CROP DIVERSITY AND TRIBAL EMPOWERMENT

XIII SWADESHI SCIENCE CONGRESS

November 6-8, 2003

Editor- in- Chief

N. Anil Kumar

Editor

K. Madhusudhanan

Organised by:

Swadeshi Science Movement, Kerala *&*
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The Editors

FOREWORD

The Community Agrobiodiversity Centre of M. S. Swaminathan Research Foundation, Kalpetta, had the privilege of hosting the 13th Swadeshi Science Congress in November 2003. The focal theme for the Congress was *Crop Diversity* and *Tribal Empowerment*. The papers presented at this important Conference were edited by Drs. N. Anil Kumar and K. Madhusudhanan and form the basis of the present book.

The following two Acts have profound significance for conservation and sustainable and equitable use of biodiversity and for recognising and rewarding the valuable contributions of tribal women and men in the area of genetic resources conservation and enhancement.

- Protection of Plant Variety and Farmers' Rights Act, 2001
- Biodiversity Act, 2002

The papers presented at the Congress covered a wide range of issues relating to both basic and applied aspects of food sciences. The emphasis was on work which can make a difference in the lives and the livelihoods of tribal families. Several papers were presented in Malayalam. Some of them are included in this book. I hope the book will be widely read by scholars, scientists and policy makers and used to improve the productivity, profitability and sustainablity of the major farming systems of tribal families. We are indebted to Dr. N. Anil Kumar and Dr. K. Madhusudhanan for this labour of love.

M. S. Swaminathan
Chairman
M. S. Swaminathan Research Foundation

25-05-2005
Chennai

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AGRICULTURAL SCIENCES

PERFORMANCE OF TOMATO VARIETIES UNDER POLYHOUSE CONDITION

S. Anbarasan & S. Rajan
Kerala Agricultural University, College of Horticulture,
Vellanikkara, Thrissur- 680 656.

Abstract

Performance of three tomato varieties was studied under polyhouose growing condition during 2000-2001 at the Vegetable Research Farm, College of Horticulture, Vellanikkara, Thrissur. Two bacterial wilt resistant varieties viz., Sakthi and Mukthi, one F1 hybrid COTH-1 were used for the study. The investigation's were carried out in two seasons, viz., January-April 2001 (summer) and June-September 2001 (kharif). The experiments were laid out in Completely Randomised Block Design with seven replication and the plants were grown in pots. The results showed that hybrid COTH-1 exhibited maximum plant height of 120.76 cm during summer and 124.76 cm during kharif season. The corresponding values for the variety Mukthi were 115.25 cm and 117.84 cm during summer and kharif season respectively. The values for the variety Sakthi were 114.89 cm and 115.74 cm during summer and kharif season respectively. The number of branches per plant was more in the hybrid COTH-1, i.e., 16.49 and 15.45 during summer and kharif season respectively. The variety Sakthi (14.35 branches per plant during summer and 14.69 branches per plant during kharif season) and Mukthi (13.60 in summer and 14.42 in kharif season). The variety Mukthi was the earliest to produce 50 per cent flowering with the mean value of 58.02 and 58.94 in summer and kharif season respectively. The corresponding values for the variety Sakthi were 59.00 and 59.10. The hybrid COTH-1 took 59.95 days in summer and 60.15 days in kharif season for this trait. The variety Sakthi envinced the lowest number of 7.23 and 7.08 fruits per plant during summer and kharif seasons respectively. The corresponding values for the variety Mukthi were 7.59 in summer and 7.32 in kharif season. The hybrid COTH-1 showed the highest number viz., 8.73 fruits/plants during summer and 8.86 fruits/plants during kharif seasons. The hybrid COTH-1 recorded the maximum yield of 237.63 g/plant during summer season and 221.19 g/plant during kharif season as compared to other varieties such as Mukthi (159.49 g/plant and 184.51 g/plant during summer and kharif season respectively) and Sakthi (142.73 g/plant in summer and 173.23 g/plant in kharif season).

Introduction

Tomato (*Lycopersicon esculantum* Mill.) is one of the most popular vegetable crop extensively grown as annual plant all over the world. It is a very good source of income to small and marginal farmers and contributes to the nutrition of the consumers. Tomato is a rich source of minerals, vitamins and organic acids. It tops in the list of industrial crops for its outstanding processing qualities and possession of several medicinal values. The crop requires adequate scientific attention for commercial exploitation in India. Hi-tech (greenhouse/polyhouse) production of vegetable is still at infancy in India. In Kerala, the production of tomato is hampered by high temperature during summer and prolonged monsoon rains during kharif season. So an experiment was conducted to assess the performance of different tomato varieties under polyhouse conditon.

Materials and Methods

The experiment was conducted during 2000-2001 at Vegetable Research Farm, Department of Olericulture, College of Horticulture, Vellanikkara, Trichur. The material comprised

of two bacterial wilt resistant varieties of tomatoes Sakthi and Mukthi and one F_1 hybrid COTH-1. The investigation were carried out in two seasons viz., January to April, 2001 (summer) and June to September, 2001 (kharif) under polyhouse condition. The experiment was laid out in Completely Randomised Block Design with seven replications. A medium cost polyhouse existing in the Vegetable Research Farm was used for the study. The plants were raised in pots and were kept in the polyhouse at a spacing of 60 cm x 60 cm. The potting mixture was prepared with sand, soil and FYM in the ratio of 1:1:1. Urea, Superphosphate and Muriate of potash were the source materials used for supplying NPK. These fertilizers were mixed in the ratio of 3.2:1:1, based upon the recommendation of 160:50:50 kg NPK/ha and this mixture was applied @ 25 g per pot. The fertilizer mixture was applied as five split doses at 15 days intervals from the date of transplanting. Five plants per replications were maintained for each treatment.

Results and Discussion

The data recorded on different growth and yield parameters were presented in table 1. The results indicated that the hybrid COTH-1 exhibited maximum plant height of 120.76 cm during summer and 124.76 cm during kharif season. Variety Mukthi gave the plant height of 115.25 cm and 117.84 cm during summer and kharif season respectively. Variety Sakthi showed the lowest plant height of 114.89 cm and 115.74 cm during summer and kharif season respectively.

The number of branches per plant was more in the hybrid COTH-1, i.e., 16.49 and 15.45 during summer and kharif season respectively. The variety Sakthi (14.35 branches per plant during summer and 14.69 branches per plant during kharif season) and Mukthi (13.60 in summer and 14.42 in kharif season). The higher plant height achieved could be due to stimulation of cellular expansion and cell division under shaded condition as reported by Muthuvel (1999).

The variety Mukthi was the earliest to produce 50 per cent flowering with the mean value of 58.02 and 58.94 in summer and kharif season respectively. The corresponding values for the variety Sakthi were 59.00 and 59.10. The hybrid COTH-1 took 59.95 days in summer and 60.15 days in kharif season for this trait.

The variety Sakthi evinced the lowest number of 7.23 and 7.08 fruits per plant during summer and kharif seasons respectively. The corresponding values for the variety Mukthi were 7.59 in summer and 7.32 in kharif season. The hybrid COTH-1 showed the highest number viz., 8.73 fruits/plants during summer and 8.86 fruits/plants during kharif seasons. The hybrid COTH-1 recorded the maximum yield of 237.63 g/plant during summer season and 221.19 g/plant during kharif season as compared to other varieties such as Mukthi (159.49 g/plant and 184.51 g/plant during summer and kharif season respectively) and Sakthi (142.73 g/plant in summer and 173.23 g/plant in kharif season).

Table 1. Performance of tomato varieties under polyhouse condition

Varieties (cm)	Plant height		No. of branches		Days to 50% flowering		Number of fruits per plant		Fruit yield per plant (g)	
	Summer	Kharif	Summer	Kharif	Summer	Kharif	Summer	Kharif	Summer	Kharif
Sakthi	114.89	115.74	14.35	14.69	59.00	59.10	7.23	7.08	142.73	173.23
Mukthi	115.25	117.84	13.60	14.42	58.02	58.94	7.59	7.32	159.49	184.57
COTH-1	120.76	124.64	16.49	15.45	59.95	60.15	8.73	8.86	221.19	237.63
CD (0.05)	0.68	1.24	0.65	0.59	0.77	0.59	0.56	0.95	27.97	17.40

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Higher fruit yield in COTH-1 may be due to the specific ability of this hybrid. This result confirms the findings of Ho (1980) who found that, genotypic difference in respect of number of fruits and fruit yield. The yield differences in the performance of cultivars can be attributed to the inherent variability that exists in tomato genotypes (Arora *et al.*, 1982; Anand *et al*., 1986).

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ORGANIC FARMING IN WAYANAD - A PRELIMINARY ANALYSIS

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Abstract

Organic and sustainable mode of agriculture are becoming widely adopted nowadays. The present study is a preliminary analysis of the scenario of organic farming in Wayanad district of Kerala State. A preliminary survey was conducted for the purpose and 27 farmers who adopted organic farming practices were identified. The extent of land holdings, number of years under organic farming, yield per hectare, the inspiration behind shifting to organic farming, problems faced to convert completely to organic system, cultivation practices and extent of knowledge on organic agriculture were recorded. Soil samples from the farms surveyed were analysed for soil reaction [pH], soil available phosphorous, soil available potassium and organic carbon. The data were analysed so as to find out the feasibility of organic farming in Wayanad. The study indicated that organic farming could be sustainably practiced in the area. However, better management practices are to be adopted so as to optimise crop yield and the income of farmers.

Introduction

The agricultural scenario is slowly shifting towards the sustainable mode. As the new century dawns upon us, we have to understand the shifting paradigms, think in terms of changing science and the needs of the vast majority of our people (Malaisamy, 2002). Wayanad District of Kerala State, a richly cultivated area situated in the Western Ghat region with its high hill ranges where people cultivate coffee, pepper and tea and the valleys in between where they cultivate paddy, banana and arecanut has good agro- ecological diversity. But, if not approached with utmost care, the exhaustion of this agroecological niche is not far away. The farmers thus, far conventionally have adopted intensive agriculture that is chemically supplemented considerably. This practice will lead to the collapse of the agro-ecosystem of the area. However, realising the harmful effects of conventional agricultural practices and the necessity of development of a better and sustainable system, some innovative farmers have shifted to organic farming. The present investigation is a preliminary effort to analyse the shift to sustainable and organic farming techniques that have been initiated in the area.

Materials and Methods

A preliminary survey was carried out in 2000 in the area to locate farmers who have shifted to organic farming. Twenty-seven such farmers who have virtually adopted organic farming could be identified in the survey from different parts of Wayanad. Details of the geographical area, area of land cultivated organically, number of years under organic farming, yield per hectare and the inspiration behind shifting to organic farming, problems faced to convert completely to organic system, cultivation practices and extent of knowledge on organic agriculture were recorded. Soil samples from the farms surveyed were collected twice at an internal of two years and were analysed for soil reaction [pH], soil available phosphorous, soil available potassium and organic carbon. The observation was analysed so as to evaluate the sustainability of organic farming in the area.

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Results and Discussion

Transition: The observations have been presented in Table 1 & 2. The land holdings that were organically cultivated varied from 0.15 hectares to 2.02 hectares, which indicates that marginal, small and medium farmers have shown interest in organic and sustainable systems of agriculture. Nineteen of them shifted around 6 years ago and others less than 4 years ago. Most of the farmers shifted to organic agriculture due to the advice of some voluntary agencies. Many farmers expressed that they observed the death of pepper vines due to continuous application of fertilizers and hence started thinking on organic nutrition and about organic farming. Increased awareness on safe and poison-free food and attending organic farming awareness programmes, lectures etc. are a few more reasons for the conversion. Farmers' observation on the disappearance of earth mounds excavated by soil ants and termites and decreasing diversity of insects in chemically administered farms also helped them to think in terms of alternate systems of farming. Some farmers were motivated by the organic-farm-certification initiated by NGO's thus getting attracted to the higher premium price fetched by organic farm produce in one of the neighbouring districts. In some cases, it was with an intention to maintain the diversity of crops and in some other cases due to the difficulty to undertake intensive agricultural practices every year.

In the course of the survey, a few farmers felt that unguaranteed price for organic produce, lack of access to organic produce market, yield fluctuations, insufficient knowledge on controlling crop pests organically and chances of adulteration from neighbouring farms were other major problems that restricted farmers from organic cultivation. Several others opined that though crops like coffee and pepper can be grown completely on organic way, it is not profitable to grow banana, amorphophalus, ginger etc. without synthetic fertilizers due to the resultant smaller size of fruits, corms and rhizomes. Moreover, a change from the traditional household system of cultivation to intensive farming contributed towards the adoption of non-sustainable farming practices. Majority of the farmers are of the view that voluntary organisations and governmental agencies should take the lead towards the development of organic and sustainable systems of farming in future.

Respondents of this survey are maintaining cow, sheep, poultry, piggery, azolla, vermi-composting units as components of organic agriculture management. Organic farms surveyed represents an integrated farming based on multiple cropping system, by cultivating crops like coffee, pepper, tapioca, amorphophalus, ginger, arecanut, coconut and medicinal plants.

Inputs: Recycling of agricultural wastes by composting either by general composting or vermi-composting, the use of green manure crops, cow dung, poultry manure, chicken waste, bone meal, neem cake, pig manure, fish pond water, azolla pond water, bio-fertilizer application etc., are the different sources in the manurial policy of organic farms in the area of study. The importance of boosting organic farming through farm waste recycling has been stressed by earlier workers (Anandhakrishnaveni and Balamurugan, 2002). Most of the farmers have the opinion that in addition to green manure and cow dung, enriched compost should be used in organic agriculture so as to increase production. About 18 such organic inputs are presently available in the markets in the headquarters of Wayanad District (Table 3). However, the cost of such organic inputs varies from Rs. 1.40 to Rs. 3.00 per kg, which indicates that such inputs should be available at lower cost. At the same time these should be free from any chemicals.

With the available information farmers in the study area are using chrysanthemum flower extract, wild camphor leaf extract, marigold plant extract, fish waste emulsion, ant-attracting technique of ground application of sugar solution, etc. for pest control. A few farmers tried commercial formulations of neem to control pepper root mealy bug, but without

much success. Not withstanding the fact that such failures in managing pest menace, farmers are thinking to adopt chemical methods again for control, in the study area. This suggests the need to train the farmers intensively on on-farm production of fresh plant extracts and other permitted organic pesticides.

Each area represents its own different features in organic movement and it is found that these features will vary depending on the farmers' ability to communicate the knowledge gathered, their educational status and willingness to accept and involve in new projects promoted by Governmental or non-governmental organisations. The survey indicated that one group has developed awareness to the extent of declaring their village as organic, maintaining farm documents and following all standards necessary for certifying the farms. Other groups among the respondents are not yet ready to follow organic methods in the case of some crops due to a decline in productivity. A third group is following the advise of an NGO which initiated organic project in their village.

Soils: Analysis of soil samples indicated a decrease in acidity of soil and an increase in organic carbon content, soil available phosphorous and soil available potassium in majority of the organically converted farms compared to the status of soil two years ago. Similar findings have been reported by Kamala Bai *et* al., 2000 in a case study on organic coffee cultivation at Yellikodige estate of Chikmagalur district in Karnataka. Out of the 27 farm soils tested in Wayanad, 23 farms have recorded decreased acidity. Though sudden increase in pH is not usually expected within a span of 2 years, the reason for such increase may be attributed to application of poultry manure and quick lime.

Out of the 26 farm soil samples tested for organic carbon content, 22 farms recorded increase in organic carbon content and reached medium rating organic carbon content. Integrated farming system and farmers' effort in supplying nutrients in all possible ways of organic source like green manure, cow dung, poultry manure, chicken waste, bone meal, neem cake, pig manure, fish pond water, azolla pond water and bio-fertilizer application has contributed to increase in organic matter status. Organic matter is the source of plant nutrients that are released in assailable forms, during microbial degradation. A major portion of N (95-99% of the total), P (33-67% of the total) and S 75% in soils occurs in organic combination, which mineralise to release the nutrients Alvares, 1996.

Fifteen farms have recorded increase in soil available phosphorous. Addition of any organic material to soil increases the production of carbonic, nitric and sulphuric acid, which favours the availability of phosphates. Practice of liming acid soils will aid in bringing about the solubility of phosphate compounds. Enzymes active in the decomposition of organic matter release various forms of organic molecules containing phosphates; these compounds are more soluble than either the complex organic phosphates or the phosphate minerals Howard, 1940.

Potassium content increase is observed only in 5 farms. Probable reason for decline in potassium content of the other 22 farm soils may be the antagonistic nature of calcium applied with soil potassium. It suggests that farmers need to be trained to include potassium rich plant wastes like wood ash and coconut husk in composting process. Animal excreta contains sufficient quantity of potassium and recycling of plant wastes also fulfils this. As an improvement through this movement, farmers practicing organic farming are withdrawing slowly from the practice of frequent deep digging of soil, realising its ecological consequences.

Yields: Some of the organic farms showed a yield at par with or higher than the national average. However, in some cases yield was not considerably high. A Swiss study reports shown that though organic farming produces lower yields depending upon the crop, it is more efficient in the long run and easier on the environment (Anonymous, 2002).

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Table-1. Observations on Organic Coffee farming in Wayanad District of Kerala

Sl.No.	Area of land cultivated [Hectare]***	No. of years under organic farming	Coffee Yield [clean coffee-kgs per hectare]	Age of coffee plants in years	Cow dung applied per hectare in tonnes**
1	0.80	4	370	4 to 6	11.00
2	0.60	4	85	1 to 2	10.00
3	1.01	5	100	1 to 4	12.00
4	1.31	5	151	2 to 4	9.00
5	0.40	5	75	1 to 4	30.00
6	0.19	4	105	1 to 2	15.00
7	0.12	4	115	1 to 2	4.00
8	0.89	4	335	2 to 8	6.75
9	0.40	4	125	1 to 2	15.00
10	0.22	4	224	2 to 3	13.50
11	0.60	5	50	2 to 4	10.00
12	0.60	5	125	2 to 3	10.00
13	0.24	5	100	2 to 4	12.30
14	0.32	4	925	2 to 5	9.20
15	2.02	6	200	3 to 7	9.00
16	1.01	5	500	4 to 9	6.00
17	1.01	4	300	3 to 10	12.00
18	0.29	4	845	2 to 7	20.00
19	1.01	4	200	4 to 9	8.75
20	0.20	6	300	4 to 12	4.00
21	1.21	7	610	4 to 13	6.00
22	0.16	4	370	10 to 12	3.00
23	1.21	3	400	7 to 12	5.50
24	0.40	5	950	10 to 15	10.00
25	0.15	6	650	15 to 18	6.00
26	0.40	4	350	6 to 7	2.50
27	0.28	3	400	9 to 16	3.50

*The above farms are coffee based with pepper, coconut, ginger, tapioca, amorphophalus, vegetables etc. as intercrops.

** Quantity mentioned is applied to coffee and intercrops

*** Area includes area under intercrops also.

Table-2. Observations on soil analysis of organic farms surveyed in Wayanad District

Sl.No.	pH [Kg/ha]		Available-P [Kg/ha]		Available-K		Organic C [%]	
	2000	2001	2000	2001	2000	2001	2000	2001
1	5.5	5.9	37.05	7.41	427.30	247.00	NA*	NA*
2	5.1	5.8	2.47	9.88	74.10	81.51	1.00	1.10
3	5.7	6.3	19.76	7.41	247.00	61.70	0.98	1.19
4	4.8	6.1	9.88	7.41	271.00	61.70	1.02	1.28
5	4.3	5.4	2.47	7.41	143.20	130.90	1.20	1.66
6	4.8	5.7	2.47	7.41	111.10	98.80	1.10	1.57
7	5.0	5.8	2.47	7.41	81.50	61.70	0.89	1.24
8	5.2	5.3	7.41	27.17	155.60	624.90	1.08	1.44
9	4.9	5.2	2.47	12.45	118.50	217.30	0.85	1.16
10	5.3	4.9	9.88	12.45	271.70	160.50	1.00	1.57
11	5.7	5.0	7.41	7.41	123.50	49.40	1.00	1.42
12	4.0	6.0	7.41	4.94	259.30	123.50	0.87	1.28
13	5.1	5.0	41.99	7.41	205.00	106.20	0.90	1.02
14	4.9	5.8	2.47	7.41	86.40	93.80	1.75	1.75
15	5.0	6.5	2.47	7.41	130.90	91.30	2.00	2.10
16	5.0	5.6	2.47	7.41	74.10	49.40	1.35	1.41
17	4.8	5.3	7.41	14.82	271.70	111.10	1.39	1.39
18	5.1	5.7	14.82	7.41	123.50	143.20	1.70	1.73
19	5.0	5.7	12.35	7.41	234.60	44.40	1.30	1.54
20	5.3	6.4	9.88	9.88	382.80	128.40	1.20	1.30
21	5.0	6.6	22.23	14.82	284.00	123.50	1.30	1.20
22	4.9	6.3	2.47	4.94	123.50	86.40	0.90	0.90
23	4.4	5.8	2.47	4.94	123.50	123.50	1.95	2.10
24	5.5	5.8	2.47	4.94	271.70	103.70	1.10	1.20
25	7.2	5.2	494	7.41	444.60	190.10	0.85	0.90
26	5.4	5.4	2.47	7.41	172.90	116.00	0.92	1.02
27	5.4	6.1	2.47	2.47	321.10	308.70	1.25	1.39

Table-3. List of organic inputs available at Kalpetta, Wayanad District.

Sl. No.	Trade name of the organic manure	Nature of materials used	Packing	Price/Bag
1	VIKAS (GODREJ)	Neem based organic manure	40 kg	Rs. 265
2	BHUJEEVAN (RALLIS)	Organic manure	50 kg	-
3	DORS (STANES)	Organic manure	50 kg	Rs. 300
4	CELLRICH	Organic manure	-	-
5	GEMINI COMPOST	Organic manure	50 kg	Rs. 135
6	BONE MEAL	Organic manure	50 kg	Rs. 400
7	NEEM CAKE	Organic manure	50 kg	Rs. 450
8	STERRAMEAL	Organic manure	50 kg	Rs. 365
9	GOLDEN MEAL	Organic manure	50 kg	Rs. 365
10	VIJAY-BIO-N	Azospirillum	1 kg	Rs. 40
11	VIJAY-BIO-P	Phosphobacteria	1 kg	Rs. 40
12	BIOSPRING	Microbial foliar spray	250 gm	Rs. 35
13	ANTAGON-TH	Trichoderma	10 kg	Rs. 500
14	CASTOR CAKE	Organic manure	1 kg	Rs. 5
15	LEATHER MEAL	Organic manure	1 kg	Rs. 6
16	KARNJA CAKE	Organic manure	1 kg	Rs. 8
17	NEEM POWDER	Organic manure	1 kg	Rs. 9
18	BIOGREEN	Enriched compost	50 kg	Rs. 250
19	NIMBECIDIN	Insecticide	100 ml	Rs. 36
20	NEEMAZAL	Insecticide	100 ml	Rs. 78
21	ACHUK GODREJ	Insecticide	100 ml	Rs. 40

Documentation of yield levels of different crops in the farms surveyed is rather difficult to bring in systematic format due to lack of proper farm record maintenance.

Marketing: Analysis of marketing aspects revealed that farmers who completely converted to organic farming receive enquiries from organic food buyers even without certification. One group of farmers in the study area arrange organic vegetable market weekly and sell good amount of farm produce at premium price. Farmers are encouraged to grow organic coffee by the organic movements in the neighbouring state. It is reported that a container of organically grown robusta cherry bulk and robusta parchment bulk produced in T. Shettigeri village of South Kodagu was shipped to Germany and the shipment realised a decent price premium (Anonymous, 2002).

The present study has indicated that organic farming can sustainably be practiced in the agricultural tracts of Wayanad District of Kerala without sacrificing the yield potential. However, better management strategies that include scientific agricultural practices should be adopted to achieve better targets. With

proper motivation and encouragement of these farmers, premium prices for such produce and sustainable markets, it is hoped to improve the scenario of organic farming.

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COMPARATIVE ANALYSIS OF JUVENILE CHARACTERS IN *VANILLA TAHITENSIS* AND *VANILLA PLANIFOLIA*

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Abstract

Vanilla planifolia is the commercial vanilla crop that has now gathered considerable attention of farmers and agricultural scientists. The diversity of the crop has not been assessed and analyzed completely. Other species like *Vanilla pompona* and *Vanilla tahitensis* are also commercially important to some extent and cultivated in some parts of the world. The present study is an effort to compare the juvenile characters of *Vanilla tahitensis* with that of *Vanilla planifolia* so as to understand the variation in morphometric characters at juvenile stage. Internodal length, vine length, leaf length, leaf width, leaf thickness, vine girth, number of nodes per metre, length of velamen roots and thickness of velamen roots of one year old plants have been studied for this purpose. The study has indicated significant difference between the species in the case of characters like vine girth, number of nodes per metre, length of velamen roots and thickness of velamen roots. However, characters like internodal length, vine length, leaf length, leaf width and leaf thickness showed no significant difference in the case of these two species at juvenile stage.

Introduction

The genus Vanilla comprises of about one hundred and ten species and belongs to the family Orchidaceae. Among these, three species are cultivated for its flavour producing beans. Vanilla is known as the 'prince of spices'. The other species are important in breeding programmes for transferring the allied genes responsible for desirable traits. The cultivated species of Vanilla are: *V. planifolia*, *V. tahitensis* and *V. pompona* of which *V. planifolia* is the most important (Anonymous, 2003).

V. planifolia is native to the humid tropical rain forests of South Eastern Mexico, Central America, the West Indies and northern part of South America. It is the major source of natural vanillin. *V. tahitensis* is the source of Tahitian vanilla and is indigenous to Tahiti, the French Oceania group of islands in the Pacific Ocean. It differs from *V. planifolia* morphologically by its narrow leaves, slender stem, reddish brown beans etc. (Correll, 1944). According to Correll (1953), attempts to introduce vanilla cultivation in India dates back to 1835.

Crop improvement programmes in vanilla have not received adequate attention so far, may be due to its exotic nature, lack of self pollination and vegetative mode of propagation. There is enormous scope for improvement of the crop in view of the wide acceptability of natural vanillin and remunerative returns. The present study is an attempt to compare the juvenile growth characters of *Vanilla tahitensis* with that of *Vanilla planifolia*.

Materials and Methods

The present study has been carried out during 2002-03 in the experimental nursery of the Genetics and Plant Breeding Division of the Department of Botany of Calicut University. One year old potted plants grown under artificial shade (60%) were observed for ten growth characters namely internodal length,

vine length, leaf length, leaf width, leaf area, leaf thickness, vine girth, number of nodes per metre, length of velamen roots and thickness of velamen roots. The trial was laid out in Completely Randomized Design with three replications per treatment. The data were statistically analyzed using appropriate methods.

Results and Discussion

Data on the ten juvenile growth characters studied in the case of *V. tahitensis* and *V. planifolia* have been presented in table1. Internodal length, leaf area, leaf width, leaf thickness, vine girth, length of velamen roots and thickness of velamen roots were lower in the case of *V. tahitensis* whereas vine length, leaf length and number of nodes per metre were higher in *V. tahitensis*. The variations were statistically significant in the case of leaf area, vine girth, number of nodes per metre, length of velamen roots and thickness of velamen roots.

The present observations indicate that in the case of most of the juvenile characters, *V. tahitensis* is inferior to *V. planifolia*. However, vine girth of *V. tahitensis* is at par with that of *V. planifolia*. Eventhough economically less important, *V. tahitensis* has got potential both as a material for cultivation and as a genetic stock for further breeding programmes.

Table-1. Juvenile growth characters of Vanilla tahitensis and Vanilla planifolia

Sl.No.	Charactor studied	*V. tahitensis*				*V. planifolia*			
		R_1	R_2	R_3	Mean	R_1	R_2	R_3	Mean
1.	Internodal length (cm)	8.50	8.43	9.70	8.88	9.50	10.60	9.47	9.86
2.	Vine length (cm)	4.50	3.75	4.00	4.08	3.80	4.00	4.30	4.03
3.	Leaf length (cm)	10.46	16.70	13.30	13.48	12.20	13.76	14.07	13.34
4.	Leaf width (cm)	1.97	3.03	2.97	2.65	3.23	4.53	4.43	4.06
5.	Leaf area (cm2)	18.12	24.68	31.28	24.69	46.30	44.06	45.01	45.12*
6.	Leaf thickness (mm)	1.20	1.48	1.30	1.35	1.35	1.70	1.70	1.58
7.	Vine girth (mm)	6.39	6.53	6.67	6.53	7.93	8.93	8.70	8.52*
8.	Number of nods per metre	12.00	13.00	12.00	12.33	9.00	11.00	9.00	9.67*
9.	Length of velamen roots	24.60	15.70	7.50	15.93	84.60	86.00	132.27	100.96
10.	Thickness of velamen roots (cm)	1.53	1.60	1.43	1.57	1.97	2.17	2.17	2.10*

* significant at 5% level.

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PRODUCT DIVERSIFICATION: MEANS TO UPGRADE TUBER CROPS FROM FOOD TO COMMERCIAL CROPS

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Abstract

Tuber crops are the richest source of carbohydrate and are grown on a wide range of soil, climate and environment of the tropics and sub tropics. The tubers are highly perishable and cannot be stored for considerable period after harvest. In order to avoid heavy post harvest losses, it is therefore necessary to process them immediately. Hence *in- situ* production of starch and value addition near the farm site is recommended for the promotion of cottage and small scale industries besides ensuring food security. Value addition can be done in three phases *viz.,* home, farm and industrial front. Home front technologies include instant and convenient food products like chips, cassava rava, porridge, batata shake; intermediary food products like jam, sauces, squash; sour products like pickles; low cost bio-technique (fermentation using mixed culture inoculum) to extract starchy flour from cassava. Farm front technologies include: ensiling technology for animal feed; protein enrichment of cassava products; cassava chipping machines (hand, pedal and electrically operated); drier for cassava chips; harvesting tools; storage technologies; multi-purpose mobile starch separation plant. Industrial technologies include: adhesives from cassava starch; cold water miscible starches; maltose and malto-dextrins from cassava starch/flour; ethanol from cassava starch and flour and solid residues; citric acid from starch factory residues; starch incorporated biodegradable plastics; biocolours from tuber crops and modified starches. Tuber crops though branded as poor mans crop have considerable unrealised potential for processing into high priced products. Product diversification is the only choice for transforming them from the status of subsistence crops to a commercial commodity. Some of the potential technologies and products are described in this paper.

Introduction

Root and tuber crops are the most important food crops in tropical countries serving more than 500 million people. They can be grown on a wide range of soil, climate and environment and have the capacity to withstand adverse biotic and abiotic stresses. The major tuber crops grown in our country are: cassava (*Manihot esculenta* Crantz), sweet potato *(Ipomoea batatas* L.), yams (*Dioscorea sp.*), aroids (*Amorphophallus sp., Alocasia sp., Xanthosoma sp., Colocasia sp.*), canna edulis, arrowroot, chinese potato, winged bean and yam bean. In addition to this, there are number of under exploited and under utilized tuber crops grown as wild cultivars having medicinal and pharmaceutical applications.

Cassava and sweet potato are the most important among the tuber crops and they find extensive use in food, feed and industrial sector. Other tubers are has changed the consumption pattern of the people in the country. During the past decade, there exists a stagnation in the area and production of tuber crops in Kerala. The low income generated from tuber crops as compared to other horticultural and plantation crops has placed tuber crops in the category of "Orphan Crops" (Balagopalan, 2000). In order to maintain the rhythm in the supply of food materials and to keep pace with the geometrically increasing population, secondary or tertiary staple food crops like tuber crops have to be retained within the cropping system of marginal farmers. Better post harvest management and

diversification for the production of value added products are some of the methods to sustain tuber crops within the cropping system.

The production statistics of the major tuber crops viz., cassava and sweet potato is given in table- 1. It is clear from the table that the highest productivity is recorded in India in the world and among the Indian States, Tamil Nadu ranks first in productivity of cassava (36.62t/ha).

cottage and small scale industries besides ensuring food security by incorporating starch to certain extent in various food preparations.

Product Diversification in Tuber Crops

The amount of starch present in various tuber crops and its properties are depicted in Table-2 (Moorthy, 2002). The starch granules are usually locked up in cells together with other constituents and have to be separated from all

Table- 1. Production scenario of cassava and sweet potato

	Cassava			Sweet potato		
Status	Production (mt)	Area (mha)	Productivity (t/ha)	Production (mt)	Area (mha)	Productivity (t/ha)
Global	183.29	17.16	10.68	135.6	9.16	14.8
India	6.77	0.253	26.76	1.01	0.114	8.85
Kerala	2.59	0.114	22.72	9000t	800ha	11.25

Table- 2. Properties of tuber crop starches

Tubers	Starch (%)	Viscosity	Clarity	Stability
Cassava	25-35	High	High	Medium
Sweet potato	20-25	Medium-high	High	Medium
Yams	15-33	Medium-high	High	High
Aroids	10-20	Low-medium	Low	High
Canna	15-25	High	High	High
Arrowroot	16-28	Medium-high	Medium	Medium

Tuber crops, cassava in particular, being perishable deteriorate rapidly after harvest and are often unfit for food or feed with in a few days. About 20-30% of the total production is lost annually due to varied reasons both during harvest and post harvest phases (Calverley, 1998). Losses appear at all stages on the field to the consumer table. These losses may be due to external agents (insects and predators), physical factors (handling, transportation and storage condition) or physiological origin. In order to overcome this problem, *in situ* production of starch and value addition near the farm site is recommended. The produce will also ensure promotion of other constituents to get the pure form of starch. Processing of tubers by wet milling is chiefly employed for the extraction of starch in all types of cassava industries irrespective of their production capacity. Since starch is the major biochemical principle present in the tubers, the tuber crops are good source of starch and conversion to starch and starch based products can be considered as a major step in value addition to the crops. Starch finds a wide array of applications ranging from food, feed and industry. Starch in its native and modified form is extensively used in view of its thickening property, adhesive nature and above all as a source of energy.

