Animal Reproduction Gynaecology and Obstetrics, COVAS, CSKHPKV, Palampur 176 062 (Himachal Pradesh)

METHODOLOGY

The survey was conducted in tehsil Karsog, dist. Mandi. as well as in Solan and Palampur area in Himachal Pradesh; and the experiment was conducted in the Department of Animal Reproduction, Gynaecology and Obstetrics. COVAS, CSKHPKV, Palampur (Himachal Pradesh). The ITK was claimed to be commonly practiced in teh. Karsog of dist. Mandi. However, no documented literature is available regarding its use elsewhere.

PRA and field study

The survey work was carried out in and around the area of Karsog, dist. Mandi. as well as in some villages of Solan and Palampur. This was done to ascertain:

(i) The incidence of retention of placenta in domestic animals;
(ii) Percentage of people practically adopting the ITK, under the investigations;
(iii) Collection and identification of the specimens;
(iv) Time/season of the availability of the specimens; and
(v) Determining the therapeutic efficacy and doses regimens of the banana inflorescence and *baykhal* twigs extract being practised.

Experiment

The trials were conducted on the animals with



Fig. 1. Banana inflorescence *(Musa paradisiaca)*



Fig. 2. Baykhal (*Prinsepia utilis*)



Fig. 3. Manual removal of placenta



Fig. 4. Retained placenta in cow

history of retained placenta (not expelled within 12 hr of post- parturition). Before adopting the treatment, complete history and clinical evaluation of the case was done. Animals having administrated any prior treatment were excluded from the trial. The animals were divided in three groups:

(a) Banana inflorescence

The animals (n=6) of this group were administered 500 g chopped banana inflorescence orally and observed for 1 hr after the treatment.

(b) *Baykhal* twig extract

This group comprised animals (n=6) treated with *baykhal* twig extract. About 15-20 twigs of *baykhal* were soaked in water for about 1 hr. They were crushed and the juice was extracted. Each affected animal was drenched 200 ml of the extract and kept under observation for 1 hr after the treatment.

(c) Control

The recently normally calved animals with history of retained placenta, of livestock farm CSKHPKV, Palampur, were kept as control and no treatment was given to these animals for next 6 hr after placental retention (18 hr after calving).

RESULT AND DISCUSSION

PRA and field study

Identification and collection

The specimens of banana inflorescence and *baykhal* were identified and collected from Palampur and Karsog areas respectively.

Field survey

The CCPI visited Karsog area and contacted Senior Veterinary Officer, Karsog, Veterinary Officers of Tehsil Karsog and the farmers of surrounding villages. The discloser was also contacted and interviewed. The information regarding the ITK was collected personally as well as with the assistance of contractual helper appointed locally under the supervision of the Veterinary Officer In charge, CVH, Pangna. In addition the farmers of Palampur and District Solan were also contacted. The information so gathered is summarized:

1. No. of villages surveyed : 37
2. No. of persons contacted : 180
3. Occupation of respondents :

(a) Agriculture : 167
(b) Government service : 10
(c) Business : 3

All the respondents were rearing the animals for more than 20 years.

Incidence

A total of 180 farmers were contacted. They had observed 2,656 calving during the period of rearing of animals, of which only 133 had suffered from retained placenta. The area-wise information as revealed by the farmers regarding number of calving observed, number of cases of retained placenta observed and incidence of retention of placenta is presented in Table 1 (Fig. 5).

The overall incidence of retention of placenta under field condition was 5% (133/2,656 calvings)

Availability

Banana was planted by limited number of farmers and usually the inflorescence was available during September to March season only. *Baykhal,* a wild shrub, grows on the uncultivable land and was abundantly available throughout the

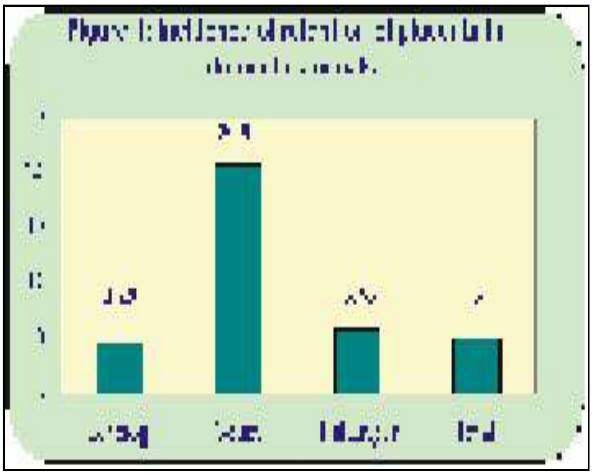


Fig. 5. Incidence of retention of placenta in domestic animals

Table 1. Incidence of retention of placenta in domestic animals

Parameter	Karsog	Solan	Palampur	Total
No. of calving observed	2,329	67	260	2,656
No. of cases of retained placenta	104	14	15	133
Incidence of retention of placenta (%)	4.46	20.89	5.76	5

year in Karsog as well as Solan area.

Treatment adopted under field conditions

The detailed information pertaining to popularity of ITK therapy, various methods being adopted by the farmers for treatment or management of retained placenta under field conditions and their efficacy are summarized in Tables 2 and 3 and Fig. 6.

Karsog, Solan and Palampur was 38.46, 96.8 and 100 per cent respectively. None of the farmers had any knowledge regarding use of ITK under investigation, however, some other indigenous decoctions were used in 25.96 and 7.14 per cent cases of retained placenta in Karsog and Solan respectively. Thirty Seven (35.57%) animals did not receive any treatment in Karsog area and

Table 2. Comparative popularity of various treatments for retained placenta under field conditions

Area	Allopathic (%)	Banana inflorescence (%)	*Baykhal* (%)	Other indigenous methods (%)	No treatment (%)
Karsog	38.46	0	0	25.96	35.57
Solan	92.8	0	0	7.14	0
Palampur	100	0	0	0	0
Total	51.12	0	0	21.05	27.81

recovered over a period of time. Arthur, *et al.* (1996) also recommended that in animals exhibiting no signs of systemic illness may recover spontaneously without any treatment.

Experiment

Efficacy: The efficacy of different treatments has been presented in Table 4. Fig. 7.

Group a: The animals (n=6) with retained

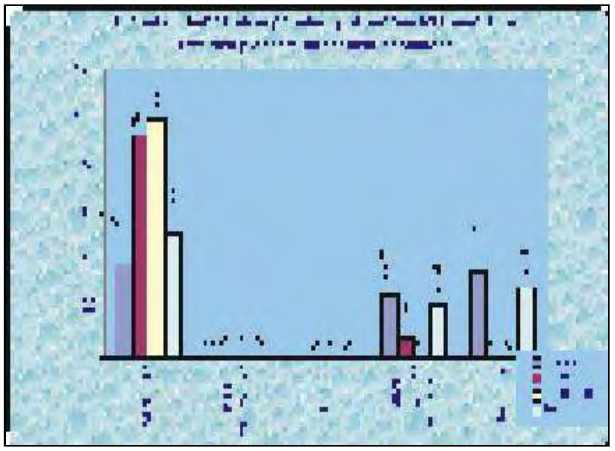


Fig. 6. Comparative popularity of various treatments for retained placenta under field conditions

Most of the farmers (51.12%) resorted to Allopathic treatment. The comparative popularity of allopathic treatment amongst farmers of

placenta were presented in clinics within 6-24 hrs post retention (18-36 hrs after calving). These animals were administered 500 grams of chopped banana Inflorescence. Though two animals (33.3%) responded to the treatment, but the time taken for expulsion of placenta was around one hr. post treatment.

Group b: The animals (n=6) having placental

Table 1. Incidence of retention of placenta in domestic animals

Method	No. of animals							
	Karsog		Solan		Palampur		Total	
	R**	T*	R**	T*	R**	T*	R**	T*
Therapeutic (Manual + Allopathic)	40	38(95%)	13	12(92.3%)	15	13(86.6%)	68	63(92.6%)
a) Banana inflorescence	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
(b) *Baykhal* twigs	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Other indigenous methods	27	27(100%)	1	Nil	Nil	Nil	28	27(96%)
No treatment	37	37(100%)	1	Nil	Nil	Nil	37	37(100%)
Total	104		14		15		133	

*T, Treated: **R, responded.

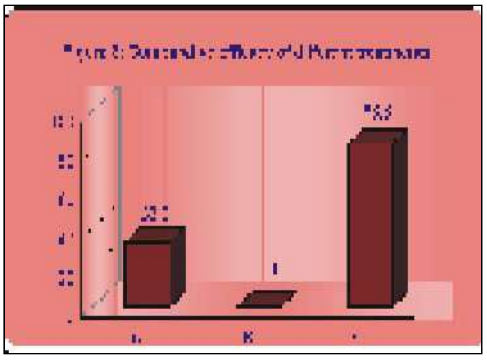


Fig. 7. Comparative efficacy of different treatments

retention for 24-48 hrs post calving were administered 200 ml of Baykhal twigs extract and observed for one hr. post treatment. None of the animals responded to the treatment.

Group c: The animals (n=6) were reported for retention of placenta following normal calving. They were observed for expulsion of placenta for 18 hours post calving. Since all the animals failed to expel the placenta they were treated successfully using conventional therapy. None of the animals expelled their placenta within the specified period (20-30 minutes after treatment) as claimed by the discloser. Only two animals expelled their placenta within 1 hr after feeding banana inflorescence.

Palatability The proposed ITK treatments (banana inflorescence and *baykhal* twig extract) were conveniently accepted by the animals specially when supplemented with molasses or jaggery.

Adverse effects The animals were observed for 4 hr after treatment. No clinical symptoms of anaphylaxis, diarrhoea, tympany, hyper salivation and

Table 4. Comparative efficacy of different treatments

Group	No of animals treated	No. of animals responded	Over all response (%)
(a)	6	2	33
(b)	6	-	-
(c)	6	5	83.3

lacrimation were evident in any of the treated animals.

CONCLUSION

Based on results of QUIK method, the ITK under investigation is not being commonly practised under field conditions for easy expulsion of retained placenta. The results of experimentation also substantiate these observations as none of the animals treated with suggested ITK herbs responded to the treatment within specified duration. Thus these findings (QUIK as well as experimentation) do not validate the claim of the discloser.

REFRENCES

Arthur, G.H., Noakes, D.E., Pearson, H. and Parkinson, T.J. 1996. *Veterinary Reproduction and Obstetrics* edn 7, pp. 294-295. W.B. Saunders Company Limited, London.

Code	:	**61**
Title of the ITK	:	**Efficacy of parched chickpea flour in butter milk (*rabadi*) for expulsion of placenta in livestock**
Description of the ITK	:	If placenta is retained in the animals, chickpea is fried, and after decortication it is ground and baited in butter milk. It is fed twice daily for 2 days.
Name and address of the discloser	:	Shri Hari Ram Kala, S/o Shri Chuna Ram, Village Balaya, P. Samiti Mundva, Nagaur (Rajasthan)
Location of use of the ITK	:	Balaya, Panchayat Samiti Mundva, Nagaur (Rajasthan)
Experimenters	:	Dr S. K. Kaushish, Head Division of Animal Science, and Shri Z. D. Kavia, Principal Scientist (Agricultural Extension), Central Arid Zone Research Institute, Jodhpur (Rajasthan)

METHODOLOGY

The study was conducted in Balaya village and in Veterinary Hospital, Jodhpur.

PRA and field study

Information about the ITK was collected in Balaya village of Nagaur district in Rajasthan from animal keepers, approaching individually as well as in-group form, by adopting the PRA technique. A structured schedule was administered for the collection of information from the villagers about the ITK.

Experiment

Experiment was also conducted to evaluate the efficacy of using buttermilk (*rabadi*) for expulsion of placenta in village Balaya and Veterinary hospital at Jodhpur during October 2002 to May 2003. The treatment was applied in 7 animals (4 cows and 3 buffaloes).

RESULT AND DISCUSSION

PRA and field study

Villagers and the ITK discloser strengthened the information provided about ITK, which is as follows: About 1 kg huskless chickpea is parched and crushed to flour (Fig. 1). The flour is mixed gradually with butter milk while boiling (Fig. 2).



Fig. 1. Parched huskless gram crushed to flour form



Fig. 2. Powdered gram mixed gradually with butter

Table 1. Efficacy of using *rabadi* in expulsion of placenta

Name and address of the farmer	ITK treatment provided to animals	Time taken for expulsion of placenta
Shri Nenu Ram Bishnoi, Ghachi Colony, Peeli Tanki, Bhagat ki Kothi, Jodhpur City	Feeding of 250 g rabadi to cow.	Placenta was expelled in 4 hours.
Shri Om Prakash S/o Sh. Ram Dayal village Balaya, district Nagaur	*Rabadi* (250 g) was prepared and was given to cow in morning and the same dose was repeated in evening	Placenta was expelled in 24 hours
Shri Golu near Polyclinic, Jodhpur City	*Rabadi* (250 g) fed to cow	After 12 hours no expulsion of placenta
Shri Narayan Ram Mundel S/o Shri Prabhu Ram Mundel village Mundwa, P.O. Mundwa district Nagaur	*Rabadi* (250 g) was given to cow in morning and the same dose was repeated in the evening for 2 days	Placenta was expelled with in 24 hours
Shri Ram Kishor S/o Sanwat Ram Kala, village Balaya, district Nagaur	*Rabadi* (250 g) was fed to buffalo	Placenta was expelled in 1 hour
Shri Raj Singh Ratanada, Jodhpur City	*Rabadi* (250 g) was fed to buffalo	Placenta was expelled in 14 hours
Shri Hari Ram Kala S/o Shri Chuna Ram village Balaya, panchayat samiti Mundva, District Nagaur	*Rabadi* (250 g) was given to buffalo in morning and the same dose was repeatedin the evening for 2 days	Placenta was expelled in 24 hours

The prepared mixture, locally called *rabadi,* is fed to the affected animals whereby placenta comes out in 2-4 hours. During the study it was also revealed that in some other village (Kharnal) animal keepers use a decoction prepared from *kheemp (Laptodamia pyrotehnica)* roots, *churmi (Abrus prekatorius)*, jaggery and chopped bamboo stick for removal of retained placenta. Other methods in use include feeding of colostrum and pearlmillet mixed with jaggery and edible oil. A decoction prepared with black pepper, coriander, *ajwain*, *sonth* and *methi* in water is also used for the purpose. Use of ITK practice was reported to be easy to apply and economic.

Experiment

Treatments imposed and the results obtained are presented in Table 1.

Results obtained indicate that feeding of *rabadi* was effective in removing placenta in 6 cases out of seven animals tried. Placenta was removed within 1 to 24 hours of feeding of *rabadi*. There was no definite advantage in administering *rabadi* twice a day. *Rabadi* was found effective equally for both cow and buffaloes. In one case, where placenta was not expelled in cow, the study was limited to 12 hours of observation.

CONCLUSION

Results of the experimental study showed that feeding of *rabadi* is efficient in expulsion of placenta that took 1 to 24 hours.

Code : **1593**

Title of the ITK : **Use of decoction of *sharifa* leaf and seed for remedy of lice and ticks in cattle**

Description of the ITK : Decoction of *sharifa* leaves and seed powder works as an insecticidal and ectoparasiticidal agent. People of Karge village of Ranchi district in Jharkhand use these for lice and tick control. Fresh leaves of *sharifa* are boiled for half an hour on fire and after cooling the water is applied twice or thrice a week on the cattles and buffalo's body for remedy of lice and tick. In this practice all ticks die and are separated from the body. It has 100% success rate and 80% farm families use this 50 years old practice. About 20% of the animals are affected with ticks and lice.

Name and address of the discloser : Dr B.K. Roy, Associate Professor, Department of Pharmacology, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

Location of use of the ITK : Karge, Mandar, Ranchi (Jharkhand)

Geographical indicators : *Sharifa* is a small, more or less evergreen tree, 15-20 feet high, bearing yellowish- green fruits, trees occurs wild and is also cultivated all over India.

Experimenter : Dr B.K. Roy, Associate Professor, Department of Pharmacology, Veterinary College, Birsa Agricultural University, Ranchi (Jharkahand)

METHODOLOGY

Location

The experiment was conducted in village Karge, block Mandar, Dist. Ranchi (Jharkhand).

PRA and field study

The PRA field study were conducted using the PRA tools with 20 respondents. The ITK was compared with allopathic treatment on selected parameters viz. tick elimination, duration of treatment, safety, cost effectiveness, increase in milk yield, and effect on heat induction.



Fig. 1. Custard apple *(Annona squamosa)*-medicine for remedy of lice and ticks in animals

Experiment

An experiment was carried out with 20 animals in two groups with ten animals in each group. One group was treated with decoction of *sharifa* leaves, applied twice in a week and the other



Fig. 2. Application of custardapple decoction of lice and tick affected animal



Fig. 3. Removed lice after application of cas custardapple decoction

group was treated with allopathic medicine (5 ml butox dissolved in 5 litre water and applied externally once in a week). The ticks were counted for a demarketed area and the percentage of elimination or death was recorded.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 show that the allopathic medicine was slightly more effective than the reported ITK in elimination of lice and tick. However, the ITK was found to be more beneficial in terms of safety and cost effectiveness than the allopathic medicine.

Table 1. Performance assessment of the use of decoction of *sharifa* leaves and seeds and allopathic medicine for remedy of lice and ticks in cattle

Criteria	Decoction of *sharifa* leaves/seeds	Allopathic medicine
Tick elimination (%)	8	9
Duration of treatment (days)	2	1
Safety	10	6
Safety	10	2
Increase in milk yield	4	2
Effect on heat induction	4	3

Table 2. Tick elimination (%) through application of decoction of *sharifa* leaves and allopathic medicine

Days after application	Decoction of *sharifa* leaves	Butox (5 mg) mixed with water
1	20	90
2	50	100
3	80	-
4	100	-

Experiment

The results presented in Table 2 show that the first two applications of decoction of *sharifa* leaves removed 50% of ticks. However, in allopathic treatment 100% of ticks were dead with in 2 days. For complete elimination of ticks (100%) the decoction of *sharifa* was applied 4 times. It was also observed that after application of decoction of *sharifa* leaf, though the ticks left the animal body, they were still alive.

CONCLUSION

Decoction of *sharifa* leaves was less effective than the allopathic medicine as it required four applications. Though the ticks left the animal's body, most of them were not dead. It was concluded that the ITK is cheaper and has property of ecto-parasiticical activity.

Code	**:**	**561**
Title of the ITK	**:**	**Use of millipede as antifever remedy for cattle**
Description of the ITK	:	The millipede, an insect, commonly seen in abundance during rainy season is fed to animal to protect them from seasonal fever. 10-12 millipedes are kept inside the kneaded flour and fed to the animals.
Name and address of the discloser	:	Shri P. S. Mehta, Technical officer and Dr I. S. Bisht, National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110 012
Location of use of the ITK	:	Barakot, Lohaghat, Champawat (Uttaranchal)
Experimenter	:	Dr V. S. Rajora, Associate Professor, Clinical Medicine, College of Veterinary Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar (Uttaranchal)

METHODOLOGY

Location

The experiment was conducted in village Barakot, block Lohaghat, Champawat (Uttaranchal) and Livestock Research Centre, College of Veterinary Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar. During rainy season the animals are more susceptible to fever, causing significant loss, if not treated timely.

PRA and field study

The PRA technique was used to gather background information about the use of the technology, informed by the discloser.

Experiment

For experimentation crossbred cows in the age group of 12 to 15 months belonging to Livestock Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar were selected. The animals were kept under similar husbandry practices and clinically examined to ensure their normal health prior to the start of experiment. The millipedes were kept inside the

kneaded flour and fed to the animals. The cows were made in to 7 groups in 5 replications. The treatments received by the animals in each group are as follows: Gr.1- control (no feeding of millipede), Gr.2- fed with 12 millipede, Gr.3- fed

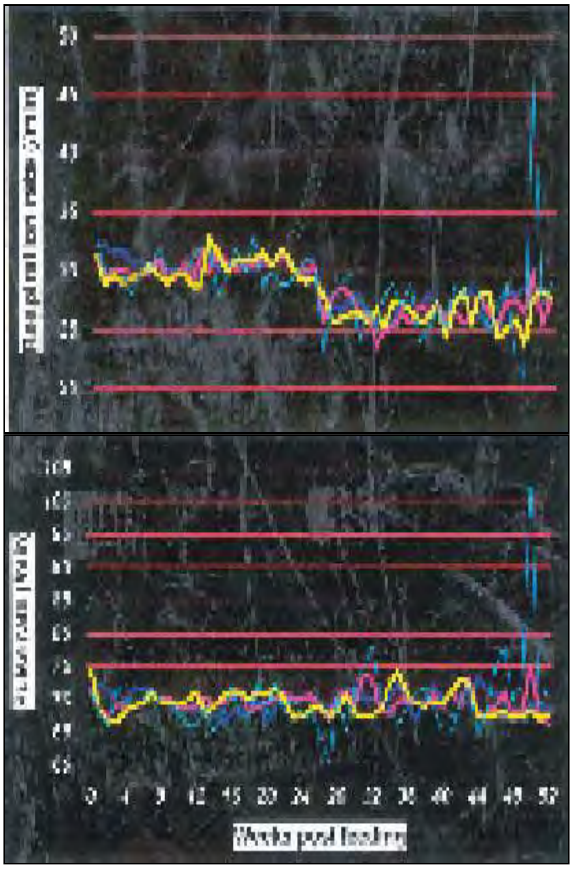


Fig. 1. Rectal temperature, respiration rate and pulse rate in control and millipede fed animals

with 10 millipede, Gr.4- fed with 8 millipede, Gr.5- fed with 6 millipede, Gr.6- fed with 4 millipedes and Gr.7- fed with 2 millipede. Millipedes were fed once in the month of November, 2002. Observations on rectal temperature, respiration rate and pulse rate were taken periodically after administering the treatments. Blood samples from each animal were collected at one month interval for estimating total erythrocyte count (TEC), packed cell volume (PCV), hemoglobin (Hb), total leucocyte count (TLC), differential leucocyte count (DLC), neutrophilis, eosinophils, basophils, lymphocyte and monocyte.

PRA and field study Results from the field study indicated that 23% respondents consider the indigenous technology is very effective and 46% of respondents considered it effective for giving protection against fever to the animals (Tables 1 and 2).

RESULTS AND DISCUSSION

Effectiveness	No of farmers	percentage
Very effective	18	23
Effective	37	46
Less effective	17	21
Uncertain	8	10

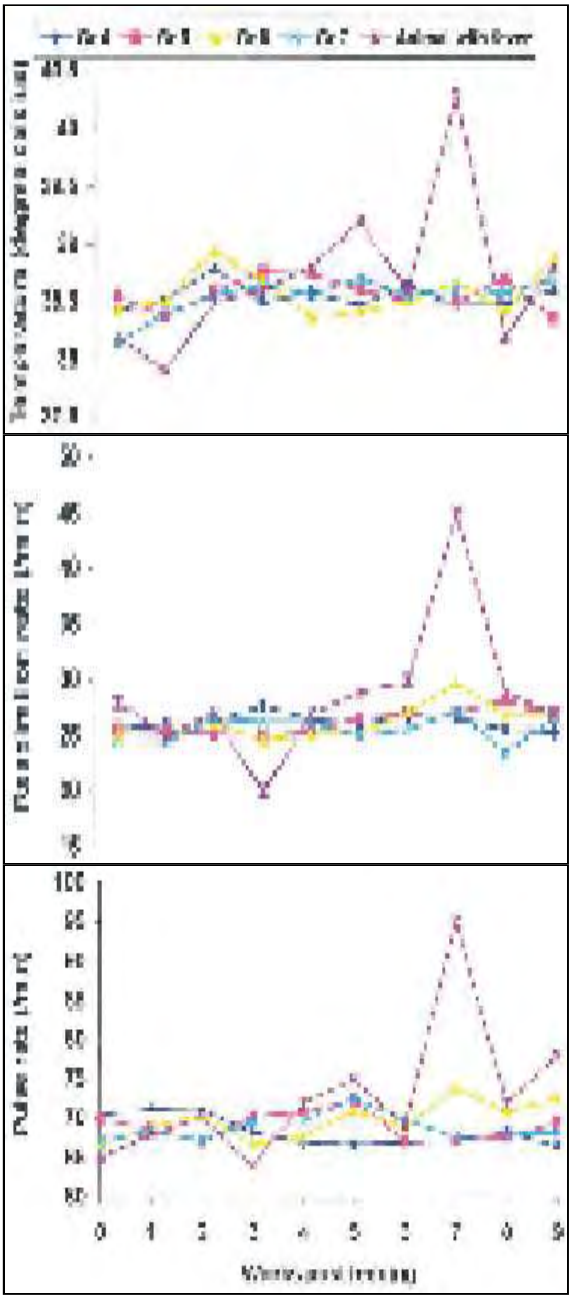


Fig. 2. Rectal temperature, respiration rate and pulse rate in millipede fed animals of phase 2

Table 2. Variations on attributes of haemogram

Attribute	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
TEC ($\times 10^{12}$/l)	6.96-7.04	7.61-7.83	7.22-7.55	7.19-7.74	7.20-7.60	7.05-7.27	7.41-7.53
PVC (%)	34.4-34.6	34.4-34.5	38.8-34.9	35.20-36.80	36.40-36.60	35.00-36.80	35.80-38.00
Hb (gm/l)	11.48-11.8	11.64-11.7	11.7-11.7	11.50-11.74	11.80-12.00	11.42-11.50	11.60-12.10
TLC ($\times 10^{9}$/l)	6.97-9.12	6.76-7.07	6.44-7.6	7.77-8.35	7.18-7.34	7.40-8.88	7.42-7.79

DLC (%)							
Neutrophils	28.4-30	29.4-40.4	28.8-30.4	28.40-29.60	28.80-32.60	31.20-40.80	30.00-33.00
Eosinophils	0.5-2.4	1.2-2.0	0.4-1.8	2.20-3.20	3.40-3.60	1.60-3.20	2.00-4.20
Basophils	0-0.2	0-0.4	0-0.4	0.00-0.20	0.00-0.20	0.00-0.20	0.00-0.20
Lymphocyte	66-70.2	56-67.4	66.2-67.8	65.00-67.00	62.20-64.40	55.60-63.20	62.60-65.00
Monocyte	0.6-2.2	1.4-2.8	1.4-2.4	1.20-3.00	1.60-3.20	1.80-2.60	1.00-2.80

Table 3. Value of various parameters recorded in the animal which showed fever post feeding of milipedes

Parameter	Phase-I (50th week group 2)	Phase-I (7th week group 6)
Ractal temperature°C	40.5	40.3
Respiration rate	47	45
Pulse rate per minute	102	95
Haemogram		
TEC ($\times 10^{12}$/1)	7.5	5.75
PVC (%)	34	28
Hb (gm/l)	11.5	9.7
TLC ($\times 10^{9}$/1)	12.5	10.95
DLC (%)		
Nutrophils	60.95	40
Eosinophils	2	5
Basophils	1	0
Lymphocyte	35	53
Monocyte	2	2

Experiment

Periodical observations on rectal temperature, respiration and pulse rate were taken. Results obtained are presented in (Figs 1 and 2). It is seen that feeding millipede had no effect on the rectal temperature of the animals. No substantial difference was also observed on respiration rate and pulse rate of the animals. The variations observed on attributes of haeogram in 7 groups of animals are presented in Table 3.

CONCLUSION

No significance difference could be observed till 168 days of observations taken between the millipede fed animals and control animals in terms of rectal temperature, respiration rate and pulse rate. The technology for control of fever in animals by feeding millipedes does not seem to be effective.

Code : **1272**

Title of the ITK : **Treatment of swelling of shoulders in bullocks/bull**

Description of the ITK : Shoulders of bullocks are swollen, due to which they become unable to do work. Mixture of *geru* (30 g) and snail shell or sipi (50 g) is boiled in caster oil. *Alua* (20 g) and *kudru/sahjan* gum (50 g) are mixed to it. This paste under warm condition is applied on the affected neck of the animal where is there swelling. This is practised by the villagers of Nayabas Kutubpur in Bulandshahr district of Uttar Pradesh.

Name and address of the discloser : Shri Prem Pal Singh Arya, C/o Shri Daal Chand, House No. 38, Purva ahiram Indra chowk, Meerut (Uttar Pradesh)

Location of use of the ITK : This condition is generally seen in draught animals. The bullocks are generally affected and the condition is known as yoke gall. The cases are generally seen in those areas where bullock carts are used for transportation of goods. Continuous chronic irritation result in painful swelling and wounds at shoulder. As shown in the figure, inappropriate size of animals in a pair used for draft or agricultural operations also lead to this disease. The ITK is practised in several villages in Bulandshahar districts, particularly where bullock carts are used extensively for rural transport and agriculture is dependent on bullocks.

Geographical indicators : Castor oil (Hindi, *eranda ka tel*)

The oil of *eranda* is useful in the pain of heart, bladder, sides of the chest, knee joint, thigh, waist, and back bone. It is also useful in flatulence, hard tumour in the abdomen, gout, splenic disorder, colic, asthma, adenitis and hiccup. It promotus strength, and is sweet and laxative. The oil of red variety is exceedingly sharp and hot. It strongly aggrivates *pitta* and is extremely putrid (Dash and Kashyap, 1980).

Soanjna gum
(Bengali, *sajna;* Sanskrit, *shigru;* Hindi, *soanjna;* Tamil, *murungai;* English, drumstick). Its botanical name is *Moringa oleifera* and it belongs to family Moringaceae.

Occurrence and distribution
Indigenous to north-west India. Plentiful on alluvial land in or near sandy beds of rivers and streams. Cultivated frequently in hedges and home yards.

Description
A small or medium-sized tree, 10 m high. Bark corky, soft, thick, deeply fissured. Wood soft. Leaves usually tripinnate, 30.5-61.0 cm long; leaflets elliptic. Flowers bisexual, irregular, fragrant, white, borne in large panicles. Pods triangular, ribbed, pendulous, greenish, 22.5-50.0 cm or more in length. Seeds trigonous, winged. Flowers in February-March and fruits in March-April.

Parts used
All parts of the plant and seed oil.

Therapeutic uses
Leaf-juice is useful in hiccoup; emetic in higher doses. Cooked leaves in a vegetable curry are considered to be efficacious in influenza and catarrhal affections. Leaf-juice, mixed with honey, is applied to the eyelids in eye diseases. Poultice of the leaves is beneficial in glandular swelling. Bark-juice, mixed with molasses, is administrated in headache. Flowers are diuretic, cholagogue and stimulant. Pods are considered to be antipyretic and anthelminitic. Root-juice is diuretic, rubefacient; beneficial in hiccoup, asthma, gout, enlarged liver and spleen calculus affection and deep-seated inflammation. It is taken internally in combination with milk. Decoction of root is prescribed as a gargle in hoarseness and throat sore. Seed oil, in combination with groundnut oil (in equal parts), applied locally to relieve pain in rheumatism. Gum is used in dental caries; mixed with sesame oil, found beneficial in otalgia. Root, bark and gum are also considered to be abortifacient.

Chemical constituents
Leaves, flowers and fruits of the plant contain minerals, vitamins and amino acids. The pods and leaves are rich source of vitamin C. The plant contains 4-hydroxymellein, vanillin, b - sitosterol, octacosanoic acid, moringine, moringinine, bayrenol, indole acetic acid, indole acetonitrile, benzylisothiocyanate, pteregospermine and carotene. Quercetin and kaempferol occur in the flowers. The fatty acid composition of the seed oil, polysaccharide and protein components of the gum exudates are also reported (Chatterjee and Pakrashi, 1995).

Snail skull-(English land snail)
The zoological name is Achatina fulica. The shell or skull is used for preparing medicated oil. (Nadkarni, 1976).

Geru

(English, bole rubra, red earth, ruddle or red ochre; Sanskrit, *gairika, rakan-pashana;* Hindi, *gerumati;* Marati, *geru;* Tamil, Telgu and Gujrati, *sona-geru,*).

Geru is a clay found in lead and iron ore and contains an excess of oxide over any other clay. It is a silicate of alumina and oxide of iron. There are two varieties: bole (yellow) and red ochre. The red ochre contains more iron than bole and is used in medicine. It sometimes occurs in powder form and sometimes as hard pieces. *Gairika,* hematite, which is red and often hard, and limonite which is yellow or brown, both occur in the form of ochres (Ray, it rapidly absorbs water if poured upon it. It is purified by being soaked in milk seven times and is sweetish, cooling, and useful as a local application to burns, ulcers, boils, pustular eruptions and aphthous sores about the month. It is rarely used internally except as an ingredient of some compound preparations containing a large number of mineral drugs, for instance *jvara-kunjara paridra rasa,* which contains nearly all the mineral substances (Nadkarni, 1976).

Experimenters : Dr D. Swarup, Head, Division of Medicine, Dr A. K. Sharma, Senior Scientist, Division of Surgery; Dr Naveen Kumar, Senior Scientist, Division of Surgery and Dr H. P. S. Arya, Head, Division of Extension Education, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122

METHODOLOGY

PRA and field study

For PRA, farmers of four villages of district Bulandshahar were contacted. The clinical trials were conducted in village Barasi, Tulsi Garhi, Danpur, Chauganpur of Bulandshar district and at Indian Veterinary Research Institute, Polyclinic, Izatnagar.

Experiment

Animal experimentation

For shoulder swelling A total number of 20 clinical cases having shoulder swelling and swelling at the joints or limbs were used in this study. The mixture as describe in ITK was applied twice daily for 7-10 days and clinical observations were made for 4 weeks. The relief in pain and shoulder swelling was seen at 1 week. Complete rest was given to the animal and no draught work was assigned during the period of treatment.

Method used: Matrix was developed (score sheet) for assessing the performance of ITK and the mean scores were taken on a scoring pattern of 0-4 scale.

For shoulder swelling

Intervals of observation after commencement of treatment:

(i) Day 7

Items of observations:

*Swelling:*Swelling status was observed and



Fig. 1. Uneven weight bearing and friction shoulder swelling in bullocks

graded as: 0=no swelling; 1=mild swelling; 2=moderate swelling; and 3=severe swelling.

Pain: Pain by pressing at the site was observed and graded as:

0=no pain; 1=mild pain; 2=moderate pain; and 3=severe pain.

Side effects: If any was observed after 7, 14, 21 and 30 days of treatment imposition

(ii) Day 14

Items of observation: same as for day 7

(iii) Day 21

Items of observation: same as for day 7

(iv) Day 30

Items of observation: Same as for day 7

For joints and limb swelling

Intervals of observation after commencement of Treatment:

(i) Day 7

Items of observation:

Swelling: Swelling status was observed and

Score sheet

Parameter	Intervals of Observation				
	0 Day	7 Day	14 Day	21 Day	30 Day
Swelling (scores)					
Pain (scores)					

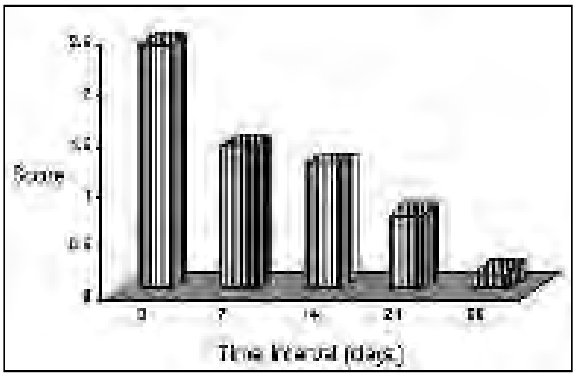


Fig. 2. Swelling scores at different time intervals in shoulder

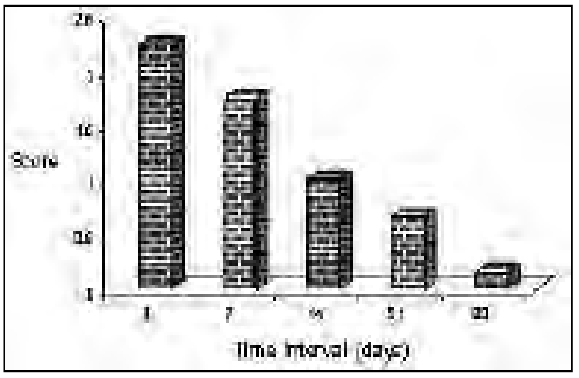


Fig. 3. Pain scores at different time intervals in shoulder swelling

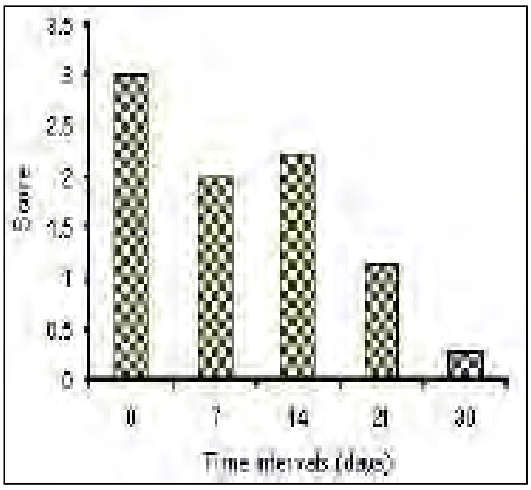


Fig.4. Swelling score at different time intervals in joints swelling

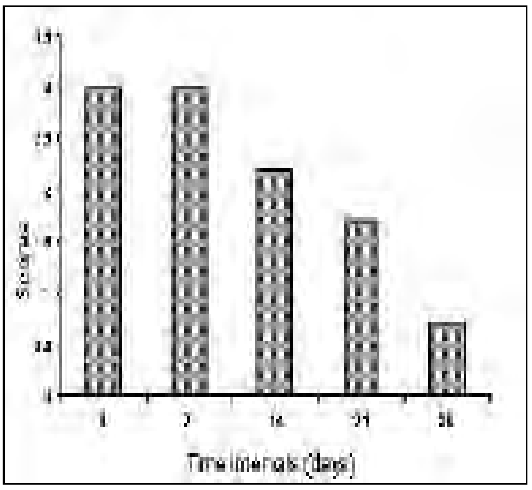


Fig. 5. Pain scores at different time intervals in joint swelling

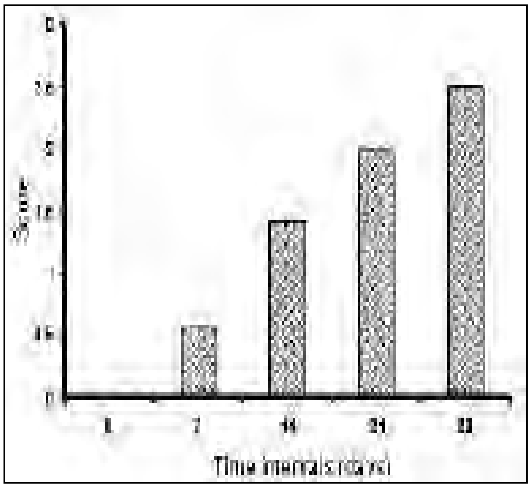


Fig. 6. Weight-bearing scores in standing position at different time intervals in joints

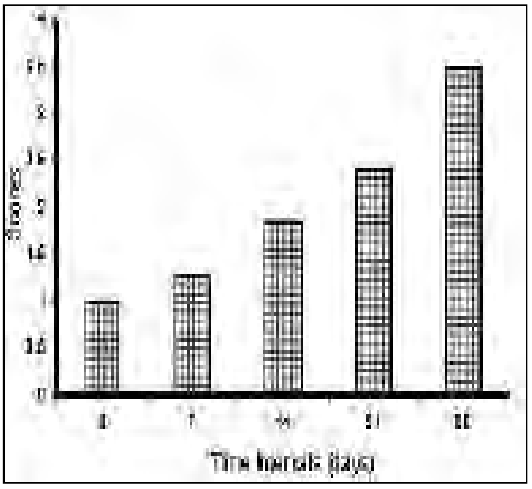


Fig.7. Weight-bearing scores while walking at different time intervals in joints swelling



Fig. 8. Treatment of swollen shoulder of bullock (a) before treatment; (b) on day 21 after treatment with ITK

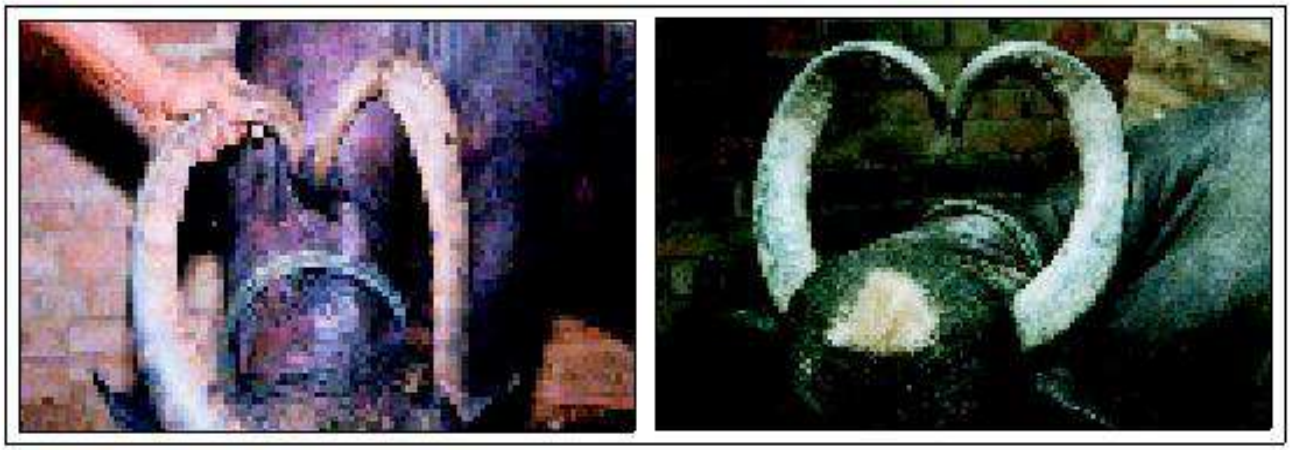


Fig. 9. Treatment of swollen shoulder of bullock (a) before treatment; (b) on day 30 after treatment with ITK

Score sheet

Parameter	Intervals of observation				
	0 Day	7 Day	14 Day	21 Day	30 Day
Swelling (scores)					
Pain (scores)					
Weight bearing in standing position (scores)					
Weight bearing in motion (scores)					

graded as: 0=no swelling; 1=mild swelling; 2=moderate swelling; and 3=severe swelling.

Pain: Pain at the site was observed and graded as: 0=no pain; 1=mild pain; 2=moderate pain; and 3=severe pain.

Weight bearing in standing position: Weight bearing in standing posture at rest was graded as: 0=no weight bearing; 1=toe touching the ground; 2=moderate weight bearing; and 3=full weight bearing.

Weight bearing in motion: Weight bearing while walking was assessed as: 1=supports the limb on the ground and put less weight; 2 =moderate weight bearing and apparently lame; 3=full weight bearing but apparently lame; and 4=full weight bearing and no lameness.

Side effects: These were observed after 9, 14, 21 and 30 days of treatment imposition.

Table 2. Score sheet for shoulder swelling

Parameter	Intervals of observation				
	0 Day	7 Day	14 Day	21 Day	30 Day
Swelling (scores)	2.42	1.42	1.25	0.75	0.17
Pain (scores)	2.22	1.75	1.00	0.66	0.16

Table 1. PRA and field survey

Criterion	Treatment	
	SVT	ITK method
High efficacy	9.6	9.3
Less duration (6–8 days)	9.1	7.3
Low cost	6.7	7.7
Easy availability	5.7	7.6
Convenience for use	8.4	9.1
Side effects	7.9	9.8

SVT, Standard veterinary treatment.

RESULTS AND DISCUSSION

PRA and field survey

The results after application of ITK on the shoulder swelling are presented in Table 2 and Fig. 2.

The mean scores of swelling decreased after application of ITK technology at the affected part.

The results of pain scores (Fig. 3) show that the mean scores of pain also decreased after application of ITK technology at the affected part. The pain score that was 2.23 on day 0 was reduced to 0.16 on day 30 after treatment.

The results after application of ITK on the joints and limb swelling are presented in the Table 3 and Fig. 4.

The reduction in mean scores of swelling was observed after application of ITK technology at the affected part.

The results of pain scores at different time intervals after treating joints swelling of limbs are presented in Fig. 5. The mean scores of pain were decreased after application of ITK technology at the affected part. The pain score that was 3 on day 0 was reduced to 0.71 on day 30 after treatment.

The results of weight bearing scores in standing position at different time intervals after treating joints swelling of limbs are presented in Fig. 6. There was gradual improvement in weight-bearing scores and on day 30 after treatment the mean score was 2.5.

The results of weight bearing scores during walking at different time intervals after treating joints swelling of limbs are presented in Fig. 7. There was gradual improvement in weight-bearing scores and on day 30 after treatment the mean score was 3.5.

The results of shoulder swelling showed that there was significant decrease in swelling and pain scores at different time intervals after commencement of treatment. It indicates that after treatment there was decrease in pain as well as swelling of the shoulder. In the treatment of joints and limb swelling, the application of ITK was also found effective. There was decrease in swelling and pain scores and on other hand there was marked improvement in lameness. The weight-bearing improved and the lameness subsided on day 30. The animal could walk normally (score=3.5).

CONCLUSION

The ITK was found very effective in treating swelling of shoulders or wounds in bullocks and

Table 3. Score sheet for joints and limb swelling

Parameter	Intervals of observation				
	0 day	7 days	14 days	21 days	30 days
Swelling (scores)	3.00	2.50	2.20	1.14	0.28
Pain (scores)	3.00	3.00	2.20	1.71	0.71
Weight bearing in standing position (scores)	0.00	0.57	1.42	2.00	2.50
Weight bearing in motion (scores)	1.00	1.28	1.85	2.4	3.5

swelling and pain of joints and limbs.

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Nadkarni, A. K. 1976. Dr K. M *Nadkarni's Indian Materia, Medica,* Vol I and II, Bombay Popular Prakashan, Bombay.

Code : 1597

Title of the ITK : Use of paste of gathjore grass for cure of fractured bones **in cattle, buffaloes and goats**

Description of the ITK : The tribals of Lohardaga district of Jharkhand are using this practice from early days. The gathjore grass is plucked and then converted into paste by pressing it. After that the deformed/fractured bone is settled and kept in exact position and then the paste is applied on the affected areas from every side and tied with cloth tightly. It is very useful and animals recover within 20 days.

Name and address of the discloser : **Shri R.K. Jha, Research Associate, Department of Fisheries,** Ranchi Veterinary College, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

Location of use of the ITK : Banpur, Kisko, Lohardaga (Jharkhand)

Experimenter : Dr B.K.Roy, Associate Professor, Department of Pharmacology and Toxicology, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

Village Banpur, P.O. Jori, block Kisko, dist. Lohardaga (Jharkhand).

PRA and field study

The field study was conducted following the PRA methodology with 20 respondents. The parameters or factors included were, extent of cure , duration of treatment , safety , bio - availability, regaining of milk, liking of plaster, effect on locomotion and effect on reproduction.

Experiment

An experiment was conducted in five replications with two treatments. In first group of five animals, the paste of gathjore was applied over the fractured bones after alignment and kept for a month. In second group of five animals plaster of paris was applied over the fractured bones after proper alignment and kept for a month.

Table 1. Matrix scoring for assessing performance of *gathjore grass in the treatment of fractured bones in* animals in comparison to allopathic treatment

Criterion	*Gathjore* grass	Allopathic treatment
Extent of cure	6	8
Days of treatment	10	5
Safety	8	7
Bio-availability	6	2
Regaining in milk	4	4
Liking of plaster	5	5
Effect on locomotion8		8
Effect on reproduction2		2

RESULTS AND DISCUSSION

PRA and field study

The data on PRA are presented in Table 1.

The results show that the ITK adopted by farmers takes more time in healing the bones as compared to allopathic system of treatment.

Table 2. Percentage cure of fractured bones after treatment with paste of gathjore grass and recommended allopathic medicine in animals

Days after treatment	Paste of *gathjore grass*	Plaster of paris
20	0.0	3/5 (60)
30	0.0	4/5 (80)
60	1/5 (20)	4/5 (80)

Figures in parentheses indicate percentages.

However, this practice ranked 6 for extent of cure and 8 for the allopathic medicine. Use of gathjore was advantageous in terms of safety and bio-availability, whereas the other parameters studied were same in both the methods of treatment.

Experiment

The extent of cure of fractured bones after treatment with gathjore grass and plaster of paris is given in Table 2. Only one animal out of five showed healing of bones on treatment with paste of gathjore after 60 days of treatment. The bone healing was not observed in any animal within 30 days of treatment with paste of gathjore grass. But four animals out of five showed bone healing after allopathic treatment. One animal did not show recovery even after 60 days with plaster of paris, perhaps due to heavy body weight of that animal, which always disturbed the plaster and could not lead to recovery.

CONCLUSION

On the basis of the results of the experiments conducted for 60 days, it is apparent that gathjore grass may not possess the property of bone healing. The results obtained for recovery of one animal may be due to proper alignment of bones. ❑

Code : **1590**

Title of the ITK : **Technique of curing bone fracture in animals**

Description of the ITK : *Harjore* is a perennial climber, which is used in treatment of bone fracture in animals as well as in human being. This practice is being used by the villagers of Samtoli village of Simdega district in Jharkhand for the last many years. Paste is prepared by crushing the *harjore* plant and it is applied on the fracture part and then tied along with sticks. At every 3 days interval, it is replaced by fresh *harjore* paste and this process is continued for 2 to 3 times.

Name and address of the discloser : Ms Sushmita Khalkho, C/o Dr Niva Bara, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

Location of use of the ITK : Samtoli, Simdega, Simdega (Jharkhand)

Geographical indicators : *Harjore,* a climber with stone fleshy quadrangular stems is found throughout the hotter parts of India and Sri Lanka.

Experimenter : Dr B.K. Roy, Associate Professor, Department of Pharmacology, Birsa Agricultural University, Ranchi (Jharkhand)

METHODOLOGY

Location

The experiment was conducted in village Samtoli, block Simdega, dist. Simdega (Jharkhand).

PRA and field study

A field study was carried out by using PRA tools covering 20 respondents. The ITK was compared with allopathic treatment on selected parameters, viz. extent of cure, duration of treatment, cost effectiveness, safety, increase in milk yield and effect on general health.

Experiment

The experiment was conducted with three replications having two treatments each. In first treatment *harjore* paste was applied over the

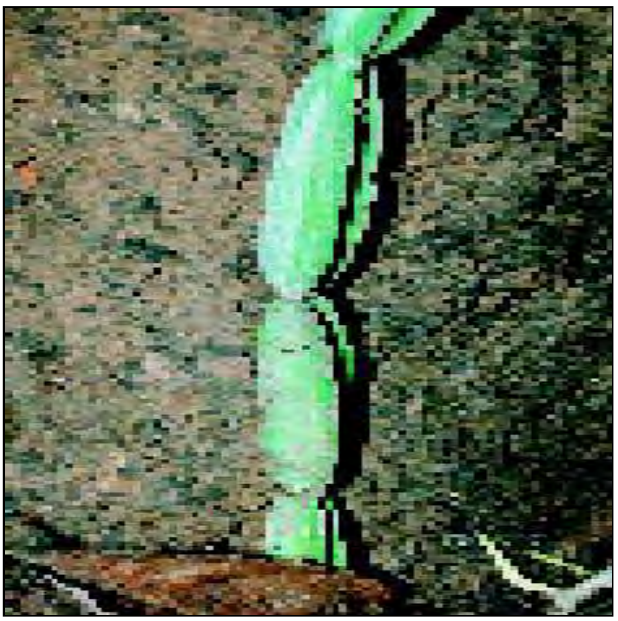


Fig. 1. Treatment of fracture by paste of *harjoren* in cattle, buffalo and goats

Table 1. Assessment of performance of harjore and plaster of paris in treatment of fracture in cattle

Criterion	Paste of *harjore*	Plaster of paris
Extent of cure	7	8
Time taken in bone healing	3	3
Cost effectiveness	10	2
Safety	6	2
Movement after cure	8	9
Licking of plaster	7	9
Perfect draft capacity	6	8

affected part, and in the second treatment plaster of paris was spread over the part.

RESULTS AND DISCUSSION

PRA and field study

Data generated from field survey reveal that farmers believe that harjore paste is 70% effective in bone healing as compared to 80% of allopathic system of plastering with plaster of paris (Table1). The time taken for bone healing is similar in ITK and allopathic system. However, the material used in ITK is cheaper and safer also. According to farmers' perception the ITK is very valuable for cure of the cases of fracture in animals.

Experiment

Results presented in Table 2 show that after application of paste of harjore, 33.3% of affected animals showed recovery within 30 days, whereas in case of plaster of paris the recovery was 66.6%. Besides, one out of three cases could not recover even after 90 days of treatment with the ITK. In allopathic system of treatment 100% cases recovered within 60 days.

Table 2. Effect of paste of harjore and plaster of paris on bone healing

Days after treatment	Recovery (%)	
	Paste of harjore	Plaster of paris
1 to 15	0.00	0.00
30	33.3	66.6
60	66.6	100.0
90	66.6	-

CONCLUSION

It was concluded that harjore plant possesses bone- healing properties.

Code	:	**864**
Title of the ITK	:	**Treatment for fractured bone in cattle**
Description of the ITK	:	Farmers in hilly areas of Kardang village in Lahaul district of Himachal Pradesh generally practice this method for treating the fractured bone in cattle. *Manu (Inula recemosa)* is a herb used for the treatment of fractured bone. Manu is ground well and its extract is spread on the fractured bone and covered tightly with the use of cotton. This practice helps in repaire of the fractured bone.
Name and address of the discloser	:	Mr. Prem Singh, Village and P.O. Kardang, Tehsil - Keylong, Lahaul and Spiti (Himachal Padesh)
Location of use of the ITK	:	This ITK is used in Keylong tehsil of dist. Lahaul and Spiti of Himachal Pradesh. This district is situated in the west of Great Himalayan range between 30° 21" and 30° 50" 57' north latitude and 75° 46" 29' and 78° 41" 34' East latitudes. Basically, the people have agriculture and animal husbandry as the main occupations. The climate of the district is most suited for production of temperate fruits and vegetables of very high quality. Majority of the area is under cold desert and is isolated, fragile, marginal and inaccessible. These areas are known for traditional ethos and wisdom for natural resource management.
Experimenters	:	Dr A.C. Varshney, Professor and Head; Dr S.P. Tyagi, Assistant Professor; Dr M.S. Kanwar, Assistant Professor; Dr S.K. Sharma, Assistant Professor and Dr Adarsh Kumar, Assistant Professor, Department of Surgery and Radiology, COVAS, CSKHPKV Palampur (Himachal Pradesh)

METHODOLOGY

PRA and field study

The experimenters visited a number of villages in Lahaul and Spiti districts, viz. Keylong, Kardang, Gauzang, Gemur, Tandi, Sansa, Tholang, Jalma, Trilokinath, Udaypur, Gondhla, Sissu, Kaza, Sagnam, Kibber and Losar. The plant *manu* is regularly cultivated in some of these villages. A number of local people, local veterinary practitioners, local medicine practitioners *(amchis)*, Ayurvedic practitioners (vaidyas) and local medicinal traders were contacted for their experience, if any, about the use of this plant as an adjunct to overall fracture management in animals. To draw conclusion for scientific validation of this ITK, information was collected in the form of a proforma. *Manu* plants and roots are shown in Fig. 1.

Experiment

The experimental study was conducted in the Department of Surgery and Radiology, COVAS, CSKHPKV, Palampur, (Himachal Pradesh). The study was conducted on five adult healthy mongrel dogs of either sex (3 male and 2 female)



Manu flowers



Manu flowers



Manu roots



close-up

Cultivated *manu*

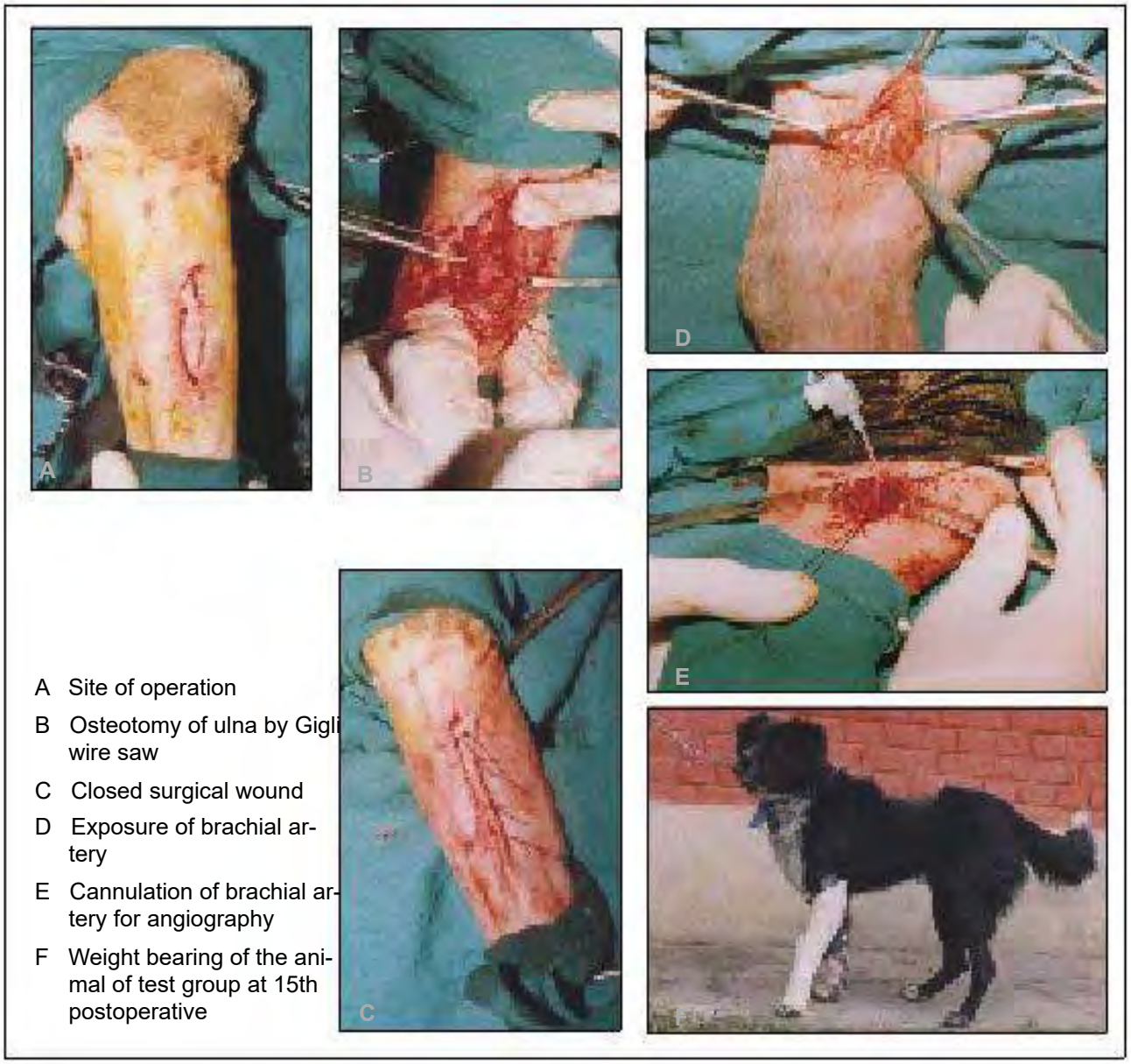


Dried *manu* roots

Fig 1. View of Manu flowers and roots

weighing 10-18 kg, divided into two groups. The first group of three animals was kept as test group, whereas the second group of two animals served as the control group.

Before start of experiment, the animals were acclimatized in college kennels as per standard practice. The animals were dewormed with suspension albendazole (Albomar, Agrivet India Ltd) @ 10 mg/kg body weight orally and vaccinated prophylactically against rabies by



A Site of operation
B Osteotomy of ulna by Gigli wire saw
C Closed surgical wound
D Exposure of brachial artery
E Cannulation of brachial artery for angiography
F Weight bearing of the animal of test group at 15th postoperative

injection of Raksharab (Indian Immunologicals) @ 1 ml per animal given subcutaneously. All the animals were maintained on standard and uniform diet during the entire course of study.

Preparation of manu root paste or ointment

The roots of manu plant (Inula recemosa) were completely dried in oven and were finely to powdered. 20 g powder was used. For one application per animal of group I, 20 g powder was usded. Just before application the powder was mixed with sufficient quantity of liquid paraffin to form a paste.

Application technique

The paste thus prepared was applied on the fractured limb after the application of few layers of cotton bandages in the animals of group I. The fractured limbs were then stabilized suitably by means of bivalved plaster cast or padded bamboo splints applied on the cranial and caudal aspects of fractured limb, and secured with adhesive tape and bandages. The manu paste was reapplied every fifth day till 15th post- operative day. No medication was used or applied on the fractured limb of animals of group II. However, external

coaptation as applied in group I was used.

Evaluation of fracture healing

Clinical Observations: All the animals were clinically examined regularly for the development and progress of inflammation and oedema at the fracture site. The extent of lameness, weight-bearing capability and extent of pain were also recorded. Besides,the routine clinical parameters such as rectal temperature, respiration rate and heart rate were also recorded at 0, 3, 7, 15, 30, 45 and 60 days after operation. The extent of lameness was evaluated during standing and locomotion phase (Table 1).

Table 1. Effect of fracture healing using paste of manu plant roots on rectal temperature in dogs

Group no.	Days post treatment						
	0*	3	7	15	30	45	60
Group-I (N=3)	102.20± 0.20	102.20± 0.00	102.00± 0.00	102.25± 0.25	101.90± 0.10	102.10± 0.10	102.20± 0.00
Group-II (N=2)	102.10± 0.10	102.10± 0.10	101.90± 0.10	102.00± 0.00	102.20± 0.00	102.00± 0.00	102.00± 0.00

*Day at which treatment was instituted; P>0.05 between days as well as groups; N, number of animals in each group; Group I, animals treated with manu paste; Group II, untreated control.

Haematological studies

From cephalic vein of all the dogs, 5 m blood was collected in heparinized syringes on days 0, 3, 7, 15, 30, 45 and 60 days after operation. A part of it was used to estimate the levels of haemoglobin (Sahli's method) , P C V (microhaematocrit method),TEC, TLC (Neubaur chamber) and DLC using Wright's staining technique.

Biochemical studies

The plasma was separated from the remaining blood samples, and the concentration of alkaline phosphates calcium and phosphorus were estimated using Semi - automatic Chemistry analyser (RA-50, Bayer India Ltd).

Radiological examination

Plain mediolateral radiographs of the fractured limb were taken at 0, 15, 30, 45 and 60 days after operation in all the animals, using standard radiographic exposure factors (Fig. 2 a-f). These radiographs were studied for assessment of fracture-healing process.

Angiographic studies

Angiograms of the fractured limb were obtained at 0, 15, 30, 45 and 60 postoperatively. Arteriography was carried out in all the animals under general anaesthesia as described earlier, taking routine aseptic precautions. Their brachial artery of the fractured limb was exteriorized and cannulated using 20 G intravenous canula. The contrast agent containing diatrizoate acid and meglumin (Contrastin 76%, Dabur India Ltd) was injected @ 20 ml per animal rapidly into the brachial artery. The medio- lateral radio graphs were taken immediately after injection using standard radiographic exposure factors. The cannula was removed and the brachial artery was sutured using 6–0 Vicryl (Ethicon). The surgical wound was closed routinely. The arteriograms were evaluated and compared, and the course, number , contour and calibre of the ves sels supplyingthe fractured areato assess the amount of blood supply at the site.

Statistical analysis

Statistical analysis of the data was carried out

using Student's t test and comparison between the treatments and days was done at 5% level of significance.

RESULTS AND DISCUSSION

PRA and field study

Information collected from field study using PRA tools is as follows

(i) Number o f persons contacted : 64

(ii) Number of persons knowing about the use of manu infracture healing in animals : 11

(iii) Species of animals in which this technique was generally used: bovine, caprine and ovine; besides two persons also talked about its use in mules as well (in general this technique was used in lighter-weight animals).

(iv) Age of animals: All age groups

(v) Sex of animals: Both sexes

(vi) Fractured body parts commonly treated: Fore and hind limbs; it was also used for tail and horn fractures sporadically.

(vii) Type of fractures : Closed and uncomplicated, long bone fractures. Mostly metacarpal, metatarsal, radius-ulna and tibial fractures were subjected to this fracture fixation technique.

(viii) Common cause of fractures: The people were inquired about the various possible causes of fractures such as automobile accidents , fall from a height , slipping , jumping, entangling a part of body in crevices etc. All causes were found to be prevalent.

(ix) Season or climatic condition at the time of fracture treatment: All seasons.

(x) Preliminary treatment adopted before the use of manu and fracture fixation: Some of the people used temporary bandaging or splints and oral feeding of some local medicines.

(xi) Time lapse between fracture occurrence and its final fixation: 0–3 days; one person also told about the use of this technique after a few weeks when the other conventional methods of fracture management failed.

(xii) The part of plant utilized for treatment: Roots

(xiii) Method of application: The roots of manu plant were thoroughly sun-dried and then finely ground and a paste was prepared with any home - available edible oil. A thick layer of this paste was thoroughly applied over the fractured part or limb and covered tightly withseveral layers of cloth bandages and cotton. A number of small wooden or bamboo splints were also applied over it with cloth bandages.

(xiv) Other treatments used concurrently: Nil

(xv) Any post - treatment precautions: Restricted activity till complete fracture healing.

(xvi) Time of removal of this coaptation: Varying from 2 to 4 months.

(xvii) Status of animal's locomotion after removal of coaptation : Mostly satisfactory.

(xviii) Complications: The people were asked about the occurrence of various complications such as haemorrhage, pus formation, excessive inflammation or oedema of the dependent part, loosening of assembly, progressive deterioration of gait, angulation of limbetc. The premature loosening of coaptation, inflammation or oedema of the dependent part and large callus formation were recorded in a few cases.

On the basis of above feedback, it was presumed that this plant may have some fracture-healing-supporting capabilities, which need to be further investigated by scientific methods.

Experiment

Clinical observations

The rectal temperature, respiration rate and

heart rate in the animals of both the groups remained within the normal range and did not show any significant change during entire course of study (Tables 1, 2 and 3). Feed intake was also normal in all the animals of both groups throughout the period of study. The animal of *manu- treated group showed greater pain and* inflammation in the immediate postoperative days up to day 15. However, in general they started early complete weight bearing on the affected limb from day 35 onwards as compared to control group (Table 4).

Haematological observations

No significant change was observed in the haematological parameters throughout the period of study in all the animals of both the groups (Tables 5, 6, 7 and 8). Although manu-treated group showed slight neutrophilia from day 0 onwards to day 30 after operation but the increase was not statistically significant (P>0.05).

Biochemical observations

Calcium level in blood increased from day 0 to day 3, declined continuously thereafter and

Table 2. Effect of fracture healing using manu plant roots paste on respiration rate of animals

Group no.	Days post treatment						
	0	3	7	15	30	45	60
Group I (N=3)	20 ą 0.0	30 ą 2.0	30 ą 2.0	30 ą 2.0	29 ą 3.0	25 ą 3.0	27 ą 1.0
Group II (N=2)	30 ą 6.0	32 ą 0.0	29ą 1.0	30 ą 2.0	27 ą 1.0	30 ą 0.0	32 ą 0.0

P>0.05 between days as well as groups.

Table 3. Effect of fracture healing using manu plant roots paste on heart rate of animals

Group no.	Days post-treatment						
	0*	3	7	15	30	45	60
Group I (N=3)	94 ą 2.0	94 ą 2.0	88 ą 0.0	87 ą 5.0	88 ą 0.0	84 ą 0.0	90 ą 2.0
Group II (N=2)	92 ą10.0	91 ą11.0	94 ą12.0	96 ą16.0	92ą6.0	95ą7.09	4ą 6.0

P> 0.05 between days as well as groups.

Table 4. Extent of lameness in animals of both groups

Group no.	Position of animal	Days interval (days)						
		0	3	7	15	30	45	60
Group I	Standing	+++	+++	+++	++	+	-	-
	Moving	+++	+++	+++	++	+	+	-
Group II	Standing	+++	+++	++	++	++	+	-
	Moving	+++	+++	++	++	++	++	+

Table 5. Effect of fracture healing using manu plant roots on haemoglobin (g %) of animals

Group no.	Days post-treatment						
	0*	3	7	15	30	45	60
Group I (N=3)	10.7ą0.50	11.2ą0.40	10.85ą0.05	9.3ą1.30	10.0ą1.0	10.4ą0.40	10.7ą0.50
Group II (N=2)	10.1ą1.90	10.05ą1.45	10.15ą1.65	10.25ą1.95	10.0ą1.80	10.2ą1.60	10.35ą1.85

P> 0.05 between days as well as groups.

Table 6. Effect of fracture healing using manu plant roots on PCV (%) of animals

Group no.	Days post-treatment						
	0*	3	7	15	30	45	60
Group I (N=3)	50ą2.0	44ą4.0	49ą1.0	43ą1.0	45ą3.0	48ą4.0	46ą2.0
Group II (N=2)	51ą7.0	49.5ą5.5	53ą7.0	51ą7.0	47ą5.0	48.5ą6.5	48ą4.0

P>0.05 between days as well as groups.

Table 7. Effect of fracture healing using manu plant roots on TLC (thousand/cumm) of animals

Group no.	Days post-treatment						
	0*	3	7	15	30	45	60
Group-I (N=3)	6.45ą 1.13	9.60ą 0.60	10.67ą 0.67	22.95ą 4.95	27.22ą 4.90	22.67ą 7.45	20.31ą 9.79
Group-II (N=2)	21.86ą 13.33	22.36ą 14.13	23.02ą 15.49	21.49ą 13.99	22.61ą 13.38	21.90ą 13.33	21.85ą 13.61

P> 0.05 between days as well as groups.

Table 8. Effect of fracture healing using paste of manu plant roots paste on DLC of animals

Group no.	Days post treatment						
	0*	3	7	15	30	45	60
Group I (N=3)	N 75ą5.0 L 25ą5.0	75ą1.0 25ą1.0	78.5ą0.5 21.5ą1.5	78.5ą1.5 21.5ą1.5	83ą3.0 17ą3.0	80ą0.0 20ą0.0	81ą3.0 19ą3.0
Group II (N=2)	N 82.5ą7.5 L 17.5ą7.5	83ą3.0 17ą3.0	18ą6.0 15ą5.0	82ą6.0 85ą5.0	86ą8.0 14ą8.0	83ą7.0 17ą7.0	83ą3.0 17ą3.0

Table 9. Effect of fracture healing using manu plant roots on calcium conc. (mg/dl) of animals

Group no.	Days post-treatment						
	0*	3	7	15	30	45	60
Group I (N=3)	12.6ą2.6	14.25ą2.25	8.1ą0.60	4.3ą0.10	4.8ą0.0	4.5ą0.0	9.95ą1.55
Group II (N=2)	15.25ą4.45	12.8ą3.0	10.3ą2.8	9.3ą2.5	865ą2.15	9.35ą1.85	12.3ą3.10

P>0.05 between days as well as groups.

Table 10. Effect of fracture healing using manu plant roots on alkaline phosphatase (U/L) of animals

Group no.	Days post-treatment						
	0*	3	7	15	30	45	60
Group I (N=3)	132ą6	135ą7	142ą14	139.5ą13	139ą7	136ą6	137ą5.0
Group II (N=2)	138ą3.0	152ą5	147ą4	134ą2	137ą7	136ą3	9.5ą8

Table 11. Effect of fracture healing using manu plant roots paste on phosphorus conc. (mg/dl) of animals

Group no.	Days post-treatment						
	0*	3	7	15	30	45	60
Group I (N=3)	5.15ą0.35	5.5ą0.30	5.05ą0.45	4.35ą1.35	5.2ą0.40	5ą0.80	5.1ą0.70
Group II (N=2)	7.2ą2.5	7.85ą2.05	8.7ą2.5	8.4ą2.4	8.25ą2.25	8.5ą2.7	7.85ą2.35

P>0.05 between days as well as groups.

almost returned to normal levels by day 60 after operation in the manu-treated group as compared to control, but the change was not statistically significant between the days as well as between the groups (Table 9). No significant difference was noted in the phosphorus and alkaline phosphatase levels in the blood of animals between the days as well as between the groups (Tables 10 and 11).

Radiological evaluation

The radiographs taken immediately after creation of fracture and coaption of limb on day 0 showed the presence of a clear radiolucent line of fracture in the proximal diaphysis of ulna in all the animals of both the groups (Fig. 2a).

In the group treated with manu this radiolucent fracture line turned hazy toward transcortical aspect of ulna at fracture site in the day 15 radiographs. However there were no radiographic signs of development of periosteal callus at this stage. In the day 30 radiographs, the development of periosteal callus was clear as a small radio-opaque area, extending beyond the caudal margin

of ulna at the fracture site The radiolucency of fracture line further decreased in the cis-cortex, but it could not be ditected in trans-cortex. The medullary cavity at the fracture site became more radiolucent (Fig. 2b). In the radiographs taken on day 45, no radiolucent fracture line was visible and the fracture gap was completely filled. The medullary continuity at the fracture site also resembled its almost normal radiographic appearance. The amount of endosteal and periosteal callus was also reduced (Fig. 2c). By day 60, the remodeling process of callus was in advanced stage, as evident by further reduction in its size (Fig. 2d).

In the animals of control group, the radiographs taken up to day 30 showed clear and discernible fracture gap, evident by dark radiolucent line. The periosteal and endosteal callus were also present but bridging was incomplete (Fig. 2 e,f).

Angiographic evaluation

Normal 0 day angiogram: The radiograph taken immediately after injection of contrast agent into the brachial artery at the distal third humoral region revealed complete opacification of the brachial artery and its distal branches throughout the distal limb. The thick brachial artery branched into relatively thinner collateral ulnar artery, superficial brachial artery and median artery at the proximal metaphyseal level of radius bone. The main trunks of these branches were clearly visible and well defined throughout their course alongside radius and ulna. The superficial brachial and median arteries, after originating from main brachial artery immediately gave rise to many prominent but smaller arterioles which coursed proximally, distally and caudally in the adjoining area. The superficial brachial artery once again branched into prominent medial and lateral divisions at about proximal third diaphyseal aspect of radius and ulna. The diameter of the main trunks of these vessels and median artery gradually decreased distally; however their entire course along side radius and ulna as well as carpal joint was very clear. The collateral ulnar artery coursed mainly on caudal aspect of ulna and tapered off quickly by the distal third diaphyseal aspect of ulna.

All along their course, all these main arteries gave rise to numerous minute branches, which supplied the bones and soft tissues of the area. The density of arterioles and other vessels was relatively more in proximal as well as in distal metaphyseal area of radius and ulna, whereas in the rest of the places the penetration of these smaller vessels was almost uniform. At dorsal aspect of radius, the intensity of vascular network appeared further less due to the presence of less quantity of soft tissue (Fig. 2a).

Angiogram at day 15: Angiograms of the limb treated with *manu* on day 15 after operation revealed extensive vascular proliferation in the entire forelimb. The vascularity was more profound in the area surrounding the fracture site. There the soft tissue thickness also increased moderately along its entire course (Fig. 2b).

The angiograms of the limb of the control group on day 15 revealed only slight increase in the overall vascular proliferative activity as compared to that of treated group. The increased vascularity was also limited mainly more or less around the fracture site (Fig. 2g).

Angiograms at day 30: On day 30, the increased vascularity was still visible. The minute vascular network was however not as much prominent as on day 15. Increased thickness of the major arteries along their entire course was still clear. Increased collateral circulation at the fracture site was evident from the development of a few thicker and minute vessels at the site. The fracture line was not clearly visible due to increased opacification of the area. The soft tissue thickness around the fracture site returned to normal (Fig. 2c).

The angiograms of the limb of the control group day 30 revealed clear and discernible radioleucent fracture line and incomplete bridging

of fracture gap. Increase in local vascularity was relatively less compared to test group (Fig. 3f).

Angiogram at day 45: on day 45, the diameters of the main vessels showed a slight decrease towards normal. The minute branches supplying the surrounding soft tissue almost returned to their normal pattern as on day 0. Radiolucent fracture line was still not visible; however periosteal callus extending beyond the caudal surface of ulna at fracture site could be identified easily. There was moderate increase in thickness of periosteum proximal and distal to this periosteal callus as well (Fig. 2d).

Angiogram at day 60: The vascular pattern now resembling to normal day 0 angiogram. The radiographic signs of fracture union were appreciable. The fracture gap was completely filled, the medullary continuity at the fracture site was restored and reduction in size of periosteal callus was evident. There was no increased thickness or radio-opacity in the periosteum adjacent to the fracture line as well (Fig. 2e).

On the basis of clinical, haematological, biochemical, radiological and angiographic studies, it can be concluded that the use of *manu* *(Inula recemosa)* in paste form over fractured area results in greater increase in blood circulation at the fracture site. This in turn brings in more nutrients, phagocytes and osteoblsats at the fracture site and thereby results in greater osteogenic turnover. This ultimately results in enhancement of fracture-healing process through early bridging of fracture gap, rapid gain in structural strength of bone and early remodelling of fracture callus. Therefore the animal experiences early restoration of ambulation and reduced overall convalescence period after fracture. The initial overall increase in blood supply at the fractured limb after the application of *manu* also results in greater pain and inflammation, therefore *manu* should be applied with caution after a gap of 3-4 days only and may be discontinued if severe inflammation of skin follows.

CONCLUSION

On the basis of the results obtained from the study, it was concluded that the use of *manu* in paste form over fractured area enhances the fracture-healing and reduces the period of convalescence.

Code	:	**1968**
Title of the ITK	:	**Wound management in animals by use of leaf extract of ridge gourd (*Luffa accutangula*)/ekdandi (*Tridax procumbent*)**
Description of the ITK	:	This practice is followed by the farmers of semi-arid tract of Western Maharashtra specially in parts of Pune, Satara, Solapur and Ahmednagar districts. Ridge gourd/*ekdandi* leaves are ground and the juice is extracted. The extracted juice is smeared over the wounds of the animal. This practice effectively controls wound in animals due to antiseptic lotion present in ridge gourd/*ekdandi* leaves.
Name and address of the discloser	:	Shri B.B. Khutal, Solapur (Maharashtra)
Location of use of the ITK	:	The practice is found in semi-arid tract of Western Maharashtra specifically in parts of Pune, Satara, Solapur and Ahmednagar districts.
Experimenter	:	Dr.S.N.Patil, Associate Professor,Surgery and Radiology, Nagpur Veterinary College, Nagpur (Maharashtra)

METHODOLOGY

Location

Vidarbha region and in veterinary hospitals in Nagpur.

PRA and field study

Cattle owners of six districts of Vidarbha region i.e. Nagpur, Chandrapur, Bhandara, Gondia, Wardha and Amaravati were randomly selected. Fifteen cattle owners from every village were interviewed to record the observations regarding the use of the ITK on a questionnaire and the results synthesized.

Experiment

he study was carried out for treatment of wound on the animals of different species brought to the different veterinary hospitals of Nagpur city and at the owners house. The fresh leaves of ridge gourd (*Luffa acutangularoxb*) were collected from Umer taluka and nearby areas. These were washed with distilled water for 2-3 times and triturated in a grinder cum mixer to form the paste. The paste was squeezed with muslin cloth to get the juice. The leaves of *ekdandi (Triadax procumbent)* were collected from the premises of Cattle Breeding Farm of Nagpur Veterinary College, Nagpur and the method used for ridge gourd was adopted for obtaining the juice.

RESULT AND DISCUSSION

PRA and field study

Livestock owners from six districts of Vidarbha region were interviewed in respect of their treatment of animal wound with leaf juice of *ekdandi* and ridge gourd. The results showed that 48.25% livestock owners are treating animal wounds with local application of *ekdandi* leaf juice. However, 5.92% of livestock owner on an average are treating wounds by smearing leaf juice of ridge gourd.

The number of days required for effecting a complete cure in minor wound with the treatment of leaf juice of *ekdandi* ranged from 4 to 10 days

and in respect of major wound it is 10 to 14 days. Time required for complete cure with treatment of leaf juice of ridge gourd ranged between 6 to 10 days and 8 to 14 days in minor and major wounds, respectively.

Experiment

A total 196 animals of different species were treated out of which 107 animals were subjected to the ridge gourd treatment and 89 animals were treated with juice of *ekdandi* leaves in cattle and buffalo. Minor wounds which were treated with juice of *ekdandi* and ridge gourd leaves took 5.5 days and 7.5 days, respectively for healing. Where as in case of major wounds the average healing time was 10.5 days and 16.5 days, respectively. In case of sheep and goat, the average healing time for minor wound was 6.5 and 7.5 days as against 10.5 days and 12.5 days in major wounds, respectively. In other animals like horse, dog and cat the average healing time for minor wounds was 6 and 8 days whereas in case of major wounds the average healing time was 12 and 17.5 days for *ekdandi* leaves and ridgegourd leaves, respectively.

CONCLUSION

The results indicated that treatment of minor and major wounds in different species in animals with juice of *ekdandi* and ridge gourd leaves took less number of days (5 to 20 days) for complete healing of wounds as compared to animals treated with local antibiotic preparations (7-22 days). ❑

Code : **279**

Title of the ITK : **Wound management in cattle**

Description of the ITK : *Kumati (Colocynthis vulgaris)* fruit pulp mixed with neem oil is used to control maggot wound in cattle. Maggots are killed by the toxic action of fruit pulp and neem oil acts as repellent for the flies. This technology is in practice for the last five years, adopted by the farmers of Kovilur village of Pudukkottai district in Tamil Nadu.

Name and address of the discloser : Permanent address: Shri K. Ganeshan, S/o. Shri Deena Pana Karuppaih, 1/327, Melakkottai Village, Kovilur, Alangudi, Pudukkottai (Tamil Nadu) 622 301, Present address: Shri K. Ganesan, Pradhna Nursery, Open-Air Theatre - Prathana, New Mahabalipuram Road, Chennai (Tamil Nadu)

Location of use of the ITK : Melakkottai, Kovilur, Alangudi, Pudukkottai, (Tamil Nadu) 622 301

Geographical indicators

Common name : *Kumati* fruit

Botanical name : *Colocynthis vulgaris*

Family : *Cucurbitaceae*

Description

The Cucurbitaceae or cucurbit family (also commonly referred to as the cucumber, gourd, melon, or pumpkin family) is a medium-sized plant family, primarily found in the warmer regions of the world. It is a major family for economically important species, particularly those with edible fruits. Some of these represent some of the earliest cultivated plants in both the Old and New Worlds. Some have medicinal and other uses. The family is distinct morphologically and biochemically from other families and is therefore considered monophyletic. General opinion is that it is closest allied phylogenetically with the Begoniaceae in the order Violales. Some of the major genera are less clearly defined and are in need of modern monographic treatments.

Distribution

Pantropical and subtropical; a few representatives in temperate to cooler climates.

Experimeters : Dr F.R. Sheriff, Director of Extension Education, Tamil Nadu Veterinary and Animal Sciences University,

Madhavaram Milk Colony Post, Chennai (Tamil Nadu) 600 051; Dr S. Thilagar, Professor and Head and Dr C. Radhakrishnan, Associate Professor. Department of Clinics, Madras Veterinary College, Chennai (Tamil Nadu) 600 007

METHODOLOGY

Location

The experiment was conducted in the Department of Clinics, Madras Veterinary College, Chennai.

PRA and field study

Unstructured interview was conducted and all the details were obtained on the use and methods of ITK.



*Kumati*plant

Experiment

Kumati (*Colocynthis vulgaris*) fruit is rounded, 2-3 cm in diameter, 20-30 g in weight, greenish yellow with white streakes found in village hedges. One fruit can yield 5-10 g of fruit pulp. The fruit pulp is a drastic hydragogue, cathartic contains mixture of alkaloid and citrullol.

Neem oil is prepared from *vembu* or neem (*Azadirachta indica*) fruits. It is cosmopolitan in distribution. Seen in deciduous forests and also widely cultivated. The oil is extracted from the seeds, oil contains *nimbin, nimbidine, limonoids* and *catechin.*

Maggot wounds are caused by certain flies, which feed on damaged tissues and lay eggs, which subsequently pupate to larva and adult fly (fig. 2).

Four groups each comprising of 6 animals with maggot wounds were constituted and given following treatments.