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Home front technologies

The simplest and most popular mode of consumption of cassava tubers is in the form of mashed tubers, prepared by boiling the tuber slices and is consumed with suitable dishes. Various traditional foods like chapathis, uppuma, puttu, idli, dosa, cutlet, bonda, custard powder, flakes, vermicelli can be made from flours. Sweet potato can be canned, frozen and dehydrated and also can be used for making purees, candies etc. Various intermediary products can be made by incorporating 50-75% of sweet potato in jams, sauces, squashes etc. Good quality pickles can be made from raw or boiled tubers of sweet potato, colocasia and amorphophallus. A simple economic process for the production of cassava based rava as a substitute for wheat semolina is developed by the controlled boiling of tubers (Padmaja and Premkumar, 2003). Sago wafers made by packing the sago in round aluminium trays, steaming and drying is an important product made in cottage scale in Tamil Nadu. Wafers of different shapes and sizes can also be made from the starch itself, which can be used after frying. A microbial technique to extract starchy flour from tubers using a mixed culture inoculum gives flours with modified functional attributes. This process yields about 20-34 kg sour flour or 17-23 kg sweet flour from 100 kg fresh tubers (Fig.1)

Farm front technologies

The poor shelf life and bulkiness of cassava tubers pose a great problem in transporting these crops from the farm to market or factory site. The simplest and most common mode of processing cassava is conversion of tubers into sun dried chips, which can be used for edible purposes, preparation of flour and in animal feed formulation. To reduce the drudgery and produce chips of uniform shape and thickness, chipping machines operated manually or by electric motor is developed. The simple hand operated cassava uprooting tools developed based on the principle of lever mechanism reduce the effort for lifting of tubers to about one fourth (Nanda *et al.*, 2002).

For the *in situ* production of starch, a multi purpose mobile starch separation plant is developed which can be transported to the village (Sajeev and Balagopalan, 2001). Ensiling of cassava for preserving the nutritive value of cassava, enhancing shelf life and increasing palatability through lactic acid enrichment is used for making good quality feed for milch animals (Fig. 2).

Industrial technologies

Sago is an important food product derived from starch and has wide use in different parts of the country and also has become an important cottage industrial product. Some products like instant puddings and custard powders based on pregelatinised starch are very commonly found items in the market. Cassava starch is used by the textile industry for sizing, finishing and printing operations in view of its high viscosity. However, the stability of the viscosity is poor and hence there is non uniformity in size. Here the aroid starches can be used since they have stable viscosity. Modified starches or a blend of cassava and aroid starches will be quite suitable. In the adhesive industries, starch and its derivative dextrin are widely used. Cassava starch in its native state is preferred in view of its bland taste, high tack and easy availability. Starch can be converted to dextrin which finds extensive use in adhesive industry for simple pastes to special gums for paper, cardboard, ceramics etc. It also finds use in foundries. Though cassava starch dextrin is considered the most suitable among the different starches other tuber starches can also be used for the purpose. Starch can be converted to glucose syrup by treatment with enzymes or acid which is widely used in confectionaries, production of dextrose, pharmaceutical preparations, etc. Glucose syrup can be partially converted to high fructose syrup which is three times sweeter than glucose and can be used in colas, jellies, squash etc. Glucose syrup can also be used for preparation of sorbitol, ascorbic acid, lactic acid, citric acid, MSG etc. Maltodextrin and maltose syrups prepared by partial breakdown

of starch by action of μ and b amylases are other important starch derived products having high demand. There are other products like erythritol, maltitol etc, which are very useful in diets of diabetics and also as noncarcinogenic sweetener. Starch also finds use in a number of other applications like drilling muds, as filler in toilet formulations, horticultural mulches, in explosives etc. In view of the global threat posed by the non biodegradable plastics, starch based biodegradable plastic has tremendous relevance. Starch can be grafted to a polymer network and this imparts partial biodegradability to the plastic films (Fig.3).

SAGO SERVE - A Tamil Nadu Experience

Phenomenal growth of cassava in the much harsher, semi arid environment of Tamil Nadu is mainly due to its utilisation in the starch-based industries and organised market support.

Fig.1. Home front technologies

Fig.2. Farm front technologies

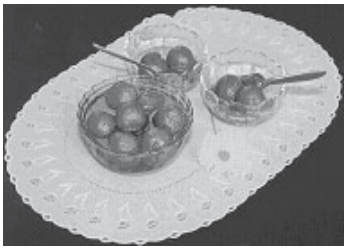

Fig.3. Industrial technologies

There are about 1000 small to medium scale starch/sago industries in Tamil Nadu state especially in Salem, Dharmapuri, South Arcot and Trichy areas. An organised market facility for cassava based finished product is established by forming a marketing organisation - **SAGO SERVE** (Salem) which eliminates the involvement of middleman and help to get remunerative price to the processors/farmers by following daily secret-tender system.

Conclusions

Tuber crops though branded as poor mans crop in rural areas have considerable unrealised potential for processing into high priced products for human, animals and industrial uses. Agro-industrial transformation of these crops by linking improved production and processing technologies, marketing techniques and institutional innovations in processing ensure food security, rural employment and adequate remuneration to growers. Better post harvest management and diversification for the production of value added products for home, farm and industrial front are the only choice to change the declining trend of production of tuber crops, transforming from the status of subsistence crops to a commercial commodity

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PARTICIPATORY EVALUATION OF THE PERFORMANCE OF XANTHOSOMA AS INTERCROP IN BANANA AMONG THE FARMERS OF CHENKAL VILLAGE

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Abstract

Banana is an important cash crop in South India. Problems were identified and action plans were drawn to overcome the low productivity of banana production system. Raising suitable intercrop in the interspaces of banana was identified as one of the ways to augment the net income from unit area in unit time. Evaluation of the performance of *Xanthosoma* as intercrop in banana was assessed in Chenkal village of Thiruvnanathapuram district under Technology Assessment and Refinement through Institution Village Linkage Programme (TAR-IVLP). The compatibility and profitability of *Xanthosoma* as intercrop in banana was evaluated through farmers participation. The study showed that *Xanthosoma* grown as intercrop in banana gave Rs. 25000 additional net returns. Farmer's reaction showed that *Xanthosoma* had good marketability and high market price. *Xanthosoma* comes up well under the partial shade of banana and gives good yield without affecting the performance of banana.

Introduction

Banana (Musa AAB) is one of the important commercial crops raised under low land production system in South India. In Kerala during the year 1999-2000, banana was cultivated in 27,000 ha. The production was 393.7 MT and the productivity was 14.1 MT/ha. Banana is raised on a large scale mainly in lowlands under canal irrigated conditions. The fully ripe fruits of banana are consumed directly and the matured raw fruits are used for preparing banana chips.

Low net returns (Rs. 75000 / ha) from banana based production system due to non-adoption of suitable intercrops had been identified as one of the problems of such production system. The crop is having duration of ten months and is susceptible to bunchy top diseases and wind damages. In order to have an insurance against total crop loss, to use the interspaces of banana profitably, suitable intercrops need to be identified and assessed for generating additional net returns. Banana is mainly grown as a sole crop and is amenable for taking up intercropping especially during the early phases of crop growth. Some farmers practice intercropping with tuber crops in Nendran banana. Such cropping system is advantageous in generating higher net income from unit area per unit time. Cultivation of *Xanthosoma* (*Xanthosoma sagittifolium* or tannia) as intercrop in banana had been identified as a potential solution in this regard.

Xanthosoma is a herbaceous perennial plant of aroid in the family Araceae. The crop is highly valued for its flask shaped large corms and is well suited for the partial shade conditions of both upland and lowlands of Kerala (Pushpakumari *et al.,* 1999). Though it proves as a remunerative crop in the homesteads and the tuber fetches very high

price in the market there is vast scope to boost the yield of the crop by intercropping in the banana fields. Hence, a detailed study was carried out as verification trial to assess the performance of *Xanthosoma* as an intercrop in banana during the kharif season.

Farmer's participation is crucial for agriculture and rural development and verification trial of technologies with their participation can lead to identify technologies compatible with farmers needs, and sustainable increase in food production. The time lag between evolving a new technology and its final reach in actual farm level is reduced through participatory evaluation. It will speed up the transfer of technology since the farmers conduct the trials in the real farming situations themselves in their own farms. By this we can save major quantum of time, human use, economic and infrastructure resources etc. There will be direct involvement of farmers in all the stages of the experiment right from the identification of the field problem, formulation of technical programme, conduct of field experiments, taking observations, evaluation through out the course of the study, arriving at conclusions of the result etc. So there is complete perfection, reliability and farmers approval. (Devadas, 2001).

Materials and Methods

The study was conducted in Chenkal village of Thiruvananthapuram district as a part of Institution Village Linkage Programme (IVLP) implemented by Central Tuber Crops Research Institute (CTCRI), Trivandrum. The Technology Assessment and Refinement thorough Institution Village Linkage Programme (TARIVLP) is an innovative project initiated by the Indian Council of Agricultural Research (ICAR). It emphasizes the technology refinement through the farmers' participation to be facilitated by the multidisciplinary team of scientists (Anantharaman *et al., 2001*).

The climate of the village is humid tropical with fairly distributed rainfall of 1500 mm during May to November, which accounts for 75% of total precipitation. January - April is the rain deficient summer months and only about 500 mm of rainfall is received during this period. Clay loam soil of the site was acidic in reaction with a pH of 4.6-5.4. The fertility status of the soil is available N: 200-230 Kg/ha; available P: 20-30 Kg/ha; available K: 125-150 Kg/ha. Organic carbon: 0.62-0.85%. Banana is an important crop of low land. The productivity of banana is low mainly due to the lack of cultivation of improved varieties and lack of proper utilization of interspaces of banana. The problem diagnosis was done using information elicited through various PRA techniques. On farm testing and verification trial with farmers' participation enable the farmers to make an active contribution as decision-makers in planning and executing an agricultural technology (CTCRI, 2000)

Xanthosoma planting materials were procured from CTCRI, Trivandrum and given it to thirty farmers. Each farmer was allowed to conduct the experiment in 400 sq. m. of banana plot (var. Nendran) where 200 sq. m. of the banana plot was intercropped with *Xanthosoma* and the remaining 200 sq. m. was treated as banana plot with no intercrops since majority of the banana farmers are keeping the interspaces of banana unutilized. The experiment was evaluated through farmer's participation by collecting data on the important morphological characters of banana such as plant population, bunch yield, number of hands per bunch, number of fingers per hand, length of finger, girth of finger etc. and that of *Xanthosoma* such as weight of the planting materials used, plant population and tuber yield.

Results and Discussion

When *Xanthosoma* was cultivated as intercrop in banana the tuber yield of *Xanthosoma* was observed to be 1.9 kg per plant. As intercrop in banana the plant population of *Xanthosoma* was about 1000 plants per hectare (Table-1). This indicates that the total yield from the crop combination is high due to compatibility of the *Xanthosoma* as intercrop in banana gardens.

It was observed that by cultivating *Xanthosoma* as intercrop in banana, farmers could gain an additional net return of Rs. 25,000 per ha. When banana alone was cultivated the benefit cost ratio was 1.69:1 only whereas, when banana was intercropped with *Xanthosoma* the benefit cost ratio was increased to 1.9:1 (table-3). This shows that *Xanthosoma* is a highly successful intercrop in banana and it gave about 34% increase in net return from the farming system when compared to banana as sole crop. Nayar *et al.,* (1992) observed that *Xanthosoma* intercropped in banana registered about 10 per cent increase in yield in the first year but a decrease in yield in the second and third year due to some unknown diseases. Karikari (1971) also observed an increase in the yield of *Xanthosoma* under the partial shade of banana. Karikari (1983) also stated that yield of root crops are not substantially reduced by the shade of plantains.

Growth and Yield of Banana

The bunch yield of banana was found to be 7.7 kg/ ha. The growth attributes of banana viz., number of hands per bunch, number of fingers per plant, length and girth of the fingers are not significantly affected. The yield components of banana were also not significantly changed (table-1). This indicates that the productivity of Nendran banana is not adversely affected by intercropping with *Xanthosoma*. This results are in agreement with the findings of Devos and Wilson (1978) and Nayar *et al.,* (1992).

Farmer's reactions on attributes

Farmers were asked to compare the different crop combinations between banana and *Xanthosoma* and with other intercrops. When *Xanthosoma* was cultivated the farmers were highly satisfied about this crop combination as it is more profitable and compatible with the existing farming system. The soil fertility of the field was increased since the crop has shown better resource use efficiency and the produce has got better marketability as well. Farmers were able to get stable market price for their produce (Rs. 15-20 kg/ha). In case of crop failure of banana due to heavy wind, yield from *Xanthosoma* reduces the risk of farmers.

Table-1. The growth and yield parameters of tannia *(Xanthosoma)* as intercrop inbanana

Attributes	Quantity
Weight of the planting materials used	200 gms / plant
Plant population used	1000 / ha
Tuber yield	1.9 kg / plant

Table-2. The growth and yield attributes of banana.

Attributes	Banana as sole crop	Banana with xanthosoma as inter crop
Plant population	2500 / ha	2500 / ha
Banana yield	7.7 kg / plant	7.7 kg / plant
No. of hands /bunch	5	5
No. of fingers /hand	8	8
Length of finger	21.8 cm	21.8 cm
Girth of finger	14 cm	14 cm

Table-3. Returns and ratio when xanthosoma intercropped in banana

Treatments	*Cost of cultivation (Rs./ha)*	*Gross returns (Rs./ha)*	*Net returns (Rs./ha)*	*Benefit cost ratio*
Banana	1,05,000	1,78,250	73,250	1.69:1
Xanthosoma	3000	28,500	25,000	9.5:1
Banana + *Xanthosoma*	1,08,000	2,06,750	98,750	1.9:10

Conclusion

The performance of *Xanthosoma* as intercrop in banana (Var. Nendran) was done through participatory evaluation by the farmers of Chenkal village of Neyyattinkara Taluk in Thiruvananthapuram district under Technology Assessment and Refinement through Institution Village Linkage Programme (TAR-IVLP). Xanthosoma intercropping in banana was compared with banana as sole crop. Farmers preferred *Xanthosoma* intercropping mainly because they are getting better additional net returns and it serves as an insurance against unexpected crop loss due to pest and diseases and wind damages. In addition, the fertility status of the soil has also increased through this practice.

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കാപ്പിയിലെ മുഞ്ഞ നിയന്ത്രണത്തിൽ ലെപ്റ്റോമാസ്റ്റിക്സ് ഡാക്ടൈലോപ്പി എന്ന പരാദത്തിന്റെ പങ്ക്

പി.എ. റഹ്മാൻ, സി.കെ. വിജയലക്ഷ്മി, കെ. ശ്രീധരൻ & എം. സെൽവകുമാർ
പ്രാദേശിക കാപ്പി ഗവേഷണ കേന്ദ്രം, ചുണ്ടേൽ, വയനാട്, കേരളം

സംഗ്രഹം

റോബസ്റ്റാ കാപ്പിയെ ഗുരുതരമായി ബാധിക്കുന്ന കീടമാണ് വെള്ളമുഞ്ഞ (*Homoptera: Psudococcidae*). **പ്ലാനോ കോക്കസ്സ്** സിട്രി എന്ന മുഞ്ഞയാണ് വയനാട്ടിൽ വ്യാപകമായി കാണുന്നത്. കാപ്പിയുടെ ഇളം തണ്ടുകൾ, പൂക്കുലകൾ, കായ്കുലകൾ, വേരുകൾ എന്നീ ഭാഗങ്ങളിൽ നിന്ന് നീരൂറ്റി കുടിച്ച് ഇവ കാപ്പിക്ക് കാര്യമായ നാശം വരുത്തിവെയ്ക്കുന്നു. ഈ കീടത്തെ നശിപ്പിക്കാൻ വെസ്റ്റിന്റീസിലെ ട്രിനിഡാഡിൽ നിന്ന് 1983ൽ **ലെപ്റ്റോമാസ്റ്റിക്സ് ഡാക്ടൈലോപി** എന്ന ഒരു പരാദത്തെ കോഫി ബോർഡിന്റെ ഗവേഷണ വിഭാഗം ഇറക്കുമതി ചെയ്ത് ചുണ്ടയിലെ കാപ്പി ഗവേഷണകേന്ദ്രത്തിൽ നിന്ന് ഏകദേശം 25ലക്ഷത്തോളം പരാദങ്ങളെ ഉൽപാദിപ്പിച്ച് വയനാട്ടിലെ 1100 ഓളം തോട്ടത്തിൽ വിട്ടിട്ടുണ്ട്. ഈ പരാദത്തിന്റെ കാര്യക്ഷമത അറിയുന്നതിനുവേണ്ടി 29 ഓളം തോട്ടങ്ങളിൽ സന്ദർശിച്ച് പഠനങ്ങൾ നടത്തിയിട്ടുണ്ട്. ഈ പരാദത്തെ ഉൽപാദിപ്പിക്കുന്നവിധം, കീടത്തെ നിയന്ത്രിയ്ക്കുന്ന രീതി, വയനാട്ടിലെ കാപ്പിത്തോട്ടങ്ങളിൽ ഇതിന്റെ കാര്യക്ഷമത ഇത്യാദിവിഷയങ്ങളാണ് ഈ പ്രബന്ധത്തിൽ വിവരിക്കുന്നത്.

ആമുഖം

റോബസ്റ്റാ കാപ്പിയെ ഗുരുതരമായി ബാധിക്കുന്ന കീടമാണ് വെള്ള മുഞ്ഞ. പ്ലാനോ കോക്കസ്സ്സിട്രി, പ്ലാനോകോക്കസ്സ്ലൈലാസിനസ് എന്നീ രണ്ടുതരം മുഞ്ഞകളാണ് സാധാരണയായി കാപ്പിയിൽ കാണുന്നത്. ഇവയിൽ പ്ലാനോ കോക്കസ്സ് സിട്രി വ്യാപകമായി വയനാട്ടിൽ കണ്ടുവരുന്നു.

കാപ്പിചെടിയുടെ ഇളം തണ്ടുകൾ, പൂക്കുലകൾ എന്നീ ഭാഗങ്ങളിൽ നിന്ന് നീരൂറ്റികുടിക്കുന്നത് കൊണ്ട് പൂക്കുലകൾ കരിഞ്ഞ് പോകുവാനും ഇളം കായ്കൾ കൊഴിഞ്ഞുപോകുവാനും ഇടയാകുന്നു. ഈ കീടങ്ങളെ നിയന്ത്രിക്കുവാൻ പര്യാപ്തമായ കീടനാശിനികൾ ഇന്ന് ലഭ്യമാണ്. എന്നാൽ ഇവയുടെ ഉപയോഗം മൂലം മനുഷ്യനും മുഞ്ഞയെ നശിപ്പിക്കുന്ന എതിർപ്രാണികൾ ഉൾപ്പെടെ പ്രകൃതിയിലെ മറ്റുജീവജാലങ്ങൾക്കും ഉണ്ടായേക്കാവുന്ന ദൂഷ്യഫലങ്ങളും അതുപോലെ തന്നെ മരുന്നുകൾ തളിക്കാനുള്ള ഭാരിച്ച ചിലവും ഒഴിവാക്കുന്നതിന് വേണ്ടി കാപ്പി ഗവേഷണ വിഭാഗം ലെപ്റ്റോമാസ്റ്റിക്സ് ഡാക്ടൈലോപി എന്ന പരാദത്തെ 1983-ൽ ട്രിനിഡാഡിൽനിന്ന് ഇന്ത്യയിലേക്ക് ഇറക്കുമതിചെയ്ത് ഉപയോഗിച്ച് വരുന്നു

ഈ പരാദം പി.സിട്രി എന്നറിയപ്പെടുന്ന മുഞ്ഞയെ മാത്രം ആക്രമിക്കുന്നു. ഒരു പരാദത്തിന് ഏകദേശം മുന്നൂറോളം മുട്ടയിടാൻ കഴിയും. ഓരോ മുഞ്ഞയിലും ഓരോ മുട്ടവീതം എന്നതോതിൽ ഒരു ദിവസം 18 മുട്ടകൾ ഇടുന്നു. ഇവ ഓവിപോസിറ്റർ ഉപയോഗിച്ച് ഒരു ദ്വാരമുണ്ടാക്കി മുഞ്ഞയിൽ നിക്ഷേപിക്കുന്നു. മുട്ടയിൽ നിന്ന് വിരിഞ്ഞുവരുന്ന പുഴു മുഞ്ഞയുടെ ആന്തരായവങ്ങൾ ഭക്ഷിക്കുന്നു. പുഴുവിന്റേയും സമാധിയുടേയും കാലദൈർഘ്യം എട്ട് ദിവസം വീതം ആകുന്നു. ജീവിത ചക്രം പൂർത്തിയാക്കാൻ പതിനാലു മുതൽ പതിനെട്ടുദിവസം വരെ എടുക്കുന്നു.

പരാദത്തെ ഉൽപാദിപ്പിക്കാനുള്ള മാർഗ്ഗം:

1. മൂത്തു പഴുത്ത മത്തങ്ങ വെള്ളത്തിൽ നന്നായി കഴുകി വൃത്തിയാക്കുക
2. ബാവിസ്റ്റിൻ എന്ന കുമിൾ നാശിനി ഒരു ഗ്രാം ഒരു ലിറ്റർ വെള്ളത്തിൽ എന്ന അനുപാതത്തിൽ ലയിപ്പിച്ച് മത്തങ്ങ അതിൽ കഴുകി എടുക്കുക.
3. മത്തങ്ങ നനവു മാറിയതിനുശേഷം ഒരു ഘന അടി അളവിലുള്ള മരക്കൂടുകളിൽ വെക്കുക. കൂടുകളുടെ ചട്ടക്കൂടും അടിവശവും നല്ലമരം കൊണ്ടുള്ളതും മുൻവശം തുറക്കാവുന്ന വിധത്തിൽ ഗ്ലാസ്സ് പിടിപ്പിച്ച വാതിലുള്ളതും, മറ്റുവശങ്ങൾ വായു സഞ്ചാരം അനുവധിക്കുന്ന മസ്ലിൻ തുണി ഘടിപ്പിച്ചതുമായിരിക്കണം.
4. മത്തങ്ങയുടെ മേൽ മുഞ്ഞയുടെ മുട്ടകൂടുകളും കുഞ്ഞുങ്ങളേയും വയ്ക്കുക.
5. മുഞ്ഞ മത്തങ്ങയിൽ പടർന്ന പിടിച്ച് കഴിയുമ്പോൾ ഏകദേശം ഇരുന്നൂറ് പാരാദങ്ങളെ കുടുകളിൽ വിടുക.
6. മേൽ പറഞ്ഞ പ്രകാരം പരാദങ്ങളെ വളർത്തുവാൻ യഥാസമയം 28°C ഊഷ്മാവ് ക്രമീകരിക്കേണ്ടതാണ്. ഇപ്രകാരം ഊഷ്മാവ് ക്രമീകരിച്ച കൂടിനുള്ളിൽ പരാദങ്ങളെ

വിട്ട് ശരാശരി 14 മുതൽ 18 ദിവസത്തിനുള്ളിൽ അതിന്റെ അടുത്ത തലമുറ ലഭ്യമാക്കാവുന്നതാണ്.

7. ഉൽപാദനത്തിന് ആവശ്യമായ പരാദങ്ങളെ നീക്കിവച്ച ശേഷം ബാക്കിയുള്ളവ ഒരു ആസ്പിറേറ്റർ ഉപയോഗിച്ച് വായു സഞ്ചാരമുള്ളതും വായവട്ടമുള്ളതുമായ ഭരണികളിൽ ശേഖരിച്ച് തോട്ടത്തിൽ വിടാവുന്നതാണ്. ഭരണികളിൽ ശേഖരിക്കുമ്പോൾ പ്രാണികൾക്ക് തേനും വെള്ളവും സമം ചേർത്ത് പഞ്ഞിയിൽ മുക്കി ഭരണിയിൽ വെക്കേണ്ടതാണ്. ഏകദേശം 7000 മുതൽ 10000 വരെ പരാദങ്ങളെ ഒരേക്കർ കാപ്പിതോട്ടത്തിലേക്ക് വിടേണ്ടതുണ്ട്.

ചുണ്ടയിലെ പ്രാദേശിക കാപ്പി ഗവേഷണ കേന്ദ്രത്തിൽ നിന്ന് ഏകദേശം 25 ലക്ഷത്തോളം പരാദങ്ങളെ വയനാട്ടിലെ 1100 ഓളം കാപ്പിത്തോട്ടങ്ങളിലായി വിട്ടിട്ടുണ്ട്. വിട്ടതോട്ടങ്ങളിൽ നിന്നും പരാദങ്ങളുടെ കാര്യക്ഷമത അറിയുന്നതിനു വേണ്ടി ചുണ്ടയിലെ ഗവേഷണകേന്ദ്രം ഒരു സർവ്വേ നടത്തുകയും ഇതിന്റെ ഭാഗമായി ഏകദേശം 29 തോട്ടങ്ങൾ സന്ദർശിക്കുകയുമുണ്ടായി.

ഓരോ തോട്ടത്തിൽ നിന്നും 25 ചെടികൾ വീതം തെരെഞ്ഞെടുക്കുകയും, അതിൽ നിന്ന് മൂന്നു കുലകൾ വീതം അടർത്തിയെടുത്ത് അതിൽ പരാദം മൂലമുള്ള മുഞ്ഞ നിയന്ത്രണം എത്ര ശതമാനം ഉണ്ടെന്ന് കണക്കാക്കി. ഓരോതോട്ടത്തിലെയും പരാദം മൂലമുള്ള മുഞ്ഞ നിയന്ത്രണ ശതമാനം പട്ടിക 1-ൽ കൊടുത്തിരിക്കുന്നു.

താഴെ കൊടുത്ത പട്ടിക പ്രകാരം ഏറ്റവും കൂടുതൽ മുഞ്ഞ നിയന്ത്രണം കാണാൻ കഴിഞ്ഞത് ചുണ്ടയിലെ ഗവേഷണ കേന്ദ്രത്തിലെ തോട്ടത്തിലാണ് (48.11%). ഏറ്റവും കുറഞ്ഞ തോതിൽ കാണാൻ ഇടയായത് പുത്തൂർവയലിലെ പ്ലാക്കണ്ടി എസ്റ്റേറ്റിലാണ്.(1.35%).. മുകളിൽ പറഞ്ഞ 29 തോട്ടങ്ങളിലേയും ശരാശരി മുഞ്ഞ നിയന്ത്രണം 15.85%മാണ്. അതുകൊണ്ട് ലെപ്റ്റോമാസ്റ്റിക്സ് ഡാക്ടൈലോപി എന്ന പരാദം കാപ്പിയിലെ വെള്ള മുഞ്ഞയെ വളരെ ഫലപ്രദമായി നിയന്ത്രിക്കുന്നു എന്ന് ഈ പഠനം തെളിയിക്കുന്നു.

പട്ടിക 1. പരാദം മൂലമുള്ള മുഞ്ഞ നിയന്ത്രണം

ക്രമ നമ്പർ	തോട്ടത്തിന്റെ പേരും വിലാസവും	മുഞ്ഞ നിയന്ത്രണം ശതമാനത്തിൽ
1.	സ്പൈസസ് ഗാർഡൻ, മേപ്പാടി	25.36
2	ശക്തിനിവാസ്, കൽപ്പറ്റ	23.62
3	തൃണയാമ്പറ്റ എസ്റ്റേറ്റ്, പനമരം	26.40
4	ലിബറ ഗാർഡൻ, മീനങ്ങാടി	28.55
5	പൂമല എസ്റ്റേറ്റ്, ബത്തേരി	26.10
6	കൃഷ്ണ എസ്റ്റേറ്റ്, പൊഴുതന	34.08
7	മുട്ടിൽ പീക്ക് എസ്റ്റേറ്റ്, എടപ്പെട്ടി	32.57
8.	ആർ.സി.ആർ.എസ് ഫാം, ചുണ്ടേൽ	48.11
9	കല്യാണ മന്ദിരം എസ്റ്റേറ്റ്, പുളിയാർമല	18.25
10	സ്ക്കൂൾ എസ്റ്റേറ്റ്, മടക്കിമല	22.13
11	ലക്ഷ്മിമന്ദിരം എസ്റ്റേറ്റ്, മടക്കിമല	12.12
12	കുസുമം എസ്റ്റേറ്റ്, പാടിവയൽ	14.33
13	ശാന്തിനാഥ് എസ്റ്റേറ്റ്, പുളിയാർമല	21.00
14	വിജയമന്ദിരംഎസ്റ്റേറ്റ് , പുളിയാർമല	14.15
15	ഈവാ എസ്റ്റേറ്റ്, മടക്കിമല	13.25
16	ശ്രീലക്ഷ്മി എസ്റ്റേറ്റ്, മടക്കിമല	24.35
17.	കമലാ എസ്റ്റേറ്റ്, മടക്കിമല	12.65
18	റോക്ക്സൈഡ് എസ്റ്റേറ്റ്, കൈനാട്ടി	4.12
19	കോർട്ട് വ്യൂ എസ്റ്റേറ്റ്, കൽപ്പറ്റ	32.13
20.	പാറയ്ക്കൽ എസ്റ്റേറ്റ്, മുട്ടിൽ	2.17
21	സുലൈഖാ എസ്റ്റേറ്റ്, പുത്തൂർവയൽ	5.12
22	എടകുനി എസ്റ്റേറ്റ്, എടകുനി	3.35
23	കരിങ്കുറ്റി എസ്റ്റേറ്റ്, കരിങ്കുറ്റി	1.95
24	തോണിക്കടവ് എസ്റ്റേറ്റ്, തോണിക്കടവ്	2.13
25.	വി.കെ. എസ്റ്റേറ്റ്, പുത്തൂർവയൽ	1.50
26.	എം.സി. വസന്ത് കുമാർ കോട്ടനാട്	2.15
27	എം.സി. അശോക് കുമാർ, കോട്ടനാട്	2.00
28	എം.സി. പത്മരാജ്, കോട്ടനാട്	4.30
29	പ്ലാക്കണ്ടി എസ്റ്റേറ്റ്, പുത്തൂർവയൽ	1.35
	ശരാശരി	**15.83**

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EFFECT OF THE INTEGRATED NUTRIENT MANAGEMENT ON THE GROWTH, NODULATION AND YIELD OF GREENGRAM (*VIGNA RADIATA* L.)

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Abstract

The Integrated Nutrient Management using organic resources and biofertilizers improve soil fertility and productivity. Land degradation and environmental pollution can be minimized for sustainable crop production. The present study was aimed to find out a suitable combination of organic manures, chemicals and bio-fertilizers to improve the yield, with the minimum use of chemical fertilizers. The combination consisted of 13 treatments with four levels of cultures (Untreated, treated with *Rhizobium*, treated with PSB, treated with *Rhizobium* & PSB) and three levels of manures (50%, 75% and 100% of Poultry Manure) and half of the recommended dose of chemical fertilizers was applied at the time of sowing. The control was with recommended dose of chemical fertilizers (NPK 20;60;20) Kg/ha. The combination *Rhizobium*+PSB+100% Poultry Manure, i.e 2.28t/ha + half inorganic Kg/ha recorded significantly higher yield than the control.

Introduction

Greengram is an important crop in the cropping system practiced in Allahabad region because of their role in crop rotation. They play a major role in improving and sustaining soil fertility and productivity. The intensive use of chemical fertilizers without organic manures has led to a significant reduction in soil fertility and productivity. The organic manures also supply the traces of micronutrients enhancing efficiency of applied nutrients and providing favorable soil physical condition. Thus, the integration of chemical fertilizers with organic manures and biofertilizers is important in crop production for the maintenance of soil fertility and yield stability. Moreover, the cost of chemical fertilizers can be minimized. The present experiment is aimed to find out the most effective combination of organic manures and biofertilizers with chemical fertilizers.

Materials and Methods

A field experiment was conducted at Crop Research Farm, Allahabad Agricultural Institute, Allahabad during Kharif 2000 on sandy loam soil having pH7.1. The available N,P and K was 0.58%, 37 and 157 Kg/ha respectively. The experiment was laid out in a 4x3x2 factorial Randomized Block Design with three replications. The combination consisted of thirteen treatments with four levels of cultures (Untreated, treated with *Rhizobium*, treated with PSB (Phosphorus Solublizing Bacteria), treated with *Rhizobium* +PSB) and three levels of manures (50% Poultry Manure, i.e., 1.14 t, 75% Poultry Manure, i.e., 1.17t /ha, 100% Poultry Manure, i.e., 2.28 t /ha). The crop was sown in line 30 cm apart adopting all standard package of practices. The control was the recommended dose of inorganic fertilizers. The half of the recommended inorganic fertilizers was applied at the time of sowing (NPK 10:30:10) in all the plots except the control.

Results and discussion

The significant difference was observed in the nodules count per plant, dry weight, pod yield, test weight and grain yield. The significant result

was recorded with NPK [10:30:10) half inorganic Kg/ha + *Rhizobium* & PSB + 2.28t PM/ha] the dry weight 19.1g,the nodule count per plant at 30 DAS-24.67, the pod yield 17.0q/ha and the grain yield12 q/ha. The increase in the test weight, 34.89g with NPK [10:30:10) half inorganic Kg/ha + *Rhizobium* + PSB + 1.17t PM/ha]. This was due to the interaction effect of manure and cultures due to the mineralisation of PM that made the easy availability of N and P from the soil with cultures. The findings are in line with that of Raundel *et* al., (1999).

The increase in the number of nodules was 47% in the treatment NPK [10:30:10) half inorganic Kg/ha + *Rhizobium* + PSB + 2.28t PM/ha] over the control [NPK 20:60:20] which may be due to *Rhizobium* +PSB application. The increase in the dry weight, pod yield, grain yield and test weight were recorded 3,1,3 and 2%over the control. Thus, findings are in close conformity with the findings of Ghosh and Poi (1998). The interaction effect due to manure and culture combination showing significant difference over the control is due to dual application of *Rhizobium* and PSB and Poultry Manure,the significant result is obtained. Similar findings have reported by Dubey (1966).