Group I: Animals having maggot wounds were treated by applying turpentine oil only (presently practised) till the larvicidal effect is achieved.

Group II: Animals were studied by applying



*Kumati*fruit

pulp of *kumati* fruit only on the maggot wounds as followed in Group I.

Group III: Animals having maggot wounds were treated with neem oil only.

Group IV: Animals having maggot wounds were treated with a mixture of *kumati* fruit pulp and neem oil. The neem oil and the turpentine oil were procured from the pharmaceuticals and local shops. The *kumati* fruit pulp was removed and paste was prepared using mortar and a pestle. In all the cases the wounds were cleaned with normal saline and the cavity was filled with gauze

soaked in turpentine oil, neem oil *kumati* fruit pulp and *kumati* fruit pulp and neem oil mixture respectively in all the groups. I, II, III, IV, respectively. The cases were observed daily for various changes and with different treatments for a period of 5_7 days. The treatments were given uniformly without any alterations between the groups.

In-vitro *study*

An *in-vitro was* study conducted separately to see the larvicidal effect in a petri-dish containing 2_3 ml/g the study materials and a live larva was kept in it. The larvicidal effect of all these preparations was studied for 24 hours (Fig. 3). The larva was in contact with these preparations during the entire period of observation.

RESULTS AND DISCUSSION

PRA and field study

Results obtained from the field study reveal that medical treatment is more efficacious in healing maggot wound as compared to the other methods (Fig. 4). Mixture of *kumati* fruit pulp and neem oil gave better response than when the components were applied separately.

Experiment

Clinical observation

Nature of wound, discharge, group details of



animals and region of wound incidence healing signs, larval stage, duration of treatment were observed daily and are given Tables 1, 2, 3, 4, 5 Figs. 5 and 6. Animal-wise and region-wise incidence of maggot among the study animals have been shown in Figs. 7 and 8 respectively.

Microbial examination

To study the various microbes involved in the maggot wounds the swab from the wound was streaked on to the nutrient agar plates. After incubation for 12_24 hours, the colonies were studied for then morphology and subjected to Grams staining and other staining procedures like Capsular staining and acid fast (if applicable), as preliminary steps towards the identification of pathogens involved. The suspected pathogenic

Table 1. Animals of Group I treated with turpentine oil

Animal	Breed	Sex	Colour	Lactation	Housing	Affected	Duration
Cow	Jersey	F	Brown	3rd	SI	Chest	4
Cow	J. Cross	F	Brown	2nd	I	Vulva	6
Bull	ND	M	Black	5 year	SI	Elbow	8
Buffalo	CB	F	Black	1st	SI	Vulva	4
Cow	CB	F	Brown	3rd	I	Tail	5
Cow	HF	F	Black and white	2nd	SI	T. Ischi	3

CB, Cross breed; SI, semi-intensive; I, intensive; J, jersey; ND, non-descript; HF, Holstein-Friesian; VA, ventral abdomen; F, female; M, male.

Table 2. Effect of *kumati* fruit pulp on animals of group II having maggot wounds

Animal	Breed	Sex	Colour	Lactation	Housing	Affected region	Duration (days)
Cow	J	F	Black	5th	SI	VA	4
Calf	J. Cross	F	Black and white	4 month	I	Chest	6
Cow	ND	F	Black	3rd	SI	Elbow	6
Buffalo	CB	F	Black	1st	SI	Vulva	4
Cow	CB	F	Black	4th	I	Vulva	5
Cow	HF	F	Black and white	2nd	SI	Neck	3

CB, Cross breed; SI, semi-intensive; I, intensive; J, jersey; ND, non-descript; HF, Holstein-Friesian; VA, ventral abdomen; F, female; M, male.

Table 3. Effect of neem oil on group III animals having maggot wounds

Animal	Breed	Sex	Colour	Lactation	Housing	Affected region	Duration (days)
Calf	CB	F	Brown	6 months	SI	Hoof	3
Cow	Jersey	F	Brown	4	SI	Thigh	4
Cow	CB	F	Black	2	SI	Abdomen	2
Buff	Murrah	F	Black	1	SI	Vulva	5
Bullock	Hallikar	M	Grey	2	I	Hoof	2
Buffalo	Murrah	F	Black	2	SI	Neck	4

CB, Cross breed; SI, semi-intensive; I, intensive; J, jersey; ND, non-descript; HF, Holstein-Friesian; VA, ventral abdomen; F, female; M, male.

Table 4. Effect of *kumati* fruit pulp and neem oil mixture on group IV animals having maggot wounds

Animal	Breed	Sex	Colour	Lactation	Housing	Affected region	Duration (days)
Buffalo	Murrah	F	Black	4th	SI	Nasal	5
Cow	J. Cross	F	Brown	2nd	SI	Chest	3
Cow	ND	F	Black and brown	2nd	SI	Vulva	4
Cow	CB	F	Black	3rd	SI	Horn	4
Cow	F. Cross	F	Black	1st	SI	Mandible	7
Buffalo	Murrah	F	Black	2nd	SI	Neck	5

CB, Cross breed; SI, semi-intensive; I, intensive; J, jersey; ND, non-descript; HF, Holstein-Friesian; VA, ventral abdomen; F, female; M, male.

Table 5. Animal-wise incidence of maggot wound

Animal	Animal-wise incidence	(%)
Cow	14	58.3
Buffalo	6	25.0
Bull/bullock	2	8.3
Calf	2	8.3

colonies were streaked uniformly in the Mueller and Hintonagar and appropriate discs were placed to know the antibiogram pattern of respective pathogens. The details of the microbes are furnished under larval study.

Larval study Out of 24 samples in all the cases the larvae responsible was identified as *Chrysomia bezziana* and the stages of larva being II and III. In one or two cases live maggots were observed even after 2_3 days in groups I, II and IV because of the nature of the wound, containing both egg and all stages of larva. The study also indicates that the preparations were not effective on the eggs of *Chrysomia bezziana* . No difference was observed in the larvicidal effect of these preparations on The surface epithelium was completely denuded and covered by sero-fibrinous exudates containing discrete neutrophils. Dermis containing numerous discrete neutrophils with loss of collagen was observed.

Group I (Turpentine oil)

Sectioned tissues showed neutrophil infiltration and a few eosinophilic infiltration in the exudates and attempting to form fibrinous vascular tissues was evident on 3_4 days. Fibroblast and angioblast were also seen at the level of the wound (Fig. 9).

Group II (Kumati *fruit pulp*): Surface was covered by marked necrotic area, containing discrete neutrophils and the base showing the fibro-vascular tissues (Fig. 10).

Group III (neem *oil*): The study revealed massive infiltration of neutrophils with a few macrophages. Fibro vascular tissues formation with surface epithelium is also replaced by necrotic tissues (Fig. 11).

Table 6. Larvicidal effect

Group	Duration (hr)	
	In-vitro study	*In-vivo* study
Turpentine oil (Group I)	4-6	Effective in 12-24 hours
Kumati fruit pulp (Group II)	18-36	Partially effective in 36-72 hours
Neem oil (Group III)	18-36	Partially effective in 36-72 hours
Kumati fruit, Pulp and neem oil mixture	12-24	Effective in 12-36 hours

Table 7. Clinical observation of wound

Group	Discharge Duration	Day of healing signs	Duration of treatment
Turpentine oil (Group I)	Reduces from day 4	Starts from day 4	Average 5-10 days
Kumati fruit pulp (Group II)	Partial on day 7	Partial on day 7	Prolonged
Neem oil (Group III)	Partial on day 7	Partial on day 7	Prolonged
Kumati fruit, pulp and neem oil mixture (Group IV)	Reduces from day 3	Starts from day 3	Average 5-10 days





In-*vitro* study of larvidical effect

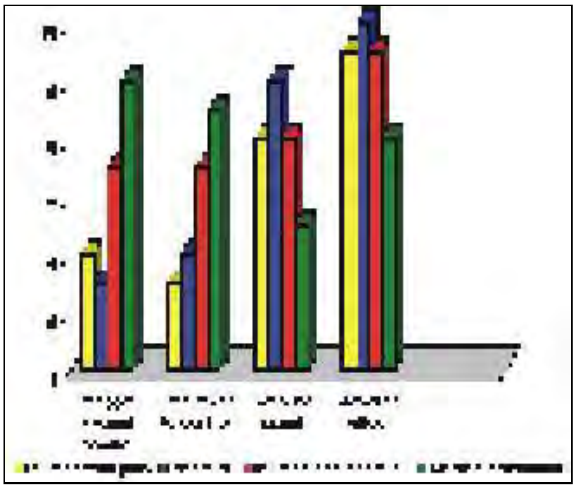


Fig. 4. Relative performance of different types of treatments



Fig. 5. Maggot wound - ventral abdomen - healing - with no discharge - 4th day



Fig. 6. Maggot Wound - Elbow Region - Healing - with no discharge - 4th day

Group IV (*kumati* fruit pulp and neem oil mixture)

Acute inflammatory exudates were seen at the level of wound containing exudates, numerous discrete neutrophils and few macrophages. Necrotic tissues were evident at the surface fibro-vascular tissues and neutrophils were seen at the level of wound. Collagen was scarce at the level of dermis (Fig. 12).

Maggot wounds

1. The maggot wounds were seen more in cow (58.3%) and buffalo (25.0%) as compared to other animals. This observation might be due to population of the cattle. Among the sites the most

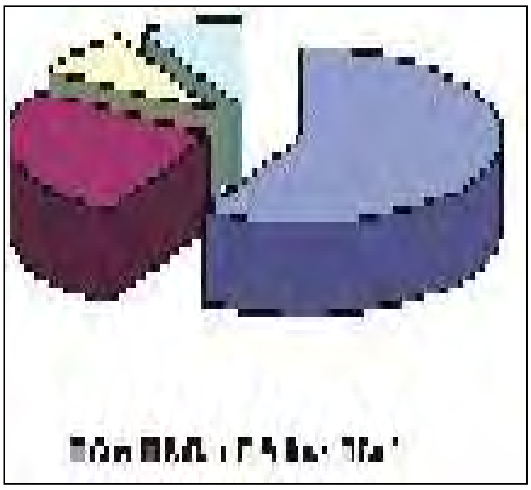


Fig. 7. Animal-wise incidence of maggot wound

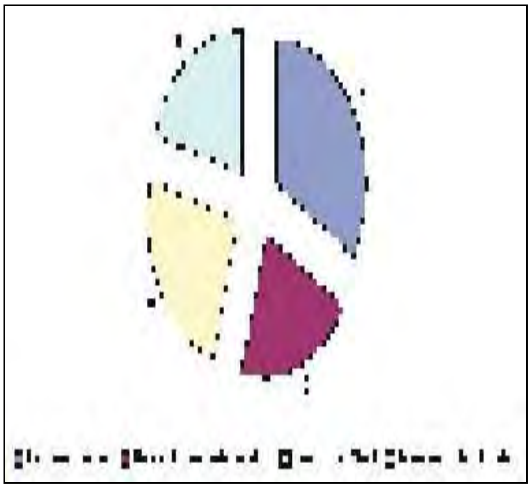


Fig. 8. Region-wise incidence of maggot wounds in animals



Fig. 11. Neem oil (Group-III)

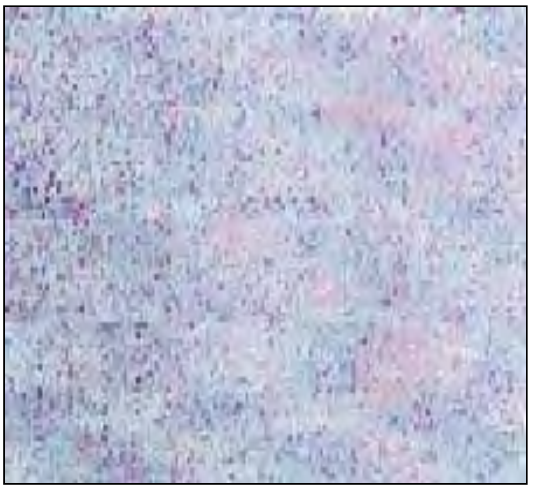


Fig. 9. Turpentine oil (Group-I)

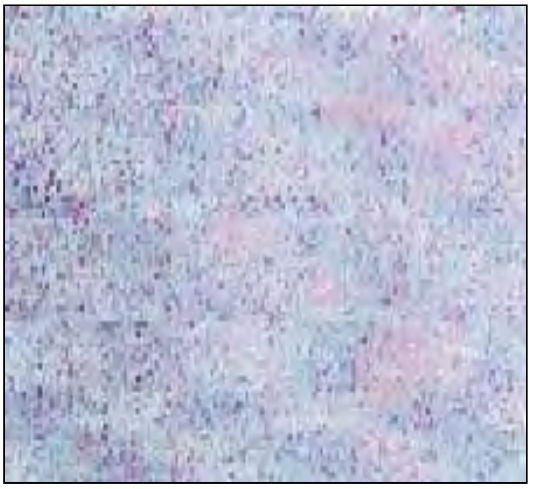


Fig. 10. *Kumati* fruit pulp (Group-II)

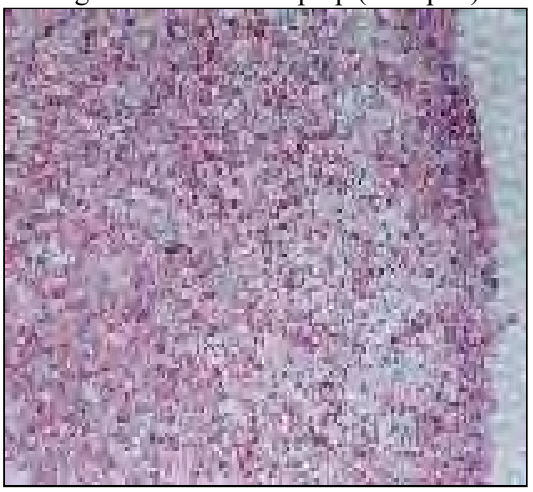


Fig. 12. *Kumati* fruit pulp + neem oil mixture (Group-IV)

common are involved was the perennial region involving tail, vulva and pelvis (33.30%), followed by head and neck (25.0%). This may be due to soiling of the region with excreta and waste body fluid and poor maintenance of region by the cattle owners.

2. The incidence was seen more in the animals reared in the semi-intensive system, which is a common practice in the

metro city.

3. The extent of the damage was more at the region where there is more muscle and 50-60 larvae were removed from such area. In contrast, in the area close to the musculo-skeletal border the number of larvae was less.
4. The larvicidal effect of all these preparations both *in-vitro* and *in-vivo* did not vary much. The effect of the neem oil and *kumati* fruit pulp and neem oil mixture showed good results, except that time taken in Group IV little more (delayed effect) than in Group I.
5. The results of the clinical symptoms like discharge, healing pattern and time and duration of treatment is encouraging and more or less similar in Group I and Groups where turpentine oil and a mixture of *kumati* fruit pulp and neem oil was used respectively.
6. This may be because of the chemical action of the turpentine oil, and the chemical content and combination of the *kumati* and neem oil mixture. Besides, in Group IV the neem oil and the paste act as coverage for this type of wounds that reduces the topical dressing commitment and cost.
7. The fly responsible for the problem is *Chrysomia bezziana* (100%) in all the cases and the reasons for this are the climatic condition and domination of the fly in and around Chennai.
8. The bacterial organisms isolated from the wounds were *Staphylococcus* and Streptococcus (41.15%) besides others like *Klebsiella, Pseudomonas, Clostridium* and *E.coli* (4.17%). The samples tested during the treatments on third day or later days also showed a few organisms suggesting that these preparations are not effective against microbes and it cannot be expected that this type of infected due the exposure to atmosphere.
9. In the present study the preparation of turpentine oil (Group-I) and *kumati* fruit pulp mixture (Group-IV) did not have any significant effect on the different stages of larva. These preparations are not 100% effective on day 2, in regards to larvicidal effect especially at the region of musculo-skeletal border (base of the horn and coronary border of the hoof). This can be became the wounds in such places which might contain even eggs that may pupate later or the preparation is not reaching the depth due to smaller hairline opening.

CONCLUSION

The ITK consisting of *kumati* fruit pulp and neem oil (1:1) was found effective in treatment of maggot wounds in cattle. Although treatment with ITK required longer duration (12-24 hr) than treatment with turpentine oil (4-6 hr) to induce larvicidal effect, it was economical than turpentine oil.

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Thilagar, S. Ayyappan, S., Richard, M. G. and Balasurbramaniam. S. 1991. *Indian Journal of Veterinary Surgery* **12** (12): 2. ❑

Code : **1283**

Title of the ITK : **Efficacy of use of *kasaundhi (Casia occidentalis)* with turmeric, salt and mustard oil for treatment of dog bite in animals**

Description of the ITK : *Kasaundhi* herb is very effective to cure the dog bite effect on the animal. Paste of *kasaundhi* seeds, salt, mustard oil and turmeric in equal quantity is heated and the paste is applied on bitten part of the animal. The infected animal is cured in two week time. This treatment costs Rs 2-5 per animal. This ITK is practised in many villages of Shahajhanpur, Bulandshahr and Bareilly districts of Uttar Pradesh

Name and address of the discloser : Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education and Extension, Jamia Milia Islamia University, Jamia Nagar, New Delhi 110 025

Location of use of the ITK : Number of cases are encountered of dog bite in animals in Bareilly and Shahjahanpur districts of Uttar Pradesh. The villagers use turmeric powder mixed with musturd oil to the wound of dog bite. Some mix *kasaundhi* seed powder and salt to the turmeric paste.

Geographical indicators : Mustard oil

(Sanskrit and Bengali, *sweet sarisha;* Hindi, *sarson;* Tamil, *avalu;* English, field mustard).

Occurrence and distribution: An important oilseed crop of India. It is commonly raised in West Bengal, Bihar, Uttar Pradesh, Punjab and Rajasthan.

Description: A highly branched annual or biennial herb, up to 1.5 m in height; taproot fusiform or tuberous; compressed stem with a rosette of large, bristly and hairy leaves, especially along the veins; usually leaves are large, petioled, more or less pinnatified; upper oblong or lanceolate; basal leaves lyrate-pinnatifid, lobes decreasing in size towards petiole; lower cauline leaves several lobed; upper cauline leaves sessile, oblong-lanceolate, sharply dentate. Flower bright yellow; pedicels 1.9 cm, ascending or spreading. Pods 3.75-7.5 cm, glabrous, suberect; seeds, small, smooth and pale yellow. Flowers and fruits occur during the winter.

Parts used: Seeds and leaves.

Therapeutic uses: The crushed seeds on external application in the form of poultice are beneficial in rheumatic affections; brushing teeth with seed oil mixed with common salt is reported to cure haemophilia and gum inflammation; used for external application in cutaneous affections; combined with camphor the seed oil finds local application in muscular rheumatism and stiff neck and is found to be efficacious when rubbed on the chest on the bronchial catarrh and influenza. The oil of sarson cures parasitic infection, itching and obstinate skin diseases including leprosy. It is light and reduces *kapha, medas* (fat) and *vayu.* It is depleting pungent and a digestive stimulant (Dash and Kashyap, 1980).

*Chemical constituents:*The seed oil contains glycerides of palmitic, stearic, oleic, linoleic, linolenic, eicosenoic, gehenic and erucic acids; the content of the glycerides of erucic acid is high (50.9-56.2%). The occurrence of sinigrin, alkenyl glucosinolates, indole glucosinolate, gluconapin, glucobrtassicanapin, gluconasturtiin, 22-dehydrocampestrol (24a-methylcholesta-5-trans-22diene-3b-ol), brassicasterol (24b-methylcholesta-5-trans-22-diene-3 b-ol), and other phytosterols, triterpenes, progoitrin gluconapoleiferin, has also been reported. The free and hydrolysable phenolic acid in seeds has been identified as *p*-coumaric, ferulic, sinapic and caffeic acids. Neutral sugar analysis of polysaccharides of seeds-epidermis shows the presence of arabinose, rhamnose, mannose and galactose (Chatterjee and Pakrashi, 1995).

Kasaundhi

The botanical name is *Cassia occidentalis* and it belongs to family Caesalpiniaceae. It is a woody herb; stem purplish or green, smooth; leaves; alternate, stipulate with a sessile dark brown gland near the base of the petiole; leaflets 3-5 pairs, opposite, short-petiloed, ovate-acuminate, 9 × 3.5 cm, bade somewhat oblique, glabrous above, glaucous beneath; flowers yellow in axillary or terminal racemes; calyx 5-partite, segments creamy yellow; petals 5, free subequal; stamens 10, unequal; fruit alinear-falcate, flat, glabrous pod; seeds many, 1-seriate. The plant is now pantropical in distribution. It is found throughout India from the Himalayas to Cape Comorin. Seeds are used for winter cough, as a cure for convulsions in children and as an excellent diuretic (Sivaranjan and Balachandran, 1996).

Experimenters :Dr D. Swarup, Head, Division of Medicine; Dr A. K. Sharma, Senior Scientist, Division of Surgery; Dr Naveen Kumar, Senior Scientist, Division of Surgery and Dr Mahesh Chander, Senior Scientist, Division of Extension Education, Indian Veterinary Research Institute, Izatanagar (Uttar Pradesh) 243 122

METHODOLOGY

Field survey was conducted in villages of Badaun, Bulandshahar and Baeilly districts in Uttar Prdesh and experimental work was done at Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh).

PRA and field study

The PRA was done in villages of Bareilly district of Uttar Pradesh.

Experiment

In experiments on animals, the antiviral activity of kasaundhi seeds was done in the laboratory.The results showed that the seeds have no anti-viral activities.

RESULTS AND DISCUSSION

PRA and field study

Farmers were not aware of ITK and they were not convinced of its use or efficacy.

Experiment

The powder of kasaundhi seeds was tested for anti-viral activity and it was found to posess no antiviral potential in vitro.

CONCLUSION

The seeds of kasaundhi showed no anti-viral property. Hence, it was decided not to use the ITK in clinical cases of dog bite, as it may predisposed chances of rabies in the bitten animal.

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Code	:	**282**
Title of the ITK	:	**Effect of black pepper *(Piper nigrum* Linn.) and turmeric (*Curcuma longa Linn.*) water to stimulate energy in day-old calf**
Description of the ITK	:	Black pepper *(Piper nigrum)* powder, if blown from the mouth of a person nursing the birth of a calf, acts as an instant energy provider to the calf. For 1 day-old calf, dysentery is prevented by giving turmeric *(Curcuma longa)* juice (1 spoonful). After birth, the calf lies on the mud. The person nursing the animal takes some black pepper in the mouth and crushes it there and then introduces the crushed substances into the nose of the calf by blowing from the mouth. This activates the calf immediately, and after some time it stands and starts running. Thus black pepper acts as an instant energy provider to the calf. Pepper costs Rs 5 and turmeric costs Rs 4. This is in practice in Midnapore village in West Bengal.
Name and address of the discloser	:	Mrs. Saroja Bala Manna, Bahichard, Naikuri, Midnapore (West Bengal) 721 627 s
Location of use of the ITK	:	Bachichard, Naikuri, Midnapore (West Bengal) 721 627
Experimenters	:	Dr F.R. Sheriff, Director of Extension Education, Tamil Nadu Veterinary and Animal Sciences University, Madhavaram Milk Colony Post, Chennai (Tamil Nadu) 600 051, Dr Cecilia Joseph, Associate Professor, and Dr S. Thilagar, Professor and Head, Department of Clinics, Madras Veterinary College, Chennai (Tamil Nadu) 600 007

METHODOLOGY

Location

The study was carried out in the Department of Clinics, Madras Veterinary College, Chennai. New born calves at the Livestock Research Station, Kattupakkam and those born at the Large Animal Clinic, Madras Veterinary College Hospital were used as experimental materials for this study.

RESULT AND DISCUSSION

Experiment

Thirty-two calves were randomly assigned for the two treatments and for the two control groups of eight each. In Group I of 16 animals, 8 animals were given one teaspoonful of turmeric mixed in water on day 1 and day 2. In Group II of 16 animals, pepper powder was blown in the nostrils of 8 animals and 8 calves were taken as controls.

Animals in Group I were clinically observed for 10 days for the occurrence of diarrhoea. Blood were collected from the calves on day 1 and day 10 for following hemato- biochemical parameters on: haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), neutrophils, lymphocytes, total protein, glucose, potassium, calcium and phosphorus.

In Group II, the animals were blown with pepper powder in the nostrils and observed for 1 hour for improvement in the respiration rate and pulse rate. Blood samples were collected before and after treatment to study the Pco_2 level in the blood of the trial calves.

All the 16 calves in Group I were apparently healthy, active and had good appetite. There was no evidence of diarrhoea both in the control and treatment groups during the period of study.

Haematology

Results obtained on haemogram, leucogram, blood chemistry, physiological parameters, and Pco_2 are given below.

In haemogram, the mean values of packed cell volume (PCV), haemoglobin (Hb) and total erythrocytes count (TEC) were 28.5 ą 1.00%, 8.38 ą 0.47 g/dl and 6.26 ą 0.35 million /ml on day 1 and 30.63 ą 0.56%, 9.00 ą 0.25 g/dl and 7.12 ą 0.27 million/ml on day 10 respectively in the control animals (Table 1). There was no significant difference in the haemogram in this group.

In the animals treated with turmeric, the mean values of PCV, Hb and TEC were 26.75 ą 0.94%, 8.0 ą 0.46 g/dl and 5.64 ą 0.23 millions / ml on day 1 and 30.38 ą 0.60%, 8.75 ą 0.25 g/dl and 6.18 ą 0.14 millions/ml on day 10 respectively (Table 2). Statistically there was no significant difference in the haemogram values in this group.

Packed cell volume, haemoglobin and total erythrocyte count were elevated in calves with diarrhoea.They were not significantly elevated in the control and treated animals in this experiment , as there was no incidence of diarrhoea in the observation period.

In leucogram, the mean value of the total leucocytic count (TLC) was 10,281 ą847/ml and 10,262 ą 598 / ml on day 1 and day 10 in the control animals (Table 1). It was 11,287 ą 633 and 10,812 ą431 in the treated animals on day 1 and day 10 respectively (Table2). There was no significant difference observed in these parameters.

The mean values of neutrophils and lymphocytes in the control group on day 1 were 42.875 ą 0.855 % and 57.125 ą 0.74 % respectively (Table 1).In theanimals treated with turmeric water, the mean values of neutrophils and lymphocytes on day 1 were 43 ą 0.57% and 57 ą 0.57 % and on day 10 were 45.63 ą 1.22% and 54 ą 1.22% respectively (Table 2).There was no significant difference in the two groups.

The total leucocyte count and neutrophil increased and lymphocytes decreased in calf diarrhoea. Since no such significant change was recorded in the mean values of the treated and control animals, there was no effect of the treatment on the day-old calves.

Blood chemistry showed that the meanvalues of total protein, glucose, potassium, calcium and

Table 1. Haematological parameters in the calves of control group

Parameter	Day 1 (Mean ą SE)	Day 10 (Mean ą SE)	T-value
PCV (%)	28.5 ą 1	30.63 ą 0.56	0.104782^{NS}
Hb (g/dl)	8.38 ą 0.47	9.00 ą 0.25	0.13952^{NS}
TEC (million/ĩl)	6.26 ą 0.35	7.12 ą 0.27	0.000634^{NS}
TLC (million/ĩl)	10287 ą 847	10262 ą 598	0.954051^{NS}
Neutrophils (%)	42.875 ą 0.855	42.88 ą 0.74	1^{NS}
Lymphocytes (%)	57.125 ą 0.855	57.125 ą 0.74	1^{NS}

NS, Non-significant.

Table 2. Haematological parameters in the calves in the treated group

Parameter	Day 1 (Mean ą SE)	Day 10 (Mean ą SE)	T-value
PCV (%)	26.75 ą 0.94	30.38 ą 0.60	0.003585 NS
Hb (g/dl)	8.0 ą 0.46	8.75 ą 0.25	0.047945 NS
TEC (million/ĩl)	5.64 ą 0.23	6.18 ą 0.14	0.002989 NS
TLC (million/ĩl)	11287 ą 633	10812 ą 431	0.1866 NS
Neutrophils (%)	43 ą 0.57	45.63 ą 1.22	0.058751 NS
Lymphocytes (%)	57 ą 0.57	54 ą 1.22	0.0587511 NS

NS, Non-significant.

phosphorus on day 1 in the control group were 5.54 ą 0.20 g/dl, 53.88 ą 5.83 mg/dl, 3.26 ą 0.20 litre, 10.83 ą 0.32 mg/dl and 3.68 ą 0.20 mg/dl respectively. On day 10, their levels were 6.33 ą 0.15 g/dl, 48.71 ą 3.58 mg/dl, 3.24 ą 0.09, 10.2 ą 0.26 mg/dl and 3.44 ą 0.14 mg/dl respectively (Table 3). Statistically there was no significant change in the levels of the parameters.

In the day-old calves treated with turmeric, the mean values of total protein, glucose, potassium, calcium and phosphorus on day 1 were 5.41 ą 0.26 gm/dl, 54.04 ą 7.14 mg/dl, 2.90 ą 0.28 day, 10.91 ą 0.46 mg/dl and 3.80 ą 0.21 mg/dl and on day 10, their values are 6.88 ą 0.20 g/dl, 47.43 ą 5.10 mg/dl, 3.68 ą 0.25 day litre 10.13 ą 0.58 mg/dl and 3.25 ą 0.24 mg/dl respectively (Table4). There was no significant difference in the levels of the parameters in this group.

Table 3. Biochemical parameters in the calves in the control group

Parameter	Day 1 (Mean ą SE)	Day 10 (Mean ą SE)	T-value
Total protein (g/dl)	5.54 ą 0.20	6.33 ą 0.15	0.000212 NS
Glucose (mg/dl)	53.88 ą 5.83	48.71 ą 3.58	0.093078 NS
Potassium (mEq/l)	3.26 ą 0.20	3.24 ą 0.09	0.890428 NS
Calcium (mg/dl)	10.83 ą 0.32	10.20 ą 0.26	0.002762 NS
Phosphorus (mg/dl)	3.68 ą 0.20	3.44 ą 0.14	0.093449 NS

NS, Non-significant.

Table 4. Biochemical parameters in the calves in the treated group

Parameter	Day 1 (Mean ą SE)	Day 10 (Mean ą SE)	T-value
Total protein (g/dl)	5.41 ą 0.26	6.88 ą 0.20	0.00126 NS
Glucose (mg/dl)	54.04 ą 7.14	47.43 ą 5.10	0.208488 NS
Potassium (mEq/l)	2.90 ą 0.28	3.68 ą 0.25	0.002423 NS
Calcium (mg/dl)	10.91 ą 0.46	10.13 ą 0.58	0.106218 NS
Phosphorus (mg/dl)	3.80 ą 0.21	3.25 ą 0.24	0.014778 NS

NS, Non-significant.

Table 5. Mean ± SE of pulse rate, respiration rate and Pco_2/nobin in Group II animals

Parameter	Pre-treatment	Post-treatment	T Value
Control group			
Pulse rate/minute	99.5 ± 1.77	97.63 ± 1.33	0.008309 NS
Respiration rate/minute	32.63 ± 0.81	32.00 ± 0.77	0.011201 NS
Pco_2 (kPa)	8.94 ± 0.36	8.75 ± 0.23	0.000073 NS
Treatment group			
Pulse rate/minute	101.25 ± 1.35	98.5 ± 1.02	0.000136 NS
Respiration rate/minute	33.38 ± 0.76	31.88 ± 0.40	0.002536 NS
Pco_2 (kPa)	8.46 ± 0.37	8.36 ± 0.22	0.007247 NS

NS, Non-significant.

Normally in calves the levels of total protein, glucose, potassium, calcium and phosphorus are elevated at birth and they decline gradually to normal values. Total protein increased and glucose, potassium, calcium and phosphorus decreased from day 1 to day 10 in control and treatment groups but these were not significant indicating that the treatment had no effect on the day-old calves.

Among physiological parameters in Groups-II, the pulse rate and respiration rate in the control animals were 99.5 ± 1.77 and 32.63 ± 0.81 before treatment and 97.63 ± 1.33 and 32 ± 0.77 after treatment respectively. In the animals treated with black pepper powder, the pulse rate and respiration rate were 101.25 ± 1.35 and 33.38 ± 0.76 before treatment and 98.5 ± 1.02 and 31.88 ± 0.40 after treatment respectively (Table 5).

The mean values of CO_2 in control animals of Groups II were 8.94 ± 0.36 kPa and 8.75 ± 0.23 kPa before and after treatment respectively. In the treated animals, they were 8.46 ± 0.37 kPa and 8.36 ± 0.22 kPa respectively (Table 5).

There was no significant change in the pulse rate, respiration rate and level indicating that the treatment did not significantly effect any change in the new born calves.

CONCLUSION

There was no significant effect of the ITK on physiology of day-old calves as compared to the control. ❑

Code	**:**	**1275**
Title of the ITK	**:**	**Protection of animals from *loo* disease by using neem (*Azardichta indica*)**
Description of the ITK	:	To control *loo* (sun stroke) and other diseases in animal, 250 g neem oil is given orally to animal in the last week of March. This treatment costs Rs 45 per animals which is practised by farmers of Multanpur and its nearby villages of Uttar Pradesh
Name and address of the discloser	:	Dr Niranjan Lal, Division of Extension Education, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122.
Location of use of the ITK	:	This ITK is used in many villages of Bareilly and Badaun districts
Experimenters	:	Dr D. Swarup, Head and Dr Reena Mukherjee, Scientist (SS), Division of Medicine; Dr Mahesh Chander, Senior Scientist, Division of Extension Education, Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122

METHODOLOGY

Location

Field survey was done in villages of Bareilly district. Experimental studies were taken up in different Divisions of Indian Veterinary Research Institute, Izatnagar.

PRA and field study

Preliminary survey was done in Bareilly district to find out the use of neem in animal ailments, but the results were not very encouraging as most of the farmers were not using it in any specific kind of ailment though most of them agreed that it is very useful and has medicinal values.

Neem has been extensively used in Ayurveda, Unani and homoeopathic medicines and has become a cynosure of modern medicine. The Sanskrit name of the neem tree is *arishtha,* meaning `reliever of sickness' and hence is considered as *sarvaroganivarini.* Neem kernel oil, neem bark and leaves contain isoprenoids and nonisoprenoides. Nimbidin, a major crude bitter principle extracted from the oil of seed kernels of A. *indica,* demonstrated several biological activities. It possesses antipyretic activity, which has also been reported and confirmed in nimbidin. Oral administration of nimbidin has significant hypoglycaemic effect in fasting rabbits. It also



Fig. 1. Twigs of neem

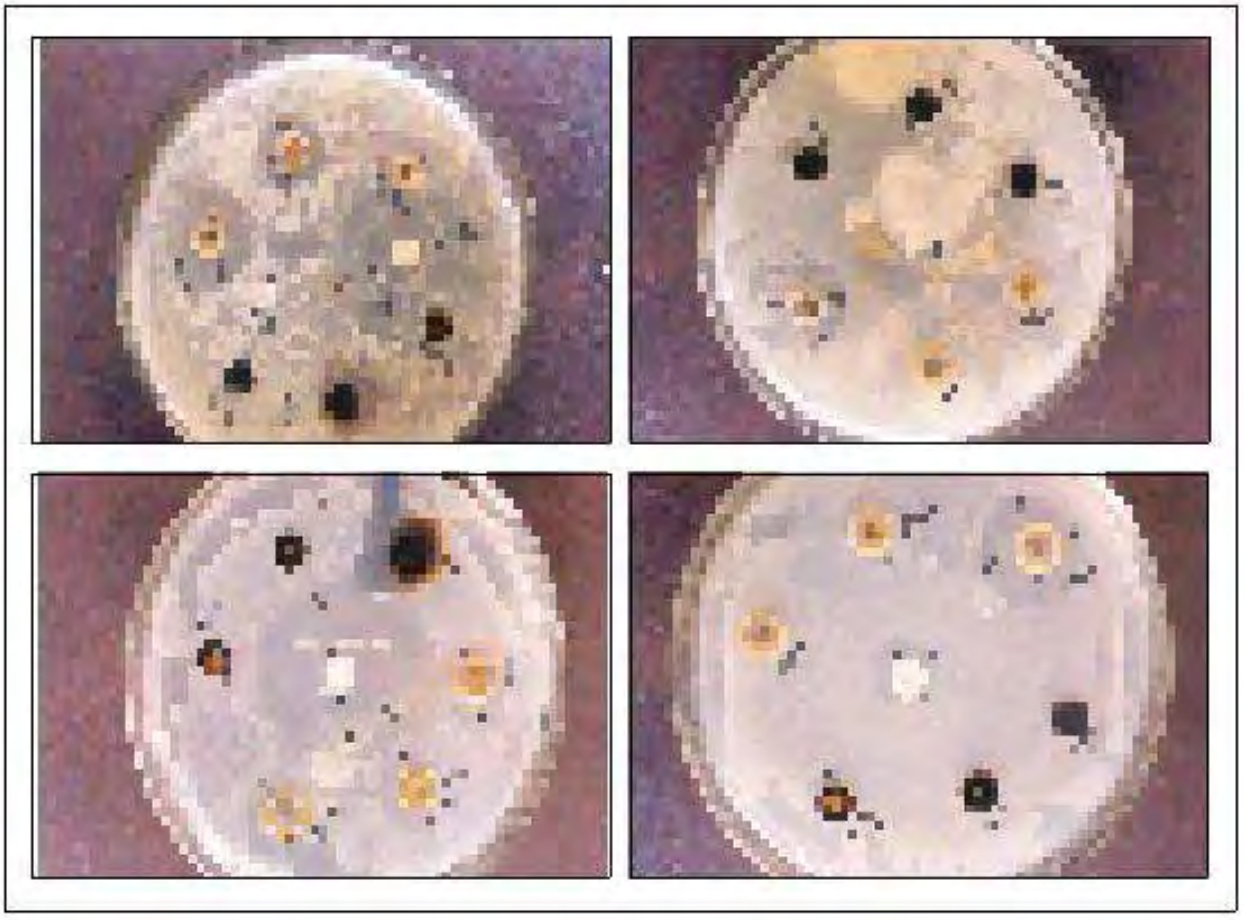


Fig. 2. In-vitro antimicrobial sensitivity of neem oil vis-a-vis standard antibiotic

possesses antiulcer, antifungal, antimalarial, immunostimulant, antibacterial, antioxidant and antiviral activity.

Experiment

In-vitro analysis of neem kernel oil and oil extract of neem leaves.

Antibacterial efficacy of the neem kernal oil and oil extract of neem leaves was seen against pathogenic microorganisms. Staphylococcus *aureus and E.coli pathogenic strains were isolated* from animals, standard culture of the bacterial isolates obtained from Division of Standardization, IVRI. The young cultures were

Table 1. Efficacy of neem oil against mange infestation in dogs

Treatment	No. of animals	Quantity of drug	Duration	Recovery (%)	Remarks
Conventional treatment	5	As per standard schedule	4 applications at 7 days interval	89	Poisonous and costly treatment
Neem bark + neem oil	8	20 ml./animal	9–15 days	43	Very safe and less costlier treatment

propagated in nutrient broth, and seeded over the nutrient agar. In 5 mm wells on the agar plates, 500, 750 and 850 µl, of neem-kernel oil was filled. Similarly, same quantity of oil extract of neem leaves was also filled. In the centre of the plates standard antibiotic plates were placed. Antibiotics used were penicillin, streptomycin, enrofloxacin, cloxacillin and ceftiozyme.

Efficacy of neem oil against mange infestation in dogs

Skin scrapping was collected from 13 dogs suffering from parasitic infestation and examined for the presence of mites. Heavily infested dogs were given conventional therapy whereas less affected dogs were given ITK treatment (Table1).

In the conventional treatment of Ridd, Ectomen or Cypermethri n @ 0.01– 0.05 % medicinal solution is sprayed at 7 days interval with 4 applications to highly poisonous drugs required special precautions. Herbal application is less efficacious against Demodectic mange in dogs,but more effective in Sarcoptic mange.

Efficacy of neem oil in canine dermatitis

Impression smear was prepared from 16 dogs suffering from abdominal boils and other skin lesions caused by bacteria. The smears stained with Grams staining for identification of pathogenic organisms. Gram staining revealed mainly Gram-positive cocci as (Table 2).

In the conventional treatment, antibiotics, antiallergic, skin tonic and skin conditioner are used. The neem bark paste and neem oil are highly effective against bacterial skin lesions

RESULTS AND DISCUSSION

The neem oil was found highly effective against *S. aureus and E. coli. Well impregnated with 850* µl neem oil showed maximum zone of inhibition, the area of zone varied from 8 mm to 15 mm with 750 and 850 µl neem kernel oil. However, the oil extract of neem leaves was not found effective against the microorganism.

Table 2. Efficacy of neem oil in Canine Dermatitis

Treatment	No. of animals	Quantity	Duration (days)	Recovery (%)	Remarks
Conventional treatment	7	As per standard	5–9	89	Costly treatment, may cause allergic reaction
Neem oil + neem bark	9	15–20 ml. dog	3–7	83	Highly efficacious, very safe, skin reactions not common

CONCLUSION

The study revealed that neem kernel oil is highly effective against pathogenic microorganism.

Neem leaf oil extract was found effective.

Neem oil was less effective in Demodectic mange mite infestation.

Neem oil proved very effective against bacterial skin lesions.

Fisheries

Code : **424**

Title of the ITK : **Use of banana pseudostem in fish pond to enhance productivity of fish**

Description of the ITK : Pseudostems of banana, after harvesting the bunch, are added to the pond by cutting longitudinally, which increases the pH of pond water and oxygenation in water. This practice results in increase in fish yield. As it involves low cost, it is being followed by 80% of the farmers in the Basta village of Balasore district in Orissa.

Name and address of the discloser : Shri Rabinarayan Mishra, College of Fisheries, Orissa University of Agriculture and Technology, Rangailurda, Berhampur, Ganjam (Orissa) 760 007.

Location of use of the ITK : Basta, Basta, Balasore (Orissa)

Experimenters : Dr C. Lodh, Lecturer, Department of Veterinary Medicine, Ethics and Jurisprudence,West Bengal University of Animal and Fishery Sciences, Kolkata, West Bengal, and Dr B.K. Chand, Farm Manager, Directorate of Research, Extension and Farms, West Bengal University of Animal and Fishery Sciences, Kolkata, West Bengal

METHODOLOGY

Location

The efficacy of banana pseudostem for increasing the water quality of pond was evaluated by participatory rural appraisal (PRA) and experimental methods. Participatory rural appraisal was done it village Basta, dist. Balasore (Orissa) and the experiment was also conducted at the same location.

Water depth of the fish-pond starts reducing and biomass of the fish gradually increases from September to May. Hence during that period there is shortage of dissolved oxygen in the pond water. The pH of the water reduces gradually and due to unfavorable condition fish starts swimming on the upper surface of the pond water in early morning hours. If such conditions prevail for longer period, fish start dying.

PRA and field study

Participatory Rural Appraisal (PRA) tools



Fig. 1. Cutting of banana pseudostem for application in fish pond

were applied to evaluate the efficacy of banana pseudostem in fish pond for maintaining the quality of water as compared to lime treatment. Different parameters studied are were: growth of fish, fish yield per unit area, effectiveness in preventing fish mortality, effectiveness in preventing disease outbreak, cost effectiveness



Fig. 2. Application of banana pseudostem in fish pond and availability of the material. In this study 16 fish farmers practicing the ITK did the matrix scoring at village Basta.

Experiment

The experiment was conducted at village Basta, using following four treatments: (i) T1, control (no treatment); (ii) T2, use of banana pseudostem @ 2,000 kg/ha, here banana pseudostem were allowed to decompose and disintegrate in the pond (designated ITK-I); (iii) T3, use of banana pseudostem @ 2,000 kg/ha, here banana pseudostem was removed from the pond after 12_15 days of application (designated ITK-II); and (iv) T4, use of lime @ 5,000 kg/ha. Three replications were used for each treatments. Before initiation of the experiment, all ponds were treated with cowdung, urea and single superphosphate at equal doses. IMC fingerlings of 2_3 inches size were stocked @ 5,000/ha with species combination of Catla:Rohu:Mrigal = 4:3:3. Duration of experiment was for 10 months (September 2002 to June 2003). Observations were taken on: (a) water-quality parameters: pH of pond water, dissolved oxygen content (ppm), total alkalinity (ppm) and total hardness (ppm); (b) growth parameters of fish: growth of fish at harvest, yield of fish (kg/ha), survival percentage of fish and incidence of diseases in fish; (c) economic parameters: total expenditure, total income and benefit cost ratio, and (d) chemical characteristics of juice extracted from banana pseudostem.

Collection of water sample

The pond water was collected in pretreated polythene bottles taking precaution not to entrap any air bubbles while sampling. The samples were collected at monthly intervals in the early hours of the day.

a. pH: It was measured at site by using pocket electronic pH-meter

b. Dissolved oxygen: The following formula was used:

Dissolved oxygen (ppm or mg/litre) = 0.1 × A × 1,000/ml sample where A=Volume of 0.0125 N sodium thiosulphate solution required up to end point

c. Total alkalinity: It was calculated from the sum of bicarbonate and carbonate alkalinity.

d. Total hardness: It was calculated from the sum of calcium and magnesium ions present in water.

e. The mineral contents in juice extracted from banana pseudostem was estimated using atomic-absorption spectrophoto-meter.

f. Collection of fish samples for growth studies: The net was cast randomly to collect fish from pond. The length and weight of fish was recorded and then released into pond. Average values of length and weight were obtained by dividing by total number of fish.

RESULTS AND DISCUSSION

PRA and field survey

The ITK had a sound effect in preventing mortality of fish as compared to the use of lime. Use of pseudo-stem was cheaper as compared to lime treatment. Use of pseudostem and lime treatment was equally effective in terms of growth of fish, fish yield per unit area, effectiveness in preventing disease outbreak and availability of

Table 1. Matrix table for assessing the performance of banana pseudostem in maintaining quality of water as compared to lime treatment

Parameter	Use of banana pseudostem		Use of lime	Control
	ITK-I	ITK-II		
Growth of fish	5	5	5	3
Fish yield per unit area	6	6	6	3
Effectiveness in preventing fish mortality	5	5	4	2
Effectiveness in preventing disease outbreak	4	4	4	2
Cost effectiveness of the treatment	6	6	2	7
Availability of material	4	4	4	4

material (Table 1). Though, discloser had mentioned that the farmers remove the banana pseudostem from the pond after 12_15 days of application, during field survey it was found that majority of farmers (about 80% cases) allow the banana pseudostem to decompose and disintegrate in the pond (designated ITK-I); whereas in some cases (about 20% cases) the farmers remove the pseudostem from the pond after 12_15 days of application, i.e. when these started decomposing (designated ITK-II).

Experiment

The results of the experiment obtained are as follows:

***p*H**

Water pH is considered as a best indicator of aquatic productivity. In the present study though there were some variations in pH value for different treatments, the general pattern of distribution of pH of water was alike in a particular treatment. Among treatments, pH tended to be high in T4 where lime was applied @ 500 kg/ha.

Dissolved oxygen

Dissolved oxygen is perhaps the best indicator of water quality.

Ponds should have dissolved oxygen concentration above 5 ppm for average or good fish production. In the present study, all the ponds under T2,T3 and T4 had dissolved oxygen above 5 ppm, whereas in T1, in some months its level in the ponds was marginally below 5 ppm.

Total alkalinity

Water having alkalinity more than 50 ppm is most productive and the one with less than 10 ppm cannot support good fish growth. Hence, all the ponds in the study can be termed productive ponds, since they had alkalinity above 50 ppm. However, total alkalinity value was marginally higher in the ponds under T2 and T3,where banana pseudo-stem was used. This indicated that banana pseudo-stem helped in increasing the fertility of pond water.

Total hardness

Total hardness of pond water includes $CaCO_3$ hardness and $MgCO_3$ hardness. The ideal range of water hardness for the fish pond is 30_150 ppm. Hence the ponds in this study had ideal water hardness.

Water quality

Water pH tended to increase in the ponds with application of lime and banana pseudo-stem. Increase in total alkalinity was observed in the ponds where ITK method was used. Since alkalinity reflects on water fertility, it indicated that ITK method helped in increasing the productivity of pond water (Table 2).

Growth parameters

In T2, T3 and T4 the growth of three species of

Fisheries

Table 2. Water quality parameters in different experimental ponds

Month	T_1				T_2				T_3				T_4			
	pH	Dissolved O_2 (ppm)	Total alkalinity (ppm)	Total hardness (ppm)	pH	Dissolved O_2 (ppm)	Total alkalinity (ppm)	Total hardness (ppm)	pH	Dissolved O_2 (ppm)	Total hardn-ess (ppm)	Total hardn-ess (ppm)	pH	Disso-lved O_2 (ppm)	Total alkalin-ity (ppm)	Total hard-ness (ppm)
Sept'02	7.8	4.8	68	72	8.1	5.4	75	74	7.9	5.5	73	74	8.6	5.2	76	70
Oct'02	7.7	5.0	68	73	8.0	5.5	78	76	8.1	5.5	76	72	8.4	5.1	76	72
Nov'02	7.9	4.9	70	74	8.1	5.3	83	75	8.0	5.6	80	71	8.4	5.2	78	71
Dec'02	8.0	5.1	71	71	8.2	5.4	82	73	8.1	5.3	79	75	8.3	5.2	80	72
Jan' 03	8.0	5.0	70	72	8.0	5.2	81	74	7.9	5.0	80	76	8.4	5.1	76	72
Feb '03	8.0	4.9	68	70	8.1	5.2	84	76	8.1	5.2	82	75	8.3	5.2	78	73
Mar' 03	8.0	5.1	68	70	8.0	5.3	83	75	8.2	5.5	84	77	8.3	5.1	78	72
Apr' 03	7.7	4.7	72	74	8.2	5.0	80	78	8.1	5.0	81	76	8.2	5.3	79	74
May'03	7.5	4.6	64	71	8.0	5.1	78	73	8.0	5.3	82	75	8.5	5.1	82	72
Jun' 03	7.6	4.7	69	73	8.1	4.9	81	79	8.2	5.1	84	80	8.6	5.2	83	71
Range	7.5-8.0	4.6-5.1	64-72	70-74	8.0-8.2	4.9-5.5	75-84	73-78	7.9-8.2	5.0-5.6	73-84	71-80	8.2-8.6	5.1-5.3	76-83	70-74
Mean	7.8	4.9	69	72	8.1	5.2	81	75	8.1	5.3	80	75	8.4	5.2	79	72

T_1 – Control (no treatment)
T_2 – Use of banana pseudostem @ 2000kg/ha (allowed to decompose in pond)
T_3 – Use of banana pseudostem @ 2000kg/ha (removed from pond after 12–15 days of application)
T_4 – Use of lime @ 5000kg/ha

Table 3. Fish production, survival rate and B.C. ratio under different treatments at the end of 10-month culture period

Prameter	T1	T2	T3	T4
Fish production (kg/ha/crop)	1739	2142	2122	2021
Survival rate at the time of harvest (%)	74	85	87	82
Av. Fish wt. (g) at harvest irrespective of species	407	504	488	493
Total expenditure (Rs/ha/crop)	44913	45682	46065	46638
Total income (Rs/ha/crop)	78255	96390	95490	90945
Benefit cost (B:C) ratio	1.74	2.11	2.07	1.95

T1_ Control (no treatment)
T2_ Use of banana pseudostem @ 2000kg/ha (allowed to decompose in pond)
T3_ Use of banana pseudostem @ 2000kg/ha (removed from pond after 12_15 days of application)
T4_ Use of lime @ 5000kg/ha

fish, viz. rohu, mrigal and catla, was better than that of control group (Tables 3 and 4).

The results obtained from this study indicated that irrespective of species, fish grew faster under treatment T2, followed by T4, T3 and T1. This indiates that use of banana pseudostem in fish pond helped in achieving better growth rate of fish. It can be further concluded that water parameters in T2, T3 and T4 were more suitable for fish growth. In all the treatments the weight of catla was highest, followed by that of rohu and mrigal.

Survival rate

Survival rate of fish was highest in T5 followed by T2, T4 and T1.

This result indicated that the use of banana pseudostem helped in maintaining good water quality in pond, resulting in better fish-survival rate. Poor survival rate was recorded in control treatment (T1) where neither banana

Table No. 4 Average weight (g) of fish under different treatments (growth parameter)

Months	T1			T2			T3			T4		
	Catla	Rohu	Mrigal	Catla	Rohu	Mrigal	Catla	Rohu	Mrigal	Catla	Rohu	Mrigal
Sept'02	17.50	16.00	14.00	17.50	16.00	14.00	16.80	16.00	14.00	17.50	16.00	14.00
Oct'02	34.50	29.00	22.50	41.00	32.50	24.00	40.40	33.50	24.90	43.00	34.00	26.50
Nov'02	59.50	48.00	39.50	62.50	54.50	42.00	61.30	56.90	40.40	59.00	58.50	45.00
Dec'02	86.30	81.20	63.25	94.15	87.20	65.50	92.50	90.20	63.50	91.50	85.80	62.10
Jan' 03	102.90	97.40	84.15	128.10	105.50	91.00	126.60	109.50	90.00	115.20	102.00	88.60
Feb' 03	161.20	140.50	105.20	182.20	163.10	120.00	184.10	167.80	125.00	164.50	148.10	118.20
Mar' 03	249.10	224.80	165.10	286.40	240.20	193.50	289.50	245.00	197.50	252.10	225.00	174.30
Apr' 03	340.00	318.00	218.00	385.00	326.00	225.00	369.00	320.00	220.00	362.00	338.00	206.00
May'03	435.00	405.00	298.00	497.00	448.00	306.00	471.00	432.00	288.00	465.00	464.00	281.00
Jun' 03	558.00	488.00	362.00	602.00	523.00	378.00	592.00	514.00	365.00	587.00	535.00	352.00

T1- Control (no treatment)
T2-Use of banana pseudostem @ 2000kg/ha (allowed to decompose in pond)

T3- Use of banana pseudostem @ 2000kg/ha (removed from pond after 12-15 days of application)
T4-Use of lime @ 5000kg/ha

pseudostem nor lime was applied.

Fish production

Fish production (kg/ha/crop of 10_month period) was high

in T2 and T3 (2,142 kg and 2,122 kg, respectively), where banana pseudostem were used. Application of lime and T4 also yielded good fish production (2,021 kg/ha/crop). The ITK method (application of banana pseudostem) proved even superior to the recommended practice of lime application in obtaining higher fish production. During the culture period of 10 months, there was no incidence of disease outbreak in any treatment.

Chemical analysis

The chemical analysis of juice extracted from banana pseudostem

revealed that it is rich in minerals like Fe, Zn, Cu and Mn. The juice is slightly acidic in nature and it is very high in alkalinity as well as hardness.

CONCLUSION

Banana pseudostem plays effective role in creating favourable environment in the pond for the fish to survive and grow in unfavourable conditions. This is in agreement with the claim of the ITK.

Code	:	**285**
Title of the ITK	:	**Effect of egg based fish bait to attract fish for easy catching**
Description of the ITK	:	Eggs of ants are collected from their nest especially from mango tree using a net with long handle made of bamboo. These eggs are mixed with moist bread or flour with a little ghee to make it semi-solid. This is then cut into small pieces and used as bait. It is very useful to lure fish especially in off-season. Higher catch leads to good earning to fishermen. Total cost may be Rs 4 and Rs 2 each bread and ghee, respectively for 50 baits. .
Name and address of the discloser	:	Ms Saroja Bala Manna, Bahichard, Naikuri, Midnapore, (West Bengal) 721 627
Location of use of the ITK	:	Bahichard, Naikuri, Midnapore (West Bengal) 721 627
Experimenter	:	Dr D. Seenappa, Associate Professor, Aquaculture Extension Education Unit, University of Agricultural Sciences, Hebbal, Bangalore, (Karnataka) 560 024

METHODOLOGY

Location

The study was carried out in the University of Agricultural Sciences, Bangalore including identification of deep freshwater bodies (perennial tanks or lakes) that have stocks of both major carps and air-breathing fishes.

RESULTS AND DISCUSSION

Experiment

Standardization of different baits (semi-solid



Fig. 1. Ants nest



Fig. 2. Bait



Fig. 3. Dough for bait

or dried; moist bread or flour) was taken up for preparation protocols through laboratoru trials

Deep freshwater bodies were identified in Bethmangala and KGF, Kolar district, which have major carps and air-breathing fishes, by practical inspection and interviewing the traditional fishermen and officers of Department of Fisheries.

For preparation of dry bait about 2 g each of dry bread and ghee were mixed thoroughly along with ant eggs (2 g) and kneaded to form the dough, which serves as the bait.

For preparation of wet bait about 2 g of dry bread and ghee each were weighed and mixed thoroughly along with ant eggs (2 g) and a few drops of water and kneaded to form the dough, which serves as the bait. The dough had better consistency and could easily be made into bait balls for fixing the rod and line.

Validation of baits for their efficiency in catching fishes is in progress.

Code : **1298**

Title of the ITK : **Traditional method of preserving fish**

Description of the ITK : Frying of fishes increases their preservation quality under local conditions. Fish are cleaned with water. A mixture of juice of four lime (20 ml), 30-50 g turmeric powder, 10 g colour jalebi is prepared in one litre water. Small fish as such and large fish in pieces are placed in the mixture for 20-25 minutes. These fishes are then placed on the dry grass or hay. The grass is subjected to fire. The fish are fried dry in this method and are as such preserved. This is practised in Kanderkhera village in Jabalpur district of Madhya Pradesh. .

Name and address of the discloser : Shri S. Punekar, Training Associate, Krishi Vigyan Kendra, Indian Veterinary Research Institute, Izatnagar, Bareilly (Uttar Pradesh) 243 122

Location of use of the ITK : The ITK is in use in Kunderkhera, Gosalpur, Katchpura and Budagarh villages of Jabalpur district in Madhya Pradesh. Generally, darhee (Puntius sophore), singhi (H. fossile), patola (N. notopterus) and murrela (Basilius bola) are locally found in the area which are preserved by this method and sold. The fishermen get more time for sale and also fetch better prices. Further, they do not have other method to increase the shelf-life in the absence of ice, which is not available in the villages. If not treated, the fish is spoiled within 8-10 hours and the fisherman had to bear the loss since they are not able to sell within this short period.

Experimenter : Dr (Ms) Shagufta Jamal, Reader, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia, Jamianagar (New Delhi) 110 025.

METHODOLOGY

Location

PRA and field study

Pilot study was conducted through PRA to find out the details of ITK actually being practised by fishermen in Kunderkhera, Gosalpur, Katchpera and Budagarh villages in Jabalpur district of Madhya Pradesh. To quantify the efficacy of ITK, four alternative practices, viz. simple smoking on hay, smoking on hay after soaking in jalebi colour, smoking on hay after soaking in a mixture of lime juice, jalebi colour and water, and keeping in ice, were subjected to matrix ranking by the fishermen through PRA. The selected 25 key informants were asked to score the practice by putting stone pieces out of 10 on 14 criteria. The criteria on which matrix scoring was done were duration of preservation, taste, colour, shining, marketability, easiness in processing, time in processing, input

availability, cost in processing, variability in species in processing, gender specification in processing, transportability, profitability and use of labour. The matrix scores were subjected to ANOVA for each criterin.

Experiment

Field study on the efficacy of the ITK was judged through four

experiments conducted in four villages (Kunderkhera, Gosalpur Katchpera and Budakhera), one experiment in each village. The fish were processed through the ITK and were kept under normal temperature for 24 hours. Unprocessed fish were also kept under the same conditions as control sample. Observations were made at every 6 hours with the help of experienced judges from the villages. Six judges were selected who used to sell their fish in market and have sufficient knowledge in respect of judging the fish quality, marketability, consumability and the market rates. They were asked to assign the score out of 10 for the processed and unprocessed fish on 6 hourly intervals. The average scores were calculated and analysed.

The same experiment was also conducted in two villages viz.

Shahwajpur and Baghwala, in Badaun district of Uttar Pradesh, where fisheries is adopted as an enterprise. The results were analysed and compared with those obtained in the villages of Jabalpur district.

Laboratory analysis were conducted at Veterinary college,

Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur and Indian Veterinary Research Institute, Izatnagar.

Proximate analysis of processed fish adopting ITK was done

for two species of fish, viz. *darhee* (*Pentius sophore*) and *patola* (*Notopterus notopterus*). Proximate analysis of unprocessed fish of darhee was also done. The results of analysis in respect of dry matter, crude protein, ether extract, calcium and phosphorus were obtained at an interval of 12 and 24 hours.

Microbial analysis was done for four species of fish, viz. *darhee (Puntius sophore)*, *singhi (H. fossile), patola (N. notopterus)* and *murrela (Basilius bola)*. The analysis was done after 24 hours for both processed and unprocessed fish in respect of TVC, S. *aureus, Lactose fermenter, Salmonella and Aeromonas.*

RESULTS AND DISCUSSION

PRA and field study

Observations made during pilot study in the area indicated that

the fishermen are using this ITK, as it is not possible for them to sell the fish on the same day of fishing. Further, at present they are not following exactly the same practice as has been reported by disclosers. It was observed that lime juice and turmeric powder are not applied while smoking (frying) on hay. The fish are smoked either with *jalebi* colour or without it.

The results of matrix scoring by 25 key informants (fishermen) on

14 criteria for four treatments are given in Table 1.

Results obtained indicate that:

1. Duration of preservation (keeping quality) was maximum in keeping the fish in ice, followed by smoking on hay and least in smoked fish with lime juice + turmeric powder and salt.

2. Taste, colour, shine, marketability, transportability and profitability were found maximum in smoking on hay after putting jalebi colour and least in keeping in ice, except in case of marketability which was lowest in smoked fish with lime juice + turmeric and salt.

3. Keeping in ice was considered best regarding variability of species in processing and gender specification. It was least in smoked fish with lime juice + turmeric and salt.

4. Smoking on hay was found best in respect of easiness in processing, less time in processing, input availability, less use of labour and less cost in processing

TABLE 1. RESULTS OF PRA MATRIX SCORING ON SMOKING OF FISH AND OTHER METHODS OF FISH PRESERVATION

CRITERIA	METHOD OF FISH PRESERVATION			
	SMOKING ON HAY	SMOKING ON HAY AFTER PUTTING JALEBI COLOUR	KEEPING ON ICE	SMOKING FISH WITH LIME JUICE + TURMERIC POWDER AND SALT
DURATION OF PRESERVATION	7.0	7.3	9.5	6.2
TASTE	7.5	8.4	3.6	5.4
COLOUR	7.7	8.5	4.1	5.3
SHINE	7.4	8.8	3.4	5.0
MARKETABILITY	7.9	8.4	6.4	4.8
EASINESS IN PROCESSING	7.2	6.8	6.7	4.4
TIME TAKEN IN PROCESSING	7.0	6.4	5.9	4.4
INPUT AVAILABILITY	7.5	6.7	2.0	5.3
COST IN PROCESSING	7.9	6.8	1.7	5.0
VARIABILITY OF SPECIES IN PROCESSING	6.7	7.2	9.3	5.3
GENDER SPECIFICATION IN PROCESSING	6.8	7.2	7.9	4.3
TRANSPORTABILITY	7.6	8.2	5.2	6.1
PROFITABILITY	7.4	8.4	2.4	5.0
LABOUR EFFECTIVENESS	6.9	6.7	2.7	3.9
AVERAGE (MAXIMUM SCORE=10)	7.3	7.6	5.1	5.1



FIG. 1. FRESH *PATOLA* FISH



FIG. 2. SMOKED *PATOLA* FISH

Keeping in ice was found worst on most of these criteria except in for easiness in processing and less time in processing, where smoked fish with lime + turmeric and salt was found to be least preferred.

5. Fish smoking on hay after putting jalebi colour was reported to be the best method to preserve the fish for 12 to 24 hours. By that time fishermen can arrange for their sale to get the maximum profitability and least spoilage.

6. Analysis of variances (ANOVA) indicated the difference between treatments as significant

Field experiment

The results in respect of average score on fish quality, marketability, consumability and market rates for both processed and unprocessed fish (darhee) at 6 hourly intervals separately for Jabalpur (Madhya Pradesh) and Badaun (Uttar Pradesh) villages are given in Table 2.

The results suggest that:

1. Processed fish are considered better by the fishermen of Madhya Pradesh in respect of quality as well as in case of market rates even at fresh stage. Processed fish are liked more by local people.
2. The people in Badaun district did not like processed fish even after 12 hours in comparison to unprocessed fish till it is spoiled.
3. Processed fish did not indicate much reduction (only 20%) in marketability, quality, consumability as well as in market rates even after 18 hours, whereas unprocessed fish indicated heavy reduction (about 80%). Even after 24 hours the reduction was 30% in case of processed fish, whereas it was 100% in case of unprocessed fish.
4. Though the processed fish were not liked by Badaun people, they retained the liking at almost same level, whereas in case of unprocessed fish there was 100% loss after 24 hours.

Laboratory experiment

The results of proximate analysis of ITK- treated two species of fish after 12 and 24 hours

Table 2. Average score on fish quality, marketability, consumability and market rates for processed and unprocessed fish at different time intervals

(Maximum score =10)

Criteria	After 6 hours		After 12 hours		After 18 hours		After 24 hours	
	Processed	Unprocessed	Processed	Unprocessed	Processed	Unprocessed	Processed	Unprocessed
Jabalpur villages (N-24)								
Fish quality	10	9	9	6	8	1	7	0
Marketability	10	10	9	7	9	3	7	0
Consumability	10	10	8	7	8	1	7	0
Market rates	10	9	9	6	8	1	7	0
Badaun villages (N=12)								
Fish quality	8	10	7	6	6	2	5	0
Marketability	6	10	5	7	5	2	3	0
Consumability	6	10	6	7	5	1	5	0
Market rates	5	10	4	6	3	2	3	0



Fig. 3. Fresh *darhee* fish



Fig. 4. Smoked *darhee* fish

are given in Table 3 along with the proximate analysis of untreated samples of one species of fish at two intervals. The results of microbial analysis of four species treated fish after 24 hours are also given in Table 4.

The results obtained on proximate and microbial analysis indicate that:

i. The loss in dry matter, calcium and phosphorus is reduced by smoking treatment of fish.

ii. There is no difference in crude protein after smoking treatment of fish.

iii. Smoking does not adversely affect the



Fig. 5. Different fish species treated with *jalebi* colour

Table 3. Content (% dry matter basis) of crude protein, ether extract, calcium and phosphorous in treated and untreated fish

Fish/treatment	Dry matter	Crude protein	Ether extract	Calcium	Phosphorus
Puntius sophore (darhee)					
Untreated after 12 hr	93.5.3	71.29	6.38	5.60	2.52
Smoked after 12 hr	91.41	77.23	5.88	4.84	2.41
Untreated after 24 hr	87.53	76.38	4.64	4.02	1.98
Smoked after 24 hr	89.46	71.97	6.71	4.06	2.47
Notopterus (patola)	89.46	71.97	6.71	4.06	2.47
Smoked after 12 hr	91.43	77.40	6.24	4.25	2.36
Smoked after 24 hr	88.93	75.53	5.33	3.44	2.01

Table 4. Microbial content in treated and untreated fish

Treatment	TVC (log CFU/g)	S. aureus (log CFU/g)	Lactose fermenter (log CFU/g)	Salmonella	Aeromonas
Untreated after 24 hr					
Puntius sophore (darhee)	7.20	4.29	6.08	Ab	P
H. fossile (singhi)	7.43	Nil	5.85	Ab	Ab
N. notopterus (patola)	7.45	4.14	6.11	Ab	Ab
Basilius bola (murrela)	7.23	4.75	6.25	Ab	Ab
Treated after 24 hr					
Puntius sophore (darhee)	6.23	Nil	4.60	Ab	P
H. fossile (singhi)	6.22	Nil	4.84	Ab	Ab
N. notopterus (patola)	6.00	Nil		Ab	Ab
Basilius bola (murrela)	5.24	Nil	5.60	Ab	Ab

Ab, Absent; P, present.

nutritional quality of fish.

iv. Smoked fish showed less microbial growth than the untreated fish. The smoked fish were tested for human consumption in respect of microbial counts and were found satisfactory even after 24 hours, whereas the untreated fish were not considered satisfactory.

v. Use of ITK helped in keeping the fish for 24 hours without significant loss in quality, consumability, marketability and in fetching market price.

vi. The liking of smoked fish varies from place to place.

CONCLUSION

Results of the study indicate that smoking of the fish, as done by the fishermen under study, could be an effective method in preventing spoilage during the period from fishing to its sale and maintaining nutritional quality of fish.

Food Product Development

Code : **1712**

Title of the ITK : **Vinegar of *jamun* (*Syzygium cumini*)**

Description of the ITK : *Jamun* (*Szygium cumini*), a multipurpose fruit is generally oblong or round in shape, deep purple or blackish blue in colour, having juicy sweet pulp and stone. Ripe fruits are collected in earthen pots, covered and sealed properly with paste of wheat/rice flour. After making the pot airtight, it is kept under sun for at least 15 days for fermentation, and the fermented juice is ready for use. In tribal villages like Samtoli of Simdega district people use vinegar/syrup of *jamun* for curing sugar, diarrhoea, heart and liver ailments. About 98% of farmers in the village use this age-old practice.

Name and address of the discloser : Ms Prabha Bara, Pathalkudwa, Church Lane, Ranchi (Jharkhand) 834 001

Location of use of the ITK : Samtoli, Semdega (Jharkhand)

Geographical indicators : *Jamum* (*Syzyquem cumini*) is large ever green tree attaining 30 m. in height and 3_6 in girth with bole up to 15 m, found throughout India, up to an attitude of 1,800 mm. The flowers are greenish. The tree grows widely in differing localities, but is generally found in streams and in damped places

Experimenter : Dr (Ms) N. Bara, Scientist, Department of Extension Education; Dr R.P. Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand), Dr A. P Singh, Head, Department of Animal Nutrition, Ranchi Veterinary College, Ranchi and, Dr (Ms) Manorama, Mishra, Head, Department of Home Science, Ranchi Women's College, Ranchi (Jharkhand)

METHODOLOGY

Location

The study was carried out in village Samtoli, Simdega (Jharkhand).

PRA and field study

The study was conducted in village Samtoli of Simdega district, from where this ITK was disclosed.

Vinegar of *jamun*, as reported by the discloser was found to be an important beverage made by tribals through indigenous techniques and popular for its medicinal value. To identify identical method of vinegar preparation, focused group interview was conducted. Fermentation by boiling emerged as another method of vinegar preparation. Both the methods (fermentation through sun-drying and boiling) were then compared. Twenty persons were interviewed.

Table 1. Matrix scoring for comparing vinegar of jamun fermented by sun-drying and fermented by boiling

Criterion	Vinegar (fermented by sun-drying)	Vinegar (fermented by boiling)
Minimum days in preparation	78	100
Materials used in preparation	98	78
Minimum labour in preparation	90	96
Simplicity of technology	95	92
Durability of products	70	98
Availability of raw materials	78	72
Cost effectiveness	82	78
Efficacy as medicine	86	90

Matrix table was prepared on the ground through PRA exercise. The parameters or factors included in the study are given in Table 1.

Experiment

The experimental methods followed for validation were both organoleptic test, and laboratory method for ingredient analysis.

The organoleptic evaluation was conducted in 10 replications through sensory evaluation method. The three methods of preparation of the beverage, i.e. vinegar fermented by boiling, vinegar fermented by sun drying and vinegar fermented by chemical, were prepared and tested organoleptically by a panel of 10 judges selected from the village as well as scientists of the university. The parameters included were colour, appearance, aroma, taste and overall acceptability.

RESULTS AND DISCUSSION

PRA and field study

An attempt was made to assess two methods of vinegar preparation by use of PRA tools. The results given in Table 1 reveal that vinegar fermented by boiling is superior to that fermented by sun-drying. Vinegar fermented by boiling has the advantage of less time taken in its preparation, less labour requirement, durability of the product, and efficacy as medicine. On the contrary, vinegar fermented by sun-drying was f ound superior to that fermented by boiling, in terms of minimum materials used in preparation and cost effectiveness.

Experiment

Keeping in view the nutritive and therapeutic value, vinegar of jamun was prepared by two different processing techniques. Their organoleptic acceptability in respect of colour, appearance, aroma, taste and overall acceptability was judged by a panel of 10 judges using 9–point Hedonic Rating Scale. The data on sensory evaluation are presented in Table 2.

The mean scores for orgnoleptic characteristics of vinegar fermented by boiling and that by sun-drying were organoleptically tested. Vinegar

Table 2. Sensory evaluation of vinegar fermented by boiling, sun-drying and chemical

Product	Colour	Appearance	Aroma	Taste	Overall acceptability
Control sample (use of chemical)	7	7	6	6	6.5
Test sample (formented by boiling)	6	6	8	8	7.0
Test sample (formented by sundrying)	7	6	7	6	6.5

Table 3. Crude protein content in two types of vinegar of jamun prepared through sun-drying and boiling (dry weight basis)

Vinegar type	Crude protein content (g/100 ml)
Fermented by sun-drying	0.153
Fermented by boiling	0.241

prepared with the use of chemical was used as the control. The results revealed that in the fermentation done by boiling, organoleptic characteristitcs like aroma, taste and overall acacetability were rated higher than the other two methods.The data further reveal that overall acceptability of control sample and vinegar fermented by sun-drying were equally liked by the people.

Laboratory analysis

Chemical analysis for estimating the content of crude protein in respect of two types of vinegar of jamun, i.e. fermentation through sun-drying and fermentation through boiling was done. Results are presented in Table 3. (laboratory analysis was done at Department of Animal Nutrition, Ranchi Veterinary College, Ranchi)

CONCLUSION

Vinegar of jamun prepared by fermentation through sun-drying was found to be acceptable. ❑

Code : **1713**

Title of the ITK : **Indigenous pudding - *futka***

Description of the ITK : *Futka* is highly nutritious and used during special occasions. Preparation of food (pudding) is very simple. About 1 kg milk is kept on the stove in a container to boil and slowly grinded *mahua* (1 kg) is added in it with addition of ragi flour (ź kg) in medium heat till it water evaporates, and then it is cooked under steam heat for 15 minutes. The practice is followed in Chainpur village of Dumari Block of Gumla district (Jharkhand) and has potential for its spread in other similar areas, where *mahua* is abundantly available. It has been found more proteinous and rich source of energy in comparison to other locally available food materials. Cost:benefit is 1:6 approximately.

Name and address of the discloser : Shri Binita Kujur, C/o Dr N. Bara, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

Location of use of the ITK : Chainpur, Chainpur, Gumla (Jharkhand)

Geographical indicators : *Mahua (Madhuca indica)* is a large deciduous tree with rather shorter bole, but large crown. Leaves 12_25 cm long, thick leathery pointed at top, nerves quite prominent. Flowers small, fleshy, pale or dull white in clusters near the ends of branches, stalks of flowers bent downwards, covered with brownish hair. Flowers strongly musk-scented, falling at dawn. Fruit 2.5_5 cm long, freshly greenish, seeds 1_4, brown shining, 2.5_3.5 cm long. It occurs in all the plains and lower tills of India upto 1200 m, it is very common in sub-mountain regions of the Himalaya, and is, at certain places, a chief constituent of the forest vegetation.

Experimenters : Dr (Ms.) N. Bara, Scientist, Department of Extension Education, Dr R.P. Singh "Ratan", Head, Department of Extension Education, Birsa Agricultural University, Ranchi (Jharkhand) 834 006, Dr (Ms.) Ruby Dutta, Head, Department of Home Science, Ranchi University, Ranch and, Dr A. P Singh, Head, Department of Animal Nutrition, Ranchi Veterinary College, Ranchi.

METHODOLOGY

Location

The study was carried out in village Chainpur, block Chainpur, dist. Gumla (Jharkhand)

PRA and field study

PRA tools were used to determine the efficacy of indigenous food *futka*, in terms of processing, easily available ingredients, nutritious, energy

Table 1. Matrix scoring for assessing different properties of two ethnic food products

Property	*Futka*	*Mahua latha*
Simple process	68	84
Easily available ingredients	66	81
Nutritous	84	78
Energy provider	78	70
Protective food	60	48
Cost effectiveness	52	90

provider, protective food and cost effectiveness covering randomly selected 20 practitioners. For validation the ITK was compared with another indigenous food, *mahua latha* (flower of *mahua Madhuca indica*, is boiled and taken as food).

Experiment

The food product was evaluated by organoleptic evaluation method. Two food materials, i.e. futka and mahua latha, were tested organoleptically (sensory method) by a panel of 10 judges selected from the village as well as scientists of the university, using 9_point hedonic rating scale. The parameters taken into consideration were taste, flavour or aroma, colour and overall acceptability.

RESULTS AND DISCUSSION

PRA and field study

Data in Table 1 show that in terms of nutrition, energy provider and protective food, *futka* was considered superior to *mahua latha*. On the contrary, in terms of cost effectiveness, availability of ingredients and simplicity of process, *mahua lattha* was rated higher than *futka*.

Experiment

The organoleptic evaluation of ethnic food, *futka* was done. The results are presented in
Table 2.

Results indicate that futka was superior to *mahu latha* in terms of taste, flavour

Table 2. Sensory evaluation of *futka* and *mahua latha*

Product	Taste	Flavour/aroma	Colour	Overall acceptability
Futka	9	8	7	24
Mahua latha	6	5	6	17

Result obtained indicate that *futka* is superior to *mahu latha* in terms of taste, flavour.

Table 3.

Items	*Ragi flour*	*Mahua* flower
Crude protein(%)	10.30	7.28
Crude fibre (%)	3.70	8.46
Fat (%)	1.20	8.53
Total ash (%)	3.80	7.61
Calcium (mg/kg)	0.61	0.33
Phosphorous(mg/kg)	0.45	-
Zinc (mg/kg)	35.0	-
Moisture (%)	-	6.37

Laboratory analysis for estimation of chemical properties of two chief ingredients of the indigenous pudding *futka*, i.e. *ragi* flour and mahua flower was done. Results are given in Table 3. (Laboratory analysis was done at Department of Animal Nutrition, Ranchi Veterinary College, Ranchi)

CONCLUSION

Futka was found organoleptically better acceptable than *mahua latha*. ❑

Code : **306**

Title of the ITK : **Meat preparation from googly (snail)**

Description of the ITK : Small oyster, i.e. googly from pond are collected, boiled with water and inner flesh taken out, and cooked as any meat preparation. Googly is equivalent to any meat, which cures dysentery.

Name and address of the discloser : Mrs. Saroja Bala Manna, Bahichard, Naikuri, Midnapore (West Bengal) 721 627

Location of use of the ITK : Bachichard, Naikuri, Midnapore (West Bengal) 721 627

Experimenters : Dr D. Seenappa, Associate Professor-Aquaculture Extension Education Unit, and Dr Kamal G. Nath, Associate Professor, Department of Rural Home Science, University of Agricultural Sciences, Hebbal, Bangalore (Karnataka) 560 024

METHODOLOGY

Location

The experiment was carried out at the University of Agricultural Sciences, Banglore (Karnataka).

Experiment

Meat picking

Googly was collected from the edges of the ponds by hand. These were cleaned in fresh clean water. One kg *googly* was weighed and the number was counted. They were boiled in hot water for 20 minutes and the meat was picked using a needle. The picked meat was weighed to determine the meat yield.

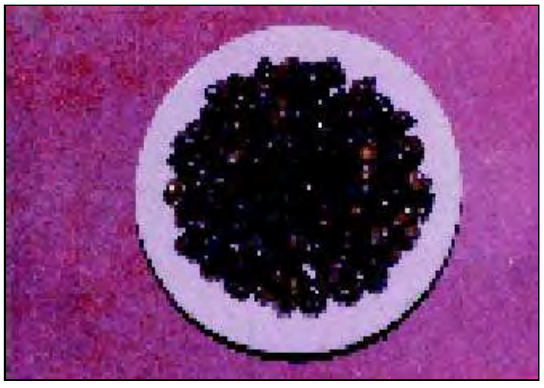


Fig. 1. *Googly* and its collection from ponds

Curry preparation

Ingredients used for preparation of 250 g meat curry are given in Table 1.

Potato, onion, garlic and tomato were cut, leaving their upper surface. Onion, garlic and ginger were made into a fine paste in a mixer. This paste along with cumin powder, turmeric and 150 g oil was mixed thoroughly with *googly* meat. It was then fried in a pan for 10 minutes and taken out of the oven. Potato slices were



Fig. 2. Meat picking from *googly*

Table 1. Ingredients used in *googly* meat preparation

Ingredients	Quantity (g)
Potato	500
Onion	250
Garlic	50
Ginger	50
Cucumin powder	50
Turmeric	25
Tomato	250
Mustard/sunflower oil	250
Cleaned *googly*	250
Salt	as per taste
Water	1,000 ml

fried in the remaining oil and the fried meat mixture was added to it. Later tomato slices were added and fried together. After about 5 minutes water and salt were added to prepare a curry. The curry was sufficiently boiled for 20 minutes and was served hot for organoleptic evaluation.

RESULTS AND DISCUSSION

Meat yield

For determining the meat yield, 355 snails (*googly*) were taken, having average weight 2.86 ą 0.12 g (n=30). Theus 1 kg *googly* gave 470 g meat, leading to 47% meat yield.

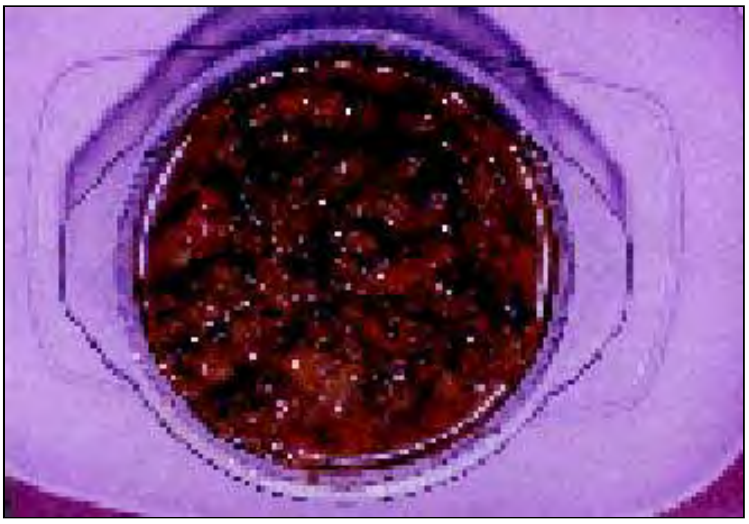


Fig. 3. Meat prepared from *googly*

Organoleptic evaluation

The product googly curry was subjected to organoleptic evaluation. A five point Hedonic Score-sheet and a descriptive score sheet were utilized for this purpose. A total number of seven semi- trained panel of judges evaluated the product. The product was served within 2 hours of preparation, at ideal temperature.

The mean score of seven panelists for the product was found to be 40.86 with a standard deviation of ą5.01. Based on mean scores the product was adjudged good and acceptable.

CONCLUSION

The disclosed information was found to be an acceptable dish. ❑

Code : 1740

Title of the ITK : Use of apple snail (Pila globosa) as ethnic food material

Description of the ITK : Small black apple snail, ghunghi (Pila globosa) is available in rice fields, ponds and rivers. Apple snail is rich in protein, fat and vitamins, which is considered as body building food as well as energetic and protective diet. Snails are boiled for 20–30 minutes. After that meat portion is removed from shell and meat is cooked with spices like other meat. It i s consumed by all the family members including pregnant and lactating women in the Sinjusrenj, Saraitoli and Sogod villages of Ranchi district in Jharkhand. Majority of the villagers use snail as ethnic food.

Name and address of the discloser **: Ms Prabha Bara, Pathalkudwa, Church Lane, Ranchi** (Jharkhand) 834 001

Location of use of ITK : The ITK is reported from Sogod village of Namkum block in Ranchi district of Jharkhand.

Experimenters : Dr (Ms) N. Bara, Scientist, Department of Extension Education; Dr R. P. Singh 'Ratan', Head, Department of Extension Education, Dr A. P Singh, Head, And, Dr R. N. Singh, Associate Professor, Department of Animal Nutrition, Ranchi Veterinary College, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

The study was conducted in Sogod village of Namkum block in Ranchi district of Jharkhand.