Table-1. Interaction effect of different levels of manures and cultures on the growth and yield of greengram.

Treatment combinations	Root nodules count/plant (30DAS)	Dry weight/plant (60DAS) (g)	Test weight (g)	Pod yield (q/ha)	Grain yield (q/ha)
C_0M_1 [(NPK10:30:10) half inor Oganic Kg/ha + untreated + 1.14 t PM/ha]	17	17.8	31.6	15.9	11.0
C_0M_2 [(NPK10:30:10) half inorganic Kg/ha + untreated + 1.17 t PM/ha]	18	17.9	31.9	16.2	11.2
C_0M_3 [(NPK10:30:10) half inorganic Kg/ha + untreated + 2.28 t PM/ha]	18	18.1	32.3	16.3	11.4
C_1M_1 [(NPK10:30:10) half inorganic Kg/ha + *Rh0 izobium* + 1.14 t PM/ha]	19	18.3	33.4	16.4	11.6
C_1M_2 [(NPK10:30:10) half inorganic Kg/ha + *Rhizobium* + 1.17 t PM/ha]	21	18.5	33.9	16.4	11.7
C_1M_3 [(NPK10:30:10) half inorganic Kg/ha + *Rhizobium* + 2.28 t PM/ha]	22	18.6	34.6	16.8	11.8
C_2M_1 [(NPK10:30:10) half inorganic Kg/ha + PSB + 1.14t PM/ha]	17	18.2	32.7	16.5	11.5
CO_2M_2 [(NPK10:30:10) half inorganic Kg/ha + PSB + 1.17t PM/ha]	18	18.5	33.2	16.6	11.5
C_2M_3 [(NPK10:30:10) half inorganic Kg/ha + PSB + 2.28t PM/ha]	22	18.7	33.6	16.8	11.7
C_3M_1 [(NPK10:30:10) half inorganic Kg/ha + *Rhizobium* + PSB + 1.14t PM/ha]	23	18.8	34.3	16.9	11.8
OC_3M_2 [(NPK10:30:10) half inorganic Kg/ha + *Rhizobium* + PSB + 1.17t PM/ha]	24	18.9	34.8	16.9	11.9
C_3M_3 [(NPK10:30:10) half inorganic Kg/ha + *Rhizobium* + PSB + 2.28 t PM/ha]	24	19.1	34.8	17.0	12.0
C_0M_0 [(NPK20:60:20) Kg/ha	16.67	18.7	33.6	16.8	11.8
CD(P=0.05)	1.39	0.05	———	0.07	0.04

Conclusion

The studies revealed that the application of organic manures with biofertilizers along the reduced dose of chemical fertilizers was found to increase the growth, nodulation and yield of greengram cv. Asha. The treatment combination (NPK10:30:10) half inorganic Kg/ha + *Rhizobium* + PSB + 2.28t PM/ha] resulted higher yield thereby suggesting a possibility of reducing about half of the recommended dose of fertilizers without any detrimental effect on the yield.

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STATUS OF TRIBAL AGRICULTURE AND EMPOWERMENT PROCESS IN RENGANATHAPURAM WATERSHED OF ATTAPPADY IN KERALA

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Abstract

The paper highlight the status of agricultural pattern, practices and the prevailing socio-economic background of tribes, which influence their empowerment process. The study is conducted in Renganathapuram watershed of Attappady region of Kerala. The area has gone under drastic environmental degradation due to human intervention and hence the life of the tribes has become miserable. The data collected indicate that 97% the tribes are involved in agriculture and associated activities. They practice settled agriculture, and major crops cultivated are cotton, ragi, thuvara, cholom, rice etc. The absence of any collective marketing systems, the middlemen are exploiting them. The traditional leadership is still revered and recognised in all the hamlets. Over all, the studies attempt to project the problems and prospects pertaining to tribal agriculture, socio-economic status and suggest suitable measures to preserve and protect the legacy of tribal agriculture.

Study Area

The Renganathapuram watershed is a part of Attappady region in Palakkad district of Kerala State, lies in Bhavani river basin of Cauvery river system. The total area of watershed is 77 sq km and situated between 11^0 8' and 11^0 13' N latitude and 76^0 32' and 76^0 40' E longitude. There are 13 hamlets in the watershed (table-1). Attappady region is dominated by medium elevation zone (54% area under relief between 600 m-1200m). The region is now highly degraded with more than 65 % of the land is not put to effective use (CWRDM, 1990 and 1997). The significant meteorological factors make Attappady a unique region in humid tropics of Kerala. The study area is considered to be among the driest part of Kerala with annual average rainfall between 1000 mm-2000 mm, making it a semi arid condition. Attappady valley falls in the Nilgris biosphere reserve and it is very close to Silent Valley, which is declared as core zone of the biosphere.

Methodology

The study is conducted in a watershed, which is a natural unit area, most suitable for natural resources conservation, management and sustainable development. The study area was delineated using the Survey of India topographical maps on 1:50000 scales. A detailed list of households and general information on hamlets falling within the watershed was prepared from panchayath/ revenue offices and other available sources through field visits. An interview schedule was prepared to generate data on socio-economic and environmental aspects. A door-to-door random sampling survey of 20% tribal household was conducted. For this purpose, trained educated tribal youths were engaged. Participatory rural appraisal methods like transect walk, group discussion, semi structured interview, participatory rural mapping etc were used, involving the tribes and their traditional leaders. This exercise helped to gather more information on the

agricultural pattern/ practices, land use, soil erosion, water availability etc. Finally, the data collected were decoded, tabulated and analysed to draw inferences of the study.

Demographic features

A significant change has taken place in the demographic features of Attappady in the past few decades because of the considerable increase in population of non-tribes. Tribal constituted the majority of the population in 1961 but by 1981 they had become a minority (CWRDM, 1994; KFRI, 1991). However, this particular watershed just maintains the majority of tribes. There are total 716 households in the watershed distributed in 13 hamlets, of which, 398 nos are tribal houses (56%). The study reveals that, the average family size of the household is 5 memebers among the tribes as well as among settlers. The dominant tribal community is Irula (83%), followed by Kurumba (16%) and Muduga (1%). Among tribal population, 26% are literate with 34% male and 17% female literacy. Most of the tribal families (99%) have their own houses with the aids provided by Govt. agencies. About 87% houses have tiled-roofs and only 2% live in huts, of which, 30% of the houses are electrified.

The study reveals that, among tribals 54% of the working population are farmer cum agricultural labourers, 28% exclusively agriculture labourers and 15% farmers. The tribes were not found engaged in any skilled or business jobs. While coming to the landholding status, 93% are landowners. The average landholding among tribes is 3.8 acres while the settlers have an average landholding of 2.1 acres. The tribal land is generally located in foothills, mid slopes, and hilltops while selter population have fertile land in valley areas. A land holding classification shows that 55% of the tribes are small farmers having land possession of 2.5 to 5 acres.

Socio-cultural aspects

The traditional leadership council system still exists in hamlets with *Moopan* (Head of the hamlet), *Bandari* (Secretary) *and Mannukkaran* (Agriculture expert). About 99% of the respondents expressed acceptance to the traditional leadership. The food habits of the tribes have changed considerably because of the environmental and social change. Earlier they used chama, ragi, cholam and pulses produced from cultivation for food. Now, almost half of the foodstuffs are purchased and market related economy is influencing much in their life. The weekly marketing system is prevailing in the absence of a well-distributed and effective co-operative marketing facility. Because of this reason, middlemen are exploiting them with pre harvest low prices advancing for the produces. The traditional medical treatment lost its charm and majority depends on modern medicine. Among 50% of the respondents, adopted family planning measures, which is reflected in the demography pattern. Perennial water is available for most of the hamlets and they prefer running water sources like river, stream and spring. They have the habit of using boiled water for drinking. Five hamlets have direct access to primary level school facilities.

Agricultural pattern and practices

The transition of the tribal society from self-reliance to dependence has been a direct result of the environmental decline of the region (Nandeshwar et al, 1984; Nandeshwar et al, 2001). The tribal agriculture is a shift from their hunting and gathering type of life style. Earlier they were practicing shifting cultivation and now it has almost ceased, except by Kurumba community practicing in a minor scale. The settled agriculture is very common among tribes, which has got almost centuries old. The Irula and Muduga communities are the pioneers of the settled agriculture in Attappady. The studies indicate that 97% of the people are involved in agriculture and its associated works. The tribal households (93%) are landowners with an average size of landholding of 3.8 acres. As the land holdings are located in hilly slopes the soil erosion is severe. The fertility status of the soil has reduced considerably, making cultivation non profitable. Tribes cultivate

Table-1. Hamlet wise households in Renganathapuram watershed (actual and surveyed)

Sl No.	Name of Hamlet	Actual house holds		House holds surveyed	
		Tribal	Settler	Tribal	Settler
1	Aralikonam	22	—	6	—
2	Buthayur	32	—	7	—
3	Chempavatta	15	40	4	2
4	Chuttara	45	17	9	2
5	Edavani	40	—	4	—
6	Mulakombu(Mele)	32	9	10	1
7	Mulakombu (Thazhe)	12	18	3	2
8	Pattanakkallu	25	50	5	5
9	Pudur	40	60	8	6
10	Renganathapuram	-	50	—	10
11	Swarnagatha	45	16	9	2
12	Thachampadika	50	40	10	4
13	Ummathampadika	40	18	8	4
	Total	**398**	**318**	**83**	**38**

predominantly food crops, i.e. cereals and pulses. The major commercial crop cultivated is cotton. The mixed cropping system is generally practiced according to the needs of the farmer, for that different choices of combinations of crops are made. The major cereals and pulses crops cultivated are ragi, cholam, thuvara, muthira etc. The crops like chama, beans, mustard, groundnut, tomato, amara etc are also cultivated in small scale. Tribes do not generally cultivate plantation crops like cashew, coffee, coconut, pepper etc. It is estimated that around 1000 acres of land is cultivated, of which, 42% is under cotton, 19% thuvara, 17% ragi, 7% rice, 5% cholam, 3% muthira and 7% other crops. The tribes do not have habit to preserve local crop varities; hence, they depend on new seeds every year brought by settlers and middlemen, except for some local seed of food crops like chama, ragi available with few farmers.

Land and water management practices

Soil conservation work has been done in the land of 67% households which comes about 1000 acres. 92% of the lands have terracing done through government assistance, which are in partially damaged condition. It is to be noted here that the soil and water conservation measures adopted have are inadequate and it needs an integrated approach on watershed basis. Animal power is used for ploughing the land, and around 18% of the households have irrigational facilities from springs, canal and stream sources.

Around 35% of the households use pesticides and fertilizers, mainly for cotton crop. Organic manures are used by 14% of the households. Among tribals, 20% have goat rearing, 13% have bullocks,19% have dry cows and 8% have milking cows. Four hamlets namely Buthayur, Chuttra, Edavani and Mele Mulakombu are engaged in collection of minor

forest produces such as honey, gooseberry, cheevikka, kolarakku, cardamom and medicinal plants. About 4% of the households have local plough and no other modern agricultural equipment is used. The studies show that 37% of the households have an average indebtedness of Rs 4300/- taken from banks and cooperative societies.

The participatory rural appraisal exercise conducted among the tribes reveals that the tribes are willing to adopt to suitable plantation crops and fruit trees to get better income and less risk as compare to rain-fed seasonal crops. The need analysis reveals, first priority to enhanced irrigation facilities, and then, on-farm development, quality seeds, fertilizers and financial assistance.

Conclusions

The occupation of 97% of the tribal households in the Renganathapuram watershed is agriculture and its associated activities. More than 50% of the households are small farmers (landholding between 2.5 acres and 5.00acres).

The agricultural land is located in hill tops/ slopes, subjected to severe erosion, hence less fertile and low productivity. Though 67% cultivated land has partial terracing which is inconsistent for soil and water conservation.

All the crops cultivated are seasonal rain-fed subjected to high-risk with the vagaries of monsoon. More than 42% of the area is cultivated with cotton and the rest is food crops i.e. cereals and pluses.

Fertilizers and pesticides are used mainly for cotton crop; and there is no thrust in organic farming.

Animal husbandry is practiced with more than 60% of households, engaged in goat rearing or cattle farming.

About 37% of the households have an average agriculture debt of Rs 4300/- per family.

The literacy is 26% among tribes and primary education facilities are available in most of the hamlets.

The self-reliance in foodstuff is lost and the food habit changed. More than 50% of food materials are purchased and the market economy is controlling their life.

The traditional leadership is still revered and recognised and political socialisation among the tribes are at slow pace, hence there empowerment process is slow.

The agriculture produces are not getting legitimate price in the absence of effective co-operative marketing facilities, hence they are exploited by the middlemen and local traders.

Recommendations

1. The watershed based development approach should be adopted for eco-restoration.
2. An integrated land and water management techniques should be implemented with participation of stakeholders.
3. Organic farming should be emphasized taking the tribal tradition.
4. The pest and disease resistant local varieties of crops should be preserved along with other bio-diversities in the region.
5. Adequate irrigation facilities should be provided, making use of available water sources in a sustainable manner.
6. A well-distributed cooperative marketing system should be established, which can provide agri-inputs and fair price for produces.
7. Training, education and extension activities for over all development with definite aim of empowerment of tribes should be provided.
8. Afforestation in the degraded areas with indigenous species and grazing in public land should be regulated.
9. The tribes should be introduced to suitable perennial crops cultivation, considering the low risk and regular income.
10. Protection of tribal ethos and culture through appropriate social/administrative/ legal measures.

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RESOURCE USE EFFICIENCY OF ELEPHANT FOOT YAM FARMERS IN ERNAKULAM DISTRICT OF KERALA

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Abstract

Among the tropical tuber crops, Elephant Foot Yam is considered to be the highest income earner to the cultivator irrespective of the production system and temporal variations. Even though it is seen cultivated throughout Kerala in the homestead gardens, commercial cultivation of this crop is seen in Ernakulam and Thrissur districts under irrigated system. It is a crop of small and weaker sections of the farming community operating under resource scarce and risk prone production systems. Optimum utilisation of resources by resource poor farmers is the prime factor influencing the productivity of any crop in any cropping system. Inefficient utilisation of resources will have an adverse impact on the productivity. Elephant Foot Yam farmers are no exception to this phenomenon. A study conducted on resource use efficiency of Elephant Foot Yam farmers under low production system in Ernakulam District of Kerala has indicated scope for reorganisation of resources so as to enhance the productivity. Nitrogenous and Potassium fertilisers are being used excessively affecting the productivity adversely. Hired and family labour, planting material inputs were found to contribute significantly to the productivity indicating the efficiency in the use of these resources. Increasing returns to scale was observed in the cultivation of Elephant Foot Yam in Ernakulam district of Kerala.

Introduction

Among the tropical tuber crops, Elephant Foot Yam is considered to be the highest income earner to the cultivator irrespective of the production system and temporal variations. Eventhough it is seen cultivated throughout India, atleast in the homestead gardens, commercial cultivation of the crop is seen mostly in Southern and Eastern parts of the country concentrated in certain districts in each State. To begin with, in Kerala, it is grown largely in Ernakulam district. In almost all the states, it is cultivated under irrigated/ low land production systems. Depending on the availability of seed materials, the crop is cultivated in two seasons in different parts of the country (Kharif seasons in Tamil Nadu, Rabi season in Kerala and in both the seasons in A.P). No authentic published area and production statistics are available under this crop. But it was estimated that nearly 50,000 ha area is under Elephant Foot Yam throughout the country and more than half of the area is concentrated in Kerala, Tamil Nadu, Andhra Pradesh and West Bengal.

Majority of Elephant Foot Yam growers are small whose resources are limited. Optimum utilization of resources by resource poor farmers is the prime factor influencing the productivity of any crop in any production system. Inefficient utilization of resources will have an adverse impact on the productivity and Elephant Foot Yam growers are no exception to this phenomenon. An attempt is made to study the resource use efficiency of Elephant Foot Yam growers in Kerala with the following objectives.

Objectives

To evaluate the resource productivity and returns to scale of Elephant Foot Yam under low land production system.

To suggest suitable adjustments in resource

use for increasing the productivity of Elephant Foot Yam under lox land production system in Kerala.

Methodology

Multi-stage random sampling technique was employed for selecting the sample. Ernakulam district in Kerala was selected for the study. From the selected district two Elephant Foot Yam growing blocks were selected having large area under the crop. From each block two villages were similarly selected on the basis of concentration of Elephant Foot Yam cultivation. Thus, 4 villages, 2 blocks, 1 district were covered in collecting the sample in Kerala. A minimum sample of 30 farmers under low land production system were contacted personally to collect required information. The study pertains to the agricultural year 2002-03. Data were collected using a well structured and pre-tested interview schedule.

A functional relationship was developed between output and the inputs to study the resource use efficiency of Elephant Foot Yam farms. In the present study, Cobb-Douglas production function was fitted after observing the scatter diagram.

The form of the production function is as follows.

$$Y = a X_1^{b1} X_2^{b2} \ldots X_n^{bn}$$

Where Y = output X_1 to X_n = inputs

This function was fitted in log term with gross returns (y) as dependent variable and inputs as explanatory or independent variables.

The production function after logarithmic transformation is erepresented as follows

$$\text{Log } y = \log a + b_1 \log X_1 + b_2 \log X_2 + \ldots\ldots + b_n \log X_n$$

Where Y = Gross returns in Rs. Per ha.

a = constant or intercept

X1 = Farm size in ha.

X2 = Human Labour in Rs. per ha.

X3 = Family labour in Rs. per ha.

X4 = Planting material in Rs. per ha.

X5 = Manures in Rs. per ha.

X6 = Nitogenous Fertilizers in Rs. per ha

X7 = Phosphatic Fertilziers in Rs. per ha

X8 = Potassium Fertilizers in Rs. per ha

The sum of regression co-efficient (åbi) indicates returns to scale.

The marginal value productivity (MVP) for each input (Xi) is calculated from the following formula.

$$Yi = Y / X_i) b_i$$

where Y_i = Marginal value productivity of input.

Y = Geometric mean of Gross returns

X_i = Geometric mean of i^{th} input

b_i = Elasticity of output with respect of factor xi.

The ratio of marginal value products to opportunity cost for each factor was calculated in order to determine the efficiently of resource use.

Results and discussion

Production elasticities and their respective standard errors for low land Elephant Foot Yam forms in Kerala were given in table-1.

From the perusal of table-1, it was observed that co-efficient of Multiple Determination (R^2) for low land Elephant Foot Yam farms in Kerala was 0.8238 which was highly significant. R^2 value clearly indicated that 82 per cent variation in gross income has been influenced by the selected variables.

The sum of elasticities (åbi) of production is an indication of the returns to scale. It is observed from the table the sum of elasticities was 0.6722 for low land elephant foot yam farms indicating increasing returns to scale.

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Production Elasticities of Variables (b_i)

Out of eight independent variables selected hired labour, family labour, seed/planting material, nitrogenous and potassium fertilizers were found to influence gross production and in turn gross income. N, K fertilizers were found to influence negatively and significantly i.e. there is excessive use of N and K fertilizers in low land Elephant Foot Yam farms.

Phosphatic fertilizers were showing negative but non significant relationship with gross income while farm size and manures were showing positive and non-significant relationship with the gross income.

Resource use efficiency

The estimated marginal value products (MVP) of all the inputs used in the cultivation of Elephant Foot Yam were tested using 't' test to find out whether MVP and opportunity costs (OC) are significantly differing. MVP, OC and ratio of MVP and OC values for low land farms of elephant foot yam were presented in Table 2.

The opportunity cost of all the variables were considered to be one rupee except that of farm size i.e., land where the actual acquisition cost was taken since it was expressed in physical units.

The utilization of the inputs - hired labour, family labour and seed/planting material were being used optimally indicating that the utilization of these inputs could be increased sufficiently. While utilization of Farm size, manures, N, P and K fertilizers were not at optimum and there were significant difference between MVP and OC as MVP were much less than acquisition costs. Hence, these inputs are being used excessively at present than required in this group of Elephant Foot Yam farms. There is a need to reduce these inputs to so as to achieve higher productivity and there by higher gross returns.

Conclusions

The study indicated excessive use of all NPK fertilizers indicating the need for rationalization of these inputs while use of inputs like labour and planting material can be enhanced without any adverse influence on productivity of the crop.

Table-1. Production elasticities of Elephant Foot Yam cultivation under low land production system in Kerala

Particulars	Low land production system (Kerala)	Production Elasticity Standard Error
Constant	4.5291	2.7899
Farm size	0.0007	0.0335
Hired human labour	0.3808**	0.0908
Planting material	0.4573**	0.1983
Manures	0.0121	0.0676
Family labour	0.1643**	0.0704
Nitrogenous fertilisers	-0.1417**	0.0680
Phosphatic fertilizers	-0.0062	0.0079
Potassium fertilizers	-0.1952**	0.0561
Returns to scale	0.6722	-
R_2	0.8238	-
F	11.6902	-

Table- 2. Marginal Value Product (MVP), Opportunity Cost (OC) and ratio of Marginal Value Product and Opportunity Cost for the Elephant Foot Yam farms under low land production system.

Type of Production system	Factors	MVP	OC	MVP/OC
Low land (Kerala)	Farm size	318.51	12150.31	38.150
	Hired human labour	3.16	1.00	3.16
	Planting material	1.64	1.00	1.64
	Manures	0.21	1.00	0.21
	Family labour	2.40	1.00	2.4
	Nitrogenous fertilisers	-7.55	1.00	-7.55
	Phosphatic fertilizers	-1.26	1.00	-1.26
	Potassium fertilizers	-11.68	1.00	-11.68

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INFLUENCE OF PLANT CHARACTERS ON DRY YIELD IN BLACK PEPPER (*PIPER NIGRUM* L.)

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Abstract

Eventhough India being a major producer of pepper, productivity of the crop is low compared to other pepper producing countries. In order to capture the world market, and to meet the internal demand, we have to boost our pepper production. Increasing the productivity of the crop through breeding of improved varieties is one of the ways to achieve this goal. Estimation of correlation between yield and its component characters are essential for effective selection programme. Hence the study was conducted at pepper garden, Department of Plantation Crops and Spices, College of Horticulture, Vellanikkara, during 2000 on vines of Panniyur 1. At the time of harvest, following observations like number of leaves per lateral, number of productive laterals per 0.25 m^2, lateral length, internodal thickness of lateral, angle of insertion of lateral, leaf area per lateral, number of spikes per lateral, spike to leaf ratio per lateral, length of spike, green yield per vine and dry yield per vine were observed. Among the 10 characters studied, nine characters viz; number of leaves per lateral, number of productive laterals / 0.25 m^2, lateral length, angle of insertion of lateral, number of spikes per lateral, length of spike and green yield per vine registered highly significant positive correlation with dry yield per vine. Path analysis study indicated high direct effect of green yield on dry yield per vine and indirect effects of all other characters through green yield per vine. The study revealed the importance of these characters for crop improvement work in black pepper.

Introduction

Black pepper is the major spice crop of India, contributing a lion share of export earnings from spice crops. Even though India being a major producer of pepper, productivity of the crop is low compared to other pepper producing countries. In order to capture the world market, and to meet the internal demand, we have to boost our pepper production. Increasing the productivity of the crop through breeding of improved varieties is one of the ways to achieve this goal. Yield is a complex quantitative character, which is influenced by a number of other plant characters. These component characters of yield are correlated with yield and they are intercorrelated among them selves. Therefore, estimation of correlation between yield and its component characters are essential for effective selection programme.

Materials and methods

The study was conducted at pepper garden, Department of Plantation Crops and Spices, College of Horticulture, Vellanikkara, during 2000 on 90 vines of Panniyur 1. At the time of harvest, following observations like number of leaves per lateral, number of productive laterals per 0.25 m^2, lateral length, internodal thickness of lateral, angle of insertion of lateral, leaf area per lateral, number of spikes per lateral, spike to leaf ratio per lateral, length of spike, green yield per vine and dry yield per vine were observed. From all sides of the vine, five laterals were selected randomly and number of leaves, lateral length, internodal thickness, number of spikes and spike to leaf ratio per lateral was recorded and the average was worked out. The length and maximum breadth of ten leaves selected from all the four sides of the vine were measured and the area

was calculated by using the formula, Area = 0.71 (length x breadth), as suggested by Kumar and Prabhakaran (1980). With the help of a square wooden frame having 0.25 m^2 area, the spike bearing laterals were counted from all four sides of the vine at chest height and the mean was worked out. At the time of harvest, ten spikes were randomly selected from each vine and spike length was recorded and the mean was worked out. Total yield of green berries per vine was recorded immediately after harvest. Percentage recovery of dry pepper per vine was computed by drying 500 of green berries of representative samples under sunlight until berries recorded a constant dry weight. Total yield of dry berries per vine was computed by multiplying the green berry weight with percentage recovery of dry pepper.

For obtaining the relationship between yield and its component characters and interrelations among the characters, correlation and path coefficient analysis were carried out using SPAR 1 package as suggested by Wright (1921) and elaborated by Dewey and Lu (1959) to partition the cause and effect relationship among the characters.

Results and discussion

The data on correlation of various yield contributing characters with dry yield per vine and intercorrelation between them in Panniyur 1 are presented in table-1. The number of leaves per lateral, number of productive laterals / 0.25 m^2, lateral length, angle of insertion of lateral, number of spikes per lateral, length of spike and green yield per vine registered highly significant positive correlation with dry yield per vine. Internodal thickness of lateral and leaf area also showed significant positive correlation with dry yield per vine at five per cent level. All these parameters recorded positive significant correlation with green yield per vine also. The result is in agreement with the earlier reports available in black pepper (Ibrahim *et al.*, 1985; Sujatha, 1991; Satheeshan, 2000).

Since most of these characters are having direct influence on yield, such positive correlation could be anticipated. Since leaf lamina is the major photosynthetic organ of the plant to intercept sunlight, the productivity of a plant depends on its leaf surface area (Wahid *et al.*, 1997). As the intensity of sunlight incident on the leaves is dependent up on their horizontality, the angle of insertion of lateral to the main stem has a direct bearing on the photosynthetic efficiency and hence the yield of pepper vines (Nambiar *et al.*, 1978).

Study on intercorrelation between these characters revealed that number of leaves per lateral had significant positive association with internodal thickness, leaf area, number of spikes per lateral and spike length. A positive correlation was observed between internodal thickness and spike length and also between leaf area and number of spikes per lateral. Number of productive laterals in a unit area was found associated with angle of insertion of lateral, leaf area, number of spikes and spike to leaf ratio whereas, lateral length showed significant positive correlation only with internodal thickness and spike length.

In the path analysis, (table-2) only green yield per vine registered high direct effect with dry yield per vine. Number of spikes per lateral expressed a low direct effect. Rest of the variables showed negligible direct effects on yield but exerted moderate to high indirect effect through green yield per vine.

The study revealed the importance of these characters while selecting for high yielding varieties in black pepper. Significant intercorrelation observed between the yield contributing characters revealed the importance of considering these inter relationships while carrying out selection for certain characters in the crop improvement work in black pepper. These explained the high correlation obtained with dry yield.

Conclusion

Among the 10 characters studied, nine characters viz; number of leaves per lateral, number of productive laterals / 0.25 m^2, lateral length, angle of insertion of lateral, number of spikes per lateral, length of spike and green

yield per vine registered highly significant positive correlation with dry yield per vine. Path analysis study indicated high direct effect of green yield on dry yield per vine and indirect effects of all other characters through green yield per vine. The study revealed the importance of these characters for crop improvement work in black pepper.

Table-1. Intercorrelation matrix of morphological characters and dry yield of black pepper var. Panniyur 1

Characters	No. of leaves per lateral	No. of productive laterals/ 0.25 m^2	Lateral length	Internodal thickness of lateral	Angle of insertion of lateral	Leaf area per lateral	No. of spikes per lateral	Spike to leaf ratio per lateral	Length of spike	Green yield per vine	Dry yield per vine
No. of leaves per lateral	1.000										
No. of productive/ 0.25 m^2 laterals	0.184	1.000									
Lateral length	0.119	0.087	1.000								
Internodal thickness of lateral	0.214*	0.014	0.228*	1.000							
Angle of insertion of lateral	0.117	0.245*	0.101	0.043	1.000						
Leaf area per lateral	0.768**	0.244*	0.099	0.149	0.114	1.000					
No. of spikes per lateral	0.679**	0.325**	-0.047	0.214	0.181	0.470**	1.000				
Spike to leaf ratio per lateral	-0.145	0.219*	-0.196	0.077	0.098	-0.187	0.610**	1.000			
Length of spike	0.237*	0.072	0.321**	0.251*	0.184	0.150	0.114	-0.090	1.000		
Green yield per vine	0.334**	0.415**	0.441**	0.202	0.316**	0.220*	0.298**	0.034	0.376**	1.000	
Dry yield per vine	0.358**	0.410**	0.449**	0.224*	0.307**	0.239*	0.313**	0.025	0.386**	0.992**	1.000

* Significant at 5 % level. ** Significant at 1% level.

Table-2. Direct and indirect effects of morphological characters on dry yield of black pepper var. Panniyur 1

Characters	No. of leaves per lateral	No. of productive laterals/ 0.25 m^2	Lateral length	Internodal thickness of lateral	Angle of inserti on of lateral	Leaf area per lateral	No. of spikes per lateral	Spike to leaf ratio per lateral	Length of spike	Green yield per vine	Correlation coefficient with dry yield
No. of leaves per lateral	-0.060	-0.000	0.001	0.004	-0.001	0.001	0.074	0.012	0.002	0.326	0.358**
No. of productive laterals / 0.25 m^2	-0.011	-0.000	0.000	0.000	-0.002	0.000	0.036	-0.018	0.001	0.404	0.410**
Lateral length	-0.007	0.000	0.010	0.004	-0.001	0.000	-0.005	0.016	0.002	0.430	0.449**
Internodal thickness of lateral	-0.013	0.000	0.002	0.019	-0.000	0.000	0.023	-0.006	0.002	0.197	0.224*
Angle of insertion of lateral	-0.007	-0.000	0.001	0.001	-0.009	0.000	0.020	-0.008	0.001	0.308	0.307**
Leaf area per lateral	-0.046	-0.000	0.001	0.003	-0.001	0.001	0.052	0.015	0.001	0.214	0.239*
No. of spikes per lateral	-0.041	-0.000	-0.001	0.004	-0.002	0.001	0.110	-0.049	0.001	0.291	0.313**
Spike to leaf ratio per lateral	0.009	-0.000	-0.002	0.001	-0.001	0.000	0.067	-0.081	-0.001	0.033	0.025
Length of spike	-0.014	0.000	0.003	0.005	-0.002	0.000	0.013	0.007	0.007	0.367	0.386**
Green yield per vine	-0.020	-0.000	0.004	0.004	-0.003	0.000	0.033	-0.003	0.003	0.974	0.992**

* Significant at 5% level. ** Significant at 1% level residual = 0.0145

0.0 to 0.09: negligible 0.1 to 0.19: low0.2 to 0.29: moderate 0.3 to 0.99: high

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EFFECT OF PRESOWING HARDENING TREATMENT WITH PGRS- BIOTIN AND THIOUREA ON GERMINATION AND SEEDLING GROWTH OF SESAMUM (*SESAMUM INDICUM*, L.VAR. KAYANKULAM-1)

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Abstract

The presowing hardening treatment in *Sesamum* seeds with biotin and thiourea was carried out and an overall significant effect on the germination and seedling growth was observed. The results obtained were compared with the untreated (control). Maximum germination and highest seedling length was in B_{50} while the maximum fresh weight of root, shoot and whole seedling was in Tu_{100}

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Introduction

Sesamum indicum L., belonging to the family *Pedaliaceae* is one of the most important oil crops of our country and the bulk of the seed is utilized for the extraction of the edible oil-gingelly oil. In this work we have attempted to investigate the effect of presowing hardening treatment with biotin and thiourea. Presowing hardening treatment is a treatment preliminary to sowing during which the seeds are moistened with a limited amount of growth regulators or water and dried back once or a number of times (Henckel, 1964). Treatments have been shown to stimulate many physiological and biochemical processes ultimately leading to an increased growth and yield (Abraham,1970.; Sahai, *et al*, 1980.; Chinoy, 1968.; Saxena, 1989.; Sing and Saxena,1991). It was also observed that this treatment had an effect in improving the germinability, seedling growth and yield (Sreemadaradhya, *et al.*,1968).

Materials and Methods

The Sesamum (var. Kayamkulam-1) seeds were obtained from Regional Rice Research Station, Kerala Agricultural University, Kayamkulam. The PGRs- Biotin (B) and Thiourea (Tu) in 3 different concentrations, 10, 50 and 100ppm were used for this study. The effect of the treatment was compared with the control (untreated). Uniform and graded seeds were washed thoroughly in distilled water three times, air dried and the modified pre-treatment method of Chinoy (1967) was used. 8 sets of seeds, 1gm. each were transferred to eight clean small, wide mouthed sterilized glass bottles and a measured volume of the PGRs which is just sufficient to dip the seeds were added. The bottles were partly covered by cotton plugs and shaken occasionally for uniform imbibition and the treatment was continued for 3 hours. Then the seeds were allowed to dry by spreading it separately on blotting papers under the fan for uniform drying.

Twenty five seeds of each treatment with three replicates were taken and uniformly placed in clean sterilized glass petridishes on a whatman No.1 filter paper and moistened with 2.5ml of distilled water. The percentage of germination was noted after regular intervals of 24 hours up to 96 hours. After every 24 hours the solutions were pipetted out and

fresh distilled water was added. Ten seedlings (3 seedlings from each petridish) after 96 hours of germination were taken for measuring root length, shoot length, whole seedling length, fresh weight of root, shoot and whole seedling. The shoot root ratio and root shoot ratio were also calculated.