PRA and field study

The field study was carried out by using PRA tools involving 20 respondents. The reported ITK was compared with another identical food material, flat n snail locally called ghongha, on two aspects, i.e. (i) different preparations and (ii) selected characteristics of the preparations. The parameters for different types of preparations included snail + tamarind, snail + oil + potato, snail + tomato and for selected properties the parameters included popularity, availability, beneficial aspects, nutritional value, medicinal value and deliciousness.

Experiment

Organoleptic test was conducted with two food items prepared from (i) small black apple snail and (ii) flat snail in 10 replications through the organoleptic evaluation method. The two food materials were cooked and the preparations were tested organoleptically (sensory method) by a panel of 10 judges selected from the village using 9–point Hedonic Rating Scale. The parameters studied were: colour, flavour or aroma, taste and overall acceptability.

RESULTS AND DISCUSSION

PRA and field study

Assessment of different preparations of snails

Data presented in Table 1 show that apple snail + tamarind water was found to be a better diatry



Fig. 1. Use of apple snail as ethnic food

preperation. Majority of the people were found to be using the preparation made from apple snail in comparison to flat snail.

Selected characteristic of two ethnic food materials

Food prepared from apple snail scored very high (96) in terms of its popularity and medicinal value (Table 2). Apple snail is considered highly nutritious (90), delicious (88) and beneficial (86). It was also revealed that these two varieties of snails were easily available. However, in terms of comparative availability, apple snail scored higher (82) than flat snail (72). Further, apple snail was rated superior to flat snail on different characters such as popularity, availability, nutritional value, medicinal value and deliciousness.

Table 1. Matrix scoring for assessing the performance of different preparations of the two species of snail

Preparation	Apple snail	Flat snail
Snail + tamarind water	89	72
Snail + oil and spices	82	68
Snail + potato	72	68
Snail + tomato	65	39

Table 2. Matrix scoring for assessing the selected characteristics/properties of the food items prepared from apple snail and flat snail

Characteristic	Apple snail	Flat snail
Popularity	96	70
Easy availability	82	72
Beneficial aspects	86	74
Nutritional value	90	80
Medicinal value	96	65
Deliciousness	88	60

Medicinal use of food materials made from apple snail and flat snail

The respondents indicated two important medicinal use, ie. increasing of eye vision and curing of tuberculosis, by eating apple snail and flat snail, out of which apple snail was reported to be better option (Table 3).

Table 3. Matrix scoring for different types of medicinal use of the two ethnic food items

Characteristic	Apple snail	Flat snail
Increasing vision	80	52
Treatment of tuberculosis79		47

Experiment

The organoleptic acceptability of ethnic food was assessed. The scores for organoleptic characteristics revealed that curry of apple snail prepared with oil and spices was rated very high (7.6) as compared to that of flat snail (6.3). Data presented in Table 4 show that curry of apple snail obtained higher scores 9 and 7 in respect of the taste and flavour respectively than the curry of flat snail with corresponding scores of 6 and 7.
The curry of apple snail is preferred over that of the flat snail.

Laboratory studies

Laboratory analysis for estimation of the

Table 4. Sensory evaluation of the ethnic food items

Product	Colour	Flavour / aroma	Taste	Overall acceptability
Curry of apple snail	9	7	7	7.6
Curry of flat snail	6	6	7	6.3

Table 5. Chemical composition of small/apple snail flesh (dry weight basis)

Moisture (%)	Crude protein (%)	Total ash	Fat (%)	Crude fibre (%)	Calcium (mg/kg)
46.0	41.49	35.17	12.03	0	2.91

chemical composition of small/apple snail flesh was done. Results are presented in Table 5. (Laboratory analysis was done at Department of Animal Nutrition, Ranchi Veterinary College, Ranchi)

CONCLUSION

Apple snail is more palatable and acceptable to the tribals than flat snail. It is also compatible with the social, cultural and environmental situations of the area. ❑

Code : 1744

Title of the ITK : Use of big snail as ethnic food

Description of the ITK : Villagers of Jojohatk of the Saraikela Khaisawan district in Jharkhand use snail for making curry. Snails are fried with mustard oil and salt is added in it for taste. This dried vegetable is useful for increasing the eye sight for longer period in human beings. All the farmers of the village use this age old practice. This ethnic food provides protein and other minerals and vitamins, which the poor people (90%) cannot afford and they get it at no cost or very low cost through gathering or collecting it from rice fields during rainy season.

Name and address of the discloser:Ms Geeta Kumari, C/o Shri K.N. Singh, Munda (Tatanagar), East Singhbhum (Jharkhand) 833 201

Location of use of the ITK : The study was conducted in village Jojohatu, Kuchai block, Saraikela district of Jharkhand

Experimenters : Dr (Ms) N.Bara, Scientist, Department of Extension Education , Dr B. K. Roy , Associate Professor, Pharmacology and Toxicology and, Dr A. P Singh, Head, Department of Animal Nutrition , Ranchi Veterinary College, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

The study was carried out in village Jojohatu, block Kuchai, dist. Saraikela (Jharkhand).

PRA and field study

Field study was conducted through PRA tools with 20 respondents. The parameters studied were: medicinal properties, nutritional value, deliciousness, availability and effectiveness for increasing vision.

Experiment

The field experimentation was conducted in 10 replications through the organoleptic evaluation method. Two types of curry were prepared by using oil and spices. Their organoleptic acceptability in respect of taste, flavour or aroma, colour or appearance and overall acceptability was judged by a panel of 10 judges from tribal community using 9–point Hedonic Rating Scale.

Table 1. Matrix scoring for assessing the properties of big snail and small snail as ethnic food

Parameter/factor	Mean score
Medicinal properties	8.4
Nutritional value	7.8
Deliciousness	8.1
Availability	7.2
Effectiveness in increasing vision	7.5



Fig. 1. Flat snail used as an ethnic food

aroma, other characteristics of curry of big snail were rated high. The mean scores for organoleptic characteristics reveal that curry of small black snail prepared with oil and spices were organoleptically very high in comparision to curry of big snail. Curry of small black snail obtained highest score, i.e. extremely liked in respect of taste, whereas taste and flavour or curry of big snail rated slightly liked. However, the mean scores on overall acceptability indicated that both preprations of ethnic food were organoleptically acceptable.

Laboratory studies

Laboratory analysis for estimation of the chemical composition of big/flat snail flesh was done. Results are presented in Table3. (laboratory analysis was done at Department of Animal Nutrition, Ranchi Veterinary College, Ranchi).

Table 2. Sensory evaluation of big and small snail as ethnic food

Product	Colour	Flavour/aroma	Taste	Overall acceptability
Curry of small black snail	9	7	7	7.6
Curry of big snail	6	6	7	6.3

Table 3. Chemical composition of big/flat snail flesh (dry weight basis)

Moisture (%)	Crude protein (%)	Total ash	Fat (%)	Crude fibre (%)	Calcium(mg/kg)
46.3	42.35	22.23	15.36	0	5.98

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 show that the reported ITK was rated highly effective for all the parameters taken into consideration.

Experiment

The mean scores for organoleptic characteristics of ethnic food are given in Table 2. It is evident that except taste and flavour or

CONCLUSION

The findings led to conclude that ethnic food made from big snail was found to be popular because of its high nutritive and therapeutic value, and it was organoleptically acceptable. ❑

Code : **306**

Title of the ITK : **Preparation of *bori* from pigeonpea *dal***

Description of the ITK : Boris are of three types as follows:

Small conical-shaped

Pigeonpea is kept overnight in water, smashed to semi-solid state, salt is added and placed on a plate smeared with mustard oil. After sun drying they are used as food by frying in oil.

Large conical-shaped

Quashed beuli mixed with salt, cumin (jeera) powder, red chilly powder, crushed bottlegourd and katchumuro, could prepared as explained above.

Designed

It is like gilipi. This is prepared along with poppy seeds. The procedure is similar to small and large bori preparation.

Name and address of the discloser : Ms. Saroja Bala Manna, Bahichard, Naikuri, Midnapore (West Bengal) 721 627

Location of use of the ITK : Bachichard, Naikuri, Midnapore (West Bengal) 721 627

Geographical indicators : Cajanus cajan





Fig. 1. Pigeonpea (a) Plant; (b)

Common name : Pigeonpea

Botanical name : Cajanus cajan

Family : *Fabaceae*

Description

The pigeon pea plant is an erect annual or short-lived perennial reaching a height of 3_10 feet. Because the coarse bush is deeply rooted, it has wide adaptability and grows well on semiarid land. It has slender, pointed trifoliate leaves and yellow or yellow and red flowers. Pods are similar to English peas, green and pointed with a bit of reddish mottling. Several pods are produced in clusters on an upright stem.

The plant is a vigorous, drought-tolerant legume, which provide large pods that are easily harvested. This pea is a heavy bearer, yielding sweet tasting peas. It is suited for early planting and will succeed under hot growing conditions.





Fig. 2. Ginger (a) Rhizome; (b) Plant





Fig. 3. Chilli (a) Pods; (b) Plant

Common name : Ginger

Botanical name : Zingiber officinale

Family : *Zingiberaceae*

Description

Ginger is a perennial root which creeps and increases underground, in tuberous joints; in the spring it sends up from its roots a green reed, like a stalk, 2 feet high, with narrow lanceolate leaves; these die down annually. The flowering stalk rises directly from the root, ending in an oblong scallop spike; from each spike a white or yellow bloom grows. Ginger flowers have an aromatic smell and the bruised stem a characteristic fragrance, but the root is considered as the most useful part of the plant.

Habitat

Said to be a native of Asia. Cultivated in West Indies, Jamaica, Africa.

Common name : Chilli

Botanical name : Capsicum frutescens

Family : Solanaceae

Description

Numerous varieties of chillies exist. The primary separating characteristics are based upon flower and seed colour, shape of the calyx, the number of flowers per node and their orientation.

Country

Latin America, India, Indonesia, Africa, China

Common name : Poppy

Botanical name : Papaver somniferum

Family : Papaveraceae

Description

The plant is an erect, herbaceous annual, varying much in the color of its flowers, as well as in the shape of the fruit and color of the seeds. All parts of the plant, but particularly the walls of the capsules, or seed-vessels, contain a system of laticiferous vessels, filled with a white latex.





Poppy plant on flower

The flowers vary in colour from pure white to reddish purple. In the wild plant, they are pale lilac with a purple spot at the base of each petal.

The capsules vary much in shape and size. They are usually hemispherical, but depressed at the top, where the many-rayed stigma occupies the centre; they have a swollen ring below where the capsule joins the stalk. Some varieties are ovoid, others again depressed both at summit and base. The small kidney-shaped seeds, minute and very numerous, are attached to lateral projections from the inner walls of the capsule and vary in colour from whitish to slate. The heads are of a pale glaucous green when young. As they mature and ripen they change to a yellowish brown, and are then cut from the stem if the dried poppy heads are required.

Poppy grows to a height of about 1 meter. It has a bare and smooth stem with broad, curly darkgreen leaves. The flowers are large, lightpurple, red or lightpink and it flowers from July_August. You can find it growing in gardens but it is rarely the real opium poppy. In large parts of Asia and Turkey it is cultivated to produce opium. Opium contains more than 30 different alkaloids i.e. morphine, codeine, heroine, noscapine and papaverine. In some parts of the world it is also cultivated to produce oil.

Habitat

An annual herb the opium poppy (Papaver somniferum, var. album) is indigenous to Asia Minor, and is cultivated largely in European and Asiatic Turkey, Persia, India and China for the production of opium. It has been observed growing on the cliffs between Folkestone and Dover.

Common name : Turmeric

Botanical name : Curcuma longa

Family : Zingiferaceae

Description

Deciduous underground rhizomes dormant through winter. New growths appear in spring and grow fast in the warm months. In summer, an inflorescence is produced from in-between the leaf petioles. The bracts are not as colorful as

other species in the genus. The uppermost bracts are white with just a hint of light mauve color on the tips. The bloom can be used as a cut flower.

Anti-inflammatory, antioxidant, anti-mutagenic, anti-cancerous, cholagogueue, depurative, diuretic, fumitory, hemostatic, hepato-protective, lactagogue, stomachic, tonic, vulnerary

Country

Brazil, China, Java, Malaya, Nepal, Philippines

Experimenters : Dr S. Ganeshan, Principal Scientist, Dr K.P. Gopala Krishna Rao, Head, Division of Post Harvest Technology and Dr I.N. Doreyappa Gowda, Sr. Scientist and Head, Division of Post Harvest Technology, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore (Karnataka) 560 089

METHODOLOGY

Location

The study was conducted at the Indian Institute of Horticultural Research, Bangalore.

Experiment

Boris of small and big size were prepared as per the recipe provided by the discloser. *Boris*

Table 1. Yield and moisture content of different types of *boris*

Type of *bori*	Yield (%)	Moisture content (%)
Big bori	84	12.5
Small designed *bori*	81	10.9
Small *bori*	85	12.9
Making cost of *bori*		Rs 50 to 60 / kg

made of pigeonpea, *khesari dal*, *urdal* with other ingredients were prepared by soaking the *dal* overnight, grinding and additing other ingredients such as ginger, bitter gourd, salt, chilly powder, *zeera* etc, and then by drying on steel plate smeared with mustard oil. Dry *boris* were packed in food-grade containers and stored. Dry *boris* were also fried in oil and tasted.

From the initial experimentation, it was found





that protein-rich, low-cost dry product can be prepared by simple recipe and procedure. The taste of mustard oil-fried *boris* is not very much acceptable in southern India. Hence attempts will be made to change the oil and see whether there will be appreciable change in the taste of the product. Information on moisture content of different *boris* and yield is given in Table 1.

CONCLUSION

Protein-rich, low-cost, nutritious food product can be prepared using common ingredients and simple recipe. There is a need to improve or change the taste of the product. ❑

Natural Yarns and Dyes

Code : **574**

Title of the ITK : **Evaluation of physico-chemical properties of *rambans (sisal)* fibre**

Description of the ITK : Sisal (*Agave sisalana*) provides good quality fibre which is traditionally used for making ropes for tying animals and in other agricultural purposes. Farmers also grow this plant on the edges of the terrace in order to protect the crop from animals. 5_6 mm thick thread of fresh *sisal* leaves are also used for tying the bundles of grass and green vegetable.

Name and address of the discloser : Shri Mohan Singh, Main Market, P. O. Thal, Pithoragarh (Uttaranchal)

Location of use of the ITK : Thal, Didihat, Pithoragarh (Uttaranchal)

Experimenters : Dr Nirmal Chandra, Senior scientist (Agricultural Extension), Social Science Section, Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (Uttaranchal) 263 601

Geographical indicators : *Sisal (Agave sisalana)* is a plant of the family Agavaceae. Its fibre is the most important of the leaf fibre group. It is widely cultivated for its large leaves that yield a stiff fibre used for making ropes and carpets. The sisal plant has a short stem of a thickness about 15 inch, from which spring upwards and out wards a number of thick rigid fleshy leaves from 4_6 feet in length, and having a maximum breadth of 4_7 inch. The leave-tapes towards the apex terminating in a long, sharp thorn. They are thickest at the base (1.25_1.75 inch), where the top surface almost flat, thinning towards the apex. Young plants, propagated from bulbils or rhizomes (underground stems) of mature plants.



Sisal (Rampans)

METHODOLOGY

A field study was done in Thal village of Didihat block in Pithoragarh district of Uttaranchal. The PRA tool was used for collection of information about the ITK. Field survey was conducted in 10 villages of Thal area. Response was taken from 70 farmers regarding their perception about the strength, appearance and durability of various ropes being used in the area on a five point continuum, viz., very good, good, uncertain, moderately good and poor. The scores were given 4, 3, 2, 1 and 0 respectively. The properties of the fibre were determined at National Institute of Research on Jute and Allied Fibre Technology, Kolkata.

Sisal is abundantly available in the wild form all over Kumaun. The rope is prepared and used extensively in Thal and nearby areas.

Extraction of fibre

Raw materials (*sisal* fibre) for the present study were extracted from the leaves of *sisal* plant,



Fibre of sisal



Mat prepared from sisal fibre

which were collected from Thal area. The leaves were crushed mildly and then were kept in slow-running stream at Hawalbagh for 10 days in August. The retted material was again crushed by wooden log (mugar). It was then thoroughly washed with fresh water and thus sisal fibre was obtained, and after drying the fibre was combed and bundle was made.

The extracted fibre was tested for its physical and chemical properties using the following procedures:

Physical properties

Fibre Length: Fibre length was determined by the oil method. In this the fibres were combed straight and vaseline was spread on glass plate. Then the fibres were mounted on glass plate along a straight line and their length was measured (by centimetre or millimetre scale).

Fibre diameter: Fibre diameter was studied under microscope. The following formula was used for calculating the diameter

Fibre diameter (μ) = Average diameter × 9.8 where, 9.8 was the least count for 100 × eye piece and 10 × objective.

Bundle strength: The bundle strength of sisal fibre was measured by stelometer. Strength was calculated by using the following formula:

$$\text{Bundle strength} = \frac{\text{Load (kg)} \cdot 15}{\text{Fibre wt (mg)}}$$

Chemical properties

Cellulose Content: The cellulose evolution was reached by boiling the fibre for 5 minutes in a dilute solution of caustic soda, to make the solution represent 1% of Na_2O, and after removing of alkali by washing, subjecting the wet fibers to the action of the chlorine gas for 1 hour or even longer as required. After further washing it was treated with 3% sodium sulphite solution and after 2 or 3 minutes of boiling a small quantity of cold water was added, and in a corked flask the contents were submitted to increasing violent shaking until the fibre was washed, then it was dried and weighed. The immersion of the chlorinated fibre in the sodium sulphite solution was accompanied by a brilliant purple or crimson coloration, if the fibre was of the lingo-cellulose type,whereasa practicallycolourless solution was obtained from non-lignified fibre.

Ash content: Theash content was determined bycomplete incineration of thefibre and weighing the residue.

Moisture content: The moisture content was determined in the ordinary manner by drying at 100–110°C and the value were expressed as a percentage of the original weight.

Solubility test

Solubility in 1% Caustic Soda: One gram fibre was taken in a beaker having 100 ml 1% NaOH solution. The beaker was heated in water bath for

1 hour with repeated stirring. The fibre was then filtered and washed with hot water, followed by 10% acetic acid and again with hot water. The washed samples were oven dried at 105°C till there was no decrease in weight.

Solubility in cold water: Solubility in cold water was carried out by taking 2 g fibre in a beaker containing 300 ml distilled water and digested at a temperature of 23 ± 2°C with frequent stirring for 48 hours. Then fibres were filtered and washed with cold distilled water, followed by drying at 105°C for 2 hours and then weighed.

The percentage of solubility was calculated by using the following formula:

Solubility in 1% NaOH/cold water/hot water

$$= \frac{W_1 - W_2}{W_1} \cdot 100$$

where, W_1 = initial weight of fibre; W_2 = weight of fibre after extraction with 1% NaOH or cold water or hot water

Bleaching of fibre

The main purpose of bleaching is to remove natural impurities in order to produce white material. The fibre was bleached by chloride and peroxide. Peroxide bleaching of fibre was carried out in an open bath (M:L = 1:50) for 50 minutes at 90°C with hydrogen peroxide (4 g/litre), trisodium phosphate (5 g/litre), sodium hydroxide (1 g/litre) and sodium silicate (10 g/litre) as bleaching bath assistants.The bleached samples were washed with cold water and then neutral wash was carried out with 2 g/litre acetic acid. It was again washed and dried.

RESULTS AND DISCUSSION

PRA and field survey

Field study conducted at Thal village in Pithoragarh of district Uttaranchal revealed that all the farmers in the village use sisal rope for various purposes. Various types of ropes are prepared from the fibre for the following different purposes:

(i) Mwal rope is used for covering the mouth of animal at the time of ploughing;
(ii) Mathani rope is used for churning for the extraction of butter;
(iii) Glaun rope is used in tying the neck of the animals;
(iv) Jature rope is used for tying the neck of the animals with agricultural implements;
(v) Dawanlrope is used for tying the bell with the neck of animal; and
(vi) Jyaur rope is used for tying grass and wood bundles.

Rope of sisal was perceived by the users to be superior with respect to appearance, durability and strength as compared to rope made from *bhimal and jute.*

Experiment

Physical properties

The average length of sisal fibre was recorded to be 52.65 cm, which was much greater than that of bhimal (7.4 cm) and cotton (2.0 cm). This is an indication of good quality of the fibre. The fibre diameter of sisal was found to be 0.14 mm, which was greater than both bhimal (0.07 mm) and cotton (0.03 mm). The strength of sisal fibre was found to be 52.24 g/tex which was much higher than that of bhimal (47.5 g/tax) and cotton (45.0 g/tax) (Table 1, Fig. 1).

Chemical properties

Moisture content of sisal and bhimal fibre was found to be almost equal (9.8% and 9.62% respectively) but higher than of cotton (7.69%). The moisture values serve as an indication of the susceptibility to rotting (Table 2).

Ash content of sisal fibre (1.60%) was higher as compared to that of bhimal fibre (0.70%) and fibre of cotton (0.77%). A high value of ash is indicative of possible mineral impurity.

Cellulose content present in sisal fibre was 90.08% which was higher than of bhimal fibre (86.7%) but less than that of fibre of cotton (97.5%).

Table 1. Physical properties of fibres made from sisal, bhimal (Grewia optiva) and cotton fibre

Property	*Sisal*	*Bhimal*	Cotton
Fibre length (cm)	52.65	7.4	2.0
Fibre diameter (mm)	0.14	0.07	0.03
Bundle strength (g/tex)	52.24	47.5	45.0

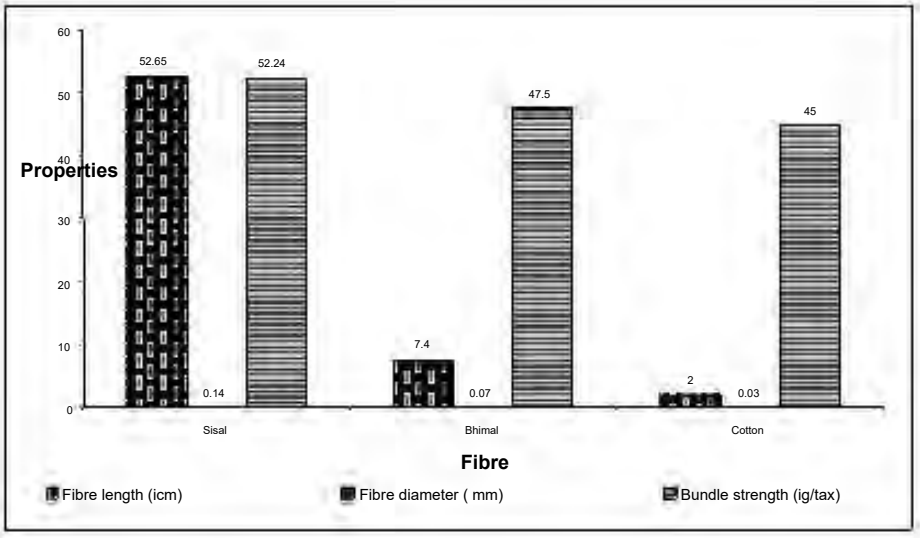


Fig. 1. Physical properties of sisal , bhimal and cotton fibres

Table 2. Chemical composition of fibres of sisal, bhimal and cotton fibre

Chemical composition (dry basis)	*Sisal*	*Bhimal*	Cotton
Moisture (%)	9.8	9.62	7.69
Ash (%)	1.6	0.70	0.77
Cellulose (%)	90.08	86.7	97.5
Lignin (%)	9.92	13.3	-

The lignin content was lower in sisal fibre (9.92%) as compared to fibre of bhimal (13.3%).

Solubility

Solubility test indicates the percentage removal of foreign matter from the fibre. Data (Table 3) show that the water solubility was more in sisal fibre (1.16%) than is fibre of bhimal (1.03%) but less than in cotton fibre (1.57%). Solubility of sisal fibre in alkali was found to be 5.0%, which was lesser than that of bhimal fibre (6.0%) but slightly greater than fibre of cotton (4.5%).

Table 3. Solubility of fibres of sisal, bhimal and cotton

Percent solubility	Sisal	Bhimal	Cotton
Solubility in water	1.16	1.03	1.57
Solubility in NaOH	5.0	6.0	4.5

The observation revealed, that water and alkali solution can be used for the washing of sisal fibre and fabrics prepared from it.

Colour

The colour of the raw sisal fibre was found to be 82.80% which increased to 86.60% when bleached with chloride (Table 4), whereas colour increased up to 90.70% when bleached with peroxide. It indicates that the peroxide bleach is better than the chloride bleach. Lustre of the fiber increased almost equally when bleached with chloride and peroxide.

Table 4. Colour of sisal fiber as affected by methods used

Properties	Control	Chloride bleach	Peroxide bleach
Colour (%)	82.80	86.60	90.70
Luster (brightness)	0.97	1.03	1.00

CONCLUSION

Results of the studies conducted in the laboratory for determining quality of fibres extracted from *sisal, bhimal and cotton revealed that fibre quality* of sisal is better than the other two sources of fibre. If further corroborates the preference of the farmers of Thal village for sisal fibre, as found from field study.

REFERENCE

Barker, S. G. Sisal, The attributes of the fibre – and their industrial significance. Imperial Economic Committee, 24th Report; “Hemp Fibers”, 1932.

Code	**:**	**1717**
Title of the ITK	**:**	**Use of bark of *arjun (Terminalia arjuna)* and *asan (Terminalia tomentasa)* for making natural dyes**
Description of the ITK	:	Bark of *arjun* and asan is boiled minimum for 2 days after soaking in water for a week. Then the product is used as dye. At the time of use, it is again boiled. The practice is followed widely in the villages of Rajnagar Block of Saraikela district (Jharkhand) and has potentiality for its further spread in the areas, where *arjun* and *asan* trees are abundantly available. Farmers are 100% satisfied with the practice. Cost:benefit is 1:8 approximately.
Name and address of the discloser	:	Sahyogi Mahila, Bagaraisai, Saraikela (Jharkhand)
Location of use of the ITK	:	Use of bark of arjun *(Terminalia arjuna)* and *asan (Terminalia tomentosa)* for making natural dye/colour has been reported by the discloser of Bagrasai and Chotakadal villages of Rajnagar block of Sariakela district of Jharkhand where this practice is very popular among Santhal tribes.
		Geographical indicators
	:	Asan (Terminalia conenulata syn. T. tementosa) is large deciduous straight stemmed tree with spreading branches of 32 m or more, distributed in Himalays from Kangra east wards to Goalpara division of Assam and in throughout the Peninsula, ascending to a altitude of 1,200 mm. Flowers are dull-yellow in terminal and auxiliary panides. The tree is one of the commonest and most widely distributed of all important timber species. *Arjun (Terminalia arjuna)* is a large evergreen tree with a spreading crown and drooping branches, common in most parts of India and also planted in many parts of Indian Peninsula along rivers, streams, ravines and dry water sources. It extends northwards to the sub-Himalayan tract where it is distributed along the bank of streams.
Experimenters	:	Dr (Ms) N. Bara, Scientist, Department of Extension Education and DR. R. P. Singh `Ratan', Head Department of Extension Education, Birsa Agricultural University, Kanke, Ranchi, Dr K.K. Kumar, Director and, Dr A. K Jaiswal, Senior Scientist, Indian Lac Research Institute, Namkum, Ranchi (Jharkhand).



Fig. 1. Asan tree (Terminalia tomentasa)



Fig. 2. Dye preparation from Asan bark



Fig. 3. Arjun tree (Terminalia arjuna)



Fig. 4. Dye preparation from Arjun bark

METHODOLOGY

Location

The study was conducted in Bagraisai and Chota Kadal villages in Rajanager block of Saraikela district of Jharkhand.

PRA and field study

To identify another identical ITK on natural dye or colour, a focused group interview was conducted. Soil colour emerged as most suitable alternative for comparison. Altogether 30 respondents were interviewed. Two matrices were drawn on the ground. The PRA method was adopted to collect the data. The parameters included durability, cost effectiveness, hygienic, aesthetic and attractive character; and availability of raw materials.

Experiment

To validate the ITK, the natural colours of *arjun, asan and soilwere prepared and used in 6* replications, each having 3 treatments, viz. wall

painting with soil colour (T_1), arjun colour (T_2) and san colour (T_3). The parameters selected for assessing the performance were: durability of colours, time and labour requirement and unit cost of production or preparation of colours.

RESULTS AND DISCUSSION

PRA and field study

In order to assess the properties of two natural colours or dyes, the PRA was conducted. Results presented in Table 1 show that for aesthetic sense and attractiveness both arjun/ as an and soil colours were preferred by the respondents. In terms of durability, hygiene and easy availability of raw material, the respondents considered arjun/ *asan colour superior. On the contrary, soil colour* was considered much more cost effective than *arjun or asan colour.*

Table 1. Matrix scoring for assessing the properties of natural colours and soil colour

Property	*Asan/arjun* colour	*Soil* colour
Durability	95	57
Cost effectiveness	68	80
Hygienic	95	60
Aesthetic and attractive	94	90
Availability of raw materials	92	70

For assessment of natural colour making technology in terms of time, ease in preparation and other uses, an attempt was made to explore the data. Table 2 show that in terms of ease in preparation and total time spent, soil colour was found to be superior. Arjun or asan colour scored much more than soil colour for its various uses. It was revealed from the key information provides and group discussion that colour of arjun and asan are also used for colouring leathers, clothes etc.

Experiment

Data presented in Tables 3, 4 and 5 revealed that colour extracted from arjun was highly durable, followed by asan and soil colours, as the colour effect of arjun was 80% even after a period of 12 months which decreased to 75 and 60% in *asan and soil colours, respectively. But in terms*

Table 2. Matrix scoring for assessing the natural colour making technology in terms of time, ease in preparation and other use

Parameter	*Asan/arjun colour*	*Soil colour*
Total time spent	90	97
Ease in preparation	64	84
Other use	86	47

Table 3. Durability (months) of natural colours on mud walls used as painting materials

Duration	Effect (%) in treatments		
	Soil colour	*Arjun colour*	*Asan colour*
After 3 months of application	100	100	100
After 6 months of application	80	100	90
After 9 months of application	75	90	80
After 12 months of application	60	80	75

Table 4. Time involved in preparation of the three natural colours

Treatment	Time involved in preparation of 100 litres of colour (in hrs)
Soil colour	16
Arjun colour	110
Asan colour	130

Table 5. Labour requirement and unit cost of production of three natural colours

Treatment	Labour requirement in preparation of 100 litres of colour (mandays)	Cost of preparation of 100 litres of colour (Rs)
Soil colour	4	240
Arjun colour	15	1050
Asan colour	18	1200

Table 6. Properties of dyes/colours prepared from *arjun and asan barks*

Property	Colour/dye	
	Arjun	*Asan*
Colour/dye content (%)	88.33	83.08
Solubility in hot spiret (%)	59.00	59.00
Solubility in cold spirit (%)	55.00	37.00
Solubility in hot water (%)	78.00	93.00
Solubility in cold water (%)	73.00	91.00

of time involvement, labour requirement and unit cost of production, soil colour was found to be superior to the arjun and asan colours. Among the two natural dyes, arjun colour was found most cost effective, less labour requiring and time intensive than the asan colour.

Laboratory analysis for estimation of colour/ dye content available in arjun and asan colours, and their solubility in spirit and water was done. Results are presented in Table 6. (Laboratory analysis was done at Indian Lac Research Institute, ICAR, Namkum, Ranchi)

CONCLUSION

Natural colours of arjun and as an are highly effective. However, considering all the parameters, arjun colour is superior to as an colour. ❑

Ethnic Food

Code : **568**

Title of the ITK : **Evaluation of Namkin jya- a traditional tea**

Description of the ITK : Traditional tea Namkeen jya is prepared from the bark of *Taxus baccata with salt, ghee and milk. It is consumed* atleast twice a day by the local people.It is believed that this protects them from common diseases like fever, asthma, cough and cold etc.

Name and address of the discloser: **Ms Meena Devi, Village-Dhapa, P. O. Munsiyari, District** Pithoragarh (Uttaranchal)

Location of use of the ITK : Munsiyari, District Pithoragarh (Uttaranchal)

Geographical indicators



Fig. 1. Branch of Taxus bacccata with fruits



Fig. 2. A Taxus baccata tree

Taxus baccata is an ever green tree usually 6 meter or so in height and 1.5 – 1.8 in girth, found in the temperate Himalyas at altitude between 1,800 to 330 meters. Bark of the tree is reddish brown, thin and scaly, leaves distichous with recurved margins. Flowers are usually dioecious, male strobili stalked. The Taxus tree is commonly found in the Himalayan forests, usually in places under trees. In the western Himalayas it is found in shady association with kharshu oak and silver fir, sometimes, but more rarely with spruce, deodar and moru oak. The tree lives to a great age but the growth is very slow, the annual rings are 12–40 per 2.5 cm radius. The bark is so thin that fire usually proves fatal to the trees (Fig. 1 and 2).

The wood is valued for its great strength, durability and decorative character. A medicinal tincture made from the young shoots is in use for the treatment of headache, giddiness and falling pulse, coldness of the extremities, diarrhoea and several other physiological disorders. The leaves are reported to contain in addition to taxine, hydrocyanic acid (12–13 mg/kg old leaves), formic acid, resins, tannins and so on. The nonpoisonous and fleshy aril is eaten by tribals. It is credited with carminative, expectorant and stomachic properties. Extracts of T. baacata can be added in cosmetics, beauty and creams and dentifrices.

Experimenter : Dr Rajio Singh, Scientist, Defence Agricultural Research Laboratory, Pithoragarh (Uttaranchal)

METHODOLOGY

PRA and field study

Namkeen jya as a drink was evaluated by using PRA and survey technique conducted in three villages, viz. Bunga, Darkot and Sarmoli, from Munsiyari block of Pithoragarh district in Uttaranchal. A total of 130 respondents were interviewed personally. Sensory evaluation was also carried out by selecting 15 judges from Munsiyari and a comparison was made from locally used other drinks like tea and coffee. Observations were taken on the following aspects: (i) Frequency of using namkeen jya; (ii) characteristics of drink as perceived by users; (iii) protection from diseases as perceived by users; and (iv) sensory evaluation for appearance, flavour, consistency and taste.

Namkeen jya is prepared in higher altitude of Himalayan region. The ingredients used in this drink are powder of Taxus baccata bark, milk, ghee and salt. A locally made wooden equipment called dumka is used for the preparation of *namkeen jya.*

Preparation of namkeen jya

Approximately 4 cupsful of water along with 2 teaspoonful bark powder of Taxus baccata tree was boiled and poured into dumka. Then 2 teaspoon ghee, ½ cup milk and salt (according to the taste) were added. The whole material was pounded for about 2 minutes and the drink was ready for sensory evaluation.

Sensory evaluation

The sensory evaluation was carried out in Munsiyari for appearance, flavour and consistency in comparison to commercial tea and coffee. The evaluation exercise was done by using a 1–5–point scale as recommended by Amerine *et al. (1966) and Meilgaard et al. (1991) with the* following descriptors:

Like extremely	5
Like moderately	4
Neither like nor dislike	3
Dislike moderately	2
Dislike extremely	1

For each product, 5 ml of the sample at normal temperature (25°C) was dispensed into coded white sensory plastic cups. The cups were coded using random numbers. Assessors were allowed to rinse their mouth after each evaluation. Average scores were considered as overall opinion of the panelists.

Extent and coverage

Namkeen jya is commonly used by people of high-altitude areas of Uttaranchal hills. The tree, *Taxus baccata, which is used as an ingredient,* grows in high-altitude areas between 1800–2400 above msl and commonly occurs in patches.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 show that about 80% respondents were the user of namkeen jya. A majority of the people (35%) were daily users.

Cold tolerance and taste were the main preferences of the users of namkeen jya (Table2). Regarding protection from diseases, cough and cold, cancer and asthma were given high ranking

Table 1. Frequency of using Namkeen jya by locals

User	Number	Percentage
Daily	46	35
Weekly	35	27
Occasionally	23	18
Non-users	26	20

Table 2. Characteristics of drink as perceived by users

Quality parameter	Total score	Mean score
Taste	128	0.98
Improved digestion	48	0.37
Cold tolerance	186	1.43
Protection from disease	98	0.75
Provide nutrition	75	0.58

Table 3. Protection from diseases as perceived by users

Disease	Total score	Mean score
Fever	90	0.69
Cough and cold198		1.52
Asthma	129	0.99
T.B.	121	0.93
Cancer	145	1.11
Diabetes	72	0.55

(Table 3).

It is evident from the data presented in Table 4 that appearance of the namkeen jya was found to be better than of tea but inferior to that of than coffee. Thus the appearance of namkeen jya is fairly good.

The results of sensory evaluation show that the flavour of namkeen jya is better than of coffee and tea (Table 5) and also that of consistency (Table 6).

Table 4. Sensory evaluation for appearance of each product

Product	Strongly dislike (1)	Moderately dislike (2)	Neither like nor dislike (3)	Moderately like (4)	Strongly like (5)	Score/rank
Namkeen jya	0	3	6	2	4	52 (II)
Tea	0	4	5	4	2	49 (III)
Coffee	0	2	4	6	3	55 (I)

Table 5. Sensory evaluation for flavour of each product

Product	Strongly dislike (1)	Moderately dislike (2)	Neither like nor dislike (3)	Moderately like (4)	Strongly like (5)	Score/rank
Namkeen jya	0	1	0	6	8	66 (I)
Tea	1	4	5	3	2	46 (III)
Coffee	0	2	4	4	5	57 (II)

Table 6. Sensory evaluation for consistency of each product

Product	Strongly dislike (1)	Moderately dislike (2)	Neither like nor dislike (3)	Moderately like (4)	Strongly like (5)	Score/rank
Namkeen jya	0	3	3	4	5	56 (I)
Tea	2	5	4	2	2	42 (III)
Coffee	1	4	3	4	3	49 (II)

Table 7. Sensory evaluation for taste of each product

Product	Strongly dislike (1)	Moderately dislike (2)	Neither like nor dislike (3)	Moderately like (4)	Strongly like (5)	Score/rank
Namkeen jya	1	2	3	5	4	54 (I)
Tea	0	3	4	4	4	54 (I)
Coffee	1	3	6	2	3	49 (II)

The results of sensory evaluation made for taste suggest that namkeen jya is as good as tea (Table7).

CONCLUSION

The results of validation indicate that namkeen *jya is a superior drink as compared to tea and* coffee. The taste, flavour, consistency and appearance are liked by the local people. Besides being nutritional and tasty, it also gives protection against the common diseases like fever, cough, cold, and asthma.

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Code : **952**

Title of the ITK : **Liquor manufacture in Kinnaur district of Himachal Pradesh**

Description of the ITK : Wine is prepared traditionally by the local people in some districts of Himachal Pradesh. The main raw material is fruits such as grapes (Vitis vinifera), wild apricot chulli (Prunus armeniaca), pears (Pyrus communis), apple (Pynus malus), wild almond behmi (Prunus delicis) etc. The fermented product of these fruits is distilled and then conserved by the people. Fruits like apple or pears are cut into pieces before putting for fermentation. Chulli fruits are dried on the roof after taking out the seeds. The fruits are then put in the drums. Generally the wooden drums are preferred for fermentation, as they keep the materials warm. Molasses are also used with the fruits. The drums are then tightly covered with wooden or stone lid. Opening the lid makes the judgement of fermentation. When the larva in the pulp dies, it means the fermentation is over. Drop of water inside the lid is other indication. Another way of judgement is that if a burning stick is taken on the pulp and if it extinguishes, the material is ready. The pulp is put in a metallic pitcher, which is covered with a slate of stone with a hole in the centre. This slate is used to avoid overflow of material during boiling. A metallic pan is kept on this slate, which also has a hole of the same size of that of slate. It has also a side pipe through which the condensed alcohol comes out. This utensil is covered with a bigger size metallic pan, which is cooled during the extraction. Two pipes, one inlet and other outlet open in this pan through which cold water falls on the pan and warm water goes out. The topmost pan is kept a bit slanting. The inlet of water is on upper side and outlet is at lower side. This cools the bottom of utensil and condenses the alcohol vapours touching its lower surface. The condensed material runs out through the side pipe of the lower utensil from where it is collected in small pot. A rubber pipe is also attached to metallic side pipe to keep some distance between the collection pot and the distillation plant. Approximately 12-13 bottles of alcohol are collected from 40 kg of fruit material. However, when it is mixed with 5-6 kg molasses the yield is 18-19 bottles. This is mainly used in Kinnaur district since time immemorial.

Name and address of the discloser : Prof. L.R. Verma, Department of Bio-Sciences, Himachal Pradesh University, Shimla (Himachal Pradesh) 171 005.

Location of use of the ITK : This ITK is prevalent in different areas of Kinnaur district in Himachal Pradesh. Kinnaur district is situated 77° 45' and 79° 00' 35" East longitude and between 31° 55' 50" and 32° 05' 15" North latitude. Basically, the people have agriculture/horticulture and animal husbandry as their main occupation. The climate of the district is most suited for production of temperate fruits and vegetables of very high quality. Majority of the area is under cold desert accounting for a population density of only 12 persons per square kilometer (2001 census). It is isolated, fragile, marginal and inaccessible. The area is known for traditional ethos and wisdom for natural resource management.


Bemi


Grape


Pear

Type of fruits used for alcohol






Distillation unit and its process



Sun-dried fruits

METHODOLOGY

PRA and field study

The PRA tools were use to collect information on the method of extraction, fruits used, purposes of extraction and gender-wise consumption.

Sample

In total 13 Villages/120 households were covered at: Leo, Pooh, Kanam, Asrang, Jangi and Moorang; 60 households (Pooh Community Development Block); Ribba, Pangi, Barang, Sangla and Kamroo 40 households (Kalpa Community Dev. Block) Chota Khamba, Bara Kamba and Thach 20 households (Nichar Community Dev. Block)

The socio-economic characteristics of sample households were:

Female-headed households 20 (17%); having Buddists in Pooh Block and Hindus in Kalpa and Nichar.These were of Rajput cast; with primary occupation agriculture or horticulture, having gross annual income Rs 15,000-45,000. They had mostly nuclear (112) families, as also joint (8) families. The household heads were illiterate. All (men and women) were Panchayat members, all women being members of Mahila Mandals and only boys of Yuvak Mandals.