Results and Discussion

This treatment was observed to have a promotive effect on germination. This may be due to the efficient capacity of the pretreated seeds to imbibe more water from the germinating medium more efficiently. The maximum germination was in B_{50} (table-1). Both biotin and thiourea had a positive effect on root length (table-2) and this is in agreement with the findings of Selveraj and Jack Quelinea Selveraj, (1994) in *Marigold*. Shoot length was also increased by biotin and thiourea and the maximum was in B_{100} and $B_{50.}$ The whole seedling length was maximum in B_{50} and this increase in root length, shoot length and whole seedling length may be due to the enhanced cell division and cell elongation. The fresh weight of root, shoot and whole seedling (table-3) was also enhanced by both biotin and thiourea, while the control showed the least in all cases. The maximum fresh weight of root was in $Tu_{100.}$ The increased fresh weight may be due to the efficiency of the treated seeds to imbibe water more efficiently for cell expansion and maintenance of higher turgor pressure. The root length was maximum in $Tu_{50.}$ The shoot length and whole seedling length were maximum in $B_{100.}$

Conclusion

Thus, from this investigation it can be concluded that this presowing hardening treatment with biotin and thiourea had a promotive effect in enhancing the percentage of germination, the root length, shoot length and whole plant length and also in increasing seedling weight. Thus, this treatment had good performance not only on germination but also on the seedling growth of this oil crop-Sesamum.

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EVALUATION OF SOME UNDER-UTILISED STARCHY TUBER CROPS

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Abstract

Apart from the major tuber crops like cassava, sweet potato, aroids and yams, many types of rhizomatous and tuber crops are grown in different parts of India. 182 accessions of lesser known starchy tuber crops were collected from different ecoregions of our country. It included 21 species of *Curcuma*, 4 species of *Zingiber*, 3 species of *Typhonium*, one each of *Theriophonum, Vigna, Tacca, Costus* and *Canna*. Dark purple accession of edible *Canna* produces highest tuber yield and highest percentage of starch followed by *Curcuma* and *Typhonium*. The viscosity of *Canna* starch was higher than other tuber starches and the gel was strong and stable. In spite of the availability of other major starchy tuber crops, these lesser known starchy tuber crops acts as carbohydrate reserve, which are unnoticed and can be exploited in order to support the food security of our country.

Introduction

Root and tuber crops have a remarkable position in the food security of the developing world due to its high calorific value and carbohydrate content. Some of them are already cultivated, but others are grown wild as a neglected group of economic plants. They are often used as food or serve as a source of raw material for the production of alcohol and animal feed. Underground parts of many wild plants form an important starchy food for the tribals inhabiting nearer to forest tracts. Most of the lesser known starchy tuber crops are important due to its medicinal as well as industrial applications. In order to explore the potentialities of these unutilised and underutilised minor tuber crops, an intensive research programme of these crops was initiated at Central Tuber Crops Research Institute, Trivandrum. Many of these crops have not spread further than their native habitat due to its physiological constraints or lack of adaptability. In the present study an attempt was made to collect and evaluate the lesser known starchy tuber crops for tuber yield, biochemical characters and the properties of starch.

Materilas and Methods

As part of the all India exploration programme for the collection of underutilised tuber crops, thirteen exploration trips were made to different parts of south India and north eastern region of the country. A total of 182 accessions of underutilised tuber crops were collected. The collected germplasm were planted in pots and polythene bags for germination. After germination, they were transferred to the field to study the tuberising characters and tuber yield. The tuber yield of each species were recorded at the time of harvest. The crop duration of majority of the crops was 8-10 months. Biochemical characters like starch; sugar; moisture; dry weight etc were studied. For analysis of starch, 2 gm of tuber sample was kept in 20 ml 80% ethyl alcohol overnight. Then filtered, and the residue contained the starch. Residue boiled with 2N HCl and the percentage starch was estimated by titrating against 1% potassium ferricyanide solution into which 2.5 N NaoH has been added using methylene blue as indicator. Standard methods as described according to A.O.A.C (1) were followed for biochemical investigations. Starch was extracted from the

tubers and the rheological properties of the extracted starch was also studied.

Results and Discussions

A total of 182 accessions of tuber crops were collected and it includes 21 species of *Curcuma*, four species of *Zingiber,* three species of *Typhonium*, one species each of *Aponogeton, Theriophonum*, *Vigna*, *Tacca*, *Costus, Curculigo, Commelina* and *Canna*. All the tubers were harvested on maturity. Out of all the collected tuber crops, the maximum tuber yield was recorded in *Canna edulis* (5-7kg/plant). The rhizomes are branching and fleshy with thick fibrous roots and formed in compact mass.The young rhizomes are eaten as as vegetable and cooked tubers are delicious.

Among the *Curcuma* species, ten species were having sessile, oblong rhizomes with characterestic aroma (table-1), two species were less tuberising and the rest were non-tuberising. The rhizomes of tuberising species are branching or non branching and fleshy. All the tuberising species of *Curcuma* recorded a good yield of starch. The starch prepared from *curcuma* is used as a substitute for arrowroot starch, and it is highly valued as an article of diet especially for infants and convalescents (CSIR, 1950). The tuber yield of the species ranged from 240 gm to 945 gm per plant. *Curcuma zedoaria* recorded the highest tuber yield (945 gm/plant) followed by *Curcuma amada*. (710 g/plant). *Curcuma aeruginosa* recorded the lowest tuber yield (240g/plant) (table-2).

For the *Typhonium* species, the tuber yield ranged from 25-180 gm/plant. *Typhonium trilobatum* recorded highest tuber yield of 180 gm/plant and *Typhonium divaricatum* recorded a tuber yield of 25 gm/plant. Cooked tubers and tender leaves of *Typhonium* are eaten. Tubers are globose and pale yellow in colour, and the tubers are highly acrid. (table-3) (CSIR,1976)

Vigna vexillata, a leguminous tuber crop of much interest recorded tuber yield of 95 gm/plant. *Vigna vexillata* is a new unexploited edible tuber crop (Chandel,et al.,1972). Tubers of *Vigna vexillata* are fusiform and usually one tuber is borne on each plant. The tubers have an easily peelable skin. The seeds can be used as a nutritive vegetable. Out of the four Zingiber species, *Zingiber zerumbet* recorded

Table- 1. Features of Curcuma species

Curcuma species with sessile, oblong rhizomes	Curcuma species with less tuberisation	Non tuberising/non sessile curcuma species
Curcuma malabarica	*Curcuma vamana*	*Curcuma albiflora*
Curcuma zedoaria	*Curcuma ecalcarata*	*Curcuma oligantha*
Curcuma amada		*Curcuma pseudomontana*
Curcuma brog		*Curcuma decipiens*
Curcuma aromatica		*Curcuma aurentiaca*
Curcuma aeruginosa		*Curcuma neilgherensis*
Curcuma raktakanta		*Curcuma karnatakensis*
Curcuma caesia		*Curcuma montana*
Curcuma sylvatica		*Curcuma cannanorensis*
Curcuma harita		

the maximum tuber yield of 550 gm/plant. The tuber yield ranged from 73 to 550 gm/plant. The rhizomes are pale yellow to green in colour and used for the extraction of starch (table-4). Among the other crops collected, *Alpinia galanga* recorded a tuber yield of 615 gm /plant, *Alpinia calcarata* 270gm/plant, and *Commelina benghalensis* 103.87 gm/plant. (table-5). The rhizomes of *Theriophonum minutum* and *Aponogeton natans* are edible. They can be consumed after boiling. The rhizomes are eaten after roasting.

Costus speciosus, having an yield of 1.3 kg/ plant has tuberous rhizome with white flesh without any aroma. The tender rhizomes are used as vegetable. The root is said to be depurgative and used as tonic and antihelminthic in Uttarpradesh (CSIR, 1950)

Table-2. Yield attributes of Curcuma species

Species	Yield per plant (g)
Curcuma malabarica	430
Curcuma amada	710
Curcuma brog	280
Curcuma aeruginosa	240
Curcuma zedoaria	945
Curcuma aromatica	634
Curcuma raktakanta	280
Curcuma caesia	312
Curcuma sylvatica	275
Curcuma harita \	410

Table-3. Yield attributes of Typhonium species

Tuber crop	Tuber weight (grams/plant)
Typhonium trilobatum	180
Typhonium flagelliforme	75
Typhonium divaricatrum	25

Table-4. Tuber yield of Zingiber species

Tuber crop	Tuber weight (grams/plant)
Zingiber zerumbet	550
Zingiber cassumunar	125
Zingiber roseum	73.34
Zingiber macrostacheum	412

Table-5. Yield attributes of different tuber crops

Crop	Yield per plant (kg)
Theriophonum minutum	3.80
Vigna vexillata	95.00
Tacca pinnatifida	118.00
Curculigo orchiodes	11.43
Commelina benghalensis	103.87
Alpinia galanga	615.00
Aponogeton natans	25.00
Costus speciosus	1.30 kg

Starch analysis

Biochemical characterisation of the different tuber crops were carried out by following the standard method of analysis. *Curcuma malabarica* yielded 21.4% starch followed by *Curcuma brog* (18%). *Curcuma amada* yielded a starch percentage of 10.22. Dark purple accession of edible *canna* possess highest dry matter (35.7%) and starch content (27.0%). This value of dry matter and starch was close to that of cassava and sweet potato. *Typhonium* species shows a starch content ranging from 22.5 to 23.4%. The dry matter content of *Typhonium* species is higher than that of *Curcuma* species. The starch content of *Zingiber* species was very low (7-14%) (TableI-4). The viscosity of canna starch shows that it is higher than any other tuber starches. (Moorthy *et*.al., 2002). The gel prepared out of canna starch are much strong and stable. This property is useful in the baking industry.

Table-6. Biochemical characters of different crops

Species name	Dry weight(%)	Moisture(%)	Starch(%)	Sugar(%)
Curcuma aeruginosa	29.30	70.7	14.1	1.41
Curcuma amada	22.40	77.6	10.22	0.72
Curcuma aromatica	28.80	71.2	15.0	0.992
Curcuma brog	30.40	69.6	18.0	0.925
Curcuma malabarica	31.40	68.6	21.4	0.91
Curcuma zedoaria	25.00	75.0	14.06	1.3
Curcuma harita	24.1	75.9	14.32	1.19
Curcuma sylvatica	21.2	78.8	10.34	1.11
Curcuma raktakanta	28.8	71.2	14.198	0.619
Canna edulis	35.7	64.3	27.0	-
Zingiber cassumunar	26.80	73.2	14.12	0.714
Zingiber roseum	22.80	77.2	7.75	0.41
Zingiber macrostacheum	26.00	74.0	10.71	0.98
Zingiber zerumbet	24.83	75.17	13.23	0.94
Typhonium flagelliforme	36.44	63.56	23.68	1.059
Typhonium trilobatum	33.00	67.0	22.5	0.714
Typhonium divaricatum	32.00	67.5	23.07	1.42
Theriophonum minutum	34.00	66.0	17.3	0.961
Aponogeton natans	32.00	68.0	12.16	0.81
Asparagus racemosus	19.72	80.28	1.7	7.8
Costus speciosus	16.4	83.6	10.46	1.3
Vigna vexillata	27.8	72.2	24.15	1.28
Tacca pinnatifida	22.4	77.6	10.22	0.54
Amorphophallus poenifolius	11.4	88.6	6.43	

The bakery products prepared from *canna* starch are much lighter and crisper than those from wheat (Hermann, 1994). In *Vigna vexillata*, the tubers possess 24.15% of starch content and it could be considered economically more viable crop since it provides both tuber and proteinaceous green pods which can be used as a vegetable. *Theriophonum minutum* and *Aponogeton natans* yield 17.3 %and 12.16% starch respectively and they are used for the extraction of starch in rural areas. In *Asparagus racemosus*, the starch percentage was very low (1.7%), but is highly medicinal (CSIR, 1950).

Conclusion

The present study was undertaken to explore the possibility of utilising some of the lesser known starchy tuber crops. Inspite of the availability of the major starchy tuber crops, these lesser known starchy tuber crops act as carbohydrate reserve, which are unnoticed and can be exploited in order to support the food security of our country. The *Canna edulis* starch resemble yam in most functional properties. The starch has good potential in food applications because of the high viscosity and gel strength, especially in canned foods that require high paste stabililty (Smith, 1982). Preliminary studies indicates that biscuits and cookies can be prepared from canna starch. The genus '*Curcuma*', '*Typhonium*', '*Theriophonum*' and '*Vigna*' possess high percentage of starch. All of the *Curcuma* species are used for extraction of starch. The young rhizomes of *Curcuma zedoaria* can be eaten fresh or cooked as vegetable (Vimala,1995). A decoction of the rhizome is beneficial for cold. The rhizome of *Costus speciosus* is edible and is used after cooking (Vimala,1995). The rhizomes of *Alpinia galanga* and *Alpinia calcarata* are highly medicinal. Considering the importance of these tuber crops as food, medicine, and in the industrial sector, these crops can be exploited at the commercial level. The compilation of the data shall be of future use in the study of their medicinal as well as ethnobotanical importance. Although many of them can be utilised as food, in the present context of rapid increase of population and consequent shortage of food grains in India, collection and utilisation of various types of lesser known starchy tuber crops as food supplementing the cereals are considered very essential. These crops also have a significant role in filling the deficiency arising on the food front of the country in the years to come.

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COMMUNICATION BEHAVIOUR OF TRIBAL FARMERS- A SYSTEM ANALYSIS

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Abstract

Despite a multitude of developmental efforts, tribals still remain in the low socio-economic stratum constituting the poorest section in the country. Modern agricultural technology has not been diffused among the tribals resulting in their continued dependence on subsistance farming. Unless the technological gap is filled by proper communication between tribals and the outside world, one cannot expect them to prosper with respect to their socio-economic condition. The present study is an attempt to understand the communication behaviour of the tribal farmers. The study was conducted in the "KANI" settlements of Nedumangad Taluk of Thiruvananthapuram district. The sample size was 110 tribal farmers named "KANIKKARS". Age, education, innovation-proneness, attitude towards block extension agency, social participation, fatalism, infromation seeking behaviour, and behaviour was the dependent variable. An attempt to identify key communicators and leadership modes was made using socio-metric test. Various statistical methods and scale were used to measure the independent variables and depedent variable.

The data were collected by interviewing the respondent using the interview schedule development for the purpose. Group discussion and participant observations were also used to elicit informantion. The data were subjected to correlation analysis and stepwise regression analysis. The study revealed that majority to the tribal farmers had only low level of communication behaviour. The information input from mass media and neighbours was relatively high, but they experienced difficulty in information decoding and encoding. Regarding information output, tribal farmers communicated information to other farmers in the settlement during personal visits. Feedback to mass media was nil. Neighbours and relatives were the most important sources of information. Correlation studies revealed that age was significantly but negatively correlated with communication behaviour and other independent variables were positively and significantly correlated. The key communicators and leaders identified among the tribal farmers were "MOOTUKANI" (the headman), "PLATHI" (the middle man) and the Secretary of Co-operative Society in the order of preference. Radio, newspaper and the tribal leaders were considered as the important credible sources of information in the order of preference.

Introduction

Tribal communities, the weakest section of the Indian society, constitute 29.9 million, which forms seven per cent of India's total population. Despite the growing importance attached by social scientists to the study of tribal development and consequent prolific growth of literature on the subject, one has reasons to feel dissatisfied with the status of tribal research in India, which is marked by a low level of sophistication.

For social scientists, tribes are those which are included in the scheduled tribe list in the Constitution of India. The 414 tribes listed following the 1956 Presidential notification differ greatly in their habitats, modes of production, degree of isolation, degree of acculturation, level of development, social customs, beliefs and so on. The anthropologists' conception of a tribe "as a small, culturally distinct and economically self-sufficient community with a language of

its own and autonomous political organisation" is utterly inappropriate to the so-called tribal groups in India. Indian anthropologists have depicted tribes as small, self contained, self sufficient and autonomous communities practicing subsistence economy with limited external trade.

In spite of all these facts, one cannot forget the widening chasm between the economically weaker sections and other sections of the society as clearly evident from the profile feature of the tribes in the country. Hence, Article 46 of the constitution of India lays down, "The State shall promote with special care the weaker sections of the people, and in particular, of the scheduled castes and scheduled tribes, and shall protect them from social injustice and all forms of exploitations". With this concern, the Government of India has launched numerous tribal development programmes.

Even after the implementation of such programmes, tribes of India still stand on a lower socio-economic stratum. The condition of 2.61 lacs tribal people in Kerala is not much different from the rest of the tribals in India. The members of scheduled tribes in Kerala belong to as many as 35 distinct communities and constitute 1.03 percent of Kerala's total population. They form the decisively poorest section of Kerala's people. Their condition has become still worse owing to the lack of communication and infrastructural facilities, improper management, organizational arrangements and, above all, the exploitation by non-tribal population. Apart from these problems, tribal communities enmeshed in age-old customs, beliefs, and superstitions, have continued to remain conservative and extremely tradition bound with morbid fatalism.

Lack of communication facilities is one of the major reasons for agricultural backwardness of tribal villages. The diffusion of knowledge of improved agriculture is limited by the communication gap in tribal society.

In order to study the communication behaviour of tribal farmers and to explore its relationship with their personal and socio-psychological characteristics and also to identify the key communicators among the tribal farmers, a research study was undertaken among 'Kanikkars", the dominant tribe in Thiruvananthapuram district. An attempt to study the leadership modes among the tribal farmers has also been made.

The specific objectives of the study were:

(i) To study the communication behaviour in terms of information input, processing, output, and feed back pattern of tribal farmers.

(ii) To study the information seeking behaviour of the tribal farmers.

(iii) To find out the relationship between personal and socio-psychological characteristics of tribal farmers and the communication behaviour.

(iv) To study the extent of credibility attached to various sources of information by the tribal farmers.

(v) To identify the key communicators among the tribal farmers.

(vi) To study the leadership modes among the tribal farmers.

Scope of the study

Transfer of technology is vital in any type of development and comes to have utmost importance in agricultural development. Since, tribal people fetch their livelihood mainly from agriculture, and the agricultural production in tribal area is found to be low, an adequate strategy for agricultural communication becomes imperative. Therefore, it is expected that the results of this study would yield types of information that may help to streamline the appropriate communication strategy for the diffusion of agricultural information among the tribal farmers.

Hypotheses

Based on the objectives the following hypotheses were formulated to test the

relationship of the dependent variable with the independent variables.

General Hypothesis (GH-1): There will be significant association between the communication behaviour of tribal farmers and the personal and socio-psychological variables.

Sub-hypotheses (SH-): There will be significant association between communication behaviour of tribal farmers and their:

1. Age.
2. Education.
3. Innovation proneness.
4. Attitude towards block extension agency.
5. Social participation.
6. Fatalism.
7. Information seeking behaviour
8. Cosmopoliteness.

Methodology

The research methods and procedures used in the study are presented under the following subheads.

A. Sampling

The head of the selected household constituted the sampling unit referred to in this study. Out of the 35 scheduled tribes, the largest group in Southern Kerala is the "Kanikkars". They are concentrated in Nedumangad and Neyyattinkara taluks in Thiruvananthapuram district and Nedumangad taluk has the maximum number of scheduled tribes. Hence, Nedumangad taluk was purposively selected as the locale of the study. This taluk consisted of 20 villages. From these 20 villages, six villages having higher population were selected for the study. They are Tholikode, Vithura, Palode, Kallara, Peringamala and Anad. From these six villages, further selection of the respondents for the study was made using random sample method. By taking ten percent of the heads of families from each of the six villages, a total sample size of 110 for the study was obtained from the only tribal community in the area i.e., "Kanikkars".

B. Selection and empirical measurement of variables

The list of variables selected along with the instruments used to measure them are given below:

Variable	Measurement technique used
Dependent variable	
Communication behaviour	The procedure followed by Sherief (1985) with suitable modifications.
Independent variables	
X1. Age	Actual age completed at the time of Interview.
X2. Education	Socio-economic status scale Developed by Trivedi (1963)
X3. Innovation proneness	Moulik's (1965) self rating innovation proneness scale.
X4. Attitude towards block extension agency	Attitude scale developed by Sadamate (1978)
X5. Social participation	The method developed by Lokhande (1974)
X6. Fatalism	The scale developed by Chadhopadhyay & Verma (1970)
X7. Information seeking behaviour	The procedure followed by Shailaja (1981)
X8. Cosmopoliteness	The scale developed by Desai (1981)

Measurement of dependent variable-Communication behaviour

The communication behaviuor of tribal farmers was measured in terms of the following sub dimensions:

1. Information input
2. Information processing consisting of information decoding and information encoding

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3. Information output

4. Information feedback

1. Information input

Information input relates to all activities performed by an individual for the acquisition of scientific and technical information from various sources. The flow of technical information from various sources. To measure this, the tribal farmers were asked to indicate how often they received information regarding improved cultivation practices for tapioca from various interpersonal sources and mass media. Based on the pilot study 12 different interpersonal and mass media sources were identified viz., Village Extension Officer, Training Staff of Mitraniketan, Junior Agricultural Officer, Newspaper, Instructors of Functional Literacy Programme, Radio, Agricultural Demonstrators, Neighbours and relatives, Tribal leader, Tribal Extension Officer, Block Development Officer, and Tribal Extension Officer.

The response of each farmer was obtained on a three-point continuum. The scoring procedure is given below:

Sl.no.	Category of response	Score
1.	Always	2
2.	Sometimes	1
3.	Never	0

The total information input score of each respondent was obtained by adding the scores obtained in respect of each source. The scores of all the respondents for each source were added for the purpose of ranking the sources.

2. **Information processing :** To measure the information processing pattern of respondents, two specific dimensions were considered. They were information decoding and information encoding.

(a) Information decoding : In the present study, information decoding was operationalised as the 'oftenness' of difficulty felt by the tribal farmers in understanding messages related to tapioca cultivation practices. The responses were rated on a three-point continuum training from 'always' to 'never'. The scores assigned were as follows:

Sl.no.	Category of Response	Score
1.	Always	0
2.	Sometimes	1
3.	Never	2

The information decoding score for each respondent was obtained by adding the scores corresponding to the pattern of response of the respondents to the five messages given for the purpose. The scores of all the respondents for each message were added for ranking the message.

(b) Information encoding: In the present study, information encoding was operationally defined as the 'oftenness' of difficulty felt by the tribal farmers in processing a technical information with regard to the improved cultivation practices of tapioca in a meaningful message of simple words. The responses were rated on a three-point continuum ranging from 'always' to 'never'. The responses were scored as shown below:

Sl.no.	Category of Response	Score
1.	Always	0
2.	Sometimes	1
3.	Never	2

The information encoding score for each respondent was obtained by adding the scores corresponding to the pattern of response of the respondent to the five messages given for the purpose. The scores of all the respondents for each message were added for ranking the message.

3. Information output: In this study, the information output was operationalized as the extent of utilization of different interpersonal communication methods by the tribal farmer for disseminating technical information related to tapioca cultivation to other tribal farmers.

To measure the information output, each respondent was asked to indicate how often he communicated the technical information

related to the selected message to the tribal leader, other farmers within the settlement, farmers outside his settlement. The respondents were also asked to indicate how frequently they used the different interpersonal communication methods for the purpose of communicating technical information related to tapioca cultivation to these communitees. The interpersonal communication methods included in the study are given below:

1. Personal talk during casual meeting
2. Personal talk during farm visit
3. Personal talk during home visit
4. Group discussion during informal meeting
5. Personal talk during home calls by fellow farmers.

The responses as to whom the tribal farmers communicated the messages and with what frequency were obtained on a three point continuu ranging from 'always to 'never'. The scoring pattern was as follows:

Sl.no.	Category of response	score
1.	Always	2
2.	Sometimes	1
3.	Never	0

The information output score for each respondent was obtained by adding the scores corresponding to the response pattern of the respondents on the two groups items in the schedule. The scores obtained by all respondents for each category of communicatees and interpersonal communication methods were added separately for ranking them.

4. **Information feedback:** In the present study, information feedback was operationalised as the oftenness of receiving the opinions, feelings, doubts, ideas, and thoughts on improved cultivation practices of tapioca by the respondents from the fellow farmers who are the secondary communicatees in the system through different interpersonal communication methods and also oftenness of sending back communication to the various sources of information by the tribal farmers.

The procedure followed for measurement of information feedback is given below:

A. The respondents were asked to indicate how frequently they received feed back from fellow farmers who are the secondary communicatees in the system through the different communication methods listed earlier and how frequently they received different types of information feedback. The types information feedback are given below:

1. Communication of information related to technical aspects.
2. Communication of information regarding sanction of subsidy
3. Communication of information regarding supply of inputs

B. The respondents were also asked to indicate how frequently they sent back communication to the sources of information cited earlier which are primary communicators in the system regarding the cultivation aspects of tapioca.

The responses were obtained on a three-point continuum ranging from 'always' to 'never'. The responses were scored as follows:

Sl.no.	Category of response	score
1.	Always	2
2.	Sometimes	1
3.	Never	0

The information feed back score for each respondent was obtained by adding the scores corresponding to the response pattern of the respondent. The scores obtained by the respondents for each method of information feedback, types of information feedback, and the feedback of the respondent towards different sources were added separately for ranking them.

Computation of scores for communication behaviour: The scores for communication behaviour were obtained by the method of

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weighted average. The total score obtained by the respondent for all the four components such as information input, information processing, information output and information feedback were found out first. Each total score was multiplied with a weight assigned to it and totalled. This total divided by the sum of weights given for all the four components. This can be represented as:

Score for communication behaviour =

$$\frac{W1\,X1 + W2\,X2 + W3\,X3 + W4\,X4}{W1 + W2 + W3 + W4}$$

Where X1 = Total score obtained by the respondent for information input; X2 = Total score obtained by the respondent for information processing; X3 = Total score obtained by the respondent for information output; X4 = Total score obtained by the respondent for information feedback and

W1 = Weight given for X1; W2 = Weight given for X2; W3 = Weight given for X3; W4 = Weight given for X4 , the weights being the number of questions asked to the respondents based on which the scores were calculated.

Categorisation of the respondents on the basis of their communication behaviour scores

The respondents were categorised into 'low', 'medium', and 'high' levels of communication behaviour based on the formula mean + or - 2 standard error of the mean which defines the 95 percent confidence limits of the mean communication behaviour (Snedecor and Cochran, 1954)

Measurement of the independent variables : The independent variables were selected based on a pilot study and they were measured using the methods mentioned elsewhere they were correlated with the dependent variable.

C. Measurement of source credibility: In the present study, source credibility was operationalised as the degree to which a tribal farmer considers a farm information source as trustworthy, competent, and reliable in adopting a new agricultural practices recommended by it. In the pilot study 12 important sources identified as mentioned elsewhere.

Most-least credibility index method was used to measure source credibility. Respondents were asked to indicate the extent of credibility (whether most credible or least credible) attached to each source. The relative credibility index was found out for each source using the following formula:

Relative credibility index = X/Y x 100/N

Where X= no. of persons who believed a source most credible; Y = No. of persons who believed a source least credible; N= Total no of persons in the sample.

The higher the index, the more the credibility.

D. Identification of Key Communicators:

The sociometric technique used in the study to identify the key communicators in the tribal areas was as follows: Every respondent was asked to name three leaders in the descending order of preference, who are the persons in the village he contacts for information and/or advice on problems regarding agriculture. The first choice was assigned a weightage of three points, the second two and the third one point. After computing the individual scores assigned by the 110 respondents, the leaders who obtained maximum total scores were identified as key communicators.

E. Technique of data collection: Interview schedule was used for data collection. A pilot study was conducted in the area before the finalisation of the schedule and it was pre-tested in a non-study area having identical conditions.

F. Statistical methods used: For analysis of data of the investigation, the following statistical tests and procedures were applied.

i. ***Percentage:*** Percentages were calculated for finding out the distribution of the respondents according to their communication behaviuor and personal and socio-psychological characteristics.

ii. **Simple correlation:** Correlation coefficients

were computed to find out the degree of association between the dependent variable and each of the independent variables under study.

iii. **Stepwise regression:** Stepwise regression procedures were applied to select the best regression equation and to determine the reliable regression coefficients for predictive purpose. These enabled to understand the relative effect of the independent variables in predicting the dependent variable and to eliminate the unimportant variables at each step.

Results & Discussion

The salient findings of the study were summarised and presented below:

The study revealed that the majority of the tribal farmers had only low level of communication behaviour. The information input of tribal farmers was relatively high since they received information from mass media such as 'radio' and 'newspaper' and pesonal localite sources such as 'neighbours and relatives'.

In both the cases of decoding and encoding, the majority of tribal farmers experienced difficulty always with regard to the messages about control of termites, about fertilizer application and about improved variety of tapioca. Regarding information output, the majority of the farmers communicated information to 'other farmers of the settlement' while 'personal talk during home visit'.

Feedback was highest about the 'information regarding sanction of subsidies etc., at the time of 'personal talk during home visit'. Feedback to the mass media such as radio and newspaper was nil. Feed back to cosmopolite sources was relatively less while that to personal-localite sources was comparatively high.

The study revealed that the majority (46 percent) of the tribal farmers had high information seeking behaviour whereas 42 percent had low information seeking behaviour.

'Neghbours and relatives' were the most important information sources followed by the 'radio' and 'newspaper'. Tribal leader and Tribal Extension Worker were the sources next in the order of importance. However, other sources such as Village Extension Officer, Training Staff of Mitraniketan, Agricultural Demonstrators, Tribal Extesion Officer, Instructors of Functional Literacy Programme, Junior Agricultural Officer, and Block Development Officer received only lower ranks as information sources.

Correlation studies revealed that age was significantly but negatively correlated with communication behaviour whereas education, innovation proneness, attitude towards Block Extension Agency, social participation, information seeking behaviour and cosmopoliteness were positively and significantly correlated.

Stepwise regression analysis revealed that all the independent variables (age, education, innovation proneness, attitude towards Block Extension Agency, social participation, fatalism, information seeking behaviour and cosmopoliteness) selected for the study, jointly explained 84.22 per cent of the variation in communication behaviour. The four variables, namely, information seeking behaviour, attitude towards Block Extension Agency, education, and social participation fitted in the regression equation alone contributed to 83 per cent of the variation. Information seeking behaviour emerged as the most important variable in the prediction of the communication behaviour, as this alone contributed to 74 per cent of the variation.

The key communicators identified among the tribal farmers were Mootukani, Plathi and Secretary of Co-operative Society in the order of preference.

Regarding the leadership 'Mootukani' is the leader, assisted by 'Plathi' (medicine man) who occupies the second position. Of late, Secretary of Co-operative society who is also a tribe has secured importance among tribals.

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Conclusion

In conclusion, it can be said that, even though Kanikkars are more progressive than the other tribal communities of Kerala, they are still less progressive compared to the nontribals of the State. For their socio-economic upliftment, the improvement in the farming system is imperative. It is possible only through systematic education and dedicated extension efforts.

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PERFORMANCE OF MEDIUM SIZED PADDY COMBINE HARVESTER IN RELATION TO SIZE OF THE PADDY FIELDS

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Abstract

Performance of a medum sized paddy combine harvester was evaluated in small paddy fields ranging from 804 to 1007 m^2 at Agricultural Research Station, Mannuthy. The area harvested by the combine having 58hp engine and cutter width of 2100 mm varied between 0.23 to 0.40 ha/hr. The efficency of the machine increased with the length of as well as area of the plot if the plot size was over 1000m^2 and length 42 m, the efficency was 0.4 ha/hr. The average output of the machine was only 0.29 ha hr. if plot size was below 100m^2. The cost of harvesting, threshing and cleaning using combine worked out to be Rs. 3500/- ha at the average efficiency of 0.4 ha. Mannual operation of these works required 40-50 labour days requiring Rs. 4000-5000/ ha. Mechanical harvesting avoided risk involved with labour unavailability at the time of paddy harvesting.

Introduction

Mechanisation of rice cultivation is getting acceptance among rice farmers in Kerala State. Newer and newer transplanters and combine harvesters are being introduced from abroad. However, machinery are going directly into the field before testing for efficiency and adaptability. Hence, the real adaptability and out put of the machinery under the average holding of the farmers in Kerala are not available (Jaikumran *et al*., 1999). Many of the machinery are used on custom hire service and hence an agronomic evaluation of machinery is more appropriate to understand economic feasibility of the machine. Hence, observational study was made on the performance paddy of medium sized combine harvester in average field condition in Kerala.

Materials and Methods

The study was conducted at ARS, Mannuthy during the year 2000-2001. The paddy variety Kanchana was transplanted using Yanji Sakthi 8 row mechanical transplanter on 13-7-2001. The crop was harvested at yellow ripe stage on 31-10-2001 using paddy combine harvester 'Crop Tiger'. The crop was raised in 6 plots of varying area as a part of students work experience programme of B.Sc. (Ag.) degree course.

The paddy combine harvester "Crop Tiger" has a cutting width of 2100 mm and machine is run by 58 hp diesel engine. The combine is running on rubber track attached to wheel, which facilitates it for easy maneuvering in boggy fields. The grain storage capacity is 1200 lit. The machine is having pick up reels mounted on front side to collect lodged paddy for reaping. The machine attached to Agriculture Department, Government of Kerala was used for the harvesting.

Each student was given approximately 60-m^2 land for work experience. The whole batch 82 students were grouped into 6 groups and cultivated paddy crop in 6 plots. Each student has manually harvested one square metre crop from his assigned area and counted plant population and yield attributes at harvest viz., number of hills m^{-2}, total number of panicles m^{-2}, number of filled grains $panicle^{-1}$ and 1000

grain weight. Later the whole plots were harvested using the machine and time required for harvest each individual plot was recorded. The output of clean grain from each plot was weighed and the straw left behind the machine was dried, collected and weighed.

Result and discussion

The general yield level of the crop (table-1) was below average due to low plant density and inadequate water management. The number of filled grains formed per panicle was between 33-59, as water scarcity was felt at the time of grain filling stage. Straw production was more favoured than grain production. Stress during grain development and ripening period usually reduced grain production and enhanced chaff in paddy (Siddiq, 1998).

The time required for harvesting each plot varied depending upon the plot size. When the plot size was below 1000 m^2 the average out put of the machine was 0.285 ha. hr^{-1} (table- 2). As the plot size enlarged the efficiency enhanced as evidenced from the table. Plot with 1007 m^2 area needed only 15 minutes for its reaping (table-1). The time also varied with dimension of plot. As the length increased, the time required for harvesting gradually declined. When length of plot was increased from 40.7 to 41.9 there was reduction in time requirement for harvest. The data also indicated that when grain yield increased, the output of the machine declined proportionately (table-1).