Liquor management

Liquor was extracted by license holder and his wife or older female members of the household. The apparatus used was locally obtained stone slab, self-fabricated wooden thoog (pipe through which the distilled liquid flows in a container), or *parat*, *lamthu* and *thoog*, all made of brass and purchased from the market.

The Raw materials used were the following: (i) The main raw material is fruits such as grapes (*Vitis vinifera*), wild apricot (*Prunus armeniaca*), pear (*Prunus communis*), apple (*Prunus malus*), wild almond (*Prunus delicis*) etc. (ii) Fresh as well as sun-dried fruits are used. Fruits like apple or pears are cut into pieces in preparation for fermentation. *Chulli* is sun-dried on the roof after de-seeding. (iii) Fruits are used individually or in combination with one another. Molasses is not used.

Fruit is not added by weight but in proportionate ratios and is commonly referred to as *chharava*. Individual variations do not permit approximation of a *charava* in kilogram etc.

Examples of average amounts distilled per *chharava* of fruit alone are: (i) only *bemi* 7 bottles, i.e. 14 ser; (ii) only *chulli* 10 bottles, i.e. 20 ser; and (iii) *bemi* + *chulli* 15 bottles, i.e. 30 ser. About 12_13 bottles of alcohol are collected from approximately 40 kg mixed fruit material.

Process

1. The fermented fruit is distilled and the distillate is stored for use.
2. Fermentation takes longer time in winter due to cold climatic conditions. Hot weather aids fermentation.
3. Generally the wooden drums are preferred for fermentation, as they keep the materials warm. However, the more durable plastic drums are used now. The drums are then tightly covered with a wooden or stone lid. Fermentation is considered to be complete when the larva in the pulp dies. Drops of water inside the lid is another indication. Yet again, if a

burning stick is taken to the pulp and the flame extinguishes, this too indicates that the material is ready. But most commonly it was reported that the experienced nose is the best judge of the odour, which is emitted and perfection is attained only through practice.

4. The pulp is put into a brass pitcher, called *lamthu* or *lambu*, which is covered with a slate of stone having a hole in the centre. The slate is used to avoid overflow of material during boiling.
5. A brass pan, called *thoog*, is placed on the slate, which also has a hole of the same size as that of slate. It also has a side pipe, through which the distillate comes out.
6. The utensil is covered with a bigger size brass pan, called *parat*, which is used to cool the vapours in the thoog below, during distillation. Two pipes, one inlet and the other outlet, ensure the circulation of cold water during distillation. The topmost *parat* is kept at a slight slant. The inlet of water is on upper side and outlet is at lower side. This cools the bottom of utensil and condenses the alcohol vapours touching its lower surface. During winter, snow is used instead of water for cooling. It is effective, as it takes long time to melt.
7. The condensed material runs out through the side pipe of the lower utensil, from where it is collected. A rubber pipe may be attached to metallic side pipe to keep some distance between the collection pot, called *lothang*, and the distillation plant.
8. The individual pans and the stone slate are held in place by dough made of buckwheat flour. This dough not only holds the distillation unit in place but also prevents any vapours from escaping. The lamthu and the stone slab may also be sealed together using a mixture of mud and cowdung.

The product is liquor since the process used is distillation. According to the respondent men, the liquor so distilled, yields the best liquor first and with each successive bottle the quality of liquor declines.

Through practice, some improvements have been made:

i. Rubber pipes are used to circulate water for cooling the vapours, as the water in the *parat* (shallow container) had to be changed very often.
ii. A rubber pipe may be attached to metallic side pipe of the *thoog* to keep some distance between the collection pot and the distillation unit.
iii. *Hopps* are sometimes added to accelerate fermentation.
iv. Collection of distillate is now done in plastic cans or glass bottles and the traditional *lothang* is no longer in use.
v. Storage is done in readily available plastic or glass bottles or cans. Wooden kegs are no longer used.

Liquor distillation

i. Rural communities with agri/horti-silvi-pastoral base are involved in this ITK.
ii. Liquor manufacture in the study area is reportedly a very old practice.
iii. Transmission of traditional knowledge over successive generations is done through verbal tradition and observation.
iv. Only edible native variety of fruit such as apple, pear, *chulli*, *bemi* (local varieties of apricot) and grape are used.
v. Grains such as barley, wheat and *phaphara* (buckwheat) are used.
vi. Per household annual extraction is need based.
vii. License holders distills liquor. The Collector/Designated Authority issues licenses. Each household can stock up to 25 bottles at a time.
viii. Consumption of liquor occurs frequently during festivals, social occasions, e.g.

weddings and arrival of guests, and is a dietary supplement due to harsh environmental conditions.

IX. Consumption is primarily the preserve of male members. Some women consume *chhang*, which is extracted from barley. It is mild and is like a beer, i.e. non-intoxicating.
10. For use in special prayer services, earlier generations used the first distillate only. Presently the first bottle from a stored batch is also used. However, in the event of ordinary prayer services, no such conditions apply.
11. Liquor in not sold, i.e. liquor is for own use.
12. The first distillate called *moori*, is considered unfit for human consumption by older generations, who recommend that it may never be consumed and, if one had to consume, it must be diluted with water and the drinker must eat something along with it.
13. When extraction is complete and the entire extract was stored as a batch in cans or kegs, i.e. when there is no distinction between the first, the middle and the last bottles, the distillate is called *raashi*. This is recommended best for consumption.
14. Though the occasional use of molasses was reported, it was mentioned that its use for distillation was highly avoidable.
15. For cost of liquor extraction (per unit) as the raw material is home produced, there is no cost of production except on equipment which is a one-time investment and may require occasional repair.
16. The reasons, gender wise, for extraction of liquor are: (a) It prevents wastage of fruit etc = 40% M 89%W

b. Dietary requirement = 100% M 100% W
c. Medicinal purpose = 100% M 100% W
d. To serve to guests = 100% M 100% W
e. For prayer service = 100% M 100% W
f. Weddings/ceremonies = 100% M 100% W
g. Sale = 0% M 0% W

Predominant raw materials used as per location are given in Table 1.
Best extract was obtained from

i. Grape distillate is called *angoori* and is considered the best. It is used even for medicinal purposes.
ii. Apple is by far the most used fruit, since B-grade apple is available in plenty and it is the principal cash crop.
iii. *Bemi* has more sugar as compared to *chulli*, which is relatively more sour.
iv. Mixed fruit yields more distillate, as the sweet and sour fruits stimulate one another during fermentation. (Table 2)

Table 1. Raw material used at different location for liquor manufacture

Location	Fruit (%)	Grain (%)
Pooh CD block	85	10-15
Kalpa CD block	85	10-15
Nichar CD block	25	75

Experiment

To validate the discloser's claim, experiments were conducted using only fruit and fruit + molasses as the raw materials in the experiments.

For chemical analysis of distilled liquor, 7 samples were extracted. Out of these, 3 samples (sample nos 5, 6 and 7) were from pure fruit, i.e. apple + *chulli* + *bemi*, and the remaining 4 were fruit + molasses (*gur*). Sample 4 was extracted from grapes + molasses. Samples 1, 2 and 3 were extracted from apple + pear + *bemi* + molasses. The following chemical tests were carried out.

i. Alcohol strength: to reveal the percentage of alcohol in the sample.
ii. Methyl alcohol: to reveal the presence or absence of poison in the sample.
iii. Total acidity: to reveal acidic content.

Table 2. Score for different fruit extract

Category	Type							
	Grape	Apple	*Bemi*	*Chulli*	Mixed Fruit *Moori*	First Bottle *Raashi*	Combined Extraction	Last Bottle
Excellent	▪▪					▪▪		
Very Good	▪▪	▪▪	▪▪		▪▪	▪▪		
Good	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	
Satisfactory	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	
Poor	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪
Mean Score (%)	100	80	80	70	80	100	70	<10

iv. Volatile acidity: to reveal acidity.
v. Esters: to reveal number of quantity of flavours (aromas).
vi. Colouring matter: to reveal the presence or absence of added materials.

These samples were tested out in Government Food Testing Laboratory located at Kandaghat in Solan district of Himachal Pradesh.

RESULTS AND DISCUSSION

The results on the various physico-chemical characteristics of the distilled alcoholic beverages are presented in Table 3.

The salient observations are the following:

1. Wide fluctuation is observed in the alcohol content amongst the various distillates. The first bottle had higher alcohol concentration than the middle or the last bottle. The latter had consistently lower alcohol levels than the first bottle. The trend can be clearly related with method of distillation normally employed in production of such beverages. Last bottle, or what is called tail, is considerably lower in alcohol content.
2. A comparison of alcohol content in these beverages would suggest that the first three samples had more than twice the normal alcohol, whereas fourth and fifth are acceptable, and that of the last bottle was considerably lower than required. The alcohol levels in various beverages varied from beverage to beverage. Cider has 4_9%, table wine 11%, fortified wine 20%, whisky 42% and brandy 42_50%, depending upon the brand.
3. From safety point of view, all the beverages were negative for methyl alcohol content. It is desirable, since methyl alcohol contents in the alcoholic beverages should be as low as possible. Small amount of methanol can be present in the brandy due to its similar properties as that of ethyl alcohol. Its amount in the California brandies has been found to be in the range of traces to 0.1888%, but fruit brandies in general have higher methyl alcohol levels than grape brandies. The methyl alcohol content is dependent upon many factors like the microorganisms employed during fermentation, the pectin content and the method of distillation.

Table 3. Physico-chemical characteristics of distilled beverage

Sample	Alcohol content (%)	Methyl alcohol	Ester (mg/100 ml of absolute alcohol)	Total acidity absolute (mg/100 ml of alcohol)	Volatile acidity (mg/100 ml of absolute alcohol)	Added colouring matter
First bottle (fruit + molasses)	107.76	-	380.00	124.80	39.00	Absent
Middle bottle (fruit + molasses)	88.46	-	137.80	191.00	61.00	Absent
Last Bottle (fruit + molasses)	72.70	-	163.10	271.20	79.89	Absent
Combined Extraction	33.98	-	368.91	1,851.47	677.88	Absent
First Bottle (Only Fruit)	33.08	-	1,024.18	3,188.66	1,050.45	Absent
Middle Bottle (Only Frui)	22.33	-	622.06	4,737.75	1,874.72	Absent
Last Bottle (Only Fruit)	17.03	-	517.25	6,451.14	2,481.69	Absent

4. Ester content in all the distillates was quite high, as is in the case of total and volatile acidity, especially the values of fifth, sixth and seventh samples. The optimum levels of total ester content are considered desirable, as it would impart fruity flavour to the beverages. Its formation is also associated with maturation of beverages. But considerably higher quantities of these in this study make the beverages unpalatable.
5. Higher volatile acidity of product fourth, to seventh samples can be correlated with such higher values in the liquor that can be considered spoiled or nearly spoiled.
6. Absence of any extraneous matter in all the samples indicates the satisfactory hygienic conditions present in their production area.
7. Considering the overall results, some improvement in the quality is needed. To improve the quality characteristics of such beverages, fermentation should be conducted with pure yeast. After fermentation, the product should be stored properly and distilled scientifically cutting the head and tail, which contain the harmful compounds.

RESULTS AND DISCUSSION

The PRA study and experimental results suggest that preparation of distilled liquor from different types of fruits is a common practice in the entire tribal district of Kinnaur in Himachal Pradesh. It is a common family drink which people use during festivals or ceremonies, also for medicinal purpose, prayer services etc. Different samples tested during the present investigation reveal that only edible fruits are used, wide fluctuations in alcohol content (17.03% 107.76%) is manifested, which can be examined at two levels, viz.

i. Samples extracted using molasses have higher alcohol content than samples extracted without molasses. This is became sugar in molasses gets converted to alcohol, adding to the overall alcohol content.
ii. Samples of the first bottle have higher alcohol content than the of the last bottles, indicating that the head is the strongest and the tail is the weakest in alcohol content.

iii. The combined extraction has the most acceptable level of alcohol.

Extraction from the batch containing pure fruit was 11 bottles and that from the batch containing fruit and molasses was 17 bottles. This confirmed that adding molasses also increases the quantity of distillate. All beverages were negative for methyl alcohol content and were safe to drink. Both ester content and volatile acidity are quite high from palatability and maturation points of view. Extraneous matter was found absent, indicating standard hygienic conditions. These results confirm traditional knowledge in that addition of molasses is avoidable as sugar turns into alcohol, thereby increasing the potency of the distillate; *raashi*, i.e. combined extraction, (sample 4), is most acceptable; *moori*, i.e. first bottle, is not good for human consumption, especially when molasses has been used, as it will cause intense heart-burn.

The results obtained from the study bring into sharp focus the need of standardization of the value addition to create a food product, liquor, using traditional methods. ❑

Code : **1047**

Title of the ITK : **Preparation of bhaley**

Description of the ITK : Bhaley is prepared on special occasions like Diwali and birthday. Bhaley contains certain nutrients like carbohydrates, protein, lipids, minerals and vitamins that provide energy. It is considered as good appetizer and overcome gastric ailments to improve the health, as it is quite hygienic food. Bhaley is prepared from mah (Phaselus mungo). About ½ kg mah is soaked in water overnight. It is ground properly in grinding stones and spices (bhabri, *jhau leaves, salt, chilli) are added accordingly, and then* mixed properly. Now chapatis or rotis are prepared from it with 1–2" diameter and fried in refined oil/mustard oil or *ghee until it turns brownish. After properly frying, it is ready* for eating. This is practiced in most of the villages in district Mandi of Himachal Pradesh. Bhabri are good appetizer and *jhau leaves overcomes gastric ailments in human beings.*

Name and address of the discloser : **Shri Amar Nath, Mera–Kushri, Nabahi, Tehsil–Sarkaghat,** Mandi (Himachal Pradesh) 175 024

Location of use of the ITK : Karsog area in altitudinal range from 651–1,800 meters above sea level. The soil types are loam to clay-loam with erratic distribution of rainfall. Traditionally, mixed farming is Mandi District of Himachal Pradesh lies in mid-hills sub-humid zone with an practiced in this zone. Cropping pattern is dominated by maize, wheat, paddy and millets. In some parts, fruits and vegetables are substituting cereal crops.

Experimenters : Dr Arvind Kumar Bhatt, Assistant Professor, Department of Biotechnology and Shri Chaman Rao, Scientific Assistant, C/o Department of Biosciences, Himachal Pradesh University, Shimla 171 005 (Himachal Pradesh)

METHODOLOGY

Location

The study was carried out in Gopalpur and Karsog area of Mandi district in Himachal Pradesh.

PRA and field study

The PRA and field study were conducted in Karsog and Gopalpur areas of Mandi district in Himachal Pradesh.

Experiment

The experiments for determining quality of *bhaley were conducted at Department of* Biotechnology, Himachal Pradesh University, Shimla and at Central Food and Technological Research Institute, Mysore as per the details given

in AOAC: Official Methods of Analysis of the *Association of Official Analytical Chemists, USA,* and the APHA Official Method of Analysis of The *American Public Health Association, USA.*

The following parameters were analysed: proximate nutritive analysis, fatty acid profile and microbiological evaluation.

RESULTS AND DISCUSSION

PRA and field survey

1. Quick or rapid survey of the whole district was done for collecting information about the ethnic food used by local people as a mark of identity of local culture.
2. Few key areas were identified in the survey for further study.
3. Small group meetings were conducted by the Investigating group members in order to make the people understand the basic aims of the study.
4. At third stage, meetings were conducted in different selected villages in Nabahi, Behna, Fatehpur, Paunta, Gopalpur, Bhambla, Bahi, Chandesh and Churag, in Gopalpur block and Sanarli, Banera, Naur, Kaa etc in Karsog block.
5. The disclosures explained their own experiences about this ethnic food and additional information was recorded by the investigating group members in the questionnaires.
6. Different methods of preparing the ethnic food were explained by d ifferent groups in these blocks and the information was entered in the questionnaires.

Bhaley, the very common traditional food item, is prepared from stone ground local pulse mah (Phaseolus munga) with addition of traditionally used spices (bhabri and jhau), salt and chillies, and fried in vegetable oil. Mah and chana are soaked overnight in water and a thick paste is made by grinding it using the stone grinder (sil-*batta). Local herbal spices like bhabri and jhau* are added to it, besides salt and chillies to taste and the mixture is kneaded properly to mix all ingredients thoroughly, fried in mustard oil or ghee, served fresh as well as kept for longer use, as it is safe for many days.

Raw material used in bhaley preparation

Bhaley in general is prepared from mah ki dal (Phaseolus mungo), chane ki dal (Phaseolus *aureus), cooking oil (refined or mustard), spices,* asafoetida, pepper, kachnar and salt etc. In addition, jhau (Tamarix spp.) and bhabri (Ocimum basilicum) are also added as a speciality item by the local people for taste or flavour and also as appetiser. The herbs make difference to the food item and people like it very much, because it also helps in curing several ailments. Analyses of samples (raw material as well as the finished products) reveal that both herbs bhabri and jhau greatly affect the nutritive status of *bhaley.*

While comparing bhaley with that produced without and with addition of bhabri and jhau, these herbs add to the nutritive status of the food item, which might improve its pharmacological properties.

A critical analysis of the results obtained and the data gathered from the localities it is evident that the speciality of the traditional food item lies in value addition through inclusions of medicinal herbs, being used by the local people. Comparison of the analytical data shows that the nutritive value of the food product is greatly influenced by the herbs, and the processing does not influence the nutritive status when compared with the reports of the herb analysis obtained from CFTRI labortorus. This is also evident from the analysis data of the food item prepared with and without these herbs.

Widely practised methods of bhaley preparation

1. Bhaleys are generally prepared form *Phaseolus mungo (mah). About ½ kg Phaseolus mungo is soaked overnight in* water and ground with the help of traditional sil-batta (manual grinder made

of stone). Then spices like bhabri, jhau (local herbs), asafoetida, chilli, salt etc. are added according to the taste. These ingredients are mashed thoroughly while adding some water to make it into a paste like form. After this, the paste is kept for some time and small-sized roties areprepared, which are then fried in vegetable oil. This dish is served with curd.

2. Danhi - pakode (bhaley). These are prepared from Phaseolus mungo (mah). *Phaseolus mungo is firstly soaked in water* overnight. It is ground with sil-butta. Spices, chilli and salt are added according to taste. Small circular roties (pakode) are prepared and fried in vegetable oil. This dish is served with curd. The only difference between these two dishes is time of mashing and size of the dish. Some people do not fry the roties in oil, but cook in steam without oil.
3. Bhaley is prepared also from a mixture of *Phaseolus mungo (mah) and Phaseolus aureus (moong). Mah and moong are* soaked overnight in water in equal proportions and ground with sil-butta. Spices, bhabri, jhau, asafoetida, chilli, and salt are added according to taste. This paste is finally prepared as circular roties, which are fried in mustard or vegetable oil.
4. Bhaley is prepared also from the mixture of kachnaar (Bavhinia variegata) fruits and Phaseolus mungo (mah). First mah is soaked overnight in water and ground with *sil – butta, mixed thoroughly , and then* finely-ground fruits of Bavhinia variegata are spread over it as small pieces or powder. Spices, chilli, salt and asafoetida are added according to taste. These ingredients are thoroughly kneaded, and circular roties are prepared, which are ultimately fried in vegetable oil. This dish is served with curd.
5. Specific methods are also being employed by the local people for preparing food items in absence of bhabri and jhau.

This ethnic food is prepared almost in every household as a traditional food item since time immemorial. on specific or festive occasions like Diwali, Holi, birthday and during winters. People's perception about bhaley in given below:

(i) cheep and easy to prepare; (ii) the raw materials are available locally; (iii) considered highly nutritive and energetic; (iv) helps in curing gastric problems; (v) highly delicious and hygienic; (vi) children, men, women all enjoy this ethnic food and thereare no discomforts by using *bhaley; (vii) this food item also* symbolizes the culture of the area and preparation method also varies a little with the area; and (viii) though all women relish this food items in some of the areas it was found that pregnant women avoid this due to very heavy calorific value.

Experiment

The following parameters were analysed for *bhaley:*

1. Proximate nutritive analysis: protein, fats, ash, fibre, carbohydrate, calorific value, vitamin C, B_1, B_2
2. Fatty acid profile: lauric, myristic, palmitic, stearic acid, oleic, linoleic and linolenic acid
3. Microbiological evaluation (Standard Plate count and Coliform count).

(i) This analysis was done in the Food Safety and Analytical Quality Control Laboratory; Central Food Technological Research Institute, Mysore, and Department of Biotechnology, H.P. University.

(ii) AOAC: Official Methods of Analysis of *the Association of Official Analytical Chemists, edn. 17. 2000. Association of*

Official Analytical Chemists, Inc. Suit-400, 2200 Willlson Boulevard, Arlington, Virgenia 22201, USA

(iii) APHA: Official Method of Analysis of the *American Public Health Association,* USA

The details regarding samples, specific analytical methods followed along with the results are given in the Tables 1 to 6.

The analytical values reported in Tables 1 and 2 indicate that both the herbs contains higher levels of protein, fats, carbohydrates and vitamins. The herb jhau contains 14.6% protein, 7.1% ash, 23.8% crude fibre and 42% carbohydrates besides 17% vitamin C.

Similarly, another herb bhabri also contains higher levels of protein (15.4%), ash (14%), crude fibre (10.6%), carbohydrates (43.9%) a nd vitamin

Table 1. Analysis of raw jhau (Tamarix sp.)

Parameter	Results	Test method
Moisture (% by wt)	9.8	AOAC, edn. 17, 2000, 953.07
Ash (% by wt)	7.1	920.93
Protein (% by wt)	14.6	984.13
Fat (% by wt)	2.8	991.36
Crude fibre (% by wt)	23.8	962.09
Carbohydrates by difference (% by wt)	41.9	*Nutritive Value of Indian Foods, Gopalan C. et al.;* NIN, ICMR, 1996
Calorific value (K.cal/100 g)	251	*Nutritive Value of Indian Foods, Gopalan C. et al.;* NIN, ICMR, 1996
Vitamin C (mg/100 g)	17.0	AOAC, edn. 17, 2000, 985.33
Vitamin B_1 (mg/100 g)	0.48	AOAC, 1995, 942.23
Vitamin B_2 (mg/100 g)	0.32	AOAC, 1995, 970.65

Table 2. Analysis of raw food samples bhabri (Ocimum basilicum)

Parameter	Results	Test method
Moisture (% by wt)	12.7	AOAC, edn. 17, 2000, 953.07
Ash (% by wt)	14.0	920.93
Protein (% by wt)	15.4	984.13
Fat (% by wt)	3.4	991.36
Crude fibre (% by wt)	10.6	962.09
Carbohydrates by difference (% by wt)	43.9	*Nutritive Value of Indian Foods, Gopalan C. et al.;* NIN, ICMR, 1996
Calorific value (K.cal/100 g)	268	*Nutritive Value of Indian Foods, Gopalan C. et al.;* NIN, ICMR, 1996
Vitamin C (mg/100 g)	10.0	AOAC, edn. 17, 2000, 985.33
Vitamin B_1 (mg/100 g)	0.26	AOAC, 1995, 942.23
Vitamin B_2 (mg/100 g)	0.43	AOAC, 1995, 970.65

Table 3. Analysis of mixed food samples bhaley before cooking

Parameters	Results	Test method
Moisture (% by wt)	18.6	AOAC, edn . 17, 2000, 953.07
Ash (% by wt)	2.25	920.93
Protein (% by wt)	14.2	984.13
Fat (% by wt)	42.9	991.36
Crude fibre (% by wt)	1.43	962.09
Carbohydrates by difference (% by wt)	20.64	*Nutritive Value of Indian Foods, Gopalan C. et al.; NIN, ICMR, 1996*
Calorific value (K.cal/100 g)	526	*Nutritive Value of Indian Foods, Gopalan C. et al.; NIN, ICMR, 1996*
Vitamin C (mg/100 g)	2.0	AOAC, edn. 17, 2000, 985.33
Vitamin B_1 (mg/100 g)	0.21	AOAC, 1995, 942.23
Vitamin B_2 (mg/100 g)	0.17	AOAC, 1995, 970.65
Fatty acid profile (% by wt of fat)		
Lauric acid = (C_{12}:0)	0.2	
Myristic = (C_{14}:0)	0.08	1. IUPAC, edn. 7, 1987
Palmitic = (C_{16}:0)	10.0	2. Lipid Analysis, W. Christie William
Stearic = (C_{18}:0)	3.2	
Oleic = (C_{18}:1)	25.0	
Linoleic = (C_{18}:2)	54.2	
Linolenic acid = (C_{18}:3)	7.4	

Composition of mixed sample (uncooked): Mixture of mah + chana in equal proportion, Bhabri and jhau ~ 5% volume of raw materials and spices and salt.

C (10%), as revealed in the analytical results obtained from CFTRI (Table 2). This might be responsible for the selective preference of the food item by the people and added properties related to medicinal values of food item containing these herbs.

Analysis of the mixed bhaley sample just before cooking was done to determine the effect of cooking on the nutritive status of the final food item, and the values are reported in Table 3. The interpretation of the values after comparing these with analytical results of the final food item after cooking showed little effect on the levels of different constituents of the food item (Table 4).

It is evident that the nutritive status of the traditional food item bhaley, which included besides others, the local herbs, added value to the nutrients as compared to the values when herbs were not mixed with bhaley (Table 5.)

A comparison of the analytical results obtained revealed that the local herbs affected the nutritive status of the food item in the following manner.

1. The protein content of bhaley was 13.8% without addition of herbs, whereas it increased to 27.8% by addition of bhabri and jhau.
2. Crude fibre level in the finished product was also greatly influenced by these local herbs (3.2% from 0.8%).
3. Marked improvement in the vitamin content was also obtained by a ddition of these herbs, i.e. vitamin C from 2.00% to 6.00%, vitamin B_1 from 0.21 to 0.36%, and vitamin B_2 from 0.10% to 0.28%.

Table 4. Analysis of the finished product bhaley addition of herbs (cooked)

Parameter	Result	Test method
Moisture (% by wt)	2.8	AOAC, edn. 17, 2000, 953.07
Ash (% by wt)	3.9	920.93
Protein (% by wt)	27.8	984.13
Fat (% by wt)	2.1	991.36
Crude fibre (% by wt)	3.2	962.09
Carbohydrates by difference (% by wt)	60.27	*Nutritive Value of Indian Foods,* Gopalan C. et al.; NIN, ICMR, 1996
Calorific value (K.cal/100 g)	371	*Nutritive Value of Indian Foods,* Gopalan C. et al.; NIN, ICMR, 1996
Vitamin C (mg/100 g)	6.0	AOAC, edn. 17, 2000, 985.33
Vitamin B_1 (mg/100 g)	0.36	AOAC, 1995, 942.23
Vitamin B_2 (mg/100 g)	0.28	AOAC, 1995, 970.65
Fatty acid profile (% by wt. of fat)		
Lauric acid = (C_{12}:0)	0.5	
Myristic = (C_{14}:0)	0.5	1.IUPAC, edn. 7, 1987 publication
Palmitic = (C_{16}:0)	11.5	2. Lipid Analysis, W. Christie William
Stearic = (C_{18}:0)	4.1	
Oleic = (C_{18}:1)	22.6	
Linoleic = (C_{18}:2)	54.1	
Linolenic acid = (C_{18}:3)	6.8	
Standard plate count/g	19×10^6	AOAC, edn. 17, 2000, 7.61 to 7.62
Coliform count (MPN/g)	240 (95%confidence limit is 90 to 1400)	APHA, edn. 4, 2001, 8.71 to 8.72
E. coli (MPN/g)	9 (95% confidence limit is 20 to 38)	APHA, edn, 4, 2001, 8.71 to 8.72

Composition of finished food product: Mixture of mah + chana in equal proportion (cooked) Bhabri and jhau ˜ 5% volume of raw materials and spices and salt, cooked in oil

4. An analysis of the fatty acid profile of the final product (Table 6) shows that linoleic acid (54.1%), oleic acid (22.6%), palmitic acid (11.5%), linolenic acid (6.8%), stearic acid (4.1%) and lauric acid and myristic acid (0.5% each) added to nutritive value of bhaley with addition of herbs.

Thus the values related to protein, ash, fibre content and all vitamins also were greatly influenced by the addition of these plant materials even in very low concentrations. Crude fibre level was affected the most, showing an increase of 3.2% from 0.80%. Similarly, there was 100% increase in protein and vitamin B_2 contents.

The information gathered on jhau and bhabri is as follows:

Jhau

1. Used as additional spice in many food items for taste, flavour and as medicine as well.

Table 5. Analysis of bhaley without herbs

Parameter	Result	Test method
Moisture (% by wt)	2.01	AOAC, edn. 17, 2000, 953.07
Ash (% by wt)	3.1	920.93
Protein (% by wt)	13.8	984.13
Fat (% by wt)	2.89	991.36
Crude fibre (% by wt)	0.8	962.09
Carbohydrates by difference (% by wt)	66.66	*Nutritive Value of Indian Foods, Gopalan C. et al.;* NIN, ICMR, 1996
Calorific value (K.cal/100 g)	582	*Nutritive Value of Indian Foods, Gopalan C. et al.;* NIN, ICMR, 1996
Vitamin C (mg/100 g)	2.0	AOAC, edn. 17, 2000, 985.33
Vitamin B_1 (mg/100 g)	0.21	AOAC, 1995, 942.23
Vitamin B_2 (mg/100 g)	0.10	AOAC, 1995, 970.65

2. Seeds are very effective for curing rheumatic diseases when mixed with oil.
3. Dry powder of jhau when consumed as such cures digestive ailments and improves appetite.
4. It is generally found in wild and not grown by the people, but collected from wild for its application.
5. Other key actions of the herb include: stimulatis secretions of bile, is anti-inflammatory and eliminates worms; and eases stomach pain and is mild anti-depressant.
6. It is also used as traditional insect repellent and insecticide.
7. Powdered shoot when mixed with glue is helpful in curing joint pain.

Bhabri

1. Grown by the local people in their kitchen gardens and also along the field margins.
2. Leaves are used as major flavouring spice in almost every traditional food item.
3. Seeds are very effective curing renal disorders. Leaves are also used for curing renal blockage besides seeds.
4. The seeds of bhabri are fed to cattle to stop jugali.
5. Seeds when mixed with oil are good for massage of kids and ladies expecting babies.
6. Paste of seeds and also leaves as such are helpful in curing urinary blockage in cattle.
7. When applied externally, the basil leaves act as insect repellent and anti-bacterial agent.

Medicinal value of the herbs (jhau and bhabri) reported in literature as well as information collected field study are as follows

1. Both the herbs are used as medicines. The essential oil has been shown in vitro to have antibacterial activity against *Staphylococcus aureus, Salmonella enteritidis and Escherichia coli; antiseptic* activity against Proteus vulgaris, Bacillus *subtilis, and Salmonella paratyph; and* antifungal activity against Candida *albicans, Penicillium notatum and Microsporeum gyseum.*
2. Oils from some Ocimum spp. have been shown to repel insects and have larvicidal activity against houseflies, bluebottle flies

Table 6. Comparative values showing effect of addition of herbs addition to bhaley

Parameter	Result			
	Bhabri	*Jhau*	*Bhaley* with herbs	*Bhaley without* herbs
Moisture (%)	12.7	9.8	2.8	2.01
Ash (% by wt)	14.1	7.1	3.9	3.1
Protein (%)	15.4	14.6	27.8	13.8
Fat (%)	3.4	2.8	2.1	2.89
Crude fibre (%)	10.6	23.8	3.2	0.80
Carbohydrate (%)	43.9	41.9	60.27	66.66
Cal. Value	268	251	371	582
Vitamin C	10.6	17.0	6.0	2.0
Vitamin B_1	0.26	0.41	0.36	0.21
Vitamin B_2	0.43	0.32	0.28	0.10
Fatty acid profile (% by wt)				
Lauric acid	-	-	0.5	-
Myristic acid	-	-	0.5	-
Palmitic acid	-	-	11.5	-
Stearic acid	-	-	4.1	-
Oleic acid	-	-	22.6	-
Linoleic acid	-	-	54.1	-
Linolenic acid	-	-	6.8	-

and mosquitoes. The effective concentration of the oil to kill 90% of the larva ranged from 113 to 283 ppm.

Camphor, d-limonene, myrcene, and thymol are some of the compounds in the oil that may provide the repellent properties. Eugenol and methylchavicol may be responsible for the larvicidal activity. Some published information can be found about the use of oil from Ocimum and fresh plant materials in the treatment of animals. However, O. basilicum has been used as an expectorant in animals.

3. The herbs are antiseptic, antidepressant, nerve tonic; antispasmodic, antiviral, balancing; clears the brain; diuretic; digestive, expectorant, antidepressant, adrenal stimulant, estrogen-like hormone qualities, stimulant; uplifting; refreshing; energizing.
4. Used to cure digestive problems like colitis, gastric spasms, flatulence, jaundice, stomach cramps, constipation, gastroenteritis, gum infections and mouth ulcers; ulcers, indigestion, sluggish liver and gallbladder.
5. Used for mild nervous disorders and for the alleviation of wandering rheumatic pains. The dried leaves, in the form of snuff, are said to be a cure for nervous headaches. Good for tired, overworked muscles and as a mouth-wash for mouth sores and infected gums. An infusion made with basil is good for chest

infections and digestive problems. Oil of basil is a wonderful treatment for acne. A drop of basil on pillow can help care insomnia and depression. Making a poultice of basil seeds aids in healing wounds because of their antibacterial properties. They are also said to cure warts. An infusion of the green herb in boiling water is good for all obstructions of the internal organs, arrests vomiting and allays nausea.

CONCLUSION

According to the disclosure of this ITK, bhaley is a very common traditional food item prepared from stone-ground local pulse mah (Phaseolus *mungo) with addition of traditionally used spices* (bhabri and jhau), salt, chilies and fried in vegetable oil. It is specifically prepared on festive occasions like Diwali, and birthdays throughout the Gopalpur and Karsog belt and adjoining areas of Mandi District, and is also useful in various ways.

The claim made by the discloser is not only correct but this ITK has revealed many more facts about the medicinal value and nutritive properties of this food item. A review of the reports in the literature regarding medicinal properties of these herbs clearly indicated medicinal applicability, which is being practised by the local people. The reports indicated clear evidence of the utility of these plants as antispasmodic, antidepressant, antiseptic, stimulant, tonic, febrifuge, diaphoretic, nervine, antibacterial, expectorant, appetizer, carminative, galactagogue and stomachic.

❑

Code :1046

Title of the ITK :Ethnic uses of gucchi (Morchella sp.) mushroom in food **and as medicine**

Description of the ITK :Rangmuto (gucchi) is found during March–May in most of the villages in Kinnaur district. It is dried for storage and mostly prepared during winter season. Fresh gucchi is washed in water and cut into small pieces. Then 20 g each of onion and garlic is added after adequately heating ghee or mustard oil. One spoonful of chili, spices and salt according to the taste is added. Then gucchi is added and allowed for cooking for about 15–20 minutes. This dish is purely vegetarian and is eaten with rice or chapati. This dish is highly nutritive, hygienic and a good source of energy. Gucchi is considered to be a good source of protein. This has been practised since time immemorial in most of the villages in Kinnaur district.

Name and address of the discloser **:Shri Dharam Lal Negi, V.P.O. Roghi (Near Kalpa), Tehsil** Kalpa, Kinnaur (Himachal Pradesh)

Location of use of the ITK :This ITK is prevalent in different areas of Kinnaur district in Himachal Pradesh. Kinnaur district is situated 77° 45' and 79° 00' 35" east longitude and between 31° 55' 50" and 32° 05' 15" north latitudes. Basically, the people have agriculture and animal husbandry as the main occupations. The climate of the district is most suited for production of temperate fruits and vegetables of very high quality. A majority of the area is under cold desert and is isolated and is accessible. These areas are known for traditional ethos and wisdom for natural resource management.

Experimenters :Dr T.N. Lakhanpal, Professor and Head, Department of Bio-Sciences; Dr Anand Sagar, Assistant Professor, Department of Bio-Sciences and Ms. Monika Rana, Scientific Assistant, Department of Bio-Sciences, Himachal Pradesh University, Shimla 171 005.

METHODOLOGY

Field survey and collection of the materials were done from different parts of Kinnaur district of Himachal Pradesh. The laboratory investigations were carried out in the Department of Biosciences, Himachal Pradesh, University, Shimla 171 005.

PRA and field study

The PRA exercise and field studies were carried out to generate information on the

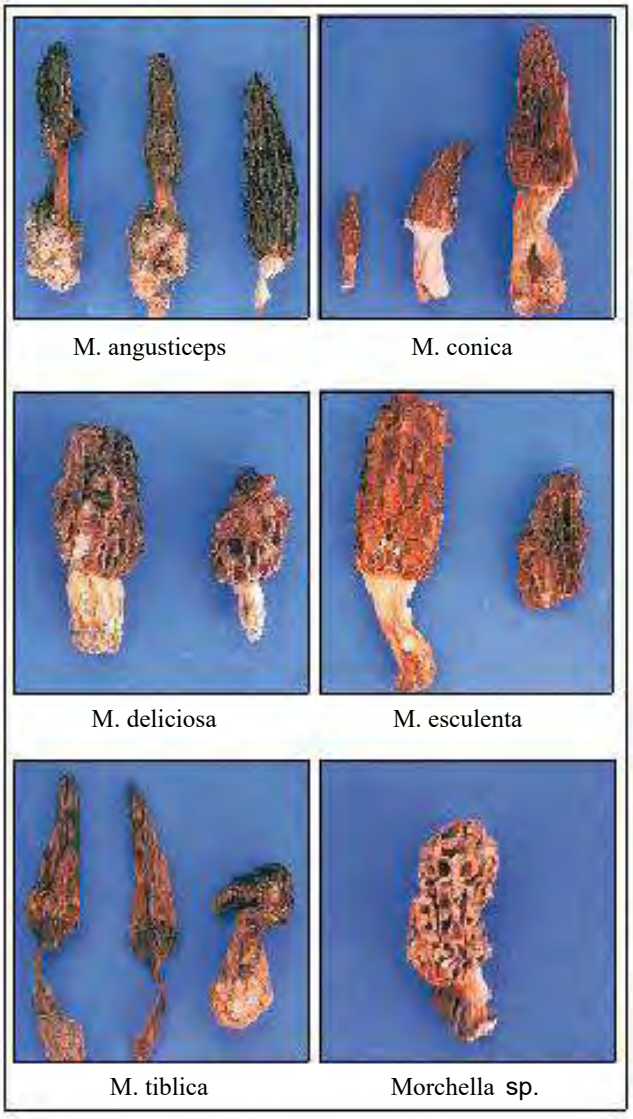


Fig. 1. Different fruiting bodies of Morchella spp

following aspects: (i) associated vegetations in different locations; (ii) general information on *guchhi mushroom (Morchella sp.) in Kinnaur* district of Himachal Pradesh; (iii) guchhi mushroom habitats; (iv) local vernacular names of Morchella spp; (v) ethnic uses of Morchella



Fig. 2. Indigenous method of drying morels by threading them into garlands





as food for traditional recipes and as well as modern recipes. (vi) ethnic use of Morchella in medicine; (vii) marketing of Morchella sp.; and (viii) myths associated with Morchella mushroom occurrence and its collection.

Experiment

Experimental studies were carried on the following aspects:

(i) studies on the characteristics and behaviourof Morchellasp. in culture,and
(ii) analysis of the nutritionally important components in Morchella sp.

Cultural study

The studies on cultural characteristics are important for understanding the nutritional behaviour of the fungus. This aspect is also essential for venturing into cultivation. Hence cultural characteristics of Morchella sp. were studied by isolations and multiplication of the mycelium on different media. The methodology followed for cultural studies is as follows:

The cultures were raised from tissues, that are actively dividing. For this, the tissues utilized were from pileus and stipular region. The tissue was taken from fruiting bodies, which were sun-dried or dried at temperatures ranging from 30° to 40°C so as not to kill the m. The bits of the tissue (2–3 mm) were taken by sterilized forceps and dipped in 0.1% mercuric chloride solution for 5–10 seconds. These bits were then transferred to solid and liquid media, kept in slants or petri-plates as per the requirements, aseptically with the help of sterilized inoculating needles. In the present study 14 solid and four liquid media were evaluated to determine the most suitable media for optimum mycelial growth. These medium were then incubated at 22 ± 1°C for 6–10 days in a BOD incubator. The growth was periodically observed. The best medium was selected on the basis of growth in relation to time period.

Nutritive analysis

The fruiting bodies collected during the fruiting season were chemically analysed for

Table 1. Localities visited and associated vegetation

Locality	Altitude (m)	Vegetation
Rekong Peo	2,290	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Kalpa	2,769	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Roghi	2,900	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Nichar	2,200	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Sangla	2,680	Broad-leaved trees,Taxus spp., Picea smithiana, Cedrus deodara, Pinus *wallichiana*
Rakchham	3,050	Broad-leaved trees,Taxus spp, Picea smithiana, Cedrus deodara, Pinus *wallichiana*
Chitkul	3,450	Broad-leaved trees,Taxus spp, Picea smithiana, Cedrus deodara, Pinus *wallichiana*
Ropa	2,200	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Rally	2,211	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Rushkalang	2,500	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Kamru	2,590	Pinus gerardiana,Quercus dilatata, Picea smithiana, Cedrus deodara
Kothigaon	2,245	Taxus spp, Picea smithiana Cedrus deodara, Quercus dilatata,Pinus *wallichiana*

various nutritional components, as given in Table1.

RESULTS AND DISCUSSION

The results of PRA field survey are presented in Tables 1–10. The experimental results related to cultural studies and nutritive analyses are summarized in Tables 11–13. The photographs of different species of Morchella, their ecological habitats and tribal communities marketing their valuable products are given in Figs 1 to 5.

PRA and field study

Table 1 lists the twelve different localities that were visited during the spring season in Kinnaur district. These localities were situated at different altitudes ranging from 22,00 to 35,00 m above msl. The most predominant vegetation was of mixed conifers e.g. Pinus gerardiana, Quercus *dilatata, Picea smithiana, Cedrus deodara etc.* The morels were collected from all the localities visited and situated in these high-altitude areas.

The nomenclature of different species of *Morchella varies with localities. Hence Morchella* is known by different names in Kinnaur. The name changes with the change in valley. This is perhaps because the means of communication were very poor in this area previously. The colour of fruiting bodies also shows variation at different altitudes. The season of collection varies from spring to monsoon.All the villagers, especially women and shepherds collect them as a source of income. The solitary and gregarious habit also showed variations with the change in colour. Black morels were always seen to occur solitary, whereas light-coloured morels were always seen to occur gregariously (Table 2).

Guchhi occupies different habitats, the predominant ones being burnt woodlands, apple orchards, leaf litter, vicinity to moist places where water is predominant, beneath trees, beneath stones, shrubs, pastures etc. The habitat preference also clearly emerges from the depiction of percentage of occurrence as shown in Table 3.

The local vernacular names of guchhi in the

Table 2. General information on guchhi mushroom (Morchella spp) in Kinnaur district of Himachal Pradesh

	Location		
	Kalpa	Nichar	Sangla
Local name	*Jangmutz, jangmooch, jangmoo, ban jangmoo, rok*	*Jangmoo, rangmoto*	*Rangmooch, rangmutz, rangmoo, rangnu*
Height above mean sea level (m)	2,900	2,530	2,680
Colour	Black, white, light brown and yellow	Black and white	White, black and yellow
Collectors (%)	1. Men= 1–5 2. Women=60–65 3. Boys and girls= 12–15 4. Shepherds=10–20	1–2 50–60 20–30 20–30	1–2 70–75 10–15 20–30
Season of collection	Spring, monsoon and rainy	Spring and monsoon	Spring, monsoon and rainy
Habits	Black=solitary/in a pair White and brown= gregarious Yellow= solitary	Black=solitary White=gregarious	Black=solitary White=gregarious Yellow=solitary

Table 3. Guchhi mushroom (Morchella spp) habitats

Habitat	Per cent occurrence
Brunt woodlands of forests	40–42
Orchards (fruit trees)	5–6
Sutad-leaf litter	5–6
Near water resources	15–20
Beneath tree	5–6
Beneath stones	8–10
Shrubs	8–10
Grass lands	2–3
Pastures	10–12

areas visited in Kinnaur district of Himachal Pradesh are shown in Table 4. Different valleys and even different villages call them by different names. In their local dialects these names figure as: jangmutz, jangmoo, jangmooch, rangmuto, *rangnu etc. This again speaks of the lack of proper* communication means earlier.

The different species of Morchella are associated with different types of vegetation as shown in Table 5. The morels are mainly associated with trees, ferns, grasslands, and are also predominantly with the areas where woodlands have been burnt in the recent past.

Morchella is served as a special delicacy on some festive occasions or to some distinguished guests. The Kinnauries consume morels in many different ways and a variety of recipes are locally available for their preparation. These recipes are named differently in different areas. The recipes and the locally used ingredients with traditional nomenclature are presented in Table 6. List of modern recipes is furnished in Table 7.

High market value has reduced the local consumption of Morchella to a great extent. Now the villagers prefer to sell them because they receive good returns. Most of the collection produce goes to markets in Delhi and Amritsar

Table 4. Local vernacular names of Morchella spp

Area visited	District	Local, vernacular name
Kalpa, Roghi, Chinni, Kashmir	Kinnaur	Jangmutz, jangmoo, jangmooch, ban-jangmoo, *rok*
Nichar, Nigulsari	Kinnaur	Jangmu, rangnu
Sangla, Rakchham, Dangdangshi, Khrogla	Kinnaur	Rangmuto, rangmutz, rangmooch rangnu
Kothigaon	Kinnaur	Jangmutz, jangmoo
Ropa, Rally	Kinnaur	Jangmoo
Rushkalang, Kamru	Kinnaur	Rangmutz, rangmooch, rangnu

Table 5. Mushroom and associated vegetation

Type of mushroom	Tree	Fern	Fruit	Grassland	Burnt woodland
Black *(Concial pileus)*	No	Yes	Strawberry, Berberis, Artimezia	Simple grass	Yes
Black (Globular pileus)	No	Yes	Yes	Yes	Yes
White	Pinus, Cedrus	Yes	No	Yes	Yes
Brown	No	Yes	No	Yes	Yes
Yellow	No	No	No	Yes	No

Table 6. Traditional recipes of guchhi mushroom

Recipe of guchhi mushroom	Material used
Pulao of guchhi with rice (guchhi ka bhat) (rangmutz ka bhat)	Oil, fruiting bodies, spices, water, salt, rice, tomatoes, green vegetables
Soup of guchhi (khaddha of rangmutz)	Oil, fruiting bodies, spices, water, salt, sauce
Pure dry vegetable of guchhi (sukhi *subzi of rangnu)*	Oil, fruiting bodies, spices, water, salt, chillies, tomatoes, green vegetables
Madra of guchhi	Oil, fruiting bodies, spices, water, salt, tomatoes, ginger, garlic, curd
Curry of jangmu	Oil, fruiting bodies, spices, water, salt, curd
Mixed vegetable (missi kissi	Oil, fruiting bodies, spices, water, salt, sliced vegetables
Rangmoo ki bhaji subzi of rangnu)	Oil, fruiting bodies, spices, water, salt, chillies, tomatoes, green vegetables
Jangmo ka khatto	Oil, fruiting bodies, spices, water, salt, curd
Misi bhaji of rangnu	Oil, fruiting bodies, spices, water, salt, sliced vegetables
Rangnu ki poore	Gram flour, red and black pepper, turmeric, all other spices and condiments and paste of ground fruiting bodies
Tise bhaji of rangnu	Fruiting bodies, sliced tomatoes, onion, spices, condiments, salt and desi makhan

Table 7. Some modern recipes of Morchella

Morchella soup	Fruiting bodies, water, sauce, flavour, spices
Morchella pakore with cheese	Fruiting bodies, besan, mustard oil, salt, chilles, spices.
Kofta of guchhi	Besan, tomatoes, onion, oil, spices, ginger, garlic paste, water
Mixed dry vegetable	Sliced green vegetables, full fruiting bodies, tomatoes, onion, garlic, ginger paste, salt
Cheese shahi mushroom	Cheese, fruiting bodies, oil, salt, water, curd, tomatoes, green chillies, garlic, ginger paste.
Morchella fried rice	Cooked rice, sliced fruiting bodies, onion, tomatoes, spices, salt and water
Morchella flavoured dish	Fruiting bodies, onion, salt, oil, spices, required flavour

from where it is exported to different countries, primarily to Europe and the USA.

The medicinal aspects of morels have not been highlighted in any of the earlier works. There is no authentic data on such uses. Most of the uses highlighted were from hearsay. During the field study, systematic survey was undertaken and the data generated from local people from Kinnaur revealed very wide ever-important traditional uses of this mushroom. Villagers preserve dried fruiting bodies for cure of various ailments such as stomach pain, pneumonia, dehydration, respiratory troubles, simple fever, cough and cold, healing of wounds and for pregnant and lactating mothers by providing nutrition and energy (Table8).

Table 8. Ethnic use of Morchella in medicine

Ailment	Use
Stomach pain	Boiled water of the fruiting bodies is given to the patient
Pneumonia	The decoction is prepared, which is called as gram kadda, and is given to the patient
Dehydration	Boiled water of fruiting bodies
Respiratory problems	The decoction is prepared and given to the patients
Simple fever, cough, cold	Boiled hot soup is given to the patients
Healing of wounds	Paste is prepared by mixing boiled fruiting bodies with deshi makhan and then applied on the wound
Pregnant women	Soup, subzi of guchhi, and decoction is given to the ladies, as it provides warmness to the body as well as energy
Lactating mothers	The decoction, soup and subzi of guchhi, is given to the patient, as it is a highly nutritive food and provides energy to the body

Morchella therefore is put to a variety of uses. It is sold in the market, used as medicine and is collected for personal consumption as food (Table9).

Table 9. Use of guchhi mushroom for different purpose

Use	Percentage
As food	0
As medicine	5–6
For sale	90–94

Thus the maximum percentage of the mushroom is now marketed rather than consumed as food, because it gives good monetary returns. Sale of Morchella is one of the highlights along with other articles of commerce, at different fairs like Lavi fair (Table 10).

This Lavi fair is the biggest trade fair in inner Himalayas held at Rampur Bushahr in Shimla district of Himachal Pradesh. Raw and semi furnished wool, woollens, patti (light blankets), pashmina, chilgoza and guchhi are sold in this fair. Tribal people from Kinnaur, Lahual and Spiti, Kullu and Ladakh come to participate in this fair Various myths are associated with the collections and appearance of Morchella, which are summarized below:

Occurrence of guchhi mushroom

1. The mushroom comes out after rain accompanying lightning and thunder. More the thunder claps, better is the crop of morels. The eruption of guchhi is directly related to thunder claps and lightning. Therefore it is also described as Earth's tears (dharti ke ansu).
2. To increase the appearance of these

Table 10. Marketing channels and price of guchhi mushroom

Channel	Disposed rate and prices realised
Lavi fair	5–16% @ Rs 2,500–3,000 per kg
Through middle man	90–98% @ Rs 1,500–2,000 per kg
Directly to main market such as Amritsar in Punjab	1–2% @ Rs 5,000–6,000 per kg

morels, the forest area is put ablaze, as the burnt areas are supposed to increase productivity level of morels.

3. There is a strong belief that the appearance of morels increases at places where goats and sheep flock stays overnight. At such places when the leaves of the tree fall upon flock excreta in autumn, this makes a very good humus under the snow during winters.
4. People in many places believe that one gets more fruiting bodies of morels in the morning hours of the day, probably because the morning sun penetrates deep and one is able to seethrough beneath the shrubs where the fruiting bodies usually occur.
5. People also believe that if one carries some morels along with him, he is able to collect more morels in the belief that like attracts like.
6. People believe that to collect a good number of morels, one should go covered with blanket, called challi or channi in Kinnaur.

Collection of guchhi mushroom

1. It is believed that morels are collected while climbing upward. While moving downward they are not visible.
2. Their collection depends upon fate; only lucky ones can find them.
3. If once spotted, they are taken out of the soil at once, whatever be the size; otherwise, they will not increase in size and will disappear after 2–3 days.

Experiment

Cultural studies

The mycelial colonies of Morchella spp. started appearing after 10 days. These were white, which turned brown later on. Fourteen different solid media were tried to observe the linear growth of mycelia. They include malt yeast agar, malt agar, potato dextrose agar, yeastal potato dextrose, pea extract, Czapek's Dox agar, maize extract, coriander extract, wheat grain extract, glucose yeast agar, bread crump agar, Catino PYG

Table 11. Average colony diameter (cm) of Morchella spp in different solid media

Medium	*M. angusticeps*	*M. conica*	*M. crassipes*	*M. deliciosa*	*M. esculenta*
Malt yeast agar	4.5	4.9	4.0	4.1	5.1
Malt agar	5.4	7.8	6.9	5.4	6.9
Potato dextrose agar	6.8	8.5	8.8	6.5	8.9
Yeastal potato dextrose	4.1	7.5	8.1	5.4	8.1
Pea extract	3.7	4.5	4.2	7.3	4.2
Czapeck's Dox agar	6.5	4.1	5.2	3.4	5.2
Coriander extract	4.5	3.8	4.0	4.9	4.0
Maize grain extract	7.3	3.9	7.3	3.0	7.3
Wheat grain extract	4.3	3.7	6.2	4.1	6.2
Bread crump agar	1.30	1.55	1.50	1.45	2.00
Catino PYG agar	6.45	6.80	7.68	6.85	7.30
Carrot agar	8.5	8.0	8.1	8.70	0.09
Elliot agar	8.53	8.0	7.94	8.69	8.01
Emerson YPSS agar	8.69	8.4	7.99	8.80	8.00

agar, carrot agar, Elliot agar and Emerson YPSS agar (Table 11).

Morchella angusticeps showed maximum average colony diameter in Emerson YPSS agar (8.69 cm) and minimum in bread crump agar (1.30 cm), M. conica showed maximum average colony diameter in potato dextrose agar (8.5 cm) and minimum in bread crump agar (1.55 cm), M. *crassipes showed maximum average colony* diameter in potato dextrose agar (8.8 cm) and minimum in bread crump agar (1.50 cm). M. *deliciosa gavemaximum averagecolony diameter* in Emerson YPSS agar (8.80 cm) and minimum in bread crump agar (1.45 cm), and M. esculenta showed maximum average colony diameter in potato dextrose Agar (8.9 cm) and minimum in bread crump agar (2.00 cm).

Four different liquid media were used to record the vegetative growth of mycelium of Morchella spp. These include glucose asparagine solution, Czapek's solution, Dimmicks solution and Asthana and Hawker's solution. The weight of the mycelium that was recorded is given in Table12.

Morchella angusticeps showed maximum growth in Asthana and Hawker's solution (210.60 mg) and minimum growth in Czapek's solution (60.30 mg). M. conica produced maximum growth in Asthana and Hawker's solution (210.60 mg) and minimum in Czapek's solution (60.30 mg). M. crassipes gave maximum growth in glucose asparagine solution (199.80 mg) and minimum in Czapek's solution (111.80 mg), M. *deloclosa showed maximum growth in glucose* asparagine solution (150.27 mg) and minimum in Dimmicks solution (35.9 mg) and M. esculenta showed maximum growth in glucose asparagine solution (200.0 mg) and minimum in Dimmicks solution (55.8 mg).

Nutrient analysis

Content of some of the nutritional components analysed for Morchella spp. are: moisture, fresh and dry weight, free amino acids, phosphorus,

Table 12. Weight (mg) of mycelium in different liquid media (average of 3 determinations, included for 10 days)

Name of medium	*M. angusticepsM.conicaM. crassipesM. deliciosaM. esculenta*				
Glucose asparagine solution	125.0	167.8	199.80	150.27	200.00
Czapek's solution	60.30	70.3	134.90	49.50	85.80
Dimmick's solution	195.0	81.4	111.80	35.90	55.80
Asthana and Hawekr's solution	210.6	73.0	127.00	70.00	85.90

Table 13. Nutritional analysis of Morchella spp

Components	*Morchella spp*	Agaricus spp
Moisture fresh weight (%)	84.15–88.45	78.3–89.05
Free amino acids (g/100 g dry wt.)	6.6–11.8	6.7–10.1
Phosphorus (g/100 g dry wt.)	1.20–1.26	1.48–1.52
Potassium (g/100 g dry wt.)	1.6–2.0	1.3–2.0
Total Protein content (g/100 g dry wt.)	31–36	23.9–30.8
Carbohydrate (%)	67.76	51.3–62.5
Nitrogen (% dry weight basis)	54.60	44.0–53.5

potassium and total protein, carbohydrate and nitrogen. The nutritional components were compared with that of Agaricus spp. The results (Table 13) suggest that free amino acids, total protein, carbohydrates and nitrogen content are more in Morchella, whereas moisture, fresh weight, phosphorus, potassium contents are higher in Agaricus. The protein content of *Morchella is higher than of most of the* vegetables, which can make a valuable addition to the nutritional aspects of vegetarian diet of human beings.

CONCLUSION

Mushrooms grow wild in nature and have been consumed by man since time immemorial. In Himachal Pradesh there are around 100 species of wild mushrooms, which are reported to be edible. Among the edible ones, no other mushroom can top morel for flavour and versatility. Himachal Pradesh, by virtue of its location and diversity in vegetation and climatic conditions, provides suitable habitats for morels to grow in plenty.

The morels comprise the genus Morchella, commonly referred to as guchhi, in Indian market. At present, it is the costliest and most sought-after edible fungus in the world. The morels possess an excellent flavour and are highly appreciated for their culinary aspects. Even the mycelia of Morchella have been stated to have the same nutritive value as the fruiting bodies. Previously they have beencollected primarily for their delicacy and some medicinal value and for home consumption. But now they are collected by the local inhabitants for generating and supplementing their family income.

The present studies were conducted on the species of Morchella in Kinnaur district of Himachal Pradesh.Some important valleys of the region, viz. Satluj, Baspa and Hangrang were surveyed. All the collections made were segregated into seven distinct species, viz., M. *angusticeps, M. conica, M. crassipes, M. deliciosa, M. esculenta, M. tibilica and M. sp.*

Data were recorded on the distribution and collection of Morchella spp. It was observed that morels are usually collected by rural women, school-going children, shepherds, herdsmen as well as inhabitants due to their commercial value. As for the distribution of species, more fruiting bodies of the species are present at high altitudes.

The ethno-mycological studies have been conducted by visiting different tribal areas and conversing with the local inhabitants. Morels are known by different names. A common name *guchhi in Hindi has many local names, e.g. jangmutz, jangmoo, jangmu, rangmutz, rangnoo, rangmuto, ban jangmu and rok etc.*

Many myths are associated with occurrence of morels. Information has been recorded on habit, habitat, methods of drying, marketing etc. Morels are found in mixed coniferous forests of chilgoza pine (Pinus gerardiana), deodar (Cedrus *deodara), oak (Quercus dilatata) rai (Taxus sp.)* and Picea smithiana.

The ethnic use of mushroom is primarily as a delicacy in food and in medicine. For consumption many recipes are prevalent. Recipes used traditionally have been recorded. Some modern recipes have also been listed.

Medicinal properties and uses of guchhi mushroom have been recorded for the first time. Local people use them for various ailments.

The best growth of M. esculenta, M. conica, *M. crassipes and M. deliciosa was observed in* potato dextrose agar medium, whereas M. *angusticeps showed best growth on maize grain* extract medium. Among liquid media, glucose asparagine solution was observed to support maximum average dry weight of the species M. *esculenta, M. deliciosa, M. conica and M. crassipes, whereas M. angusticeps showed best* growth in Asthana and Hawkers solution.

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Code :1741

Title of the ITK :Vegetable of leaves and flowers of munga (Moringa ***oleifera)***

Description of the ITK :Munga/sahajan has high qualitative medicinal properties. Fresh dried leaves and fruits are used for making vegetable and also used as dal. Every part of the plant, i.e. root, shoot, flower, fruit and leaf are used. It controls blood circulation of the body and the paste of roots is used a medicine, when snake bites a person. It is very useful for women because of presence rich iron in the plant. Maximum number of people in the district of Ranchi, Jharkhand use this age-old practice. Protinous, nutritious and expensive vegetables are unaffordable to about 95% of farmers. It is a low cost, easily available nutritious vegetable. It saves money instead of purchasing expensive vegetables and medicines. Munga sag is used as ethnic food for prevention or cure of several diseases.

Name and address of the discloser **:Ms Prabha Bara, Pathalkudwa, Church Lane, Ranchi** (Jharkhand) 834 001

Location of use of ITK :Sinjusereng, Namkum and Chatwal, Mandar, Ranchi (Jharkhand)

Geographical indicators :Munga (Moringa oleifera) a small or medium sized tree about 10 m high, found wild in sub-Himalyan tract, from chenals cost words to sarda and cultivated all over the plains of India. The tree is indigenous to north-west India.

Experimenters :Dr (Ms) N. Bara, Scientist , Department of Extension Education; Dr R Bhakt, Associate Professor of Nutrition, Dr R.P. Singh, "Ratan", Head, Department of Agricultural Extension and, Dr A. P Singh, Head, Department of Animal Nutrition, Ranchi Veterinary College, Birsa Agricultural University, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

The study was carried out in village Sinjusereng, block Namkum and village Chatwal, block Mandar, Ranchi (Jharkhand).

PRA and field study

The reported ITK was compared in terms of leaf and flower of munga through PRA tools involving 20 respondents. The parameters or factors studied were: assessment of different dietary preparations and properties like medicinal value, deliciousness, value addition, availability, popularity and sale value.

Experiment

A study was conducted by preparing vegetables using fresh leaves of munga (T_1), dry



Fig. 1. Vegetable of leaves and flowers of munga

leaves of munga (T_2), fresh flower of munga (T_3) and dry flowers of munga (T_4). The food materials in 10 replicates were tested organoleptically (sensory method) by a panel of 10 judges selected from the villagers as well as scientists of the university using 9–point Hedonic Rating scale. Selection of judges was done out of 30 persons (experts and experienced) by providing them different concentrations of chief ingredients. The persons having average scores were selected. The parameters included in the study were colour, aroma or flavour, taste and overall acceptability.

RESULTS AND DISCUSSION

PRA and field study

Assessing different preparations of munga sag

An attempt was made in this study to assess different preparations using munga leaves and flowers. For matrix scoring, 6 different preparations were taken into account. Table 1 shows that vegetable of munga leaves scored higher than of the flowers. Fresh leaves of munga

Table 1. Matrix scoring for assessing different dietary preparations from munga leaf and flower

Dietary preparation	Leaf	Flower
Fresh vegetable	90	68
Dry parts (sukhauta)	70	9
Fresh vegetable + dal	86	4
Sukhauta + dal	10	0
Sukhauta + rice water	74	0
Fresh part + rice water	65	0

and dal were the second best liking. People also preferred sukhauta + rice water and fresh part + rice water in munga leaves. Data further suggest that preparations of munga leaves scored higher than those of munga flowers.

Assessing properties of food materials prepared from munga leaves and flowers

Data in Table 2 show that food materials of both the categories were beneficial. However, leaves of munga scored higher than the flowers.

Table 2. Matrix scoring for assessing the properties of two food materials prepared by using leaves and flowers of munga

Property	Leaf	Flower
Medicinal value	80	60
Deliciousness	86	76
Value addition	72	10
Availability	96	48
Popularity	90	80
Sale value	26	92

In terms of availability, leaves of munga scored higher than the flowers, because leaves are found throughout the year, whereas flowers are available only in the winter season. Except sale value, all other properties were favourable for the preparations made from the leaves.

Table 3. Sensory evaluation of vegetables prepared from munga leaves and flowers

Product	Colour	Aroma/flavour	TasteOverall	acceptability
Vegetable of fresh leaves	7	7	8	7.33
Vegetable of dry leaves	6	5	7	6.00
Vegetable of fresh flower	8	6	6	6.66
Vegetable of dry flower	4	5	5	5.00

Experiment

Sensory analysis of the food materials was done (Table 3). The mean scores for organoleptic characteristics reveal that cooked vegetable of fresh leaves of munga prepared with oil, tomatoes and spices were very high (7.33) in comparison to vegetables of dry leaves, fresh flowers and dry flowers. Most of the organoleptic characteristics of vegetable of fresh leaves were rated high, ranging from 7 to 8 scores. It is also evident that vegetable of fresh flower of munga was also organoleptically rated high, (i.e. 8, 6 and 6) in terms of colour, aroma and taste, respectively. However, vegetable of dry flowers was rated poorly (i.e. 4, 5 and 5) in terms of colour, aroma and taste respectively than other preparations. Mean scores on overall acceptability indicated that all preparations of dry flowers of munga are also organoleptically acceptable.

Laboratory studies

Laboratory analysis for estimation of the chemical composition of leaves of munga was done. Results are presented in Table 4. (Laboratory analysis was done at Department of Animal Nutrition, Ranchi Veterinary College, Ranchi)

Table 4. Chemical composition of leaves of munga (dry weight basis)

Moisture (%)	Crude protein (%)	Total ash	Fat (%)	Crude fibre (%)	Calcium(mg/kg)
71.9	9.49	13.33	1.23	19.12	0.95

CONCLUSION

The findings lead to conclusion that ethnic food (vegetable) of munga is a boon for people. Dietary preparations from leaves and flowers of munga are popular because of its high nutritive and therapeutic value. ❑

Code :1742

Title of the ITK :Use of sanai (Crotalaria juncea) flower as vegetable–an **ethnic food**

Description of the ITK :Flowers of sanai (Crotalaria juncea) are used for making vegetable by tribals of Ranchi district in Jharkhand. Yellow flowers of sanai also have medicinal properties. It is used as a medicine against cancer and bark of the plant is used for making ropes. The vegetable is prepared by frying the flowers with mustard oil then adding tomato and chilli powder in it. All the tribal farmers in the district use this age-old practice. Nutritious, protineous, expensive vegetable are unaffordable for about 85% of poor farmers. Tribals of this place consider flower of sanai as cheap and nutritious vegetable. It saves money instead of purchasing expensive vegetables.

Name and address of the discloser **:Shri Ranjit Bara, Pathalkudwa, Church Lane, Ranchi** (Jharkhand) 834 001

Location of use of the ITK :Hatma, Mander, Ranchi (Jharkhand)

Geographical indicators :Sunhemp (Crotalaria juneca) is grown in almost all parts of India. But the state of Jharkhand, Uttar Pradesh and Madhya Pradesh are most prominent in this respect. The crop is grown best in tropical and subtropical climate. A minimum of 40 cm of rainfall distributed is not less than 50 rainy days during the growing season is a primary requisite of the crop.

Experimenters :Dr (Ms) N. Bara, Scientist, Department of Extension Education, Dr R.P. Singh "Ratan", Head Department of Extension Education, Dr A. P Singh, Head, and Dr R. Bhakta, Departmentof Animal Nutrition, Ranchi Veterinary College, Ranchi

METHODOLOGY

Location

The study was carried out in village Hatma, block Mander, dist. Ranchi (Jharkhand).

PRA and field study

The reported ITK was compared with kudrum (Hibicus sabdaeriffa), an identical ITK, for preparation of ethnic food. PRA/field study was conducted involving 20 respondents. The parameters or factors studied were beneficial, nutritious, delicious,easily available and popular. Assessment of different preparations was also done through PRA.

Experiment

An experiment was conducted for organoleptic

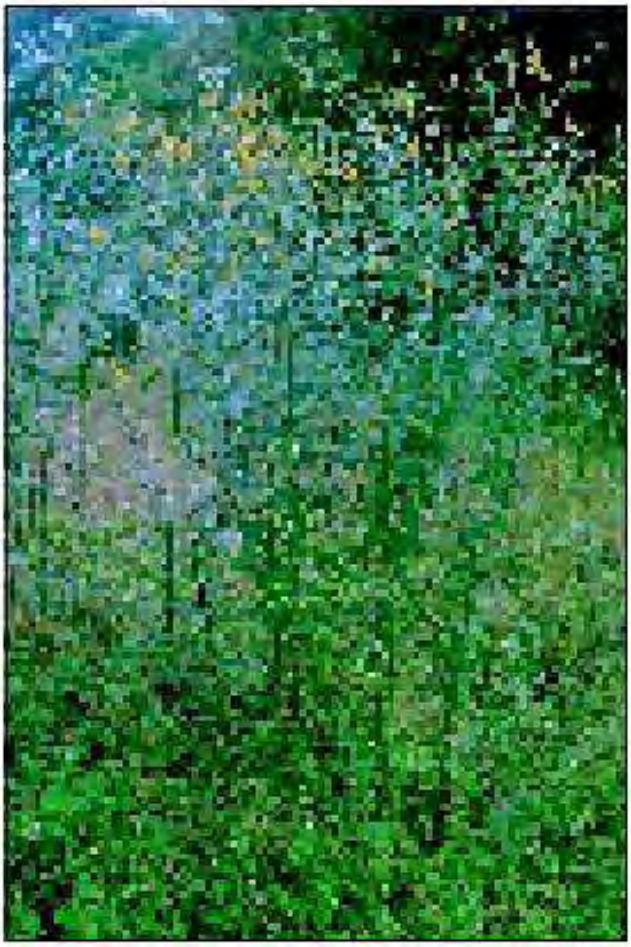


Fig. 1. Use of sanai flowers as vegetables —an ethnic food

evaluation in 10 replications with two treatments, viz. T_1 –vegetable of fresh sanai flower; and T_2 – vegetable of dry sanai flower.

RESULTS AND DISCUSSION

PRA and field study

Data presented in Table 1 reveal that all the

Table 1. Matrix scoring for assessing different preparation of sanai and kudrum

Preparation	*Sanai*	*Kudrum*
Fresh vegetable	88	32
Vegetable of sukhauta (dried)	89	41
Fresh flower + rice water	75	37
Bhurta	84	27
Chutni	75	56

Table 2. Matrix scoring for assessing different uses of sanai and kudrum

Use	*Sanai*	*Kudrum*
Vegetable	95	56
Fuel	82	63
Medicine	73	74
Rope	70	86

preparations of sanai flower were rated higher than those of kudrum flower. Hence sanai flower was preferred to kudrum. The second matrix was prepared for different uses of the two indigenous food materials. The data are presented in Table2.

The results show that sanai flower had more use than kudrum in terms of its use as vegetable or fuel and medicine.

The third matrix was prepared for different characteristics of the two food materials. Data given in Table 3 reveal that both the food materials

Table 3. Matrix scoring for assessing different characteristics of sanai and kudrum

Character	*Sanai*	*Kudrum*
Beneficial	90	80
Nutritious	78	72
Delicious	72	66
Easily available	80	72
Popular	76	67

were rated to be at par considering all the parameters

Experiment

An experiment was conducted in 10 replications through the organoleptic evaluation method. The two food materials , i.e. vegetable of fresh flower of sanai (T_1) and vegetable of dry flower of sanai (T_2), were cooked and were tested organoleptically (sensory method) by a panel of 10 judges selected from the villagers as well as

Table 4. Sensory evaluation of vegetable of sanai flower

Product	Colour	Flavour/aroma	Taste	Overall acceptability
Vegetable of fresh flowers	7	7	8	7.3
Vegetable of dry flowers	6	6	6	6.0

scientists of the university using 9–point Hedonic Rating scale.

The data in Table 4 show that vegetable of fresh flower was found to be most popular dietary preparation in terms of taste and was rated very high (9). Flavour or aroma and colour of vegetable of fresh flower were found to be liked very much (7). All the organoleptic scores assigned to vegetable of dry flower were in the category of moderately liked (6). However scores for overall acceptability of vegetable of fresh flower was much higher (7.3) than those of vegetable of dry flower (6.0).

Laboratory studies

Laboratory analysis for estimation of the chemical composition of sanai flower was done. Results are presented in Table 5. (Laboratory analysis was done at Department of Animal Nutrition, Ranchi Veterinary College, Ranchi)

Table 5. Chemical composition of sanai flower (dry weight basis)

Moisture (%)	Crude protein (%)	Total ash	Fat (%)	Crude fibre (%)	Calcium (mg/kg)
90.4	9.79	7.08	0.82	12.93	1.08

CONCLUSION

Vegetable of fresh flower of sanai was organoleptically highly acceptable than vegetable of dry flowers of sanai.

❑

Code :1743

Title of the ITK :Use of beng sag (Centella asiatica) as vegetable and **medicine**

Description of the ITK :Beng sag (Centella asiatica) has qualitative medicinal properties and is used for making vegetable. Fresh and dried leaves of beng sag are used for making vegetable. Its roots are used for treatment of jaundice. Minced root water is given to the affected person twice or thrice a day for 12–15 days and paste of roots is also placed on legs and hands of that person. The rate of success in jaundice disease is 99%. People of Ranchi district in Jharkhand use this age-old practice. Proteinous, nutritious and expensive vegetables are unaffordable to about 85% of farmers and hence all the villagers use beng sag as vegetable.

Name and address of the discloser **:Shri Ranjit Bara, Pathalkudwa, Church Lane, Ranchi** (Jharkhand) 834 001.

Location of use of the ITK :Sogod village, Rajaulatu Panchayat, Namkum Block, Ranchi (Jharkhand).

Geographical indicators

Centella asiatica, a prostrate perennial, faintly aromatic herb found wild throughout India and Sri Lanka upto an attitude of 2,000 feet.

Experimenters :Dr (Ms) N. Bara, Scientist, Department of Extension Education; Dr R.P. Singh "Ratan", Head, Department of Extension Education, Dr K. K. Singh, Head, Department of Veterinary Pathology and, Dr A. P Singh, Head, Department of Animal Nutrition, Ranchi Veterinary College, Birsa Agricultural University, Ranchi (Jharkhand) 834 006.

METHODOLOGY

Location

The study was carried out in Sogod village, Rajaulatu Panchayat, Namkum block in Ranchi district (Jharkhand).

PRA and field study

Muchari sag was compared with reported ITK involving 20 respondents. The two ITKs were compared for three aspects i.e. different types of preparations, general properties and medicinal values. The parameters selected for different types of preparations included raw use, marjhor, squash, bhunjari, chutney and bhurta. For general properties the parameters studied were medicinal value, deliciousness, value addition, nutritious, availability and popularity.

Experiment

Experimentation was done in 10 replications



Fig. 1. Beng sag (Centella asiatica)—an important ethnic food material and medicinal plant for different types of preparations

through the organoleptic evaluation method. The three food materials, i.e. raw beng sag (T_1), squash of beng sag (T_2), and cooked vegetable (T_3), were tested organoleptically (sensory method) by a panel of 10 judges selected from the village as well as scientists of the university using 9 point Hedonic Rating scale. Selection of judges was done out of 30 persons (experts and experienced) through providing them with different concentrations of the chief ingredients. They were asked to rate the ingredients. The persons having average scores were selected finally.

The parameters/factors undertaken for sensory evaluation were taste, flavour or aroma and colour.

Table 1. Matrix scoring for assessing different preparations of beng sag and muchari sag

Preparation/use	Beng sag	Muchari sag
Raw use	97	5
Marjhor	46	43
Suash	94	0
Bhunjari	100	93
Chatni	100	11
Bhurta	88	80

RESULTS AND DISCUSSION

PRA and field survey

An attempt was made to assess the different preparations of two ethnic food materials, i.e. *beng sag (Cestella asiatica) and muchari sag* (Lymnophylla conferta). The findings are presented in Tables 1 and 2.

Data presented in Table 1 show that beng sag was preferred over muchari sag on all the parameters studied. An informal discussion with the respondent on different types of preparations of plant parts revealed that beng sag was consumed in raw form and in form of squash for medicinal purpose.

Table 2. Matrix scoring for assessing different general properties of beng sag and muchari sag

General property	Beng sag	Muchari sag
Medicinal value	98	63
Delicious	97	76
Value addition	98	31
Nutritious	96	73
Easily available	99	95
Popular	100	9

General properties of beng sag and muchari *sag*

An attempt was made to assess the general properties associated with the two food materials,

Table 3. Matrix scoring for assessing medicinal use of two ethnic food materials

Medicinal use	*Beng sag*	*Muchari sag*
Appetizer	78	77
Blood purifier	76	76
Remedy for gas	76	74
Urine purifier	86	54
For checking vomiting	71	47
For checking fever	78	72
Remedy for jaundice	100	19

Table 4. Sensory evaluation of beng sag

Product	Taste	Favour/aroma	Colour	Overall acceptability
Raw use of beng sag	5	6	5	16
Squash or beng sag	8	7	6	21
Cooked vegetable	9	8	7	24

i.e. beng sag and muchari sag.

Data in Table 2 show that both the food materials were easily available in the locality. It is further revealed that both the food materials are rated high in terms of their nutritional value. Both beng sag and muchari sag are popular and are easily available.

Medicinal use of ethnic food materials

The respondents were asked to point out medicinal use of beng sag and muchari sag. Respondents could name seven different medicinal uses associated with beng sag and *muchari sag They were identified as appetizer,* blood purifier, remedy for gas, urine purifier, for checking vomiting and fever, and remedy for jaundice (Table 3).

Experiment

Experiment was conducted in 10 replications through organoleptic evaluation method for beng *sag. The findings are presented in Table 4. The* mean scores for organoleptic characteristics reveal that cooked vegetable, prepared with oil, tomatoes and spices, is organoleptically rated very high in comparison to squash and raw use. Squash of beng sag was moderately liked whereas raw use of beng sag was rated very low. Vegetable of *beng sag was organoleptically highly acceptable.*

Laboratory studies

Laboratory analysis for estimation of the chemical composition of beng sag was done. Results are presented in Table 5. (Laboratory analysis was done at Department of Animal Nutrition, Ranchi Veterinary College, Ranchi)

Table 5. Chemical composition of beng sag (dry weight basis)

Moisture (%)	Crude protein (%)	Total ash	Fat (%)	Crude fibre (%)	Calcium(mg/kg)
71.7	9.34	23.09	1.53	15.9	1.06

CONCLUSION

The mean scores for organoleptic characteristics of beng sag (Centella asiatica) reveal that cooked vegetable prepared with oil, tomatoes and spices was organoleptically rated very high in comparison to squash and raw use. Squash of *beng sag was moderately liked, whereas raw use* of beng sag was rated very low. Vegetable of beng *sag was organoleptically highly acceptable.*

Thermal Efficiency

Code : **293**

Title of the ITK : **Evaluation of wood stove/*chullah* for thermal efficiency**

Description of the ITK : Design and fabrication of portable single-pan wood-stove with high efficiency could be put in use both for domestic as well as industrial applications. The present design and fabrication of the improved wood-stove is a low-cost device. The stove is cylindrical in shape and made up of mild steel of thickness 2 mm. It is divided into two chambers, called combustion chamber which is located in the central part of the stove, and annular surface surrounded by combustion chamber called air-flow chamber. The air-flow chamber is conical in shape. There are two types of air control valves available to regulate air supply. The primary air control valve, is directly joined to the combustion chamber to enrich the combustion rate. The secondary air-control valve, is joined to the air-flow chamber and the air is passed to the inlet of the combustion chamber from the top. The secondary air from the air-flow chamber increases the flame temperature at the top of the combustion chamber and exits from the air-flow chamber. It also burns the unburnt combustibles. The height of the combustion chamber from air nozzle to grate is about 12 cm. The grate is placed in the middle of the combustion chamber. The fuel or wood is loaded in the grate up to the level of air nozzle. The bottom of the grate has an iron-wire mesh, which is used to retain heat in the combustion chamber, where the wood is placed. The primary air passes between the grate and the iron-wire mesh through primary air control valve. The area below the iron wire-mesh is known as the ash pit. The ash and the residuals from the combustion chamber drop in the ash pit after burning and can be removed easily. The stove is placed on the base of an iron stand. Field level use of improved wood-stove at Guru Match Industry at Sivakasi, Tamil Nadu proved that the cost of wax melting costs per month has gone down to Rs 450 from Rs 1000.



Fig.1.Single pan wood stove

Name and address of the discloser : Shri I. Sulthan Sikkanther, S/o Shri Y. Ismaeil, 50, Staff Quarters, Telephone Exchange, Melur, Madurai (Tamil Nadu) 625 106

Location of use of the ITK : The improved wood stove was developed by the discloser at Madurai to use it for domestic and industrial application.

Experimenters : Dr K. Koodalingam, Professor (Breeder Seeds), Centre for Plant Breeding and Genetics, Dr A. Sampath Rajan, Professor and Head, Department of Bio-Energy and Dr P. Venkatachalam, Associate Professor, Department of Bio-Energy, College of Agricultural Engineering, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) 641 003

METHODOLOGY

Location

The wood stove was evaluated at Gasifer Action Research Centre, School of Energy Science, Madurai Kamaraj University, Palkalainagar, Madurai, (Tamil Nadu) and Guru Match Industry, Research Line, Shacheyapuram, Sivakasi, dist. Virudhunagar, (Tamil Nadu).

Extent and Coverage

At the village and industries level mud-stove (chulha), wood-burning *chulha*, kerosene stove and LPG stove are used. The LPG and kerosene stove are not readily available every day and the cost is very high; besides the usage pattern is very difficult and risky. The farmers of the village are used to open, three stone fire places or mud stove for cooking and heating purposes. Their fire-places are dirty and inefficient. The smoke irritates, and may be a danger to health. They are also inefficient, because only less than 10% of the energy content of the fuel wood is used for cooking and heating. The rest goes up in the air.

PRA and field study

Unstructured interview was conducted and obtained all the details on the use and methods of ITK.

Experiment

The experimental method employed was to test the efficiency of the *chulha* by water-boiling test at the laboratory and actual tests at the work place by following the procedures as detailed below.

Measured quantity of water was taken in a vessel with lid, which was placed above the stove. Then 250 g firewood was fed every 15 minutes. Water temperature was noted every 15 minutes by using a thermometer. The lid was removed when water temperature reached 98°C. Heating of water continued and the temperature was noted periodically. Weight of fuel and ash was recorded.

RESULTS AND DISCUSSION

PRA and field study

Performance of different stoves relating to consumption time, space consumption and maintenance, determined by field study, is shown in Fig. 2. Improved wood stove was found better than traditional stove in all the parameters studied, except space requirement.

Experiment

The burning rate and efficiency of the wood stove was tested using different fuel materials such as *Casuarina equisetifolia*, coconut shell,

Table 1. Burning rate and efficiency of stoves using different fuels

Feestock	Burning rate (Kg/hr)	Efficiency (%)
Wood (*Casuarina equisetifolia* Forst)	5.2	23.2
Coconut shell	5.6	20.3
Coconut rachis	6.0	24.9
Arecanut (*Bentinckia coddapanna* Berry) husk	8.4	20.7

coconut rachis and arecanut (Bentinckia coddapanna Berry) husk. The results obtained are given in Tables 1 and 2. The burning rate was observed to be 5.2 to 8.4 kg/hr. The higher density materials had lesser burning rate. The efficiency of the wood-stove with different fuel sources was 20.3 to 24.9%. It was observed that the efficiency of the stove did not depend on the type of fuel material used.

The observed efficiency of the wood stove, using different fuel materials was compared with the claimed efficiency. In all these trials (except for Manjanethe), the claimed efficiency was 25 to 32% whereas the observed efficiency was lesser than the claimed efficiency, being 21 to 28%.

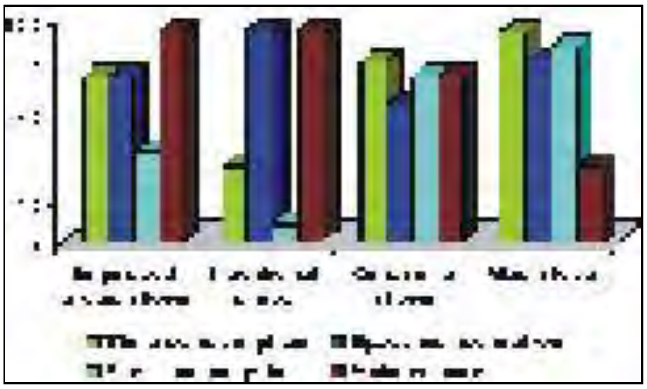


Fig.2. Relative performance of different stoves

Table 2. Efficiency of the stove with different wood sources

Name of the wood	Energy input (KJ)	Energy output (KJ)	Efficiency (%)
Subabul (*Leuceana leucocephala*)	50,400	13,079.6	25.95
Acacia nilotica	48,720	13,079.6	26.85
Mixed wood (*Casuarina equisetifolia* Forst)	47,040	12,967.9	27.56
Tamarind (*Tamarindus indica* Linn.)	47,040	13,076.8	27.79
Neem (*Azadirachta indica* A. Juss)	49,560	13,980.8	28.21
Kathi-savukku (*Casuarina equisetifolia* Forst)	42,000	13,531.6	32.22
Vaagai (*Acacia speciosa* Willd. W & A.)	42,000	13,305.6	31.68
Manjanethe (*Morinda bracteata* Roxb. W & A)	52,920	13,302.8	25.14

CONCLUSION

The observed efficiency of the wood stove was 2 to 5% less than of the claimed efficiency. However, the stove proved more advantagous than the conventional *chullah*.