Table-1. Yield attributes and grain yield of Kanchana paddy crop and time required for harvesting using 'Crop Tiger' paddy combine.

Group No.	Area of plot (m^2)	Plant population m^2	No. of panicles m^{-2}	No. of filled grain per panicle	1000 seed weight (g)	Grain yield m^2	Straw yield m^2	Grain yield per plot (kg)	Straw yield per plot (kg)	HI	Harvesting time per plot (min)
1.	804	34	282	35	27.0	0.396	0.924	161	184	0.47	15
2.	994	35	289	59	26.5	0.376	0.656	135	201	0.57	20
3.	1007	27	290	50	26.5	0.380	0.851	116	189	0.38	15
4.	943	36	288	46	27.0	0.358	0.812	176	228	0.43	25
5.	936	35	280	33	26.5	0.408	0.705	174	184	0.49	19
6.	991	20	260	41	27.0	0.318	0.716	129	153	0.46	21

Table-2. Out put of the 'Crop Tiger' in relation to plot size

Group	Plot size (m X m)	Area (m^2)	Out put of combine harvesterha hr^{-1}
1	41.9 x 19.2	804	0.322
2	41.85 x 23.70	991	0.298
3	41.5 x 24.20	1007	0.403
4	41.0 x 23.0	943	0.226
5	40.7 x 23.0	936	0.296
6	40.7 x 24.35	991	0.283

Average forward speed of the machine remains static when plot length increases. When length of the plot reduces, the number of negotiation the machine has to make with corners at unit time interval increases. Hence, the average working speed and output of the machine comes down proportionately. During the same season, in the farm, the working demonstration of the machine in another seed plot of 57.85 m x 23.3 m size revealed that Kanchana paddy crop could be harvested in 17 minutes. The out turn of the machine in this case worked out 0.4757 ha^{-1}.

This observational study indicated that the average operational out put of the 'Crop Tiger' paddy combine harvester will be around 0.28-0.3 ha-hr, if plots are lesser than 1000 m^2 in size and length is about 40-42 m. The efficiency will be increased to more than 0.4 ha hr^{-1} if

plot area is above 1000 m^2 and length of plot more than 42 m. The plots may be set up that machine makes lesser negotiation with corers at unit time interval and has maximum forward speed per unit time. The length may be so chosen without any hindrance to effective water management.

Study conducted by Jacobi (1975) revealed that small Japanese combine harvester of 0.50 m cutting width has the efficiency of 0.095 ha hr^{-1}. An average of paddy crop producing 3 tonnes of grain and 5 tonnes of straw when harvested manually needed 181, 45,132 and 51-man hours ha^{-1} for harvesting, transporting (250 m lead), threshing and cleaning and drying respectively. This indicated that 51 labour days are needed for harvesting and post harvest processing of paddy. Labour charges vary between Rs 4,000/- to 5,000/-, depending upon the local wage rate. The combine harvester was available at the rate of Rs. 1400/- hr^{-1}. This worked out Rs. 3500/- ha^{-1} as the harvesting and post harvest processing of paddy using the combine harvester at the average out put of 0.40 ha^{-1}. The net saving of Rs. 500/- to 1500/- is assured if combine harvester is used. The most advantage of combine harvester is that it eliminates the risk associated with labour unavailability at the time of harvesting at the time of paddy harvesting. It also reduces crop loss due manual handling at the time of harvesting and transporting. Such situations are experienced specifically in rice bowl tracts like *kole* lands where vast area under paddy matures simultaneously. Risk removal associated with labour unavailability and inefficiency through mechanisation is stepping stone for sustaining paddy cultivation in the State.

Conclusion

The study revealed that harvesting of paddy using medium sized combine harvester assures saving of Rs. 500 to 1,500/- ha^{-1}. It eliminates the risks associated with labour unavailability at the time of harvest. Mechanising paddy cultivation is the stepping stone for sustaining paddy cultivation in the state.

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COMMUNITY FEED GRAIN BANKS FOR POULTRY DEVELOPMENT FOR STRENGTHENING LIVELIHOOD AND NUTRITIONAL SECURITY

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Introduction

More than 70% of the population of India depends on agriculture and allied activities for their subsistence. Over the years, rural India has evolved efficient mechanisms like Agroforestry, mixed crop cultivation, crop rotation, mixed farming, etc. creating multiple livelihood systems with agriculture at the central foci to try and utilize natural resources in an efficient and sustainable manner. Developmental changes, growing population, growing economic pressure from urban sector and changing lifestyle often leads to loss of linkages among different subsystems in the village setup. M.S. Swaminathan Research Foundation is addressing one such problem through its site office at Namakkal.

The developmental process in India has given rise to different revolutions in the production sector. Namakkal being a hot semi arid region, the green and white revolutions of the 60's and 70's were not able to make headway, due to its low rainfall, low water holding capacity and less green cover. However, in 1970 the yellow revolution took place when the Poultry industry initiated in the region yielded good results in Namakkal, Mohanur and Rasipuram taluks. Numerous small poultry units with 1000 to 2000 birds came up in the region. During the 90's larger poultry units with 25,000 to 35,000 birds came up; but during the same period the marginal farmers operating smaller units abandoned them in the face of rising costs, heavy losses and operational non-viability. The main factor is seen to be high cost of poultry feedgrain most of which comes from outside the State.

Integrated agriculture with crop, animal husbandry, agro processing and agribusiness is the base of the livelihood and ecological security systems of the country, in addition to being the foundation for nutritional food security systems (Swminathan, 2003). Under the project initiated with support from the Venkateshwara Hatcheries Group, attempts are being made now to work towards a feedgrain movement in the State, generating awareness among farmers, forming Farmers' Associations, developing linkages with poultry units through Feedgrain Banks and also promoting backyard poultry among small farmers for their greater livelihood and nutrition security. With this model the work emphasizes agriculture to be an integrated approach with crop and animal husbandry The process was initiated by trying to understand the prevailing scenario and the gamut of problems with regard to units going defunct, shortfall in feed grain availability, feed mix composition, feed costs et al.

The Poultry Industry Scenario in Namakkal Region:

Though poultry farms emerged during the 70's, most of the marginal farmers started poultry units only between 1985 and 1990 (Table-1) with units ranging from minimum Rs.0.35 lakh investment cost to Rs.3.5 lakh and an average investment of Rs.1.14 lakh. On an average these farmers were able to continue in the business for about 7 years. Units started closing

down from 1992 from minimum 2 year old units to 20 year old units with a minimum of 1000 birds to maximum of 5000 birds.

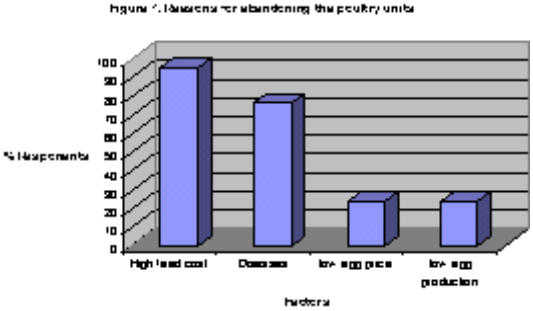
Small and marginal farmers also have backyard poultry units ranging from 3 to 40 birds, with an average of 12 birds. In a village ecosystem, backyard poultry is one component of the mixed farming systems for the traditional community. Such backyard poultry systems played important role in nutritional security at household level. The modern development process has led to change in the prevailing mixed farming system, reduced the feed availability, led to poor nutrition and diseases for the birds and gradually led to reduced interest in the backyard poultry.

A survey of defunct units in the area (Table 1)

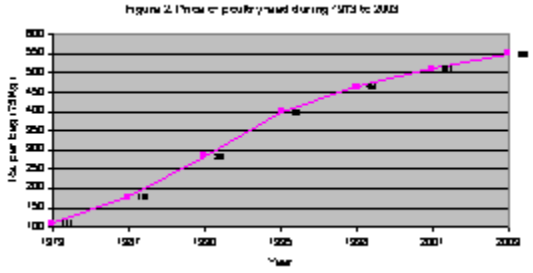
Table-1. Starting date, investment and closing date of the poultry units of marginal farmers in Nammakkal

Sl no	Name	Starting date	Investment (Lakh)	Closing date
1	C.Mani	1990	3	2001
2	M.Fine rose	1994	0.8	1996
3	Karuppannan	1989	0.7	1995
4	Selvaraj	1989	0.7	1996
5	Vennilla	1994	0.7	1998
6	Nachimuthu	1985	1	1992
7	Ramanathan	1985	3.5	1993
8	Navaladi	1988	1.25	1996
9	Selvaraj	1989	1.25	1996
10	Periyasamy	1988	0.9	1999
11	Chettiyar Periyasamy	1991	0.7	1999
12	Mani	1987	1.5	1993
13	Mani	1973	1	1993
14	Nallusamy	1989	0.75	1997
15	Velusamy	1990	0.8	1995
16	Subramani.C	1992	0.5	1995
17	Kandasamy	1992	1.5	1995
18	Thamariselvan	1990	1.5	1996
19	Sellamuthu	1988	0.95	1996
20	V.Chidabaram	1989	0.65	1995
21	Swaminathan	1989	0.35	1994

was conducted to understand the reasons for the same. Among the various issues facing the industry at large and particularly responsible for the smaller units going defunct are – inability to cope with high feed cost (more than 90%); 76 % of the farmers face the problem of disease attack (Raniket, IBD and cold) on poultry and 24% of the farmers encounter low egg production and are affected by low market cost for the eggs (Fig. -1).



Analysis of Feed Cost: Analysis of feed cost from 1973 shows that there was a steady increase in price of the feed - within four decades it increased by five times the original cost. On an average, every year the price has doubled but the egg cost has stagnated for the past two decades (Fig. -2).



The present feed mix cost is Rs 525.00 per bag (75 Kg) in which 46 % of the mixture is imported from other States accounting for 47% of the total cost. Among the feed grains the marginal farmers can grow Maize, Soyabean and Cholam. However, only Maize and Cholam is used directly in grain form. When farmers cultivate Maize and Cholam locally, its market cost could reduce to Rs.484.60 per bag with a saving of Rs.40.40 (table-2). Quality of different ingredients used in the feed mix

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is given fish meal is essentially added to feed mix for the protein content, maize, rice, pearl millet, for carbohydrate and the Soyabean and mustard oilcake are for minerals and vitamins.

Table-2. Composition of the prescribed feed mixes in Namakkal

S/No	Ingredients	% Comp	Price Rs/bag (75Kg)	
			(M)	(G)
1	*Maize (NA)	30.00	137.25	101.25
2	*Soybean cake (NA)	5.00	48.75	48.75
3	Ground nut cake (NA)	6.00	42.75	42.75
4	Mustard cake (NA)	5.00	22.50	22.50
5	Vitamins (LA)	0.25	9.38	9.38
6	Minerals mixture (LA)	2.50	4.69	4.69
7	Shell (LA)	2.00	3.00	3.00
8	Fish meal (LA)	7.50	59.06	59.0625
9	Broken rice (LA)	20.00	81.00	82.50
10	Pearl millet (LA)	5.00	21.75	21.75
11	*Cholam (LA)	5.00	20.63	15.00
12	Sunflower cake (LA)	10.00	45.00	45.00
13	Calcite (LA)	1.50	1.97	1.97
14	Trace minerals (LA)	0.15	4.50	4.50
15	Antibiotics (LA)	0.10	22.50	22.50
	Total	100.00	525.00	484.60

(M) When all the mixes purchased from market; (G) – When some of the crops grown by the marginal farmers; * - Crops could be grown.

In Tamilnadu, the poultry industry is predominantly centred in Namakkal district due to its favorable socio-economic and ecological conditions. Namakkal district receives average rainfall of 700 mm with hot dry climate. Many farmers have switched over to allied agriculture activities like poultry farming with broilers and layers. Around 12 lackh layers were grown in this district, demanding 2.37 lackh tones of maize. Apart from that breeders require 35,000 tones and other livestock units need 12,000 tones. But, the capacity of the Tamil Nadu state is only 1 lakh tones of maize, the remaining 7.4 lach tones is imported from other states like Karnataka, Andhra Pradesh and Bihar. Transport becomes a major cost component and as a result the feed cost increases whenever cost of fossil fuel increase. Farmers and poultry unit owners in Namakkal have been trying to promote Maize cultivation locally.

Promoting Feed Grain Cultivation:

The Community Feed Grain Bank (CFGB) model emphasizes on increasing sustainable production of Maize in the State to being down feed grain cost to make small-scale poultry operation viable once again and on strengthening backyard poultry at the household level. The climatic changes in the drier tracts demands alternative for cereals like rice, which are water-demanding crops. Maize cultivation will enhance the livelihood option in these areas. In the tribal areas of Kolli Hills, CFGB model focuses on enhancing the viability of backyard poultry in these areas for sustainable development.

Community Feed Grain Bank for Livelihood security:

It is in the prevailing scenario that MSSRF identified community feed grain bank as an effective mechanism for coordinating the production and supply of feed material for the poultry units benefiting the farmers, the poultry industries and for promoting livelihood and nutritional security. Maize being a new crop for many of the farmers, progressive farmers were identified, and organized as farmers club for promoting cultivation of the crop. The farmers club members were trained for cultivating the maize crop through demonstration, participatory evaluation and selection of method of cultivation, varieties, post harvest processing, quality maintenance, storage and distribution. With these farmers in the center of focus, a feed grain bank model has been developed by MSSRF. As indicated, in the forthcoming phase, the farmers club will encourage landless

laborers group (SHG), preferably women, to undertake suitable seed production (hybrid seed), purchase it from them and encourage landed farmers to cultivate maize with the seeds, with an agreement to purchase these grains from them at reasonable cost. Another group of landless laborers will undertake maize de-shelling (prototype of a simple mini maize sheller has been designed by the office) for a price and linked with the Maize-cultivating farmers. Maize cellulose that remains after shelling could be used for making paper that can be an enterprise activity for another SHG.

The grains procured will be tested for quality, weighed and stored in the feed grain bank and sold to the poultry units periodically at a favorable price. Farmers' clubs role with assistance from NABARD under the Vikas Volunteer Vahini scheme will be to continuously help introduce new technology to the farmers and create essential linkages with the bank for necessary financial support. In the process landed farmers, landless farmers and the farmers club farmers' will be able to increase their incomes by meeting the demand shortfall through ensuring availability and arresting the increase in feed cost for the poultry farmers both for backyard and poultry units (Fig. 2).

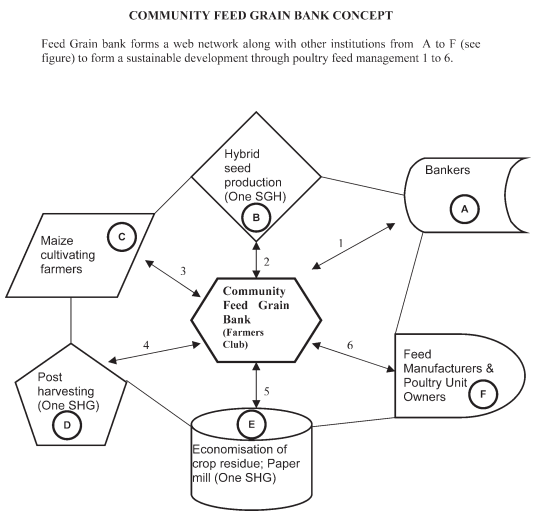

Fig. Community feed grain bank concept

Feed grain bank forms a web network along with other institutions from A to F (see figure) to form a sustainable development through poultry feed management 1 to 6.

Box-1. Increasing Sustainable Production Of Maize

Area selection

Maize is a crop that neither grows in wetland nor in dry conditions; hence a pilot study was undertaken with two women SHGs cultivating maize on leased land and also encouraging the farmers at random to grow maize in Parali and Tholur Panchayats of Namakkal in 2002. It was found that in the well-drained red soil areas, the performance of the crop was poor. The performance was better on black cotton soil. With this experimental intervention as a base, MSSRF staff discussed with the Tamil Nadu Agricultural University and Government Agricultural Department for suitable areas of Maize promotion. Varagur in Namakkal and Veerabayangaram in Authur were identified for creating a model for maize area expansion.

Farmer's club formation

Discussion with the farmers with smallholdings revealed that it is difficult to encourage them to cultivate maize for the first time unless they are assured of good returns; therefore large land holding progressive farmers were approached and we discussed

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maize area expansion with them. MSSRF approach is to work with groups. These progressive farmers could not be formed into SHGs since it was not logical; the alternative was found in forming farmers club under the concept of Vikas Volunteer Vahini of NABARD. With the help of Indian Bank, a group of progressive farmers were identified in both villages and farmers' club for Community Feed Grain Bank activities have been formed.

Demonstration of Maize cultivation

Maize crop was demonstrated by MSSRF at both farmers' field and on farm trial plots of MSSRF in Namakkal. The demonstrations was of Maize intercropping with soybean in Tholur, Parali and Kondichettipatty in Namakkal in the first year. Five different varieties of maize with different cultivation pattern like different spacing, bio fertilizer treatments was demonstrated in Namakkal this season. Five different varieties with 20 treatments with different spacing, irrigated and rain fed condition, bio fertilizer, farmyard manure, Vermicompost and also without fertilizer trails was made in Veerapayangaram village in Authur.

Training on maize cultivation

The members of farmers club were initially asked to test on their plots with initial training at MSSRF Namakkal regarding cultivation aspects of Maize. Simultaneously the farmers were engaged in participatory study on the demo plots at Namakkal and Authur. The farmers were given training on seed processing, sowing, spacing between rows and plants for different conditions. During the growing season a training program was conducted to identify nutrient deficiencies, pest attack, and maize crop growth through experts and visual explanation on the field. In end of the season the crops were harvested and post harvest training programs were conducted. The farmers were trained on drying the crops for moisture maintenance, shelling, grading through visits to feed units, nutrition department of veterinary college and discussing with different experts.

Seed Distribution

The farmers of the farmers club in Varagur were provided with popular varieties of seeds as loan for demonstrating the farmers in their region. The cost of the seeds will paid back to MSSRF and the interest will go to the club towards the club fund. With this venture, hundred acres of land in Varagur and three hundred and fifty acres of land in Veerabayangaram were put under maize on-farm demonstration for farmers in Namakkal and Authur. Scientists from MSSRF periodically visited these plots and provided guidance as required.

Confidence building Awareness

Farmers in general would like to have secure price and profitable agriculture. Meetings, workshops and brainstorming were conducted on economy of maize cultivation, marketing strategy. In this exercise leading personalities from the poultry industry, and

bank had free and fair dialogue with the farmers. Public awareness was created through local newspaper, magazine, pamphlets and public meetings. Farmers from different regions of the district visited the site office and obtained details of cultivation and guidance throughout the cropping season. Farmer's club members are also creating awareness in their neighboring villages and providing necessary inputs for cultivating the maize crop.

As a result of direct and indirect impact of these activities around thousand acres of land is under maize cultivation in and around Namakkal this season.

With regard to backyard poultry by small farmers, broken rice and cholam is the common feed for backyard poultry without fortification with vitamins, minerals and antibiotics. Further, as stated earlier, in the rural and tribal tracts, interest in backyard poultry is reducing in the face of cropping pattern changes with modernization leading to nutritional insecurity. MSSRF has been focusing on these issues, building capacity of the traditional communities in giving proper feed, handling disease, health management, and breeding and encouraging them to revive their mixed farming systems through mixed cropping with feed crops Box 2.

Box-2. Backyard Poultry Development

In Kolli Hills three villages have been selected for promoting and strengthening backyard poultry for household nutritional security. In these villages birds were distributed to SHG members and various training extended towards this goal.

Bird Management

The SHGs are asked to feed the birds with prescribed quantity and mixture of millet grains of locally available as per recommendations from the Nutrition Department of Veterinary College. Weekly records were maintained on feeding behavior of the birds recorded through measuring the feed provided to the birds and health through recording their body weight and general observation of eyes nose, legs and feathers for any changes. Health cards were given to the people for cross checking their feeding behavior, growth and diseases. Nutrient deficient symptoms were taught to the people and appropriate nutritive tablets like B-complex given for appropriate use.

Vaccination training

Apart from maintaining the general bird health the backyard poultry farmers are also trained to locally vaccinate their birds periodically. Three training programs were conducted during their growing period in which Lassota vaccine at the interval of twenty days was fed to the birds through mouth, nose and eyes. Farmers were also taught to provide preventive antibiotics to the birds at times of sickening posture.

Feed Crop Cultivation

Samai, Thinai and Maize seeds were distributed from the seed bank at Kolli Hills

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to the farmers to cultivate and feed the birds. Farmers were trained to cultivate these crops in mixed cropping and intercropping with tapioca, for the nutritional security of the birds and at their household level through consuming eggs and chicken meat.

Discussion

Livelihoods based on agriculture have been decreasing with the development of science and technology. The balance between these could be attained only through blending traditional wisdom with frontier technology (Swaminathan, 2003). Since 1980's many NGO's in developing world incorporate elements of both traditional knowledge and modern agriculture science to achieve both ecological and agricultural goals (Altieri, 2002). Developing countries like India with its high population need development processes to absorb the growing labour force productively; rural development initiatives in recent times have tended to focus on promoting group activity. Group enterprises have resilience capacity for any adverse changes particularly in the agriculture sector. The aim of the Community feed grain bank movement is to strengthen linkages between agriculture, poultry and animal husbandry for efficient agriculture based enterprises. MSSRF had created a model in this dimension for supporting the poultry industries and at the same time increasing household nutritional security in the rural and tribal community.

The Community Feed Grain Bank model with the banking facility for feed grain cultivation would enhance the poultry industry capacity to sustain with better efficiency on the other hand the model enhances multiple livelihoods for the labour community for their survival. Further, in a larger context, poultry industry produces nutritious food at cheaper cost through egg and meat, which enhances the nutritional security of the community.

Acknowledgement

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APPROACHES FOR RURAL FOOD SECURITY: A CASE FROM KOLLI HILLS

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Abstract

Food security in general parlance is thought to be merely sufficient food production. But actually it is a multidimensional concept covering the aspects of availability, access, nutritional absorption and environmental sustainability. According to FAO, food insecurity exists when all people at all times do not have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.(FAO, 1996). Expanding further on this, we undertake to define food security as physical, economic, social and ecological access to a balanced diet and safe drinking water so as to enable every child, woman and man to lead a healthy and productive life (MSSRF, 2003). Food Availability is a function of food production and food inflows net of outflows. Closely linked to production is environmental sustainability in terms of conserving natural resources and maintaining the ecological balance. Food Access is a function of purchasing power and livelihood access. Food absorption is the ability of the body to assimilate the food consumed for a healthy life.

Rural development projects with a top-down approach largely tend to focus on agricultural production sector with over emphasis on economic benefits, without much concern for the local needs and social and cultural value systems. Cultivation of commercial crops for quick cash often reduces land under cultivation of staple crops. These weaken the food security of a region. Therefore there is an urgent need for evolving holistic projects based on participatory approach and emanating from the grass roots. The M.S. Swaminathan Research Foundation (MSSRF) with its mandate of sustainable rural development attempts to do this in its areas of operation by establishing micro-level models jointly with the local community's participation. One such area of work is Kolli Hills, a tribal block in Namakkal district of Tamil Nadu. This paper highlight the nature and relevance of the interventions initiated by MSSRF in addressing the Food Security situation in Kolli Hills

Introduction

Food security in general parlance is thought to be merely sufficient food production. But actually it is a multidimensional concept covering the aspects of availability, access, nutritional absorption and environmental sustainability. Rural development projects with a top-down approach largely tend to focus on agricultural production sector with over emphasis on economic benefits, without much concern for the local needs and social and cultural value systems. Cultivation of commercial crops for quick cash often reduces land under cultivation of staple crops. These weaken the food security of a region. Therefore there is an urgent need for evolving holistic projects based on participatory approach and emanating from the grass roots. The M.S. Swaminathan Research Foundation (MSSRF) with its mandate of sustainable rural development attempts to do this in its areas of operation by establishing micro-level models jointly with the local community's participation.

Kolli Hills:

The Kolli Hills are situated at the tail end of the Eastern Ghats and are part of the Talaghat stretch. The hills have deep ravines and high

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peaks. On the western, eastern and southern sides they rise abruptly from the plain and on the northern side ascend to it by numerous long and gently sloping spurs. Kolli Hills is a block comprising of 246 villages dominated by tribal communities and is spread over an area of 28,293 ha and agricultural activities take place in 51.6 percent of the total area; forests occupy 44 percent; and other activities concern less than five percent of the territory. The 1991 census gives the total population of Kolli Hills as 33,888 distributed over 6,840 households. More than 95 percent of the inhabitants are tribal people belonging to the Malayali community. The population density is 119 per km^2. The area receives an average of 1440-mm annual rainfall distributed fairly over the two seasons. The elevation ranges between 1000 and 1350 meters. Irrigation facilities are available to less than 15 percent of the people through springs and wells. The remaining area is under rain-fed farming. The agricultural season starts with the onset of the southwest monsoon in June-July. Agriculture is practiced on three types of landscape lowland or wetland, upland, and rocky terrain land. Paddy is the dominant crop in lowland, in upland and rocky terrain millets like little millet (*Samai*), foxtail millet (*Thinai*), finger millet (*Ragi*), *Varagu* and *Panivaragu* are cultivated as both mono and mixed crop. The mixed crop cultivation includes Cereals, Pulses, Vegetables and Oil seeds. Horticulture crops cultivated include banana, jack, guava, pineapple, mango, citrus fruits and spices like coriander, fenugreek, clove and cinnamon. Such cultivation practices supported variety of mixed farming systems with cattle, poultry, piggery, etc. supplementing the setup and enhanced sustainable environment and food security of the region.

The Kolli Hills are known for their crop genetic diversity, especially in minor millets. But the agro biodiversity has been declining and there has been a rapid shrinkage in the area under minor millet cultivation in the last three decades. The introduction of cash crops primarily cassava, declining soil fertility, drudgery involved in processing, lack of market channels, increasing transport facilities, availability of cheap rice under the public distribution system, rice as a symbol of social mobility – all these are factors which have affected the cultivation and consumption of minor millets in the Kolli Hills. Although the drastic changes in cropping patterns have taken place in the last three decades only, the region seems to have undergone a major change in crops over the last one hundred years. Secondary statistical data show that in 1883, in the Nammakal region, nearly 1113 ha was under minor millet cultivation as against 967 ha in 1996-97. Similarly in 1883, tapioca was not listed as a cultivated crop in the Kolli Hills, whereas in 1996-97 the area under the crop was 5000 ha. (FAO-MSSRF, 2002, Rural and Tribal Women in Agro biodiversity Conservation – An Indian Case Study)

Cassava Cultivation and Food Security:

During the eighties, roads were constructed linking Kolli Hills to the plains. This was primarily with an eye to transporting economically valued timber and forest products. The roads were laid into many villages and laid the foundation for promotion of commercial crop cultivation like Coffee, Silver Oak and Cassava during the nineties. Among these, Cassava from Kolli Hills had high starch content and attracted large number of vendors from the plains. Support and incentives aided this like crops loans and advance cash payment by brokers leading to rapid expansion of cassava cultivation. Thus expanding cassava cultivation replaced many of the millets and horticultural crops, leading to shift in food habits from consumption of nutritious millets to rice, reduced consumption of pulses. This trend in turn led to reduce intake of protein, minerals, vitamins, etc. sowing the seeds of food insecurity in the region. Random interviews with villagers reveal that at least one individual falls ill once a week in a household with common diseases like cold, cough, fever, rheumatic pain; frequent cases of anemic and calcium deficiency are reported among the children and

women. Earlier, villagers used to carry head load of marketable items (fruits and vegetables) to local markets and plains on foot. The present generation is not been able to lift them even across short distances. These are pointers that though access to food has been increased through cassava cultivation the availability of staple food and nutritional security of the region have deteriorated.

Approaches for Augmenting Food Availability:

Ensuring local food availability in the rural sector should be based on maximizing the local production system for food based on sustainable use of natural resources. Kolli Hills being an elevated region in the dry semi arid track receives moderate rain to support subsistence agriculture. During the last two decades road construction has led to destruction of forest patches and denudation of private land from tree cover resulting in reduced rainfall. This increased the rate of change of cultivation to cassava over a large area replacing large agro biodiversity of the region. Cassava once used during lean season as coping strategy for food has become major crop due to its drought tolerance, economic potential and facilities like loans, nearby factory, government public distribution of food grains at lower cost, etc. Since, these tubers are not consumed for food, large quantity of food is purchased from the plains. This results in reduced consumption of millets, pulses and vegetables, which in turn leads to shortage of vitamins, protein and minerals in the diet affecting nutrition security. Traditional management systems for seed storage, crop breeding, farming and cultural linkages with the cropping systems have also been weakened. Moreover, cassava cultivation requires regular fertilizer application, exhausts soil nutrients and nothing is returned as crop residue, the crop residue being burnt.

On the other hand the traditional crops of cereals, pulses, vegetables and fruits were empirically selected and suited for variety of environmental conditions both in spatial and temporal scale, with variety of traditional techniques like crop rotation, mixed cropping and mixed farming helping to maintain the soil nutrient level, and supporting livestock and many other agricultural activities. Commercial exploitation of natural resources through cassava cultivation has been leading to loss of their basic production systems like soil fertility, water holding capacity, genetic diversity, and adversely affecting human health.

MSSRF has been working on an approach of promoting Conservation and Consumption through a variety of interventions like ensuring seed security, participatory varietal selection, community food banks and seed banks, and building of market linkages where possible. Seed security was promoted through revitalizing their traditional grain storage system *thombai* into seed bank with necessary modification, institutionalized, and enhanced seed exchange (Rengalaksmi *et* al., 2003). The tribal communities were trained to maintain the stock and record of different seeds of cereals, pulses, vegetables and other horticultural crop seeds in the storage systems at community level and distribute for the people at need and get back with interest. Sustainability of such mechanisms was further ensured through improved agronomic practices with seed treatment techniques, bio-fertilizers, bio-pesticides and quality seed production (Rengalakshmi *et* al., 2003).

However, the local production system through their empirical knowledge takes longer time to evolve strategies to increase their production system through traditional breeding and natural selection than through population growth. To feed the increasing number of mouths there is need for rapid increase in the traditional production system. This was promoted through participatory research in which traditional breeding and varietal selection were encouraged. In varietal selection, series of selections were made by the tribal community from more than 6000 accessions of millets from different millet research stations, cultivated in controlled conditions and are being tested in their agricultural land (MSSRF, 2002).

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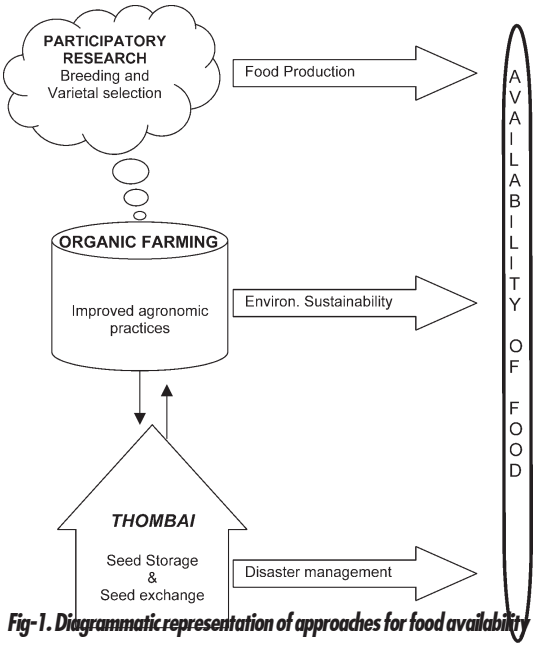

Fig-1. Diagrammatic representation of approaches for food availability

Approaches for Access to Food: Development projects should ensure enough livelihood option for the people to access food. In rural conditions such as livelihoods should be based on agriculture supporting agribusiness in the region with suitable infrastructure for diverse crop cultivation, storage and transport. MSSRF has developed models of community seed bank, community grain bank, collection center, zero energy cool chamber for increasing shelf life of vegetables, information network etc; these infrastructure support cultivation of a variety of cereals, pulses, fruits and vegetables. Seven seed banks were developed in different regions of Kolli Hills and they support more than twenty-five varieties of seasonal crops. These have helped increase both wage labour and self-employment through processing and distribution and opened pathways for different agriculture based business through marketing. Different groups were encouraged to process millets with mini mill for de-husking, de-stoning and grinding and distribution to market. Supply linkages have been built with both the local market and the Food World Chain of Departmental Stores in Chennai. Such processed agro-products are also further value added to produce ragi malt, health drink and other household food products with a view to enhancing both nutrition security and livelihood security. Pathways to increase income were also facilitated through building capacity towards organic certification for pineapples grown in the region and their export.

While cassava cultivation supports agribusiness through increasing wage labour, the multiplicity of production in the value addition chain is carried out by rich merchants, restricting agriculture related employment opportunities to six months in a year; The lack of self-employment or wage labour during the remaining months encourages seasonal migration of people. Further cassava cultivation releases excess money in a short period leading to social disruption through problems like addiction to alcohol (Fig- 2).

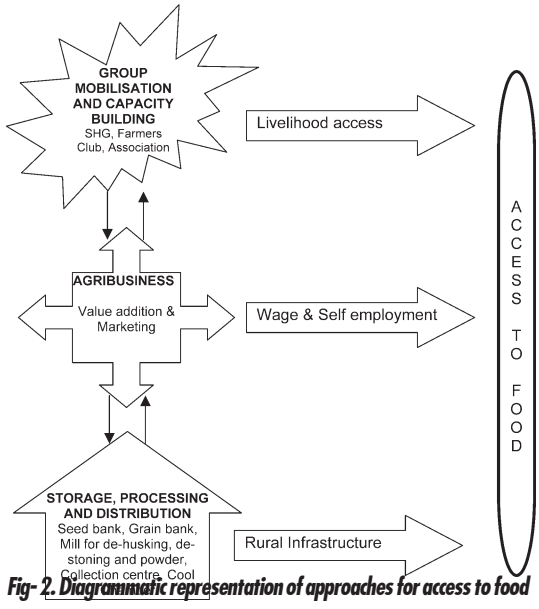

Fig- 2. Diagrammatic representation of approaches for access to food

Food Absorption: All living beings need balanced nutritional intake for healthy survival; such nutritional security in a community should be based on balanced

consumption of cereals, pulses, vegetables and fruits. In the rural agricultural sector, consumption of such balanced diet has been happening by default. Therefore interventions in agricultural production and cultivation practices should be more careful than in any other sector. Since development of rural sector needs agricultural interventions, the endeavors should also address balanced food absorption and health infrastructure. In cases of interventions like cassava in Kolli Hills atleast awareness should have been created among the tribal community to utilize the extra income that obtained through commercial agriculture for balanced nutritious food intake.

Similarly while creating the health infrastructure, sudden introduction of unfamiliar modern medicine (Allopathy) into the system also creates problems by over dependence on the doctor or neglect of treatment. MSSRF has been trying to build on the knowledge of the community regarding medicinal value of plants that grow locally and initiate medicinal plants garden at household and community levels for revitalization of traditional healing methods. Models of kitchen garden and poultry units have been created to combat malnutrition among the traditional community. Parallel training is undertaken on a continuous basis to promote cultivation and consumption of vegetables, pulses, nutritious millets and animal products like milk and eggs, by depicting their nutritive value and hygienic consumption. The importance of consuming enough food and need of pregnant women and nursing mothers for more nutritious food is also highlighted. Women usually have a tendency of giving nutritious food to men and taking only the leftovers. MSSRF also emphasizes on educating about the importance of adequate food intake by women and children in different meetings. To enhance this further, tribal communities are taken on exposure visits to learn through observation.

Since in the changing socio-economic conditions, people are interested in consuming modern preparations, such modern preparations are also thought using locally available nutritious material to enhance efficient use of resources (Fig.3).

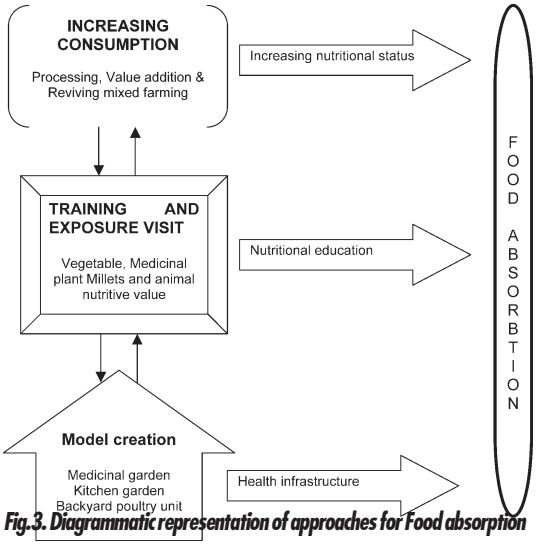

Fig.3. Diagrammatic representation of approaches for Food absorption

Discussion

Development projects aiming at development of a region have to take into account the long-term perspective of the overall development of the region. Particularly in rural sectors, development activity should focus on agriculture without disrupting the local agro biodiversity and social structure. In Kolli Hills, rampant Cassava cultivation would lead to deleterious effect if supporting food security projects were not implemented. MSSRF had made an attempt in this direction and created models to support people in getting rid of such deleterious effects. On the other hand it is not that such project are useless. The message is to see the limitations of such project and evolve mechanisms to cope up with the changing scenario at right time.

To reiterate, food security should emphasize on availability of food, access to food and nutritional security with social and gender equity; otherwise ultimately such development will lead to negative impact rather than overall sustainable development of the region.

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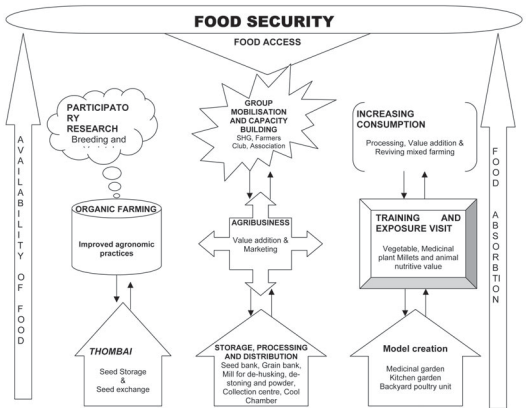
Sustainable food production and its availability are further enhanced through strategies for disaster management and environmental sustainability. Therefore MSSRF in Kolli Hills has created models through participatory research in breeding and varietal selection supported by improved agronomic practices, seed storage and seed exchange systems. Food production also linked with creating livelihood access through agribusinesses ensuring processing and distribution supported by storage infrastructure with social and gender equity. The social equity was attempted through addressing people with land by involving them more on livelihoods based on production sector and the landless labourers in the processing, value addition and agribusiness. Gender equity has been attempted throughout in all activities through capacity building of the community and empowering women with technology and knowledge. Such an approach also encourages local food absorption and increased nutrition status supported by nutrition knowledge and appropriate health infrastructure developed for them. This concept of food security could be universally applied in all rural areas with adaptations according to local needs. (Fig.4).



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We are grateful to Prof. M. S. Swaminathan for his keen interest and constant encouragement. We acknowledge the support of District Rural Development Agency (DRDA), Agricultural Departments, Hoticultural Departments etc. Namakkal and Indian Bank Kolli Hills. This work has been supported by SDC, IFAD, WFP Donors, their contributions are greatly acknowledged.

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DOMESTICATION OF PINK *PLEUROTUS* (*PLEUROTUS EOUS*) COLLECTED FROM THE FOREST OF WAYANAD, SOUTH INDIA

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Summary

A pink coloured oyster mushroom, later identified as *Pleurotus eous* was found growing on the dead decayed woods of *Jatropha curcas* and *Erythrina indica* in the forest of Wayanad in Kerala, India. A pure culture of this fungus was isolated from the stipe region and maintained in Potato Dextrose Agar (PDA) slants. The conventional substrate namely paddy straw was used for cultivation and it produced pink coloured sporocarps within 10-12 days of inoculation. The substrate was pasteurized with steam and the yield performance of this species grown on paddy straw was compared with that of *P. sajor- caju* and *P. citrinopileatus*. The spawn run period of *P. eous* was completed in 10 days and it produced a yield of 570g with a biological efficiency of 69.9% on paddy straw. The total cultivation period for *P. eous was* 32 days, whereas *P. sajor-caju* and *P. citrinopileatus* took 48 and 42 days respectively. A comparative sensory evaluation of *P. eous* with *P. sajor- caju* and *P. citrinopileatus* revealed that *P. eous* has got an excellent edibility and acceptability among mushroom growers and house wives.

Key Words

Biological Efficiency, Domestication, Pink *Pleurotus*, Spawn, Substrate

Introduction

Species of *Pleurotus* are now preferred owing to simple cultivation practices and time advantage over other cultivated mushrooms (Chang et *al*., 1981). *Pleurotus* species are known for their ability to grow on various crop residues and the yield of fruiting bodies varies considerably (Madhusudhanan and Chandra Mohanan, 1997). Compared to various species of *Pleurotus*, *P. sajor-caju* is known to produce very high yields on paddy straw (Bisaria et *al*., 1987). In nature *Pleurotus* species grow on the living or dead parts of the plants, which are generally poor in nutrients and vitamins. For better mycelium growth and fruiting body development, various lignocellulosic materials were used (Eager et *al*., 1976). The ultimate goal of commercial mushroom cultivation is to obtain high as well as steady yield of mushrooms throughout the year with short cultivation period and good consumer acceptability. Consumers' acceptability of *P. sajor-caju* has not been appreciable due to tough texture of the stipe, brown to grey colour of the fruiting bodies and moderate aroma. In this paper we report the isolation of a wild edible *Pleurotus* collected from the forest of Wayanad, its isolation, cultivation and yield performance in paddy straw. The sporophore production of this new isolate has been compared with that of *P. sajor-caju* and *P. citrinopileatus* in paddy straw.

Materials and Methods

Collection of samples, isolation and identification:

A pink coloured *Pleurotus* found growing in clusters on dead woods of *Jatropha curcas* and

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Erythrina indica were collected from the forest of Wayanad in Kerala during rainy season. The collected sporocarp's pileus region was surface sterilized with 70% ethanol and then a portion of the pileus was excised and plated in Potato Dextrose Agar (PDA) medium with antibiotic tetracycline (30mg/ml). The inoculated plates were incubated at 23ºC ± 2ºC for a week. The pure culture was isolated and sub cultured periodically and maintained on PDA slants and stored in refrigerator for further use.

Detailed studies were conducted on morphological, cultural and taxonomical character of the isolate of the *Pleurotus* species collected from the nature. Singer's (1975) classification, terminology, genetic and species concept was followed for the taxonomic studies and identification of the isolate collected. Fruiting body shape, its size, texture, nature of lamellae, hyphal system, spore print colour, spore size and shape were recorded.

Spawn preparation and cropping:

Paddy based spawn was prepared and inoculated to sterilized paddy straw. The paddy straw was chopped into 5-6 cm bits and it was soaked in water for 6 hours and then sterilized (at 120º C for 30 min.). The sterilized substrate was inoculated with 20 days old spawn of the respective *Pleurotus* species at 2 percent of wet weight of the substrate. High-density high molecular polythene (HMHDP) bag of 55cm x 45cm size (100 gauge thickness) was used as the container. Multilayered spawning technique was followed for inoculating the substrate. After filling, the mouth of the bags were tied with rubber bands and incubated in the spawn run room of the mushroom house. At the end of the spawn run period, the bags were kept open and watered daily by sprinkling water over the bag and the beds were shifted to the cropping room. Fresh weight of the sporophore was recorded immediately after harvest. Three flushes were harvested from each bag and the biological efficiency (B.E.) was calculated by dividing the average yield of mushroom /bed by dry matter weight of substrate/bag, multiplied by 100. Six replicates were maintained for each species. At the time of spawning and bags filling, 100g of the wet substrate were collected for determining the dry weight of substrate. Five replicate samples were collected and kept in oven at 70ºC. Dry sample weight was recorded when it showed constant weight. Moisture content (%) was the loss of moisture (100-dry weight of the sample).

Sensory Evaluation:

The new isolate collected from nature viz., Pink *Pleurotus* and *P. sajor-caju* and *P. citrinopileatus* were subjected to sensory evaluation (appreciation per cent) by employing a panel of five judges based on a modified sensory assessment score card as suggested by Rangamma (1997) and Hittalmani (1986). The sensory assessment scorecard is based on the following characteristic features and the score value is given in parenthesis:

1. Colour of the sporocarp- White (7); attractive and appealing colour (5); Brown grey (3); Black (1)
2. Texture of the sporocarp- Firm crisp and melting (7); Firm crisp and not melting (5); soft (3); leathery (1)
3. Taste and flavour of the sporocarp- Excellent (7); Good (5); Average (3); Poor (1)
4. Keeping quality of the sporocarp- For a week (7); 4-5 days (5); up to 3 days (3); Only one day (1)

Appreciation percent was calculated using the following formula =

$$\frac{\text{Score obtained}}{\text{Max. Score (28)}} \times 100$$

Results and Discussion

Pileus was conspicuous pinkish red, thin imbricate, small, cap 2.5 – 6 cm. diam., at first narrowly spathulate to flabelliform, sessile with narrow point of attachment. Surface pinkish, flesh colour or paler (M.YR/7.0/6.0 to 2 YR/8.1), glabrous smooth, margin incurved, entire. Lamellae decurrent, white to cream, very

narrow, extremely thin crowded, with lamellulae of four lengths. The pinkish colour which, fades under exposure to light and temperature. Basidiospores are 6.6- 8.6ìm long, ellipsoid to rounded-cylindrical with suprahilar depression, thin walled, hyaline, inamyloid. Basidia 12-15 x 4-5ìm, narrow clavate, bearing four sterigmata. *Pleurocystidia* absent. The sporophores mostly appeared in bunches. Hyphal system was monomitic throughout. The spore print colour was white. Based on the above taxonomical description the *Pleurotus* isolate (pink *Pleurotus*) collected was identified as *P. eous* (Berk.) Sacc. The taxonomical description of *P. eous* given by Pegler (1976) was in agreement with the present findings.

The yield performance of *P. eous, P. sajor- caju* and *P. citrinopileatus* were presented in table-1. The spawn run period was completed within 10 days in the case of *P. eous*, where as it took 12-14 days for *P. citrinopileatus* and 16-18 days for *P. sajor- caju* on paddy straw. As seen table-1, the pink *Pleurotus - P. eous* sporocarps were ready for harvest (first flush) at 10-12 days of cropping. In the case of *P. citrinopileatus* and *P. sajor-caju* first harvest was obtained at 14-16 days and 20-22 days of cropping respectively, by which time a second harvest could be obtained from *P. eous*. The biological efficiency of *P. eous* has been reported to be far superior to that of other two species of *Pleurotus* used in the present study. Bano *et* al. (1979) showed that *P. flabellatus*, which produces white fruiting bodies, also gives high yields, however its biological efficiency was not comparable to that of *P. sajor-caju*. *P. eous* used in the present study recorded higher yields in lesser cultivation time. The total cultivation period also varies for the three *Pleurotus* species studied. It was 30 days for *P. eous*, 42 days for *P. citrinopileatus* and 48 days for *P. sajor-caju*. Among the three species grown on paddy straw highest yield was obtained in *P. eous* with a total yield of 570g/ bag and lowest yield was in *P. citrinopileatus* with a total yield of 440g/bag. The total yield obtained in the case of *P. sajor-caju* was 515 g/bag with a biological efficiency of 63.3%.

The sensory evaluation studies of the three *Pleurotus* species revealed that *P. eous* has got an overall higher sensory evaluation point. *P. citrinopileatus* scored seven points for its white attractive flush colour while the pink *Pleurotus* (*P. eous*) scored five points for attractive pink colour and *P. sajor-caju* scored only 3 points for its gray colour. Regarding the texture of the fruiting bodies, *P. eous* scored seven points for its firm crisp melting texture, where as it was only five points for *P. sajor-caju* and three points *P. citrinopileatus* for its soft texture. With respect to the taste all the three *Pleurotus* species categorized as good with five points. Sensory evaluation was based also on the comparison of the keeping quality of the fruiting bodies of three mushrooms after harvest in the open condition. Both *P. eous* and *P. citrinopileatus* has got a less keeping time of one day with one points where as *P. sajor-caju* has got comparatively higher self life of 2-3 days with three points. Thus, based upon the overall percent appreciation score, *P. eous* was superior which was once again in agreement with the findings of Singh and Rajarathnam (1977) who also reported better sensory qualities of *P. eous* than *P. flabellatus*.

We can conclude that pink *Pleurotus* (*P. eous*) has higher yield potential comparable to that of *P. sajor-caju* and *P. citrinopileatus*. It also comes to yield earlier and the total cultivation period is shorter than the two species studied. Due to its attractive colour, texture and in overall assessment of sensory evaluation, *P. eous* is superior compare to that of the other two species. Therefore, pink *Pleurotus* (*P. eous*) collected from Wayanad, South India can be successfully domesticated and used for cultivation on paddy straw throughout the year.

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Table 1. Yield performance of P. eous, P. sajor-caju, and P.citrinopileatus on paddy straw

Pleurotus species	First Flush		Second Flush		Third Flush		Total Cultivation Period (days)	Total B.E. (%)	
	Day	Yeild (g)	Day	Yeild (g)	Day	Yeild (g)		yeild*	(g)
P. eous	10-12	350	20-22	150	28-30	70	30	570	69.9
P. sajor-caju	20-22	290	30-34	90	46-48	135	48	515	63.3
P. citrinopileatus	14-16	240	34-36	50	40-42	150	42	440	54

Dry weight of substrate/bag=815 g
*Mean of 6 bags/treatments

Table 2. Comparative sensory evolution of pink Pleurotus (P. eous) with P. sajor-caju and P. citrinopileatus

Sl.No	Pleurotus species	Colour of the Sporocarp	Texture of the Sporocarp	Taste of the Sporocarp	Keeping quality of the sporocarp	Over all sensory evaluationscore
1	*Pink Pleurotus (P. eous)*	5	7	5	1	18
2	*P. sajor-caju*	3	5	5	3	16
3	*P.citrinopileatus*	7	3	5	1	16
Score index		White-7; Attractive Appealing-5; Brown Grey-3; Block-1	Firm crisp, Melting-7; Firm crisp not melting-5; Soft-3; Leathery-1	Excellent-7; Good-5; Average-3; Poor-1	**W**eeks time-7; 3-5 days time-5; Up to3 days; One day-1	**Max. Score=28**

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ജൈവകൃഷിരീതിയിലൂടെ പച്ചക്കറി കൃഷിയിൽ ഉല്പാദനക്ഷമത കൈവരിക്കൽ– ഒരു പരീക്ഷണം

ജോൺ മാസ്റ്റർ
വസുധ, മൂലങ്കാവ്, സുൽത്താൻ ബത്തേരി, വയനാട്

സംഗ്രഹം

ജൈവവളങ്ങളുടെ സാവധാനത്തിലുള്ള വിഘടനപ്രക്രിയ ദീർഘകാല വിളകളെ കാര്യമായി ബാധിക്കുന്നില്ലെങ്കിലും ഹ്രസ്വകാല വിളകളെ സാരമായി ബാധിക്കുന്നു. ഹ്രസ്വകാലവിളകൾ വേഗം വളരുകയും ചുരുങ്ങിയ കാലം കൊണ്ട് അതിന്റെ ആയുസ്സ് അവസാനിക്കുകയും ചെയ്യുന്നു. ഹ്രസ്വകാലവിളകളായ പല പച്ചക്കറിവിളകളും അഞ്ചൊ ആറൊ ആഴ്ചകൾ കൊണ്ട് ഫലം തന്നുതുടങ്ങുന്നു. ഈ ചുരുങ്ങിയ കാലയളവിൽ പ്രവർത്തനക്ഷമമാകുന്ന ജൈവവളങ്ങൾ ഇന്നും സുലഭമല്ല. ഇത് കർഷകരെ അലട്ടുന്ന ഒരു പ്രശ്നമാണ്. ഇതിന് പരിഹാരം കണ്ടെത്താനുള്ള ശ്രമമാണ് കർഷകർക്ക് ഏറെ പ്രയോജനകരമായ ഈ കണ്ടെത്തൽ

ലഭ്യമായ ജൈവവളത്തിന്റെ പ്രവർത്തനക്ഷമത വിലയിരുത്താനായിരുന്നു ആദ്യപരീക്ഷണം. നല്ലവണ്ണം സൂര്യപ്രകാശം ലഭിക്കുന്ന ഒരു സെന്റ് സ്ഥലമാണ് പരീക്ഷണത്തിനായി തെരഞ്ഞെടുത്തത്. സ്ഥലത്തെ മണ്ണ് പരിശോധിച്ചു. സ്ഥലം രണ്ടു സമഭാഗങ്ങളായി തിരിച്ച് ഒരു ഭാഗം പരീക്ഷണസ്ഥലവും മറ്റെഭാഗം നിരീക്ഷണസ്ഥലവുമാക്കി തക്കാളി, ചീര, ബീൻസ്, പയർ എന്നിവ രണ്ടു ഭാഗത്തും തുല്യമായി കൃഷി ചെയ്തു. ജൈവവളപ്രയോഗം, നന, പുതയിടൽ എന്നിവ രണ്ടു ഭാഗത്തും തുല്യമായി നടത്തി. ജൈവവളം പരീക്ഷണസ്ഥലത്ത് നൽകി വിളവ് ശ്രദ്ധിച്ചു. അധികവളം നൽകിയ പരീക്ഷണസ്ഥലത്ത് നേരിയ വിളവർദ്ധന ഉണ്ടായെങ്കിലും തൃപ്തികരമായ ഫലം കണ്ടില്ല. പരീക്ഷണ സ്ഥലത്തു നിന്നും നിരീക്ഷണസ്ഥലത്തുനിന്നും മണ്ണെടുത്ത് പ്രത്യേകം പരിശോധിച്ചു. നേരിയ വ്യത്യാസം മാത്രമേ മണ്ണു പരിശോധനയിൽ കണ്ടുള്ളൂ.

പെട്ടെന്ന് പ്രവർത്തനക്ഷമമാകുന്ന ജൈവവളം കണ്ടെത്തുന്നതിനെപ്പറ്റയായിരുന്നു തുടർന്നുള്ള ആലോചന. 1999 ഫെബ്രുവരിയിൽ പ്രസിദ്ധീകരിക്കപ്പെട്ട ജൈവ കർഷകപ്രകൃതി മാസികയിൽ ചാണകം, മണ്ണ്, മൂത്രം, ജലം എന്നിവ ചേർത്ത് നിർമ്മിക്കുന്ന ഒരു ദ്രാവകവളത്തിന്റെ കൂ പ്രസിദ്ധീകരിച്ചിരുന്നത് ശ്രദ്ധയിൽപ്പെട്ടു. ചാണകം, ഗോമൂത്രം, തൈര്, പാൽ, നെയ്യ്, പനംചക്കര, കരിക്കിൻവെള്ളം, വെള്ളം എന്നിവചേർത്ത് ഉണ്ടാക്കുന്ന പുളിപ്പിച്ച ദ്രാവകവളത്തെപ്പറ്റി ഡോ. മധുസൂദനൻ, എം.എസ്. സ്വാമിനാഥൻ ഗവേഷണ കേന്ദ്രം– പുത്തൂർവയൽ, ശ്രീ. പി. രവികുമാർ, സ്പൈസസ് ബോർഡ് കല്പറ്റ എന്നിവർ ചേർന്ന് പ്രസിദ്ധീകരിച്ച് ലഘുലേഖയും ഞാൻ വായിച്ചു.

ചാണകം, ഗോമൂത്രം എന്നിവയെക്കാൾ സസ്യപോഷകങ്ങളടങ്ങിയ ആട്ടിൻകാഷ്ടം, ആട്ടിൻമൂത്രം, തൈര് എന്നിവ ചേർത്ത് ഒരു ദ്രാവകവളം നിർമ്മിച്ചാൽ മെച്ചപ്പെട്ട ഫലം കിട്ടുമെന്ന് എനിക്കുതോന്നി.

ചാണകം, ഗോമൂത്രം എന്നിവയെക്കാൾ സസ്യപോഷകങ്ങൾ അടങ്ങിയ ആട്ടിൻകാഷ്ടവും മൂത്രവും എനിക്ക് സുലഭമാ

പശു ആട് എന്നിവയുടെ വിസർജ്യങ്ങളിലെ സസ്യപോഷകങ്ങളുടെ താരതമ്യപഠനം
ശതമാനം

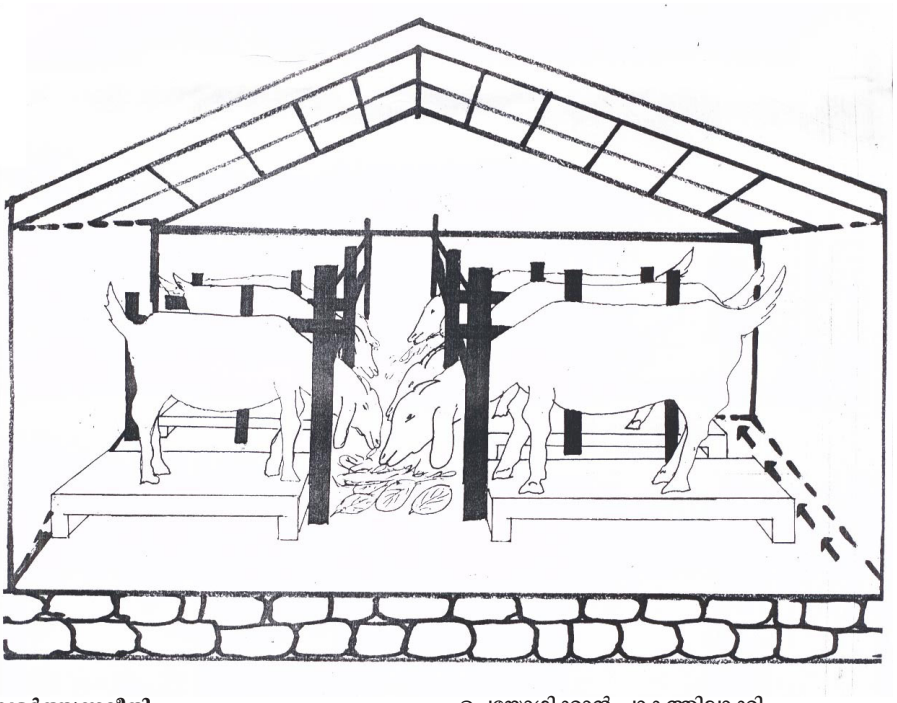
	Organic Matter	Mineral Matter	N	P	K	Lime
ചാണകം	15.2	3.6	.3	.18	.18	.36
ആട്ടിൻകാഷ്ടം	31.1	4.7	.7	.51	.29	.46
ഗോമൂത്രം	4.8	2.1	1.21	.01	1.35	.01
	3.3	4.6	1.47	.05	1.96	.16

യിരുന്നു. അതിനുകാരണം ഒരു പ്രത്യേക രീതിയിലാണ് ഞാൻ ആടുകളെ വളർത്തിവരുന്നത്.

ആടുകളെ അഭിമുഖമായി ഒരു പുൽത്തൊടിയുടെ രണ്ടുവശത്തുമായി കെട്ടുന്നു. ആടുകൾക്ക് പുൽത്തൊടിയിൽ നിന്ന് തീറ്റയെടുക്കാൻ സൗകര്യമുണ്ടാകും. തറ സിമന്റിട്ടതായതിനാൽ മൂത്രം, കാഷ്ടം എന്നിവ പ്രത്യേകം ശേഖരിക്കാൻ കഴിയും. മൂത്രം ആടുകൾക്ക് പിന്നിലെ ഓവുചാലിൽ കൂടി ഒഴുകി ഒരു കുഴിയിൽ ശേഖരിക്കപ്പെടുന്നു.

നിർമ്മാണരീതി

അഞ്ചുകിലോ ഉണങ്ങാത്ത ആട്ടിൻ കാഷ്ടത്തിൽ അഞ്ചു ലിറ്റർ വെള്ളം കുറേശ്ശയായി ചേർത്ത് ഇളക്കി യോജിപ്പിച്ചു. അതിൽ അഞ്ചു ലിറ്റർ ആട്ടിൻമൂത്രം ചേർത്ത് രണ്ടാഴ്ച വച്ചു. മറ്റൊരുപാത്രത്തിൽ ഒരു ലിറ്റർ തൈര് രണ്ടാഴ്ച വച്ചു. രണ്ടാഴ്ച കഴിഞ്ഞ് രണ്ടുപാത്രത്തിലെ ദ്രാവകങ്ങളും ഒരു ലിറ്റർ പാലും ചേർത്ത് ഇളക്കി ഒരാഴ്ചവച്ചു. അതിനുശേഷം ഈ പുളിപ്പിച്ച ദ്രാവകത്തിൽ പത്തിരട്ടി വെള്ളം ചേർത്ത് ഉപയോഗിക്കാൻ പാകത്തിലാക്കി.



ആടുകളെ വളർത്തുന്നരീതി

താഴെപ്പറയുന്ന പദാർത്ഥങ്ങൾ ഉപയോഗിച്ച് ആട്ടിൻവളദ്രാവകം നിർമ്മിക്കാൻ തീരുമാനിച്ചു.

1. ആട്ടിൻകാഷ്ഠം 5 കിലോ.
2. ആട്ടിൻമൂത്രം 5 ലിറ്റർ
3. തൈര് 1 ലിറ്റർ
4. പാൽ 1 ലിറ്റർ
5. വെള്ളം

മുമ്പ് കൃഷി ചെയ്തിരുന്നസ്ഥലത്തു തന്നെ വീണ്ടും അതേ പച്ചക്കറികൾ പരീക്ഷണസ്ഥലത്തും നിരീക്ഷണസ്ഥലത്തും നട്ടു. രണ്ടുസ്ഥലത്തും വളം, പുത, ജലസേചനം എന്നിവ തുല്യമായി നൽകി പരീക്ഷണ സ്ഥലത്തുള്ള ഓരോ ചെടിക്കുചുറ്റും ആഴ്ചയിൽ ഒരു പ്രാവശ്യം ഒരു ലിറ്റർ ആട്ടിൻ വളദ്രാവകം വീതം രണ്ടാഴ്ച ഒഴിച്ചുകൊടുത്തു. മൂന്നാം ആഴ്ച മുതൽ ചെടിക്ക് രണ്ടുലിറ്റർ വീതം നൽകി. പരീക്ഷണ സ്ഥലത്തെ വിളവ് വളരെ മെച്ചപ്പെട്ടതായിരുന്നു. ചീരയിൽ

ആടുവളദ്രാവകം ഉപയോഗിച്ചപ്പോഴുണ്ടായ വിളവിലെ വ്യത്യാസം

കൃഷിസ്ഥലം	വിസ്തീർണ്ണം	വിളകൾ	എണ്ണം	ഉൽപാദനോപാധികൾ
നിരീക്ഷണസ്ഥലം	1/2 സെന്റ്	പയർ, ബീൻസ്, ചീര, തക്കാളി	40, 40, 35, 12	പുതയിടൽ, കമ്പോസ്റ്റ്, ജലം
പരീക്ഷണസ്ഥലം	1/2 സെന്റ്	പയർ, ബീൻസ്, ചീര, തക്കാളി	40, 40, 35, 12	പുതയിടർ, കമ്പോസ്റ്റ്, ജലം

മണ്ണുപരിശോധനാ വിവരങ്ങൾ

തീയ്യതി	സ്ഥലവിവരം	Soil acidity	Rating	Av. P. Kg/acre	Rating	Av. K. Kg/acre	Rating
3-7-01	പച്ചക്കറി ആരംഭിക്കുന്നതിന് മുമ്പ്	4.9	A	1	L	45	L
13-9-02	പരീക്ഷണസ്ഥലം	5.1	A	1	L	53	M
13-9-02	നിരീക്ഷണസ്ഥലം	5.3	A	1	L	25	L
12-3-03	ആട്ടിൻവളദ്രാവകം ഉപയോഗിച്ച സ്ഥലം	6.7	N	43	H	155	H

A. acidic, L. low, M. medium, H. high

നിന്ന് മൂന്നിരീയും മറ്റുള്ളവയിൽ നിന്ന് ഇരട്ടിയിലധികവും വിളവുലഭിച്ചു. ഇതേ പരീക്ഷണം വീണ്ടും ആവർത്തിച്ചു അപ്പോഴും മെച്ചപ്പെട്ട വിളവ് ലഭിച്ചു. പരീക്ഷണ സ്ഥലത്തെ മണ്ണ് പരിശോധിച്ചു. മറ്റു വിളകളിൽ ഉപയോഗിച്ചപ്പോഴും നല്ല വളർച്ച കണ്ടു.

വിലയിരുത്തൽ

മേൽക്കാണിച്ച മണ്ണുപരിശോധനാ വിവരങ്ങൾ പരിശോധിച്ചാൽ ഫലപുഷ്ടിയിൽ പെട്ടെന്ന് ഉണ്ടായവർദ്ധന മനസ്സിലാക്കും. 5.1 ആയിരുന്ന P.H, വള പ്രയോഗത്തോടെ മണ്ണിന്റെ അമ്ലസ്വഭാവം മാറി 6.7 ആയി മാറി ചെടികളുടെ വളർച്ചയ്ക്ക് അനുയോജ്യമായി മാറി. ഫോസ്ഫറസ്സിലും വർദ്ധന രേഖപ്പെടുത്തി. പൊട്ടാഷിന്റെ മൂന്നിരട്ടിയായി.

പുളിപ്പിച്ച ദ്രാവവളം വിഘടനം നടന്നുകഴിഞ്ഞതിനാലാണ് വേഗത്തിൽ ലഭ്യമായത്. കൂടാതെ സൂക്ഷ്മജീവികളുടെ പ്രവർത്തനഫലത്താൽ ഉണ്ടാകുന്ന പല എൻസൈമുകളും വളർച്ചാത്വരകങ്ങളാണ്.

ഈ വളം മണ്ണിന്റെ ഫലപുഷ്ടി വർദ്ധിപ്പിക്കുകയും മണ്ണിന്റെ P.H ചെടികൾക്ക് അനുകൂലമാക്കിത്തീർക്കുകയും ചെയ്യുന്നു. ദ്രാവകരൂപത്തിൽ നൽകാൻ കഴിയുന്നതിനാൽ നനയ്ക്കൽ പ്രക്രിയയും നടക്കുന്നതിനാൽ ഏതുകാലത്തും ഈ വളം ഉപയോഗിക്കാൻ കഴിയും.

കൃഷിയിടത്തിലുള്ള കളനിയന്ത്രണത്തിനും നല്ലവളം ലഭിക്കുന്നതിനും ഇത്തരത്തിലുള്ള ആടുവളർത്തൽ അഭിലഷണീയമാണ്. ആടുവള ലായനി ഉപയോഗിച്ചാൽ ജൈവകൃഷിയിലൂടെ ഹ്രസ്വകാലവിളകളിലും പച്ചക്കറി വിളകളിലും ഉല്പാദനക്ഷമതകൈവരിക്കാനാകും. എല്ലാവിളകൾക്കും ഈവളം ഉപയോഗിക്കാം.