Weather Forecasting

Code	**:**	**1305**
Title of the ITK	**:**	**Case study on warning of heavy rains by observing ants transferring eggs**
Description of the ITK	:	Prior indication and prediction of rain helps the farmers to take appropriate decisions on the farm activities. Ants transfer their eggs from one place to another. It is a sign of heavy rain, as followed by the farmers of Nayabas Kutubpur in Bulandshahr district of Uttar Pradesh.
Name and address of the discloser	:	Shri Prem Pal Singh C/o Shri Dal Chand, House No. 38, Purva Ahiran, Indra Chowk, Meerut (Uttar Pradesh)
Location of use of the ITK	:	The ITK is being followed for forecasting rain in several districts of western Uttar Pradesh, specially in Buland Shahr, Badaun, Bareilly, Etah, Aligrah districts. Generally black small ants are considered more reliable to predict rain. The ants generally lay their eggs in holes in earth near the walls or at uplands near the houses. They start taking out their eggs from holes and transfer to a higher place. This is an indication of heavy rains to follow.
Experimenters	:	Dr (Ms) Shagufta Jamal, Reader, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia University, Jamianagar (New Delhi) 110 025

METHODOLOGY

PRA and field study

Field study was conducted in four villages, viz. Nayabas and Danpur in Bulandshahar district, and Manda and Kamua villages in Bareilly district of Uttar Pradesh through PRA to find out the details of ITK actually being used for prediction of rains by the farmers. To quantify the efficacy of ITK, four alternative observations, viz. few ants carrying eggs, ants with eggs in large number, ants carrying eggs from low to high place and



Fig. 1. Ants transferring eggs

ants carrying eggs to a dry place, were subjected to matrix ranking by the farmers through PRA methods. The selected 25 key informants were asked to score the practice by putting stone pieces out of 10 on six criteria. The criteria were rain the same day, rain after 1 day, extent of rain, storm only, clouds only and extent of reliability. The matrix ranking for each criterion were subjected to ANOVA test for significance of difference.

Case study

The best possible method for validating this ITK under the existing resources is through search and observation of ants transferring their eggs in respect of change in weather and occurrence of rain for the next two or three days. Efforts were made to search such cases from Bareilly, Bulandshahar and Badaun districts of Uttar Pradesh. In all 12 cases were found, and observations were noted.

RESULTS AND DISCUSSION

PRA and field study

Information collected through pilot study in the area indicated that though the practice is believed to be highly reliable, it is not very common to find such cases. It is only by incidence or chance that such cases are observed both in the field and in the houses. Generally, the ants are observed transferring egg in July only. Further, only one species, i.e. black small ants are seen transferring their eggs.The results of matrix scoring using 25 key informants on six criteria for four alternative observations are given in Table1.

The findings suggest the following:

(i) The key informants mostly opined that when ants carry eggs in large numbers, rain will be occurring the same day. The difference between treatments in respect of rain occurring the same was highly significant.

(ii) The maximum score was given to treatment 2 (ants with pupae in large numbers) for the criterion rain after 1 day. The difference between treatments in respect of rain after 1 day was highly significant.

(iii) Treatment 2 (ants with eggs in large numbers) also scored maximum in respect of extent of rain. The difference between treatments in respect of extent of rain was

Table 1. Matrix scores of behavioural changes of ants in anticipation of rain

Criterion	Behaviour of ants				
	Few ants carrying eggs (T_1)	Ants with eggs in large number (T_2)	Ants carrying eggs from low to high places(T_2)	Ants carrying eggs toward dry places(T_3)	CD
Rain same day	4.4	8.9	7.7	6.7	**
Rain after 1 day	4.9	9.4	7.8	7.4	**
Extent of rain	4.4	9.0	7.7	7.3	**
Storm only	3.0	4.5	4.6	4.4	*
Clouds only	3.9	5.4	5.3	5.4	**
Extent of reliability	4.3	9.7	8.1	7.2	**
Average (maximum score=10)	4.1	7.8	6.9	6.4	**

*Significant at (P=0.05); **Significant at (P=0.01).

highly significant.

(iv) The maximum score was given to treatment 3 (ants carrying eggs from low to high place) for the criterion storm only. The difference between treatments in respect of storm only was significant.

(v) The maximum score was given to treatment 2 (ants with eggs in large numbers) for the criterion clouds only. The difference between treatments in respect of clouds only was highly significant.

Case study

The observations made are presented below case-wise.

Case 1

Small black ants were seen transferring eggs in large numbers on 26 May, 2002 at 2.00 pm near the gate of the Division of Extension Education at Indian Veterinary Research Institute, Bareilly (Uttar Pradesh). They were taking the pupae or eggs from their holes towards the dry place and also from downside towards upside the wall. It continued from 2.00 to 4.00 pm. The temperature at that time was 36ºC and humidity 62%. Same day at 6.00 pm the clouds appeared and a few showers of the rain occurred at 9.00 pm. Heavy rain occurred in the next day, on 27th May in the evening at about 7.00 pm.

Case 2

Small black ants were transferring pupae or eggs in large numbers on 29 May, 2002 at 8.00 am, near the kitchen in the house of Shri Sarman Singh at village Nayabas, dist. Bulandshahr a (Uttar Pradesh). They were taking the pupae from downside to upward side on the wall. The down place was damp. Just after 2 hours heavy rain occurred, which continued for 2-3 hours.

Case 3

Small black ants were observed transferring eggs near the wall of a semi-pucca house in Danpur village of Bulandshahar district on 31 July, 2002 at 11.00 am. They were taking eggs and pupae from the ground level to the wall upward at about 15 cm height in a hole. The down place was a little damp. It was little cloudy day with hot temperature (40ºC). Just after 3½ hours clouds came and at 3.00 pm, there was storm and rain with thunder. It continued for 2 hours.

Case 4

Small black ants were seen transferring eggs near a semi-*pucca* house of Shri Amar Singh in Nayabas village of Bulandshahar district in 1 August, 2002. The ants were only a few and were seen only for 15-20 minutes at 12.00 noon. It was clear sky and the temperature was 39ºC. Clouds started coming at 2.00 pm and a little shower started at 3.00 pm. There was a little drizzle for 2 hours.

Case 5

The ants were seen taking pupae in Manda village of Bareilly district on 7 August, 2002. The ants were taking pupae from ground to the bund in a plot near the village at about 5.30 pm. The place was damp and wet. It was cloudy day. Rain occurred during the night at about 11.00 pm. On the next day heavy rains were there in the afternoon.

Case 6

On 16 June, 2003 at about 3.00 pm small black ants were observed carrying eggs at the corner of the *katcha* plateform of Shri Pratap Singh of Dohna village of Bareilly. The platform is built in front of common sitting place. It was hot sunny day, but the ants were seen in the shadow on one corner near the wall. During evening at about 5.00 pm there was likelihood of storm in the sky towards west and at about 6.30 pm storm came with speedy winds full of dust. After 30 minutes it ended with showers. This continued till 10.00 pm.

Case 7

Shri Sher Singh of Manda village in Bareilly district observed near the wall of his semi-pucca

house on outside that black ants were transferring their eggs at about 5.30 pm on 5 July, 2003. They were taking their eggs from a lower place to the upper place in a hole of the wall. This was observed only for about 15 minutes. At that time there were no clouds in the sky and the temperature was 38°C. Clouds were observed during night and on the next day morning there were heavy clouds. Rain started at 10.00 am. It was medium rain and dizling continued till evening up to 4.30 pm. There was no rain on 7 July, 2003.

Case 8

On the *katcha* roof of the house of Shri Surajpal Singh of village Nayabas in district Bulandshahar black small ants were seen transferring their eggs from one place to the other at about 5.00 pm on 5 July, 2003. It was a hot day. The temperature was 39°C. During night clouds started forming and by morning at about 8.30 am on 6 July 2003 there was heavy rain for 2 hours and dizzling continued for another 2 hours.

Case 9

Black ants were seen transferring eggs on a *bandi* of the field near village Nawada of Badaun district at about 7.30 am on 9 July 2003. The case was observed by Shri Net Ram of the village. The ants were transferring their eggs from one place to the other at a distance of about 10 m but on almost the same level. They continued transferring their eggs for about 30 minutes. Little clouds were already there in the sky. But within 1 hour clouds started concentrating. There was very heavy rain at about 12.00 noon, which continued for 3 hours and then dizzling continued till 8.00 pm. The dizzling, however, was observed many times throughout night of 9 July 2003. There was again very heavy rain at 5.00 pm on the following day.

Case 10

In Baghwala village of Badaun district on 20 July 20, 2003 at about 4.00 pm, when ants were seen carrying their eggs near the *katcha* wall of Shri Mohd Ismail. The ants were carrying the eggs to an upper place. It was observed for about 15 minutes. It was a cloudy day. There was rain 2 days before. At about 8.00 pm, the clouds were concentrated. There were thunders. Heavy rain took place at 10.00 pm which continued till morning of 21 July 2003.

Case 11

On 20 July, 2002 at 3.00 pm Shri Har Pal Singh of Danpur village in Bulandshahar district observed ants carrying eggs near their semi-***pucca*** house. The small black ants were taking their eggs from a hole near the drainage channel of the hand pump. They carried their eggs inside the house in a dry hole. The distance was about 10 feet. They continued transferring their eggs for 15 minutes. It was hot sunny day with a few clouds. Heavy clouds from east started coming at about 5.30 pm, which resulted in heavy rains at about 6.00 pm onwards. Heavy rain continued for 2½ hour, after which showers continued with a few breaks till morning of 21 July 2003.

Case 12

Shri Ram Phal of Nayabas, district Bulandshahar observed ants carrying their eggs in a common sitting room near the wall from a hole on the *katcha* floor. They were carrying their eggs to another hole in the same room near the wall at a distance of about 7 feet. The level of the two holes was almost same. This activity continued for about 20 minutes from 7.30 am on 28 July 2003. It was cloudy day. It rained on the previous day also but with little showers. It was on 28 July 2003 at about 11.00 am that clouds were concentrated and there were heavy rains with speedy winds like storm. It continued till evening.

The findings of the above mentioned 12 cases are summarized in Table 2.

This information indicates that out of 12, in 10 cases rain occurred within 2 to 7 hours from

Table 2. Findings of case study

Date	Place of transferring eggs	Time of observation	Temperature (°C)	Occurrence of rain
26 May	Bareilly (from lower to upper place)	2.00 PM	36°C	Little rain at 9.00 PM, heavy rain at 7.00 PM on next day
29 May	Nayabas, Bulandshahr(near kitchen from lower to upper place)	8.00 AM	35ºC	Heavy rain at 10.00 AM
31 July	Danpur, Bulandshahr (lower to upper place on wall)	11.00 AM	40°C	Storm and rain with thunder at 3.00 PM
1 August	Nayabas, Bulandshahr (few ants for 15–20 mintues)12.00 noon		39ºC	Little showers for 2 hours at 3.00PM
7 August	Manda, Bareilly (lower to upper place on bund)	5.30 PM	38.4ºC	Little rain at 11.00 PM Heavy rain next day at 1.00 PM
16 June	Dohna, Bareilly (from lower to upper place)	5.30 PM	41ºC	Dusting at 6.30PM followed by showers of rain
5 July	Manda, Bareilly (from lower to upper place)	5.30 PM	38ºC	Clouds during night and heavy rain at 10.00AM on 6.7.2003, no rain on 7.7.2003.
5 July	Nayabas, Buland Shahr (from one place to other)	5.00PM	39ºC	Clouds during night and 8.30 AM on 6.7.2003.
9 July	Nawada, Badaun (from one place to other at same level)	7.30AM	32ºC	Clouds came in one hour, heavy rain at 12.00 noon for 3 hours
20 July	Baghwala, Badaun (from lower to upper place)	4.00PM	35ºC	Heavy rain at 6.00PM with thunders
20 July	Danpur, Badaun (from wet place to dry place)	3.00 PM	36ºC	Heavy rain at 6.00PM with thunders
28 July	Nayabas, Buland Shahr (from one hole to other at same level)	7.30 AM	32ºC	Heavy rain with storm at 11.00 AM

the time the ants were observed carrying their eggs. In the remaining two cases, heavy rain occurred on the next day. Storm and rain with thunder occurred in five cases. In two cases rains were limited to a few showers only. In one case dusty storm with little showers occurred within 1½ hour when the ants were carrying their eggs.

CONCLUSION

Prediction of rains by observing the ants carrying their eggs appear to be reliable and valid, as observed in 12 case studies. The findings, however, need confirmation by observation of at least 40 more cases. ❑

Code	:	**1304**
Title of the ITK	:	**Frolicking of house bird (gauraiyya) on sand as natural indicator of rain - case study**
Description of the ITK	:	Prior indication and prediction of rain help the farmers to take appropriate decision on the farm activities. When a house bird (gauraiyya) moves its wings while sitting on the sand, it is the indication that rain will be there within short time. This information has been reported from Nayahar Kutalapur village of Buland Shahr district (Uttar Pradesh).
Name and address of the discloser	:	The ITK is being believed to be an indicator of rain within few days as reported by the villagers of Bulandshahar district, in Uttar Pradesh .
Location of use of the ITK	:	Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia University, Jamianagar (New Delhi) 110 025.
Experimenter	:	Dr (Ms) Shagufta Jamal, Department of Adult and Continuing Education and Extension, Jamia Millia Islamia University, Jamianagar (New Delhi) 110 025.

METHODOLOGY

Location

The study was conducted in Bulandshahar, Badaun and Bareilly districts of Uttar Pradesh as well as in Delhi. The field study through PRA was conducted in six villages, three from Bulandshahar and three from Badaun districts. The cases of house-birds frolicking their wings on sand were observed in these villages as well as in Delhi. As many as 38 cases could be studied on this aspect .

PRA and field study

Field study was conducted through PRA to find out the details of ITK actually being used for prediction of rain by the farmers. As many as 90 farmers from 8 villages were contacted. The key informants were generally those who actually are involved in decision making in farming.

To quantify the efficacy of ITK, three alternative observations, viz. sparrow frolicks wings on dry sand, sparrow frolicking wings on dry sand during noon time, and sparrow frolicking wings in dry sand during hot summer, were subjected to matrix ranking by the farmers through PRA method. The selected 25 key informants were asked to score the practice by putting stone pieces out of 10 on six criteria. The criteria were: rain same day, rain after 1 day, extent of rain, storm only, clouds only and extent of reliability. The matrix ranking for each criterion was subjected to ANOVA test for significance of difference.

Case study

The best possible method for validating this ITK under the existing resources is through search and observation of real cases of sparrow frolicking in respect of change in weather for the next 2-3 days. Efforts were made to search and collect as many cases as possible from Bulandshahar and Badaun districts of Uttar Pradesh and Delhi. In all 38 cases were found and observations were noted.

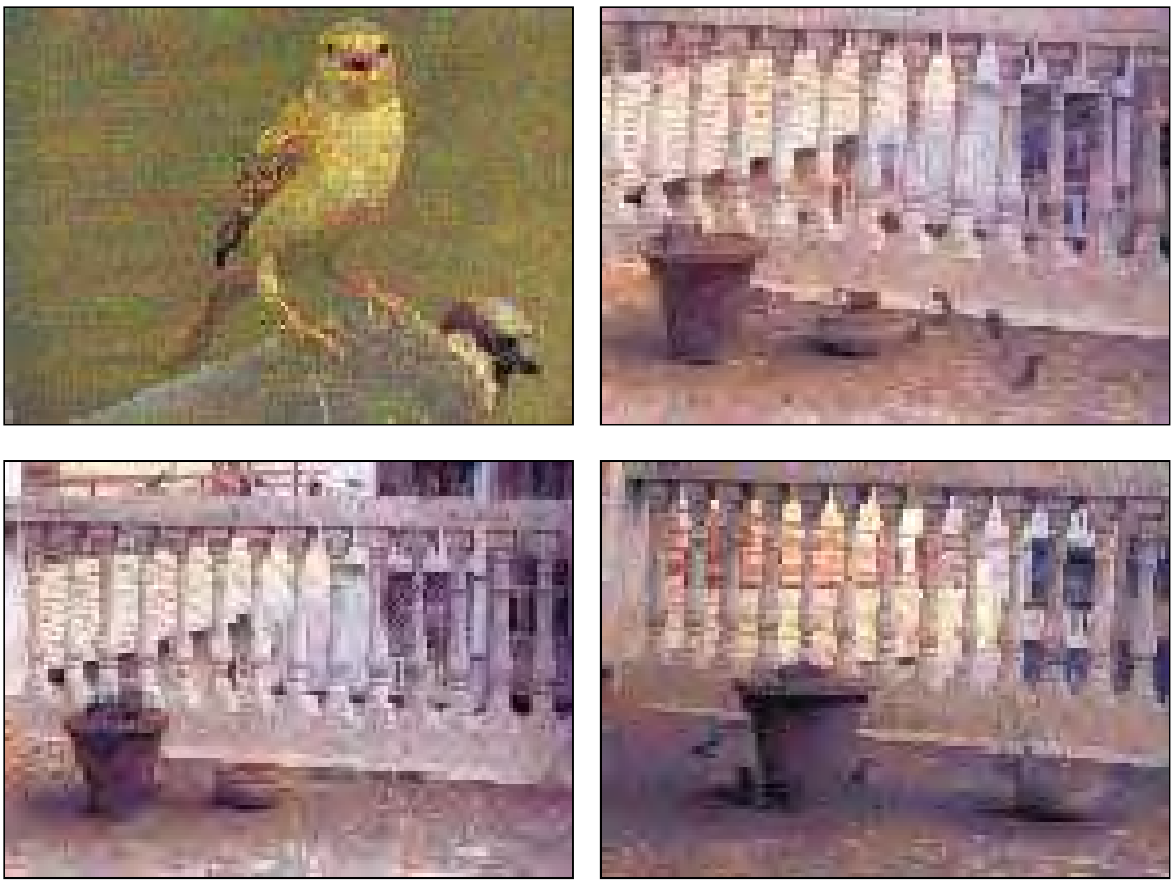


Fig. 1. House bird *(gauraiya), Passer domesticus* frolicking their wings on sand

RESULT AND DISCUSSION

PRA and field study

During pilot study it was reported that when there is high temperature and there is dust on the earth or on pots, the house bird sit there, observe for few minute and start frolicking their wings on the sand. Within short time, other house birds also join it and start frolicking on the sand. If the

Table 1. Result of matrix scoring made by 25 key informants on six criteria for three alternative observations

Criteria	Observations on frolicking of wings by sparrow			
	Sparrow frolicks wings in dry sand/dust S D			S D
		During noon time	During hot summer	
	(T1)	(T2)	(T3)	
Rain same day	8.4	5.8	7.6	**
Rain after 1 day	9.0	6.8	8.7	**
Extent of rain	8.1	6.4	7.9	**
Storm only	4.9	4.5	4.6	N.S.
Clouds only	5.8	5.4	5.8	N.S.
Extent of reliability	9.4	6.4	9.2	**
Average (Maximum score=10)	7.6	5.9	7.3	**

**, Significant at (=0.01); NS, nonsignificant

Table 2. Results of the case study

Date	Place	Time of oservation	Temperature(C)	Humidity %	Occurence of rain
19 July	Nayabas, Bulandshahr	11.00 AM	37.5	62	Clouds seen at 5.00 pm
20 July	Nayabas, Bulandshahr	12.00 noon	39	65	Clouds seen at 6.00 pm
25 July	Nayabas, Bulandshahr	10.30 am	37.4	51	Clouds seen at 4.00 pm
27 July	Nayabas, Bulandshahr	6.15 pm	38.5	77	Clouds seen at 7.00 pm
29 July	Danpur, Bulandshahr	11.30 am 5.00 pm	40.0	61	Clouds seen at 9.00 pm Rain Occured at 3.00 am next day
30 July	Danpur, Bulandshahr	6.00 pm	40	65	Clouds seen at 7.30 pm
31 July	Danpur, Bulandshahr	10.00 am	39.8	74	rain with thunder at 3.00 pm
1 August	Nayabas, Bulandshahr	8.00 am	38.3	83	Little shower at 3.00 pm
3 August	Shekhupur, Budaun	7.00 am	37.6	81	Little rain at 6.00 pm, clouds whole day
4 August	Shekhupur, Budaun	8.00 am	35.0	86	Clouds and little shower whole day
5 August	Khairpur, Buduan	8.00 am	34.4	88	Only clouds seen
6 August	Khairpur, Buduan	9.00 am	35.0	86	Little showers at 4.00 pm for 1 hour
7 August	Buduan	5.00 pm	38.4	92	Rain at 11.00 pm
8 August	Buduan	8.00 am	36.0	87	Heavy rain at 1.00 pm
12 August	Buduan	9.00 am	34.0	75	Heavy rain at 4.00 pm
15 August	Buduan	8.00 am	35.0	82	Rain at 5.00 pm
17 August	Buduan	7.00 am	34.0	65	Rain at 6.00 pm
20 August	Buduan	7.00 am	35.0	62	Rain at 5.00 pm
3 January	Delhi	9.30 am	16.0	65	Clouds on 5.1.2003
19 January	Delhi	10.00 am	14.0	68	Rain on 22.1.2003
3 January	Delhi	11.00 am	38.5	65	Clear sky, no sign of cloud or rain
4 July	Delhi	11.00 am	39	62	Cloud seen at 5.00 pm
5 July	Delhi	11.30 am	38	65	Cloud seen, no rain
5 July	Badaun	2.00 pm	39	66	Cloudy, heavy rain on 6.7.2003
6 July	Badaun	12.00 Noon	30	63	Clouds at 6.00 pm and dizzling at 7.00pm
7 July	Badaun	10.30 am	36	76	Rained whole day
8 July		10.00 am	35	75	Clear sky
8 July	NayabarBulandshahar	2.00 pm	39	76	Clear sky, rain on 9.7.2003
9 July	Badaun	10.00 am	35	80	Heavy rain at 12.00 noon
10 July	Badaun	11.30 am	36	85	Heavy rain at 5.00 pm
20 July	Delhi	2.00 pm	35	97	Showers at 6.30 pm Heavy rain at10.00 pm next day
21 July	Delhi	8.30 am	36	98	Cloudy, showers at 10.00 pm
22 July	Delhi	11.00 am	29	100	No rain, cloudy
24 July	Delhi	11.00 am	36	93	Cloudy, no rain
25 July	Delhi	11.30 am	25.6	88	Cloudy, no rain
27 July	Delhi	11.30 am	36	85	Cloudy, showers
28 July	Delhi	10.30 am	35	87	Heavy rain at 6.00 pm
28 July	Nayabas, Buland Shahr	11.00 am	36	88	Heavy rain at 6.30 pm

space is limited, they frolick one by one. It was also reported that generally male house bird frolick first followed by females. The villagers reported that frolicking of birds on the sand is an indicator of rain which may occur within few days. Sometimes, these birds continue frolicking

daily for 2_3 days and rain occurs after that.

The result of matrix scoring made by 25 key informants on six criteria for three alternative observations are given in Table 1.

The findings are summarised as following:

i. The key informants gave maximum score to Treatment 1, indicating that when sparrow frolicks wings in dry sand or dust, rain occurs on the same day. The difference between treatments in respect of rain occurring the same day was highly significant.

ii. On the second criterion also the maximum score was given to Treatment 1, indicating that when sparrow frolicks wings in dry sand or dust, rain occurs after 1 day. The difference between treatments in respect of rain after 1 day was highly significant.

iii. Treatment 1 was scored maximum in respect of extent of rain also. The difference between treatments in respect of extent of rain was highly significant.

iv. No significant difference was found between treatments in respect of occurrence of storm only or cloud only.

v. Treatment 1 also scored maximum in respect of reliability of rain. The difference between treatments in respect of reliability of rain was highly significant.

Case study

Results of the case study are summarized in Table 2.

It was generally observed that the male bird first tests the sand with the help of its beak, perhaps for its temperature, and then frolicks its wings on the sand. Then female bird comes there and frolicks. If there is a problem of space, they bath turn-by-turn, otherwise they can take bath in sand together. In the mean time, they call other birds by making sound. Within a few minutes, a group of birds assemble and frolick either turn by turn or together depending upon the space available. While bathing, they also make cluttering sound.

The results indicate that there is relation between frolicking of birds and appearance of clouds. In all the cases clouds were generally seen on the same day, whereas in 24 cases out of 38, rain was also observed. Heavy rain was observed only in eight cases. In most of the cases (16 cases) only little showers were observed.

The validation results obtained by PRA method could not be supported as such by the actual cases observed. However, in all cases clouds appeared on the same day. Rain occurred in 65% cases.

CONCLUSION

The findings of 38 observed cases indicated that in all the cases the clouds did appear. But rain occurred only in 24 cases (63%). It can be concluded that the ITK is good indicator of clouds with possibility of rainfall.



Code : **1691**

Title of the ITK : **Use of tamarind fruits and mahua flowers as weather indicator**

Description of the ITK : When stored tamarind and mahua softens, it indicates incoming of rains shortly. Tamarind and mahua are hygroscopic, due to presence of sugar, which absorbs moisture from the atmosphere in humid conditions. This 20 year old practice is followed by 62% farmers in the Dakari and Ashanpahari villages of Dumka district in Jharkhand.

Name and address of the discloser : Shri Veeresh Kumar, Department of Extension Education, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

Location of use of the ITK : Village Dakri and Ashanpahari, Block Dumka, Dumka (Jharkhand)

Geographical indicators : Tamarind (Tamarindus indica): Amomirate to large tree, up to 24 m in height, 7 m in girth but generally small, cultivated or found naturalized almost through out the plain and sub-Himalayan tracts of India. Flowers are small, yellowish with pink strips. Mahua (Madhuca indica): Large evergreen tree, 10_40 m high, dome-shaped crown and straight, stout bole. It has been found wild and also cultivated in India for at least 2000 years.

Experimenters : Dr A. Wadood, Senior Scientist-cum-Associate Professor and Head, Department of Agricultural Physics and Shri Sanjiv Kumar, Research Associate, Agromet Advisory Service and Dr R.P.Singh `Ratan', Head, Department of Extension Education, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

The study was carried out in village Dakari andAshanpahari,
block Dumka, dist. Dumka (Jharkhand).

PRA and field study

The field study was conducted following the PRA tools and focused group interview involving 50 respondents. The parameters or factors studied were; degree of accuracy in prediction, usefulness of ITK and popularity of the ITK

Laboratory studies

The experiment was conducted in the Department of Agricultural Physics, Birsa Agricultural University, Ranchi. Tamarind fruits and mahua flowers were procured; sun-dried and kept in special designed perforated plastic pots. Gain and loss in weight was monitored daily. The experiment was started on 5 June, 2003, well

before the onset of the monsoon.

RESULTS AND DISCUSSION

PRA and field study

The reported technology (ITK) was found to exist in one of the two villages. In the village Dakri 20 farmers responded that the ITK was existent in this village. Data on PRA are given in Table 1.

Table 1. Matrix scoring for prediction of rains through use of tamarind fruits and *mahua* flowers

N=50

Factors/parameters	Mean Score
Degree of accuracy in prediction	9.25
Usefulness of ITK	7.80
Popularity of ITK	7.50

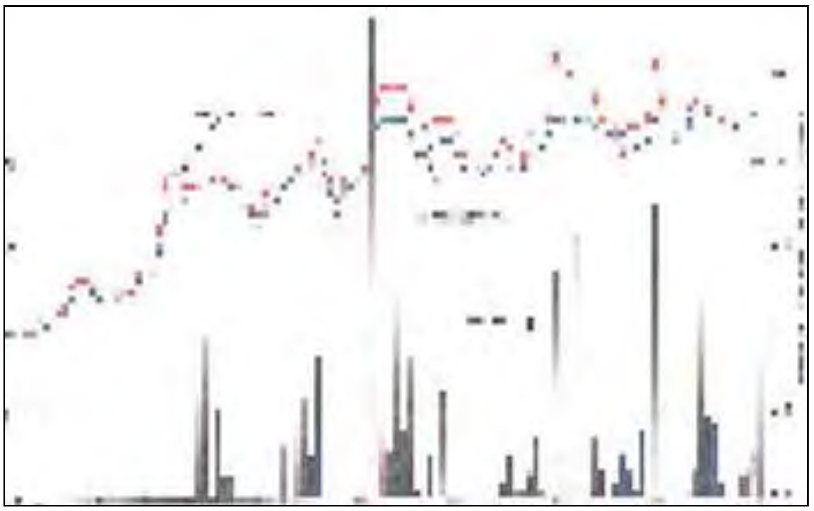


Fig. 1. Relationship between weight gain in tamarind fruits/mahua flowers and rainfall

Table 2. Weight of tamarind fruits or mahua flowers and daily rainfall

Date	Weight (g)		Rainfall (mm)	Date	Weight (g)		Rainfall (mm)
	Tamarind fruit	*Mahua* flower			Tamarind fruit	*Mahua* flower	
1	2	3	4	5	6	7	8
5 June	5	5	0	29 July	5.42	5.48	1.2
6	5.01	5.03	0	30	5.42	5.48	0
7	5.018	5.037	2.8	31	5.43	5.49	9.2
8	5.03	5.04	0	1 Aug	5.46	5.5	0
9	5.04	5.049	0	2	5.45	5.5	24.8
10	5.06	5.08	1.6	3	5.45	5.5	2.2
11	5.1	5.133	1.8	4	5.42	5.47	3.4
12	5.1	5.12	0	5	5.38	5.41	0
13	5.1	5.133	0	6	5.378	5.39	0
14	5.08	5.092	1	7	5.36	5.39	0
15	5.07	5.083	0	8	5.38	5.4	0
16	5.07	5.083	0	9	5.39	5.4	0

(Contd.)

1	2	3	4	5	6	7	8
17	5.079	5.098	0	10	5.4	5.45	3.6
18	5.084	5.095	0	11	5.4	5.45	10
19	5.08	5.092	0	12	5.38	5.4	0.8
20	5.13	5.139	1	13	5.37	5.39	2.2
21	5.132	5.136	2.6	14	5.42	5.46	5.6
22	5.137	5.147	7.2	15	5.43	5.47	14
23	5.21	5.27	8.2	16	5.43	5.47	2
24	5.3	5.38	48	17	5.47	5.49	0
25	5.3	5.38	0	18	5.5	5.67	5.4
26	5.31	5.37	0	19	5.5	5.67	15.4
27	5.312	5.321	0	20	5.49	5.6	3
28	5.33	5.37	23.1	21	5.5	5.6	61.2
29	5.35	5.378	39.2	22	5.5	5.6	0
30	5.35	5.353	0	23	5.5	5.6	13.8
1 July	5.355	5.375	21.4	24	5.47	5.5	6.8
2	5.35	5.358	6	25	5.47	5.49	0
3	5.35	5.37	5.6	26	5.45	5.49	2.8
4	5.32	5.34	0	27	5.47	5.4	10.1
5	5.3	5.34	1.2	28	5.44	5.48	6
6	5.28	5.29	0	29	5.43	5.48	1.2
7	5.25	5.28	0	30	5.44	5.47	16.2
8	5.3	5.34	0	31	5.45	5.49	0
9	5.3	5.34	0	1 Sep	5.5	5.64	69.1
10	5.32	5.36	13.6	2	5.49	5.53	1.6
11	5.36	5.38	0	3	5.49	5.52	5.2
12	5.36	5.38	29.4	4	5.44	5.5	0.8
13	5.38	5.4	24.5	5	5.44	5.5	1.6
14	5.378	5.39	9.5	6	5.52	5.54	6.2
15	5.4	5.46	33.2	7	5.52	5.55	47
16	5.39	5.42	0	8	5.525	5.55	19
17	5.34	5.37	0	9	5.49	5.5	16.6
18	5.28	5.3	0	10	5.49	5.5	3
19	5.34	5.37	0	11	5.47	5.49	0
20	5.34	5.37	0	12	5.48	5.49	0
21	5.35	5.36	0	13	5.47	5.5	4.6
22	5.39	5.4	0	14	5.47	5.5	5.2
23	5.45	5.48	114.2	15	5.49	5.51	10.5
24	5.5	5.58	28.4				
25	5.5	5.58	11.2				
26	5.5	5.575	69.8				
27	5.5	5.579	16.4				
28	5.5	5.579	33.4				

Data on mean scoring with respect to the three factors (Table 1) revealed that the reported ITK was accurate up to 92.5%, being useful up to 78.0% and is popular among 75% farmers of Dakri village, though it was reported to be practised by 62% of the farmers only.

Experiment

The change in weight (gain or loss) recorded daily, during 5 June to 15 September, 2003 and the dates of receipt of rainfall are indicated in Table 2. The data in Table 2 reveal that as and when there were weight gains, it was followed by rainfall. During the dry spells of 3_4 days, both the materials either lost some weight or maintained their weights. The *mahua* flowers were more sensitive than tamarind fruits in gaining or losing weights in response to the increased or decreased wetness of the atmosphere. On the basis of the result obtained form this laboratory experiment, it is inferred that tamarind fruits and *mahua* flowers have hygoscopic properties and can be used as indicators of atmospheric wetness, and on this basis occurrence of rainfall can be predicted in the monsoon season.

CONCLUSION

Results obtained from both the PRA and laboratory experiment are in good agreement with each other. Hence gain in weights of dry tamarind fruits and *mahua* flowers just before the monsoon and within the monsoon season can be taken as indicators of rainfall.

Code :1692

Title of the ITK :Forecasting the onset and cessation of rains (monsoon) **by observing orientation of spider web**

Description of the ITK :In this practice the weather is predicted with the help of spider's web. When the rain is about to begin, the spider makes its webs in opposite direction to which the rain is coming, i.e. spider makes web vertical to the earth and sky; and after rain the direction of web is horizontal to the earth and sky. All the farmers of the Banda Jaipur village of Ranchi district in Jharkhand use this age-old practice.

Name and address of the discloser **:Ms R. Kandulna, Hawai Nagar (Merina X-ray Clinic),** Hatia, Ranchi (Jharkhand) 834 006

Location of use of the ITK :Village Banda Jaipur, Block Raniya, Ranchi (Jharkhand)

Experimenter :Dr A. Wadood, Senior Scientist-cum- Associate Professor and Head, Department of Agricultural Physics, Birsa Agricultural University, Kanke, Ranchi (Jharkhand) 834 006

METHODOLOGY

Location

The study was carried out in village Banda Jaipur, block Raniya, dist. Ranchi (Jharkhand).

PRA and field study

Validation through PRA was conducted in Banda Jaipur village of Ranchi district (Jharkhand) covering 49 practitioners to determine the relevance and use of the ITK. Five factors were considered for eliciting the respondents' opinion on the referred ITK.

Experiment

Case studies were conducted during pre-monsoon and monsoon periods in Banda Jaipur and other adjoining villages of Rania block (Ranchi district) to determine the accuracy of the forecasting or prediction of rains through the reported ITK.

RESULTS AND DISCUSSION

PRA and field study

Data on PRA presented in Table 1 reveal that the referred method of weather forecasting is 70.4% accurate. The respondents also perceived that occurrence of rains is most likely to happen within a week (62.2%), followed by rain occurring within 2 weeks (60%). However, there is least possibility of the occurrence after 2 weeks of forecasting (less than 50%). But its usefulness was found to be about 60%.

Table 1. Matrix scoring for assessment of accuracy and usefulness of forecasting of rains through orientation of spider web

Factor	Mean score
Accuracy of forecasting/prediction	7.04
Duration between forecasting and occurrence (within 1 week)	6.22
Duration between forecasting and occurrence (within 2 weeks)	6.00
Duration between forecasting and occurrence (after 2 weeks)	4.53
Usefulness of the method	5.88

Table 2. Orientation of spider webs before and after onset of monsoon (monsoon breaking on 21 June 2003)

Monsoon status	Date of observation	Spider webs surveyed/studied	Horizontally oriented webs		Vertically oriented webs	
			No.	%	No.	%
Pre-monsoon	9 June 2003	38	35	92.1	37.9	
	11 June 2003	25	15	60.0	10	40.0
	15 June 2003	75	5	6.7	70	93.3
	18 June 2003	52	3	5.8	49	94.2
During monsoon	Monsoon broke on June 21 2003					
	23 June 2003	87	2	2.3	85	97.7
	29 June 2003	19	1	5.3	18	94.7
	5 July 2003	34	5	14.7	29	85.3
	20 August 2003	11	4	36.4	76	3.6
	7 September 2003	47	3	6.4	44	93.6

Experiment

Spider webs in orchards, bamboo fields and huts were surveyed and studied for their orientation before and after the onset of monsoon. Data generated out of this case study are presented in Table 2.

Data presented in Table 2 reveal that percentage of vertically oriented spider webs increased with the passage of time from dry season (pre-monsoon) to the onset of monsoon and remained at higher percentage in the monsoon season. Reverse trend was found in the horizontally oriented webs. Based on this it was inferred that the vertical orientation of the majority of the spider webs can be taken as an indication of monsoon onset.

CONCLUSION

Based on the field/case study the ITK was found valid to be used for the forecasting of onset of the monsoon, as most of the surveyed spider webs (just before the monsoon and within the season) were found vertically oriented. ❑

Low cost Housing Materials

Code	**:**	**579**
Thematic area	**:**	**Low cost housing material**
Title of the ITK	**:**	**Validation of wood and stone houses- a case study**
Description of the ITK	:	The ITK is practiced in Uttarkashi district. In this area the houses are built using wood and stone and are supposed to be earthquake proof. The wooden logs are placed in between the wall (after every one feet of stone wall). Roof also is made of wood. These houses are earthquake proof and provide good insulation against cold climate.
Name and address of the discloser	:	Shri Narasimha Reddy, Nallavelli, Ranga Reddy (Andhra Pradesh)
Discloser of the ITK	:	Shri Gajendra Singh, Village Dharali, District Uttarkashi (Uttaranchal)
Location of use of the ITK	:	Uttarkashi and Chamoli districts in Uttaranchal
Experimenters	:	Dr. R. P. Singh, Assistant Professor (Extension) and Dr. Ambrish Kumar, Assistant Professor (Ag. Engineering), College of Forestry and Hill Agriculture, G. B. Pant University of Agriculture and Technology, Ranichauri, Tehri Garhwal, Uttaranchal

METHODOLOGY

Location

Evaluation of traditional method of constructing houses against resistance to earthquake was made by a case study done in the villages of Uttarkasi and Chamoli districts which experienced devastating earthquake in 1991.

Extent and coverage

Uttaranchal hills are earthquake prone which results in heavy casualties. The people of Uttarkashi have traditionally developed technique for construction of earthquake resistant houses by using locally available materials i.e. wood, stone and mud mortar. This type of houses has been widely constructed. The latest disastrous earthquake was experienced in the year 1991 in the reported area which caused heavy loss to human lives and property. It was seen that mostly those houses got damaged which were not built by traditional method.

Field study

Information were collected by using PRA tools regarding opinion of people, their technical knowledge and economic aspects. Also observations were taken on materials used in traditional houses, their structure and other technical aspects. From ten worst affected villages (five from each district) 120 respondents were interviewed. Data were collected on comfortness, warmth, durability, availability of material, sanity and safety from earthquakes for traditionally and modern built houses.

To measure the perception of people about the various quality parameters of traditional and modern houses, response was taken on 3 point continuum scale whether they strongly agree, agree or disagree and scores were given 2, 1 and 0 respectively.

RESULTS AND DISCUSSION

Results presented in Table 1 show the important

Table 1. Perception of owners for the characteristics features of two types of houses village of Ranga Reddy district of Andhra Pradesh during 2002

Parameter	Traditional Houses (n=60)			Modern Houses (n=60)		
	Total Score	Index Value	Rank Value	Total Score	Index Value	Rank Value
Warmth	72	1.2	II	47	0.78	IV
Comfort	69	1.15	III	86	1.43	II
Sanitation	43	0.72	V	103	1.72	I
Protection from earthquakes	86	1.43	I	28	0.47	V
Durability	54	0.90	IV	79	1.32	III

Distinctive features present in the wood and stone houses have been presented in Table 2. It is evident that the wood and stone houses have the requisite features that make this technology suitable for the region. Figures 1 and 2 show the extent of damage caused in 1991 earthquake in stone and wood houses and modern building, respectively.

Table 2. Distinctive features found in the wood and stone house village of Ranga Reddy district of Andhra Pradesh during 2002

S.No.	Feature	Scientific Rationale
1.	Use of wooden blocks along the wall	Act as a shock absorber
2.	Wooden tie-bands as beams and vertical	To make the load vertical in the wall units timber columns as pins
3.	Long stones with flat surfaces	To minimize the tendency of the wall stones to push or run outwards
4.	Vertical corner reinforcements	To distribute the seismic load
5.	Low height of the roof	To keep the center of gravity low
6.	Minimum number of openings	To provide good insulation
7.	Use of mud and cow dung as plastering material	To provide better insulation



Fig. 1. Wood and stone houses—no damage due to earthquake



Fig. 2. Modern house damaged due to earthquake

Reasons for not building traditional type house by the villagers

1. The traditional houses are not in fashion
2. Modern technique of house building is very quick and cheap
3. poor sanitation and light in traditional houses
4. traditional houses require more time to build
5. Non availability of wood and slate stones
6. Skilled masons for traditional construction are rarely Available
7. There is always a fear of fire.

Perceived reasons for less or no damage to the traditional house due to earthquake.

1. Stone are used through Jod-Tod technique for wall making.
2. Wood structure gives support to the stones.
3. The foundation of the house is better.
4. The hinge joint of wooden frame is strong and has shock absorption capacity.
5. 'Konia' technique is used at the outer side corners of the house.
6. The walls are thick.
7. Thin and flat stones do not displace from the wall.

CONCLUSION

The present study conform the in-built characteristics of wood and stone houses to resist seismic forces.