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ക്ഷീരവികസനവും വയനാടും

എം. പ്രകാശ്,
ചീഫ് എക്സിക്യൂട്ടീവ് ഓഫീസർ, ബ്രഹ്മഗിരി ഡവലപ്പ്മെന്റ് സൊസൈറ്റി, വയനാട്
പി.ബി നം:10, മീനങ്ങാടി പി.ഒ, വയനാട് ജില്ല

ഭാഗം - 1 വികസന ചരിത്രം

അതിപുരാതന കാലം മുതൽക്കേ മനുഷ്യൻ മാംസത്തിനു വേണ്ടി മൃഗങ്ങളെ ഉപയോഗപ്പെടുത്തിവന്നു. മാനവികത യിലേക്കുള്ള ഗതിമാറ്റത്തിനിടയിൽ മാംസത്തിന്റെ ഉപയോ ഗത്തോടൊപ്പം അതിശ്രേഷ്ഠമായ പാലിന്റെ ഉപയോഗത്തി ലേക്കുള്ള അവന്റെ ചരിത്രപരമായ പ്രയാണത്തോടെ കറ വമാടുകൾ നമ്മുടെ കുടുംബാംഗങ്ങളായി. പിന്നീട് അവ യുടെ ഊർജ്ജം ഉഴവിനും, ഭാരം വലിക്കുന്നതിനും, യന്ത്രം പ്രവർത്തിപ്പിക്കുന്നതിനും പ്രയോജനപ്പെടുത്തിയതോടുകൂടി കന്നുകാലി വളർത്തലിന് കൂടുതൽ പ്രചാരം ലഭിച്ചു. പശു വിൽ നിന്നുള്ള ഉൽപ്പന്നങ്ങളുടെ വൈവിധ്യങ്ങൾ തിരിച്ചറി ഞ്ഞതോടുകൂടി പശുക്കൾക്ക് ഭാരതീയ സംസ്കാരത്തിൽ ദൈവിക പരിവേഷം കൈവന്നു. കാലികളുടെ എണ്ണം ഐശ്വര്യത്തിന്റെയും പ്രതാപത്തിന്റെയും അളവുകോലായി. പിന്നീട് പാൽ, ഇറച്ചി എന്നിവയുടെ വാണിജ്യസാധ്യതകൾ മനസ്സിലാക്കിയതോടുകൂടി പശുവളർത്തൽ വ്യാപകമായി.

ക്രിസ്തുവിന് നാലായിരം വർഷങ്ങൾക്ക് മുമ്പ് യൂഫ്രട്ടീസ് - ടൈഗ്രീസ് നദീതട പ്രദേശങ്ങളിൽ ലോകചരിത്രത്തിലെ ആദ്യത്തെ സാങ്കേതിക വിപ്ലവത്തിന്റെ ഭാഗമായി മൃഗങ്ങ ളുടെ ശക്തി "മോട്ടീവ് പവ്വറായി" പ്രയോജനപ്പെടുത്തുന്ന കണ്ടുപിടിത്തം നടത്തിയിരുന്നതായി ചരിത്രം രേഖപ്പെടു ത്തുന്നു. ഇന്ത്യയിൽ ബി.സി. മൂവായിരത്തിന് മുമ്പേതന്നെ പശുക്കളെയും എരുമകളെയും വളർത്തിയിരുന്നു. ബി.സി. രണ്ടാം നൂറ്റാണ്ടിൽ ഇന്ത്യയിലെ സിന്ധുനദീതടങ്ങളിൽ "നിത്യ സനാതന ഹൈന്ദവ ഗ്രാമ വ്യവസ്ഥയിൽ" കാളവ ണ്ടിയും ഉഴവുകാളകളും ഉൽപ്പാദനരംഗത്തിന്റെ ഭാഗ മായിരുന്നെന്ന് കണ്ടെത്താനാകും.

ഇന്ത്യയിൽ വാണിജ്യാടിസ്ഥാനത്തിൽ കാലിവളർത്തൽ ആരംഭിക്കുന്നത് 1920 ലെ ഇന്ത്യൻ ഡയറി എക്സ്പെർട്ട് എന്ന സ്ഥാപനം രൂപീകരിച്ചത് മുതലാണ്. 1923ൽ ഇംപീരി യൽ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് അനിമൽ ഹസ്ബന്ററി എന്ന സ്ഥാപനം ബാംഗ്ലൂരിൽ ആരംഭിച്ചു. 1928ലെ റോയൽ കമ്മീ ഷൻ ഓഫ് അഗ്രികൾച്ചറിന്റെ ശുപാർശകൾ ക്ഷീരവികസ നത്തിന് വളരെയേറെ സാധ്യതകളുണ്ടെന്ന് ചൂണ്ടിക്കാട്ടി. ഇതിന്റെ ഫലമായി ക്ഷീരോൽപ്പാദനം ഗ്രാമങ്ങളിലേക്കും അർദ്ധ പട്ടണങ്ങളിലേക്കും വ്യാപിക്കുവാൻ തുടങ്ങി.

1.1 ക്ഷീരവികസനവും പഞ്ചവത്സര പദ്ധതികളും

ഒന്നാം പഞ്ചവത്സര പദ്ധതിയിൽത്തന്നെ (1950-55) കീ വില്ലേജ് സ്കീം പ്രകാരം കൃത്രിമബീജാ ധാന കേന്ദ്രങ്ങൾ സ്ഥാപിക്കുന്നതിനും, വിത്തുകാളകളെ വരിയുടച്ച് ഇണചേർക്കൽ നിയന്ത്രിക്കുന്നതിനും, കാലി വളർത്തൽ പ്രോത്സാഹിപ്പിക്കുന്നതിനും, തീറ്റ പുൽകൃഷിക്ക് സബ്സിഡി നൽകുന്നതിനും, ക്ഷീരസഹ കരണ സംഘങ്ങൾ രൂപീകരിക്കുന്നതിനും തുടക്കം കുറി ച്ചു. രണ്ടാം പഞ്ചവത്സര പദ്ധതിയിൽ (1955-60) പാൽ വിപണനത്തിന് ഊന്നൽ നൽകി. മൂന്നാം പഞ്ചവത്സര പദ്ധതിക്കാലത്ത് (1965-70) ദേശീയ ക്ഷീര വികസന ബോർഡ് സ്ഥാപിച്ച് ക്ഷീര വികസന പ്രവർത്തനങ്ങൾക്ക് സുപ്രധാനമായ രൂപവും ഭാവവും നൽകി. നാലാം പദ്ധ തിയിൽ (1970-75) ലോകപ്രസിദ്ധമായ ധവളവിപ്ലവത്തിന് തുടക്കം കുറിച്ചു. അഞ്ചാം പദ്ധതിയിൽ (1975-80) ക്ഷീര വിപണനത്തിന് ദ്വിതല സംവിധാനം (പ്രാഥമിക ക്ഷീര സംഘങ്ങൾ - മിൽക്ക് യൂണിയനുകൾ) നടപ്പിൽവരുത്തി. ആറാം പദ്ധതിയിൽ (1980-85) സഹകരണ മേഖലയിൽ ത്രിതല വിപണന സംവിധാനമെന്ന (പ്രാഥമിക ക്ഷീര സംഘം - മേഖലാ യൂണിയൻ - ഫെഡറേഷൻ) നൂതന ആശയം പ്രയോഗത്തിൽവന്നു. ഏഴാം പദ്ധതിയിൽ (1985 -90) ക്ഷീരവികസന മേഖലയിൽ നടപ്പിലാക്കിയ ബഹു മുഖ ക്ഷീരവികസന തന്ത്രങ്ങൾ പാലുൽപ്പാദനം ഗണ്യ മായി വർദ്ധിക്കുവാൻ ഇടയാക്കി. എട്ടാം പഞ്ചവത്സര പദ്ധതിയിൽ (1992-97) ക്ഷീരമേഖലയിൽ പുത്തൻ സാമ്പ ത്തിക നയങ്ങൾക്ക് (ഡീ ലൈസൻസിംഗ്) തുടക്കം കുറിച്ചു. എന്നാൽ സഹകരണമേഖലയ്ക്ക് തെല്ല് ആശ്വാസം നൽകിക്കൊണ്ട് മിൽക്ക് ആന്റ് മിൽക്ക് പ്രൊഡക്സ് ഓർഡർ (എം.എം.പി.ഒ 1992) നടപ്പിലാക്കി. ഒമ്പതാം പഞ്ചവത്സര പദ്ധതി (1997-2002) അവസാനി ക്കുമ്പോൾ ലോകത്തിലെ ഏറ്റവും കാലിസമ്പത്തുള്ള രാജ്യമെന്ന ഖ്യാതിയോടൊപ്പം (214876992 എണ്ണം) പാലുൽപ്പാദനത്തിൽ ഒന്നാം സ്ഥാനവും (77180000 മെട്രിക് ടൺ) കൈവരിച്ചു. പത്താം പഞ്ചവത്സരപദ്ധതി (2002-07)യുടെ ആരംഭത്തിൽത്തന്നെ ക്ഷീരമേഖല ആഗോളവൽക്കരണത്തിന്റെ കരിനിഴലിലാണ്.

ഇന്ത്യയിലെ പാലുൽപ്പാദനം	-	77180000 മെട്രിക് ടൺ
അമേരിക്കയിലെ പാലുൽപ്പാദനം	-	73804000 മെട്രിക് ടൺ
ലോകത്തിലെ കാലിസമ്പത്ത്	-	1335773090 എണ്ണം
ഇന്ത്യയിലെ കാലിസമ്പത്ത്	-	214876992 എണ്ണം
അമേരിക്കയിലെ കാലിസമ്പത്ത്	-	9911530 എണ്ണം
ബ്രസീലിലെ കാലിസമ്പത്ത്	-	16347000 എണ്ണം

1.2 ക്ഷീരവികസനവും കേരളവും

തിരുവിതാംകൂറിൽ 18-ാം നൂറ്റാണ്ടുവരെ വളർത്തുമൃഗങ്ങളെ വേണ്ടത്ര ഉപയോഗപ്പെടുത്തിയിരുന്നില്ലെന്ന് വാൾട്ടർ ഹാർമിൽട്ടന്റെ (1810) സഞ്ചാരക്കുറിപ്പുകളിൽ നിന്നും മനസ്സിലാക്കാം. അദ്ദേഹത്തിന്റെ പരാമർശം ഇപ്രകാരമാണ്.“ഈ ദിക്കിലെ കന്നുകാലികളും എരുമകളും വലിപ്പം കുറഞ്ഞ് കുരിടിച്ചവയാണ്. ഇവയെ ഭാരം ചുമക്കുന്നതിന് ഉപയോഗിക്കാറില്ല. കുതിര, കഴുത, ചെമ്മരിയാട്, കോലാട്, പന്നി എന്നീ മൃഗങ്ങളെ വളർത്തി പരിപാലിക്കുന്ന പതിവ് ഇവിടെയില്ല. ഏതായാലും അവയുടെ എണ്ണം അവഗണിക്കാവുന്നതാണ്. മുൻകാലത്ത് (യൂറോപ്യന്മാരുടെ വരവിനു മുമ്പ്) കോഴിയെ വളർത്തുന്ന പതിവ് ഇവിടെയുണ്ടായിരുന്നില്ല”. 1810ൽ ലോകസഞ്ചാരിയായിരുന്ന ക്യാപ്റ്റൻ റിച്ചാർഡ് ബർട്ടണെ മലബാറിലെ നാൽക്കാലികളുടെ അഭാവം ആശ്ചര്യപ്പെടുത്തുകയുണ്ടായി. കുതിര, ചെമ്മരിയാട്, കോലാട് എന്നിവ അദ്ദേഹത്തിന് കണ്ടെത്താനായില്ലെന്നും പശുക്കൾ ഇംഗ്ലണ്ടിലെ കഴുതകളുടെയത്ര വലിപ്പമുള്ളവയായിരുന്നില്ലെന്നും രേഖപ്പെടുത്തിയിട്ടുണ്ട്. എന്നാൽ 1503ൽ ബാർബോസ മദ്ധ്യകേരളത്തിൽ എരുമകളേയും കാളകളേയും ഉപയോഗിച്ച് പുലയ സമുദായക്കാർ നെൽകൃഷി ചെയ്തിരുന്നതായി രേഖപ്പെടുത്തിയിട്ടുണ്ട്. പത്തൊമ്പതാം നൂറ്റാണ്ടുമുതൽ കന്നുകാലിവളർത്തലിൽ കാലാനുസൃതമായ പുരോഗതി ഉണ്ടായിട്ടുള്ളതായി മനസ്സിലാക്കാൻ കഴിയും.

കേരളത്തിലും ഒന്നാം പഞ്ചവത്സര പദ്ധതിക്കാലത്തുതന്നെ കീ വില്ലേജ് സ്കീം പ്രകാരം കൃത്രിമബീജാധാന പരിപാടി ആരംഭിച്ചു. നാലാംപദ്ധതിയിൽ മൃഗസംരക്ഷണ വകുപ്പുമുഖേന ഊർജ്ജിത കന്നുകാലി വികസന പദ്ധതി (ഐ.സി.ഡി.പി) പ്രകാരം സാധാരണക്കാരന് അപ്രാപ്യമായിരുന്ന കൃത്രിമബീജാധാനം ഗ്രാമീണ തലത്തിൽ സ്ഥാപിതമായി. 1962ൽ ക്ഷീരവികസനത്തിന് ഒരു പ്രത്യേക വകുപ്പുതന്നെ രൂപീകൃതമായി. പാൽ സംഭരണത്തിനും വിപണനത്തിനും പ്രാഥമിക ക്ഷീരസംഘങ്ങൾ രൂപീകരിച്ചു. 1972ൽ ക്ഷീരവികസന വകുപ്പ് ക്യാറ്റിൽ ഇംപ്രൂവ്മെന്റ് അസിസ്റ്റന്റുമാരെ നിയോഗിച്ച് കൃത്രിമബീജാധാനം കർഷക ഭവനങ്ങളിലെത്തിച്ചു. ഇതോടെ സങ്കരവർഗ്ഗ പശുക്കളോടൊപ്പം പാലുൽപ്പാദനവും ക്രമാനുഗതമായി വർദ്ധിച്ചു. ഇൻഡോ സ്വിസ് പ്രോജക്ട് (1975) മുഖേന കൃത്രിമബീജാധാന പരിപാടി വളരെ ഊർജ്ജിതമായി നടപ്പിലാക്കി. അഞ്ചാം പദ്ധതിയിൽ ദ്വിതല പാൽ സംഭരണ സംവിധാനങ്ങളും ആറാം പദ്ധതിയിൽ ത്രിതല പാൽ സംഭരണ സംവിധാനങ്ങളും (പ്രാഥമിക ക്ഷീരസംഘങ്ങൾ, രണ്ട് മേഖലാ യൂണിയനുകൾ, സംസ്ഥാനതലത്തിൽ ഫെഡറേഷൻ) സ്ഥാപിതമായി. 1965ൽ കേരളത്തിലെ ക്ഷീരോൽപ്പാദനം 2 ലക്ഷം ടണ്ണായിരുന്നത് 1995 ആയപ്പോഴേക്കും 22 ലക്ഷം ടണ്ണായി ഉയർന്നു. 2001-02ലെ ക്ഷീരോൽപ്പന്നം 27-35 ലക്ഷം ടണ്ണാണ്. 31.03.2002ലെ കണക്കനുസരിച്ച് 3143 ക്ഷീരസംഘങ്ങൾ സംസ്ഥാനത്ത് പ്രവർത്തിക്കുന്നു.

1.3. ക്ഷീരവികസനവും വയനാടും

വയനാട്ടിലെ മൃഗപരിപാലനം സംബന്ധിച്ച വിശദവിവരങ്ങൾ ചരിത്രഗ്രന്ഥങ്ങളിൽ കാര്യമായൊന്നുമില്ലെങ്കിൽ കൂടി കേരളത്തിലെ ഇതരജില്ലകളോടൊപ്പംതന്നെ വയനാട്ടിനും ക്ഷീരമേഖലക്ക് ചരിത്രപരമായ ഒരു പശ്ചാത്തലമുണ്ടെന്നു വേണം കരുതാൻ.

13-ാം നൂറ്റാണ്ടിൽ കർണ്ണാടകയിലുള്ള ഹെയ്സാല രാജവംശത്തിന്റെ കീഴിൽ ഒരു കർഷകജനത നൂൽപ്പുഴയിൽ താമസിച്ചിരുന്നതായി കരുതപ്പെടുന്നു. 18-ാം നൂറ്റാണ്ടിൽ വയനാട്ടിലേക്കുള്ള ആദ്യകുടിയേറ്റക്കാർ ക്ഷീരവികസന സാധ്യതകൾ ഉപയോഗപ്പെടുത്താൻ തുടങ്ങി. 19-ാം നൂറ്റാണ്ടിൽ പാലുൽപ്പാദനത്തിനും ഉഴവിനും ഭാരം വലിക്കുന്നതിനും ജൈവവളത്തിനുംവേണ്ടി കന്നുകാലികളെ വളർത്തിവന്നു. കാലികളെ അഴിച്ചുവിട്ടുമേയ്ക്കുന്ന സമ്പ്രദായമാണ് അന്നുണ്ടായിരുന്നത്. ആദിവാസി വിഭാഗമായ കുറുമർ, കുറിച്യർ എന്നിവർ കൃഷിയോടൊപ്പം കാലിവളർത്തലിലും ഏർപ്പെട്ടിരുന്നവരാണ്. അടിമകളായിരുന്ന പണിയരും തന്റെ യജമാനന്മാരുടെ കാലികളെ മേച്ചിരുന്നു. വന്യമൃഗങ്ങളിൽ നിന്ന് സംരക്ഷിക്കുന്നതിന് വേണ്ടി പെടത്ത്യാല, പൊതാല, പ്ടാവ് എന്നെല്ലാം അറിയപ്പെട്ടിരുന്ന താൽക്കാലിക വേലികളിൽ പാർപ്പിച്ചിരുന്നു. കാടുകളിൽ മേഞ്ഞിരുന്ന കന്നുകാലികളുടെ ഗതി, സ്ഥാനം എന്നിവയറിയുന്നതിനുവേണ്ടി കഴുത്തിൽ മരംകൊണ്ടുള്ള മണി (തട്ട) കെട്ടിയിരുന്നു.

1945ന് ശേഷമുണ്ടായിട്ടുള്ള കുടിയേറ്റത്തിന്റെ ഭാഗമായി വാണിജ്യാടിസ്ഥാനത്തിലുള്ള കാലിവളർത്തൽ ആരംഭിച്ചു. വിട്ടുകാലി സമ്പ്രദായത്തിൽനിന്നും പശുക്കളെ കെട്ടിയിട്ട് വളർത്താനും സ്ഥിരമായ പാർപ്പിട സൗകര്യമുണ്ടാക്കുവാനും തുടങ്ങി. ഉൽപ്പാദനക്ഷമത കൂടിയ സിന്ധി ഇനത്തിൽപ്പെട്ട പശുക്കളെയും എരുമകളെയും വളർത്തുവാൻ ആരംഭിച്ചു. പാലുൽപ്പാദനത്തിലൂടെ വരുമാനം നേടാനുള്ള ശ്രമങ്ങൾ തുടങ്ങി. ഇതോടെ ജില്ലയിൽ കാലിവളർത്തലിന് പ്രചാരം വർദ്ധിച്ചു. വീടുകളിലും ഹോട്ടലുകളിലും ആയിരുന്നു വിപണനം നടത്തിയിരുന്നത്. പാൽ വിപണനം വേണ്ടത്രയുണ്ടാകാതിരുന്നത് പാലുൽപ്പാദന വർദ്ധനവിന് തടസ്സമായി.

1960 – 70

1962ൽ ജില്ലയിലെ ആദ്യത്തെ ക്ഷീരസംഘം സുൽത്താൻ ബത്തേരിയിൽ പ്രവർത്തനമാരംഭിച്ചു. മൃഗസംരക്ഷണ വകുപ്പിനോടൊപ്പം ക്ഷീരവികസന വകുപ്പിന്റെ പ്രവർത്തനങ്ങളും

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തുടങ്ങി. ജില്ലാ മിൽക്ക് യൂണിയൻ 1969ൽ ആരംഭിച്ചു. വൈത്തിരിയിൽ ഒരു പാൽ ശീതീകരണ കേന്ദ്രം തുടങ്ങി. സങ്കരവർഗ്ഗ പശുക്കളുടെ എണ്ണം വർദ്ധിച്ചു, തീറ്റപുൽകൃഷി ആരംഭിച്ചു. 1973ൽ ചുണ്ടേൽ ആനപ്പാറയിൽ ഏഷ്യയിലെ ഏറ്റവും വലിയ തീറ്റപ്പുൽ സീഡ് ഫാം ആരംഭിച്ചു.

1970 – 80

1974ൽ ക്ഷീര വികസന വകുപ്പ് നിയോഗിച്ച ക്യാറ്റിൽ ഇംപ്രൂവ്മെന്റ് അസിസ്റ്റന്റുമാർ മുഖേന വയനാട്ടിലും കൃത്രിമബീജാധാനം കർഷകഭവനങ്ങളിൽ എത്തിച്ചു. കുന്നമ്പറ്റയിലേക്ക് പാൽ ശീതീകരണകേന്ദ്രം മാറ്റി സ്ഥാപിച്ചു. പ്രസ്തുത കേന്ദ്രം ജില്ലാ മിൽക്ക് സപ്ലൈ യൂണിയന് കൈമാറി. കൂടുതൽ ക്ഷീരസംഘങ്ങൾ രൂപീകരിച്ചു. ഐ.സി.ഡി.പി സബ്സെന്ററുകൾ വ്യാപകമായി പ്രവർത്തനമാരംഭിച്ചു. സങ്കരവർഗ്ഗ പശുക്കളുടെ എണ്ണം വർദ്ധിച്ചതോടുകൂടി പാലുൽപ്പാദനം വർദ്ധിച്ചു. പാൽ വിപണനത്തിൽ വർദ്ധനയുണ്ടായി. 1984ൽ തൊഴിൽ പ്രശ്നം മാനേജ്മെന്റിന്റെ കെടുംകാര്യസ്ഥിതി തുടങ്ങിയ കാരണങ്ങളാൽ ബൃഹത്തായ സീഡ് ഫാം അടച്ചുപൂട്ടി.

1980 –90

കേന്ദ്രസർക്കാരിന്റെ സാമ്പത്തിക സഹായത്തോടെ ജില്ലയിൽ ക്ഷീരമേഖലയുടെ സമഗ്രവികസനത്തിനായി ക്ഷീര വികസന വകുപ്പുമുഖേന 1980ൽ സിൽവി പാസ്ചർപദ്ധതി ആരംഭിച്ചു. തീറ്റപ്പുല്ലുൽപ്പാദനം വർദ്ധിപ്പിക്കുക, സങ്കരവർഗ്ഗ പശുക്കളെ ഇറക്കുമതി ചെയ്യുക, ക്ഷീരസംഘങ്ങൾ രൂപീകരിക്കുക, പാൽ ശീതീകരണ സൗകര്യങ്ങൾ ഒരുക്കുക തുടങ്ങിയവയായിരുന്നു പദ്ധതിയുടെ ലക്ഷ്യങ്ങൾ. 1982 ൽ പാൽവിപണനത്തിനായി വയനാട് ജില്ലാ സഹകരണ മിൽക്ക് സപ്ലൈ യൂണിയൻ നിലവിൽ വന്നു. എൺപതുകളുടെ അവസാനത്തോടെ പാലുൽപ്പാദനം ഗണ്യമായി വർദ്ധിക്കുവാൻ തുടങ്ങി. എന്നാൽ പാൽ വിപണനത്തിന് വേണ്ടത്ര പുരോഗതിയുണ്ടായില്ല. മിൽമയുടെ പ്രവർത്തനം ജില്ലയിലെത്താതിരുന്നത് ക്ഷീരവിപണനത്തിന് പ്രധാന തടസ്സമായി. മീനങ്ങാടി, മാനന്തവാടി എന്നവിടങ്ങളിൽ പാൽ ശീതീകരണ കേന്ദ്രങ്ങൾ സ്ഥാപിച്ചു.

1990 – 2000

1991ൽ മലബാർ മേഖലാ സഹകരണ ക്ഷീരോൽപ്പാദക യൂണിയൻ നിലവിൽ വന്നു. തുടർന്ന് നോർത്ത് കേരള ഡയറി പ്രോജക്ട് ആരംഭിച്ചു. കാർഷിക മേഖലയിൽ മാന്ദ്യം അനുഭവപ്പെട്ടു തുടങ്ങി. കുരുമുളകിന്റെ ദ്രുതവാട്ടം പോലുള്ള കാർഷിക രോഗങ്ങൾ വ്യാപകമായി. കാപ്പി തുടങ്ങിയ വിളകളുടെ വിലക്കുറവ് കർഷകരെ സാമ്പത്തിക പ്രതിസന്ധിയിലാക്കി.

1995ന് ശേഷം ജനകീയാസൂത്രണം തുടങ്ങിയ പ്രവർത്തനങ്ങൾ, ക്ഷീരമേഖലയിൽ പ്രവർത്തിക്കുന്ന സർക്കാർ ഏജൻസികളുടെ പ്രവർത്തനം, ആഗോളവത്ക്കരണത്തിനെതിരെയുള്ള ചെറുത്തുനിൽപ്പ് തുടങ്ങിയ കാര്യങ്ങൾ ക്ഷീരമേഖലയുടെ വികസന പ്രവർത്തനങ്ങൾ ത്വരിതപ്പെടുത്തുന്നതിന് സഹായകരമായി. തത്ഫലമായി ക്ഷീരമേഖലയിലെ അടിസ്ഥാന സൗകര്യങ്ങളുടെ വർദ്ധന, അധികാര വികേന്ദ്രീകരണം, കുടുംബശ്രീ അയൽക്കൂട്ടങ്ങളുടെ രൂപീകരണം, കൂടുതൽ ക്ഷീരസംഘങ്ങളുടെ ആവിർഭാവം, കാർഷിക മേഖലയിലെ മാന്ദ്യം തുടങ്ങിയ പ്രവർത്തനങ്ങൾ ക്ഷീരമേഖലയുടെ പ്രസക്തി വർദ്ധിപ്പിച്ചു. ക്ഷീരവികസന വകുപ്പിന്റെ നേതൃത്വത്തിൽ ജില്ലാ ഭരണകൂടത്തിന്റെ അനുമതി പ്രകാരം ക്ഷീരസഹകരണ സംഘങ്ങളുടെ അനുമതിയോടെ ജില്ലയിലെ ക്ഷീരമേഖലയുടെ അടിസ്ഥാന വിവരശേഖരണം, പ്രശ്നവിശകലനം, പരിഹാര നിർദ്ദേശങ്ങൾ, സാധ്യതകൾ തുടങ്ങിയ വിഷയങ്ങളിൽ പങ്കാളിത്താധിഷ്ഠിത സർവ്വേയും പി.ആർ.എയും നടത്തി. ഇതിന്റെ അടിസ്ഥാനത്തിൽ ബ്രഹ്മഗിരി ഡയറി പ്രോജക്ടിന് രൂപം നൽകി. പ്രോജക്ടിന്റെ നടത്തിപ്പിനായി ബ്രഹ്മഗിരി ഡവലപ്പ്മെന്റ് സൊസൈറ്റി 1999 –ൽ പ്രവർത്തനമാരംഭിച്ചു. ജനകീയാസൂത്രണംവഴി മൃഗസംരക്ഷണ മേഖലയുടേയും ക്ഷീരസംഘങ്ങളുടേയും അടിസ്ഥാന സൗകര്യങ്ങൾ വർദ്ധിക്കുകയും വിവിധങ്ങളായ ക്ഷീരവികസന പ്രവർത്തനങ്ങൾ നടപ്പിലാക്കുകയും ചെയ്തു. പാലുൽപ്പാദനവും വിപണനവും വർദ്ധിച്ചു. ക്ഷീരവികസന വകുപ്പിന്റെ സാമ്പത്തിക സഹായത്തോടെ അമ്പലവയൽ, മീനങ്ങാടി എന്നീ ക്ഷീരസംഘങ്ങൾ ആരംഭിച്ച് കാലിത്തീറ്റ ഫാക്ടറികൾവഴി ഗുണനിലവാരമുള്ള സമീകൃത കാലിത്തീറ്റ കൃഷിക്കാർക്ക് ലഭ്യമായി.

2000 – 2003

കാർഷിക മേഖലയുടെ തകർച്ചയും സാമ്പത്തികമാന്ദ്യവും ക്ഷീരമേഖലയിലേക്ക് ധാരാളം പേർ കടന്നുവരാനിടയായി. വിവിധ വകുപ്പുകളുടെയും ബ്രഹ്മഗിരി ഡവലപ്പ്മെന്റ് സൊസൈറ്റി യുടേയും പ്രവർത്തനം ക്ഷീരമേഖലയിൽ വൻ കുതിച്ചുചാട്ടമുണ്ടാക്കി. ബ്രഹ്മഗിരി സൊസൈറ്റിവഴി നടപ്പിലാക്കിയ സി.ഒ-3 ഇനം സങ്കരനേപ്പിയർ കൃഷി, അസോളകൃഷി, സുസ്ഥിര ക്ഷീരവികസന പരിപാടി തുടങ്ങിയ വികസന മാതൃകകൾ കൃഷിക്കാർക്ക് നവ്യാനുഭവം പകരുകയും ക്ഷീരോൽപ്പാദനം കൂടുതൽ ലാഭകരമാക്കുകയും നിക്ഷേപവസ്തുക്കളുടെ ലഭ്യതക്കുറവെന്ന പരിമിതികൾ മുറിച്ചുകടക്കാൻപറ്റിയ സാങ്കേതികവിദ്യകളായി മാറുകയും ചെയ്തു. മറ്റ് ജില്ലകളിൽ 18% പാലുൽപ്പാദനം കുറഞ്ഞപ്പോൾ വയനാട്ടിലെ പാലുൽപ്പാദനം ഗണ്യമായി വർദ്ധിച്ചു. ഇപ്പോൾ മേഖലായൂണിയൻ പ്രതിദിനം 1.05 ലക്ഷം ലിറ്റർ പാൽ സംഭരിക്കുന്നു. തിരുവനന്തപുരം ജില്ലകഴിഞ്ഞാൽ സംസ്ഥാനത്തെ ഏറ്റവുമധികം പാൽ സംഭരിക്കുന്ന ജില്ല, മലബാറിലെ വർദ്ധിച്ച പാൽ സംഭരണം, കേരളത്തിലെ ഏറ്റവുമധികം പാലുൽപ്പാദന സാന്ദ്രതയുള്ള ജില്ല എന്നിങ്ങനെയുള്ള ബഹുമതികൾ വയനാട് സ്വന്തമാക്കുന്നു. ജില്ലയിൽ പ്രചാരം നേടിവരുന്ന ജൈവകൃഷിയുടെ ഒഴിച്ചുകൂടാനാവാത്ത ഘടകമാണ് പശു വളർത്തലെന്ന വസ്തുത ക്ഷീരമേഖലയുടെ പ്രസക്തി വർദ്ധിപ്പിക്കുന്നു.

		1987	1996
1. കന്നുകാലികൾ	163510 എണ്ണം	172981	284116
2. എരുമകൾ	10435 എണ്ണം	20681	10435
3. ആട്	72518 എണ്ണം	32421	72518
4. പന്നി	11799 എണ്ണം	4642	17799
5. കോഴി	836502 എണ്ണം	428080	847781
6. താറാവ്	9518 എണ്ണം	ലഭ്യമല്ല	9518
7. മുയൽ	5521 എണ്ണം	ലഭ്യമല്ല	5521
8. ചെമ്മരിയാട്	447 എണ്ണം	ലഭ്യമല്ല	1173

ചാർട്ട് 1: വയനാട് - ഏതാനും സ്ഥിതിവിവരകണക്കുകൾ

ഭാഗം – 2

ക്ഷീരവികസനവും വിവിധ ഏജൻസികളും

മറ്റ് വികസന മേഖലകളിൽനിന്നും വിഭിന്നമായി ക്ഷീരവികസന മേഖലയിൽ താഴെപറയുന്ന ഏജൻസികൾ പ്രവർത്തിച്ചുവരുന്നു.

2.1 ക്ഷീരവികസന വകുപ്പ്

വിജ്ഞാന-വ്യാപന പ്രവർത്തനങ്ങൾ, തീറ്റപ്പുൽകൃഷി വികസനം, മാതൃകാ കന്നുകാലിത്തൊഴുത്ത് നിർമ്മാണം, കറവമാടു വിതരണം, ചെറുകിട ഡയറി ഫാം യൂണിറ്റുകളുടെ വ്യാപനം, ക്ഷീരഗുണനിയന്ത്രണം, ക്ഷീര സംഘങ്ങളുടെ രൂപീകരണവും നവീകരണവും, ക്ഷീരസംഘങ്ങളുടെ ഭരണ നിയന്ത്രണം തുടങ്ങിയ പ്രവർത്തനങ്ങൾ ഏറ്റെടുത്തു നടത്തുന്നു.

2.2 മൃഗ സംരക്ഷണ വകുപ്പ്

വിജ്ഞാന-വ്യാപനം, മൃഗചികിത്സ, കൃത്രിമ ബീജാധാനം, രോഗപ്രതിരോധ നടപടികൾ, വികസന പ്രവർത്തനങ്ങൾ തുടങ്ങിയവ നടത്തിവരുന്നു.

2.3 മിൽമ

പാൽ സംഭരണം, സംസ്കരണം, മൂല്യവർദ്ധിത ഉൽപ്പന്നങ്ങളുടെ നിർമ്മാണം, വിപണനം, വിജ്ഞാന-വ്യാപന പ്രവർത്തനങ്ങൾ എന്നിവ നിർവ്വഹിക്കുന്നു.

2.4 കേരള ലൈവ്സ്റ്റോക്ക് ഡവലപ്പ്മെന്റ് ബോർഡ്

കൃത്രിമബീജാധാനത്തിനാവശ്യമായ ബീജോൽപ്പാദനം, സംഭരണം, വിപണനം, തീറ്റപ്പുല്ലിന്റെ ഉൽപ്പാദനം, ഗവേഷണ പ്രവർത്തനങ്ങൾ തുടങ്ങിയവ നടപ്പിലാക്കുന്നു.

2.5 കേരള കാർഷിക സർവ്വകലാശാല

ക്ഷീരവികസന മേഖലയിൽ ഗവേഷണ പ്രവർത്തനങ്ങൾ നടത്തുന്നു.

2.6 ക്ഷീരസഹകരണ സംഘങ്ങൾ

ഗ്രാമീണതലത്തിൽ കർഷകരിൽനിന്നും പാൽ ശേഖരിച്ച് പ്രാദേശിക വിൽപ്പനയ്ക്ക് ശേഷം ബാക്കി മേഖലാ യൂണിയന് (മിൽമ) നൽകുന്നു. കർഷകർക്ക് ആവശ്യമായ കാലിത്തീറ്റ, മറ്റ് അസംസ്കൃത സാധനങ്ങൾ തുടങ്ങിയവ വിതരണം ചെയ്യുന്നു. ക്ഷീരോൽപ്പന്ന നിർമ്മാണവും, വിപണനവും ഏറ്റെടുത്ത് നടപ്പിലാക്കുന്നു. വിവിധ ഏജൻസികളുടെ വികസന പ്രവർത്തനങ്ങളും സേവനങ്ങളും കർഷകരിൽ എത്തിക്കുന്നു.

2.7 ബ്രഹ്മഗിരി ഡവലപ്പ്മെന്റ് സൊസൈറ്റി

സുസ്ഥിര ക്ഷീരവികസനം ലക്ഷ്യമാക്കി പ്രവർത്തിക്കുന്നു. കാർഷികാനുബന്ധ മേഖലയ്ക്ക് ഊന്നൽ നൽകുന്നു. വിവിധ ഏജൻസികളുമായി ഏകോപിച്ച് പ്രവർത്തിക്കുന്നു. ക്ഷീരകർഷക സ്വാശ്രയ ഗ്രൂപ്പുകൾ സംഘടിപ്പിച്ച് തൊഴിലില്ലായ്മ പരിഹരിക്കുവാൻ ശ്രമിക്കുകയും ക്ഷീരകർഷകരുടെ സ്വാശ്രയത്വം ലക്ഷ്യമാക്കി പ്രവർത്തിക്കുകയും ചെയ്യുന്നു. ജൈവകൃഷി പ്രോത്സാഹിപ്പിക്കുന്നു.

കൃത്രിമ ബീജാധാന സൗകര്യങ്ങൾ	സ്ഥാപനങ്ങളുടെ എണ്ണം	പ്രജനനശേഷിയുള്ള കന്നുകാലികളുടെ എണ്ണം	നടത്തിയ കൃത്രിമ ബീജാധാനത്തിന്റെ എണ്ണം	ജനിച്ച കന്നുകുട്ടികളുടെ എണ്ണം	
				ആൺ	പെൺ
1. മൃഗാശുപത്രികൾ	27		19341	4494	4209
2. ഐ.സി.ഡി.പി സബ്സെന്ററുകൾ	74		33457	6229	6100
3. ആപ്കോസ് സൊസൈറ്റികൾ	15		16200	2427	1685
ആകെ	**116**	**71412**	**68998**	**13650**	**11994**

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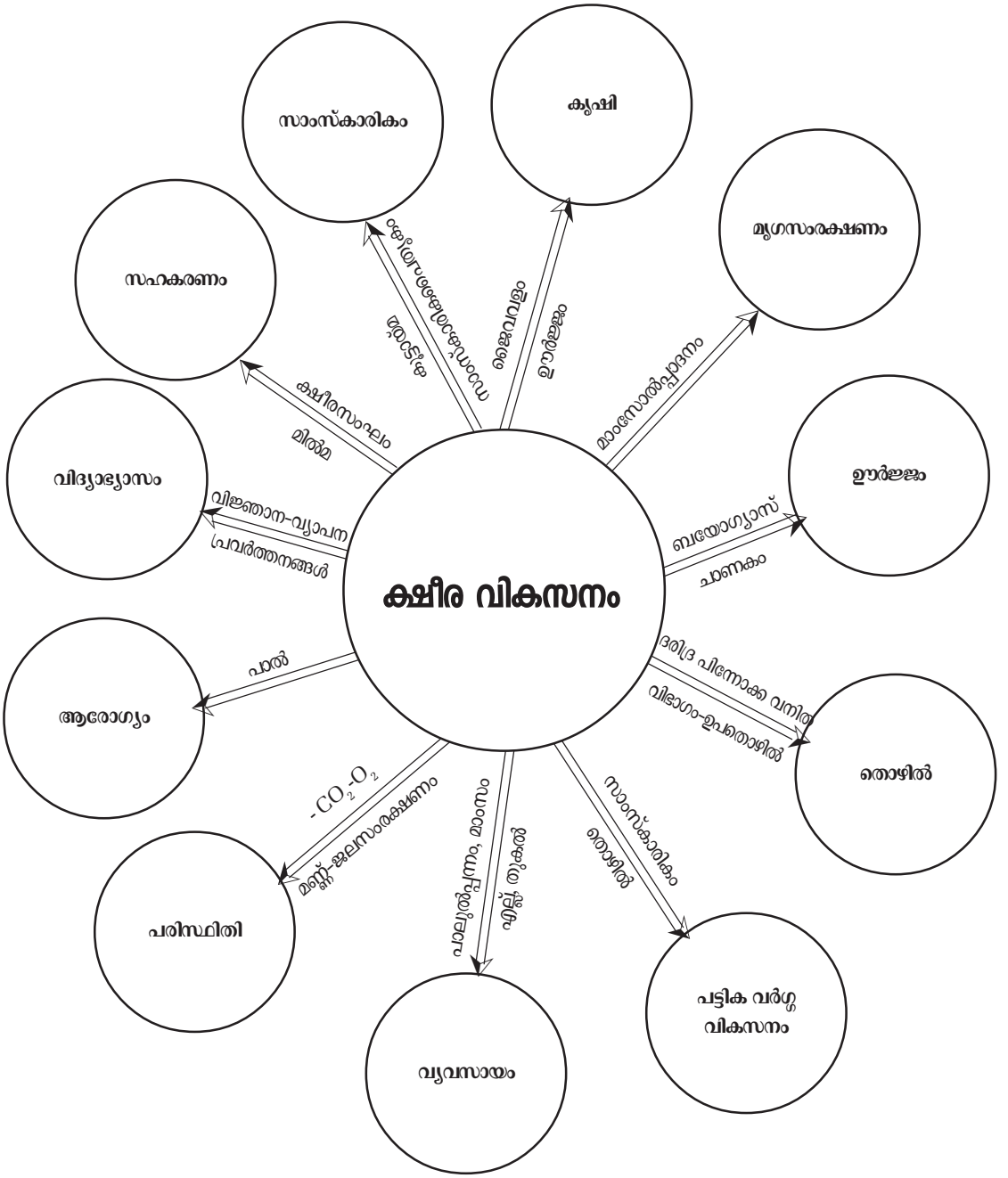

(വികസനം + വിദ്യാഭ്യാസം + പരിസ്ഥിതി + സ്വാശ്രയത്വം = സുസ്ഥിര വികസനം)

ചാർട്ട് 2 ക്ഷീരമേഖലയും മറ്റ് വികസനമേഖലകളുമായുള്ള ബന്ധം

ഭാഗം : 3

കന്നുകാലി ജനുസ്സുകൾ

വിവിധ പ്രദേശങ്ങളിലെ കാലാവസ്ഥയ്ക്കനുയോജ്യമായ സ്വഭാവ വിശേഷങ്ങളുള്ള വിവിധയിനം കന്നുകാലിജനുസുകൾ ഇന്ത്യയിലുണ്ട്. ഉയർന്ന ചൂടു സഹിക്കാനുള്ള കഴിവ്, വർധിച്ച രോഗപ്രതിരോധശക്തി എന്നിവ ഇന്ത്യൻ ജനുസുകളുടെ സവിശേഷതകളാണ്. പഞ്ചാബ്, ഹരിയാന, രാജസ്ഥാൻ, സൗരാഷ്ട്രി, മഹാരാഷ്ട്ര, മദ്രാസ്, മൈസൂർ, ആന്ധ്ര എന്നിവിടങ്ങളിലാണ് ഇന്ത്യയിലെ പ്രമുഖ കന്നുകാലിജനുസുകൾ കണ്ടുവരുന്നത്. മഴ വളരെ കൂടുതലുള്ള കേരളം, ആസാം, ബംഗാൾ എന്നീ സംസ്ഥാനങ്ങളിൽ വേർതിരിച്ചു പറയാൻ തക്ക ജനുസുകൾ കാര്യമായി ഒന്നുംതന്നെയില്ല.

ഉപയോഗമനുസരിച്ച് ഇന്ത്യൻ കന്നുകാലി ജനുസുകളെ പ്രധാനമായും മൂന്നായി തരംതിരിക്കാം. കൂടുതൽ പാലുൽപ്പാദനക്ഷമതയുള്ള ജനുസുകളെ ഗവ്യജനുസുകളെന്നും, പ്രധാനമായും പണിയാവശ്യങ്ങൾക്കുപയോഗിക്കുന്നവയെ പ്രവൃത്തി ജനുസുകളെന്നും പറയുന്നു. ഈ രണ്ടു ജനുസുകളുടെയും ഗുണങ്ങൾ കുറേയൊക്കെയുള്ള ജനുസുകളെ ദ്വയോപയോഗജനുസുകളെന്നും പറഞ്ഞുവരുന്നു.

സഹിവാൾ, ചുവന്ന സനിന്ധി, ഗീർ എന്നിവ ഗവ്യജനുസിനും, കാങ്കയം, ഹലിക്കർ, ആലമ്പാടി എന്നിവ പ്രവൃത്തി ജനുസിനും ഓങ്കോൾ, കാങ്റേജ്, താർപാർക്കർ എന്നിവ ദ്വയോപയോഗ ജനുസിനും ഉദാഹരണങ്ങളാണ്.

സഹിവാൾ

പടിഞ്ഞാറൻ പാക്കിസ്ഥാനിലെ മോണ്ട്ഗോമറി ജില്ലയാണ് ഇവയുടെ ഉത്ഭവസ്ഥാനം. പഞ്ചാബ്, ഡൽഹി, ഉത്തർപ്രദേശ്, ബീഹാർ എന്നിവിടങ്ങളിൽ ഈയിനത്തെ അധികമായി കാണാം. ഇന്ത്യയുടെ ഒട്ടുമിക്ക പ്രദേശങ്ങളിലും ജീവിക്കാനിവയ്ക്കു പ്രത്യേക കഴിവുണ്ട്. നല്ല പാലുൽപ്പാദനശേഷിയുള്ള സഹിവാൾ പശുക്കൾ 300 ദിവസത്തെ കറവക്കാലത്ത് ശരാശരി 2725 മുതൽ 3175 കിലോഗ്രാം വരെ പാലുൽപ്പാദിപ്പിക്കുന്നു. ഈ ജനുസ് കാഴ്ചയിലും സ്വഭാവത്തിലും സൗമ്യമാണ്.

ഗീർ

ഗുജറാത്തിലെ ഗീർ വനാന്തരങ്ങളിലാണ് ഇവ ഉടലെടുത്തതെന്ന് വിശ്വസിക്കുന്നു. നല്ല കറവയുള്ള ഗീർ പശുക്കളെ അവയുടെ തനിമയോടെ തന്നെ ഈ പ്രദേശത്തും ചുറ്റുപാടും കണ്ടുവരുന്നു. ഒരു കറവക്കാലത്തെ ശരാശരി പാലുൽപ്പാദനം 1675 കിലോഗ്രാമാണ്. ശരീരത്തിൽ ഉയർന്ന തോതിൽ മാംസമുള്ള ഇവയെ ഇറച്ചിക്കായി ഉപയോഗിക്കാവുന്നതാണ്.

ചുവന്ന സിന്ധി

പടിഞ്ഞാറൻ പാക്കിസ്ഥാനിലെ കറാച്ചിയും അതിനു ചുറ്റുമുള്ള സിന്ധ് പ്രവിശ്യയുമാണ് ഇവയുടെ ആവാസമേഖല. എന്നാൽ ഈയിനത്തെ ഇന്ത്യയിലെ ഒട്ടുമിക്ക സ്ഥലങ്ങളിലും കാണാം. ഏതു കാലാവസ്ഥയിലും കഴിയുവാനുള്ള ഇവയുടെ കഴിവ് ഒന്നു വേറെതന്നെയാണ്. കേരളത്തിൽ കൃത്രിമബീജാധാനപരിപാടിയുടെ ആരംഭഘട്ടത്തിൽ നാടൻ ഇനങ്ങളുടെ പാലുൽപ്പാദനശേഷി വർധിപ്പിക്കാനായി സിന്ധിക്കാളകളുടെ ബീജം ഉപയോഗിച്ചിരുന്നു.

ലാഭകരമായ പാലുൽപ്പാദനത്തിനു പറ്റിയ ഒരു ഇന്ത്യൻ ഇനമാണ് ചുവന്ന സിന്ധി. മുന്നൂറുദിവസത്തെ കറവക്കാലത്ത് ഇവയുടെ ഉയർന്ന പാലുൽപ്പാദനം 5440 കിലോഗ്രാം വരെയാണ്. മെച്ചപ്പെട്ട സിന്ധിയിനങ്ങളുടെ ശരാശരി പ്രതിദിന പാലുൽപ്പാദനം 4.5 മുതൽ 6.5 കിലോഗ്രാം വരെയാണ്. കാളകളെ ഭാരം വലിക്കാനും നിലമുഴാനും ഉപയോഗിച്ചുവരുന്നു.

ഓങ്കോൾ

ആന്ധ്രപ്രദേശിലെ നെല്ലൂർ, ഗുണ്ടൂർ ജില്ലകളിലാണ് ഈയിനത്തെ കണ്ടുവരുന്നത്. പാലുൽപ്പാദനത്തിനും പണിക്കും വേണ്ടി ഉപയോഗിക്കുന്ന ഒരു ഇനമാണിത്. വണ്ടിവലിക്കാനും നിലമുഴാനുമായി കാളകളെ അധികമായി ഉപയോഗിച്ചുവരുന്നു. ഇവയുടെ ഒരു കറവക്കാലത്തെ ശരാശരി പാലുൽപ്പാദനം 1360 കിലോഗ്രാമാണ്. രോഗപ്രതിരോധശേഷി, കുറഞ്ഞ അളവിൽ തീറ്റവസ്തുക്കൾ കഴിച്ചുകൊണ്ട് ജീവിക്കാനുള്ള കഴിവ് എന്നിവ ഇവയുടെ പ്രത്യേകതകളാണ്. തന്മൂലം ഇവയെ അമേരിക്ക മുതലായ സ്ഥലങ്ങളിൽ സങ്കരപ്രജനനത്തിനുപയോഗിച്ചിട്ടുണ്ട്.

താർപാർക്കർ

പശ്ചിമ പാക്കിസ്ഥാനിലെ തെക്കുപടിഞ്ഞാറൻ സിന്ധ് പ്രദേശമാണ് ഇവയുടെ ഉത്ഭവസ്ഥാനം. ഇടത്തരം ശരീര വലിപ്പം, ഒതുങ്ങിയ ശരീരഘടന എന്നിവ താർപാർക്കറിന്റെ പ്രത്യേകതകളാണ്. ജനുസുകളിൽ മുന്തിയ സ്ഥാനമാണ് താർപാർക്കർക്ക്. 300 ദിവസ കറവക്കാലത്ത് 1815 മുതൽ 2720 കിലോഗ്രാം വരെ പാലുൽപ്പാദിപ്പിക്കുന്ന ഇവയുടെ ശരാശരി ഉൽപ്പാദനം 1360 കിലോഗ്രാമാണ്.

കാങ്റേജ്

ഇന്ത്യയിലെ വലിപ്പം കൂടിയ ജനുസുകളിലൊന്നാണിത്. ഗുജറാത്തിലെ കച്ച് പ്രദേശത്തിനടുത്താണ് ഇവയുടെ ഉത്ഭവം. സൂറ്റ്, കത്തിയവാർ, ബറോഡ എന്നിവിടങ്ങളിൽ പണിക്കായി ഏറ്റവും കൂടുതൽ ഉപയോഗിക്കുന്നത് കാങ്റേജ് ജനുസിൽപ്പെട്ട കാളകളെയാണ്. ഇവയുടെ ഒരു കറവക്കാലത്തെ ശരാശരി പാലുൽപ്പാദനം 1360 കിലോഗ്രാം. ഇന്ത്യയിലെ ദ്വയോപയോഗ ജനുസുകളിലെ ഒന്നാന്തരമിനമാണ് കാങ്റേജ്.

ഹരിയാന

ഇന്ത്യയിലെ ഏറ്റവും മുന്തിയ ദ്വയോപയോഗജനുസാണിത്. ഹരിയാനയാണ് ഇവയുടെ ഉറവിടം. ഹരിയാനയിനത്തിൽപ്പെട്ട കാളകൾ നല്ല പണിമിടുക്കുള്ളവയാണ്. പശുക്കൾക്ക് നല്ല പാലുൽപ്പാദനശേഷിയുണ്ട്. തിരഞ്ഞെടുക്ക

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പ്പെട്ട പശുക്കളുടെ ശരാശരി പ്രതിദിനപാലുൽപ്പാദനം 4.5 കിലോഗ്രാമാണ്. ഉത്തർപ്രദേശ്, ബംഗാൾ എന്നീ സംസ്ഥാനങ്ങളിലെ കന്നുകാലികളുടെ ജനിതകമൂല്യം വർധിപ്പിക്കാനായി ഹരിയാന വിത്തുകാളകളെ ഉപയോഗിച്ചിരുന്നു.

വിദേശ ജനുസുകൾ

ജേഴ്സി

പാലുൽപ്പാദനത്തിനായി ഉപയോഗിക്കുന്ന ഏറ്റവും ചെറിയ വിദേശ ജനുസായ ഇവ ഇംഗ്ലീഷ് ചാനലിലെ ജേഴ്സി ദ്വീപിലാണ് ഉരുത്തിരിഞ്ഞത്. സാഹചര്യങ്ങളുമായി ഒത്തിണങ്ങാനുള്ള സവിശേഷ കഴിവുമൂലം ഇവ ലോകത്തിന്റെ എല്ലാകോണുകളിലുമെത്തിച്ചേർന്നു. ലാഭകരമായ് പാലുൽപ്പാദനത്തിനുപറ്റിയ ജേഴ്സിയുടെ പാലിൽ 5.14 ശതമാനത്തോളം കൊഴുപ്പും 9.43 ശതമാനം കൊഴുപ്പൊഴിച്ചുള്ള ഖരപദാർത്ഥങ്ങളുമടങ്ങിയിരിക്കുന്നു. ഇവയുടെ ഏറ്റവും കൂടിയ പാലുൽപ്പാദനം 365 ദിവസത്തെ കറവക്കാലത്ത് 11381 കിലോഗ്രാമാണ്.

ഇന്ത്യയിൽ, പ്രത്യേകിച്ചും കേരളത്തിൽ നാടനിനങ്ങളിൽ കൃത്രിമ ബീജാധാനം നടത്തി സങ്കരവർഗ്ഗത്തെ ഉരുത്തിരിച്ചെടുക്കാനായി ആദ്യകാലത്തുപയോഗിച്ചത് ജേഴ്സി വിത്തുകാളകളുടെ ബീജമായിരുന്നു. വിദേശയിനങ്ങളുമായി ഏറ്റവും ചെറിയ ഇനമായ ജേഴ്സിക്കു മറ്റു വിദേശയിനങ്ങളുമായി താരതമ്യം ചെയ്യുമ്പോൾ തീറ്റ വളരെ കുറച്ചുമതി. വീട്ടാവശ്യത്തിനായി പശു വളർത്തുന്നവർക്ക് ഏറ്റവും അനുയോജ്യം ജേഴ്സി സങ്കരമാണ്.

ബ്രൗൺസ്വിസ്

സ്വറ്റ്സർലൻഡിലെ മലമടക്കുകളിൽ ഉരുത്തിരിഞ്ഞവയാണിവ. മര്യാദയും അനുസരണയും ഇവയുടെ പ്രത്യേകതയാണ്. പാലുൽപ്പാദനം, ഇറച്ചിയുൽപ്പാദനം, പണിമിടുക്ക് എന്നീ മേഖലകളിലെല്ലാം തന്നെ മികച്ച ഇവയ്ക്കാണ് വിദേശജനുസുകളിൽ ഏറ്റവും കൂടുതൽ ചൂട് സഹിക്കാനുള്ള കഴിവുള്ളത്. ഇവയുടെ ഒരു മീറ്ററിൽ താഴെയാണ് ഉയരം, ശരാശരി ശരീരതൂക്കം 125-150 കിലോഗ്രാമായിരിക്കും. സാധാരണ കാണപ്പെടുന്ന ശരീരനിറങ്ങൾ കുത്തും പുള്ളികളുമൊന്നുമില്ലാത്ത കറുപ്പ്, വെളുപ്പ്, ചുവപ്പ് എന്നിവയാണ്. ചെറുതും മുന്നോട്ടു വളഞ്ഞതുമായ കൊമ്പുകൾ, കഴുത്തിനു പിന്നിലായുള്ള പൂഞ്ഞ്, നീളമുള്ളതും നിലത്തു മുട്ടുന്നതുമായ വാല് എന്നിവയുടെ ഇവയുടെ പ്രത്യേകതകളാണ്. ചില മൃഗങ്ങൾക്ക് ചെമ്പൻ കൃഷ്ണമണിയും കൺപീലികളും ഉണ്ടാകാം. വളരെ കുറച്ചു തീറ്റ മതിയെന്നാണ് ഇവയുടെ മറ്റൊരു പ്രതയേകത. ഈയിനത്തെ വംശനാശത്തിൽ നിന്നും രക്ഷിക്കാനുള്ള ചില പരിപാടികൾ മണ്ണുത്തി വെറ്റിനറി കോളേജിൽ നടന്നുവരുന്നു.

ഭാഗം 4 :

ക്ഷീരവികസനവും അനുകൂല ഘടകങ്ങളും

ഏതൊരു മേഖലയുടേയും വികസനം ലക്ഷ്യമിടുമ്പോൾ പ്രസ്തുത മേഖലയുടെ അനുകൂലഘടകങ്ങൾ വിശകലനം ചെയ്യേണ്ടത് അതിപ്രധാനമാണ്. ക്ഷീരമേഖലയുടെ അനുകൂല ഘടകങ്ങൾ ചുവടെ ചേർക്കുന്നു.

4.1 സമഗ്ര കാർഷികവൃത്തി

2001 ലെ കാനേഷുമാരിയനുസരിച്ച് വയനാട്ടിലെ ജനസംഖ്യ 7,80,167 ആണ് ഇതിൽ 17.31% പട്ടികവർഗ്ഗക്കാരും 4.06% പട്ടികജാതിക്കാരുമാണ്. വയനാടിന്റെ സാമ്പത്തിക അടിത്തറയും തൊഴിലും ഏതാണ്ട് പൂർണ്ണമായും കാർഷിക അനുബന്ധ മേഖലയെ ആശ്രയിച്ചിരിക്കുന്നു.

ജനസംഖ്യയിൽ 80 ശതമാനത്തിലധികം കാർഷിക വൃത്തിയും, അനുബന്ധതൊഴിലുകളും മുഖ്യ ജീവനോപാധിയായി സ്വീകരിച്ചിട്ടുള്ളവരാണ്. കാർഷിക മേഖലയും - ക്ഷീര മേഖലയും പരസ്പര പൂരകങ്ങളാണ്.

ഇനം	ചാണകത്തിന്റെ ലഭ്യത (ടണ്ണിൽ)	ചാണകത്തിന്റെ മൂല്യം (ലക്ഷം രൂപ)	മൂത്രത്തിന്റെ ലഭ്യത (ടണ്ണിൽ)
കന്നുകാലികൾ	598182	2991	398788050
ആട്	123023	62	6151122
പന്നി	2085	10.4	4317220
കോഴി	11363	57	ഇല്ല
മൊത്തം	623932	3120.4	409256392

കാർഷിക മേഖലയിലെ വിവിധ ഉൽപ്പന്നങ്ങൾ പശുക്കളുടെ തീറ്റയായി ഉപയോഗപ്പെടുത്താം. ഉദാ:- വൈക്കോൽ, തവിട്, ധാന്യങ്ങൾ, വൃക്ഷയിലകൾ മുതലായവ. മറിച്ച് ക്ഷീര മേഖലയിലെ ചാണകം, ഗോമൂത്രം തുടങ്ങിയവ കാർഷിക മേഖലയിലും ഉപയോഗപ്പെടുത്താം.

കൂടാതെ കാർഷിക വിളവെടുപ്പുകാലങ്ങളിലൊഴികെയുള്ള ഏതാണ്ട് 8 മാസക്കാലം ദരിദ്രരും, ഇടത്തരം വരുമാനക്കാരും ഉപജീവനം കണ്ടെത്തുന്ന പ്രധാനവരുമാന സ്രോതസ്സ് ക്ഷീരോൽപ്പാദനമാണ്.

4.2 ക്ഷീരോൽപ്പാദനം

ജില്ലയിലെ ഏറ്റവും പ്രധാനപ്പെട്ട ഉപതൊഴിൽ

1996 ലെ ,കനേഷുമാരി പ്രകാരം വയനാട്ടിൽ 1,63,510 കാലികളുണ്ട്. ഇതിൽ 42,904 എണ്ണം നാടനും, 1,20,606 എണ്ണം സങ്കരവർഗ്ഗവുമാണ്. ലഭ്യമായ കണക്കനുസരിച്ച് 2002 ലെ വയനാട്ടിലെ പാലുൽപ്പാദനം 69.214 ടണ്ണാണ്. 2002-03 വർഷം ജില്ലയിലെ 51 ക്ഷീരസഹകരണ സംഘങ്ങളിലൂടെ

2,80,44,043 ലിറ്റർ പാൽ സംഭരിച്ചുവെന്നാണ് ഔദ്യോഗിക കണക്കുകൾ സൂചിപ്പിക്കുന്നത്. ഇതിൽ 35% പാൽ ജില്ലയിലും, 65% പാൽ മിൽമവഴി അന്യ ജില്ലകളിലും വിറ്റഴിച്ചു. വയനാടൻ കൃഷിക്കാരുടെ മൊത്ത വരുമാനത്തിൽ 23% ക്ഷീര മേഖലയിൽ നിന്നാണെന്ന് പഠനങ്ങൾ വെളിപ്പെടുത്തിയിട്ടുണ്ട്.

4.3 സംഘടിത മേഖലയുടെ ശക്തമായ പ്രവർത്തനം

വയനാട്ടിൽ 51 ക്ഷീരസഹകരണ സംഘങ്ങൾ നല്ല നിലയിൽ പ്രവർത്തിക്കുന്നു. കേരളത്തിൽ ഏറ്റവും കൂടുതൽ പാൽ സംഭരിക്കപ്പെടുന്ന ക്ഷീരസംഘങ്ങൾ വയനാട്ടിലാണ്. ജില്ലയിലെ മൊത്തം പാലുൽപ്പാദനത്തിന്റെ 32.66% സംഘടിത മേഖലയിൽ വിറ്റഴിക്കപ്പെടുന്നുണ്ട്. ഇതുവഴി 22.05 കോടി രൂപാ ഗ്രാമീണ ക്ഷീരകർഷകരുടെ ഇടയിൽ വിതരണം ചെയ്യപ്പെടുന്നു. പാൽ വിലയുടെ സിംഹഭാഗവും അന്യ ജില്ലകളിൽ നിന്നാകയാൽ വയനാടൻ ഗ്രാമീണ സമ്പദ് വ്യവസ്ഥയിൽ ശക്തമായ സ്വാധീനം ചെലുത്തുന്നുണ്ട്. ഇക്കാര്യത്തിൽ മിൽമയുടെ സേവനം പ്രത്യേകം പ്രസ്താവ്യമാണ്. ജില്ലയിൽ സംഘടിത മേഖലയിൽ സംഭരിക്കുന്ന പാലിന്റെ 53.02% സുൽത്താൻ ബത്തേരി വികസന ബ്ലോക്കിൽ നിന്നാണ്. 700 ൽ പരം ജീവനക്കാർ ജില്ലയിലെ ക്ഷീരസഹകരണ സംഘങ്ങളിൽ ജോലിചെയ്തുവരുന്നു.

4.4 പാലിന്റെ സ്ഥിരമായ വിലയും വിപണിയും

മറ്റു കാർഷികോൽപ്പന്നങ്ങളെ അപേക്ഷിച്ച് പാലിന്റെ വിലയും വിപണിയും ഏതാണ്ട് സ്ഥിരമായിത്തന്നെ നിലനിൽക്കുന്നു. ഇതിന് മിൽമയും, പാൽ സഹകരണ സംഘങ്ങളും അടങ്ങുന്ന സംഘടിത മേഖലയുടെ പങ്ക് എടുത്തു പറയേണ്ടതാണ്. ഏതാനും സ്വകാര്യ ഏജൻസികളും ഈ രംഗത്ത് പ്രവർത്തിക്കുന്നുണ്ട്.

4.5 പ്രതിശീർഷ ഭൂമിയുടെ ലഭ്യത

കേരളത്തിലെ ആളോഹരി ഭൂമിയുടെ പ്രതിശീർഷ ലഭ്യത 33 സെന്റാണ്. എന്നാൽ വയനാട്ടിൽ ഇത് 78 സെന്റാണ്. ഇത് കന്നുകാലി വളർത്തലിന് അനുകൂല ഘടകമാണ്.

4.6 പച്ചപ്പുല്ലിന്റെ ലഭ്യത

ജില്ലയിൽ വർഷത്തിൽ ആറുമാസക്കാലം (ജൂൺ മുതൽ ഒക്ടോബർ വരെ) സുഭിക്ഷമായി പച്ചപ്പുല്ല് ലഭിക്കുന്നു. മറ്റു മാസങ്ങളിൽ പച്ചപ്പുല്ലിന്റെ ലഭ്യത കുറയുന്നുണ്ടെങ്കിലും കേരളത്തിലെ ഇതര ജില്ലകളെ അപേക്ഷിച്ച് ലഭ്യത കൂടുതലാണ്.

4.7 കാലാവസ്ഥാനുയോജ്യത

കേരളത്തിലെ ഇതര ജില്ലകളെ അപേക്ഷിച്ച് തണുപ്പുള്ള കാലാവസ്ഥ വയനാട്ടിൽ കന്നുകാലി വളർത്തലിന് ഏറ്റവും അനുകൂലമായ ഘടകമാണ്. വിദേശ സങ്കരയിനം ജനുസ്സുകൾക്ക് ഇവിടത്തെ ദിനാന്തരീക്ഷ സ്ഥിതി ഏറ്റവും അനുയോജ്യമാണ്. മാത്രമല്ല വയനാടൻ കാലാവസ്ഥയും മറ്റ് ഭൗതിക ഘടകങ്ങളും അന്താരാഷ്ട്ര ഗുണനിലവാരമുള്ള പാലുൽപ്പാദനത്തിനും ഉൽപ്പന്ന നിർമ്മാണത്തിനും സംസ്കരണത്തിനും ഏറ്റവും അനുയോജ്യമാണ്.

4.8 ജലവിഭവശേഷി

അമ്പതോളം പുഴകളും, തോടുകളുമടങ്ങുന്ന ജലസ്രോതസ്സുകളുടെ സമൃദ്ധി വയനാടിനെ കാലിവളർത്തലിന് അനുയോജ്യമാക്കുന്നു.

4.9 വനിതാ വികസനം

കുറഞ്ഞ മുതൽമുടക്ക്, പെട്ടന്നുള്ള വരുമാനം, കുറഞ്ഞ സാങ്കേതികവിദ്യ, ഗൃഹജോലികൾക്കിടയിൽ ചെയ്യാവുന്ന സ്വയംതൊഴിൽ, പാലിന്റെ സ്ഥിരമായ വില, കയ്യെത്തും ദൂരത്തുള്ള വിപണനകേന്ദ്രങ്ങൾ തുടങ്ങിയ കാര്യങ്ങൾ ക്ഷീരവികസനം ഗ്രാമീണ വനിതകളുടെ ഏറ്റവും അനുയോജ്യമായ സ്വയംതൊഴിലാക്കി മാറ്റുന്നു. സഹകരണ മേഖലയുമായുള്ള ബന്ധം വനിതകളുടെ സാമൂഹികോന്നമനത്തിന് വളരെയേറെ പ്രയോജനകരമാണ്. ക്ഷീരസംഘങ്ങളിൽ ശരാശരി അംഗങ്ങൾ വനിതകളാണെന്നുള്ള വസ്തുതയും ഭരണസമിതികളിൽ അവരുടെ സാന്നിദ്ധ്യവും പ്രത്യേകം ശ്രദ്ധേയമാണ്.

4.10 പട്ടികജാതി /പട്ടികവർഗ്ഗക്കാരുടെ തൊഴിൽ സാധ്യതകൾ

കേരളത്തിലെ ആദിവാസി ജനസംഖ്യയിൽ 35% വയനാട്ടിലാണ്. കുറുമർ, കുറിച്ച്യർ എന്നീ ആദിവാസി വിഭാഗക്കാരുടെ സംസ്കാരവുമായി ബന്ധപ്പെടുത്തുമ്പോൾ കന്നുകാലി വളർത്തലിന് വൻ പ്രാധാന്യമാണുള്ളത്. പട്ടിക വർഗ്ഗക്കാക്കിടയിൽ ഇന്നുള്ള കാലി വളർത്തൽ അശാസ്ത്രീയവും കറവമാടുകൾ പാലുൽപ്പാദനശേഷി കുറഞ്ഞവയുമാണ്.

	വയനാട്	കേരളം
1. തീറ്റപ്പുൽ ആവശ്യകത	2.484 ലക്ഷം ടൺ	161.119 ലക്ഷം ടൺ
2. തീറ്റപ്പുല്ലുൽപ്പാദനം	0.7473 ലക്ഷം ടൺ	19.239 ലക്ഷം ടൺ
3. തീറ്റപ്പുൽകൃഷിക്ക് ലഭ്യമാക്കേണ്ട സ്ഥലം	28945 ഹെക്ടർ	
4. ആളോഹരി പാൽ ലഭ്യത	225 ഗ്രാം	
5. ആളോഹരി മുട്ടയുടെ ലഭ്യത	73 ഗ്രാം	

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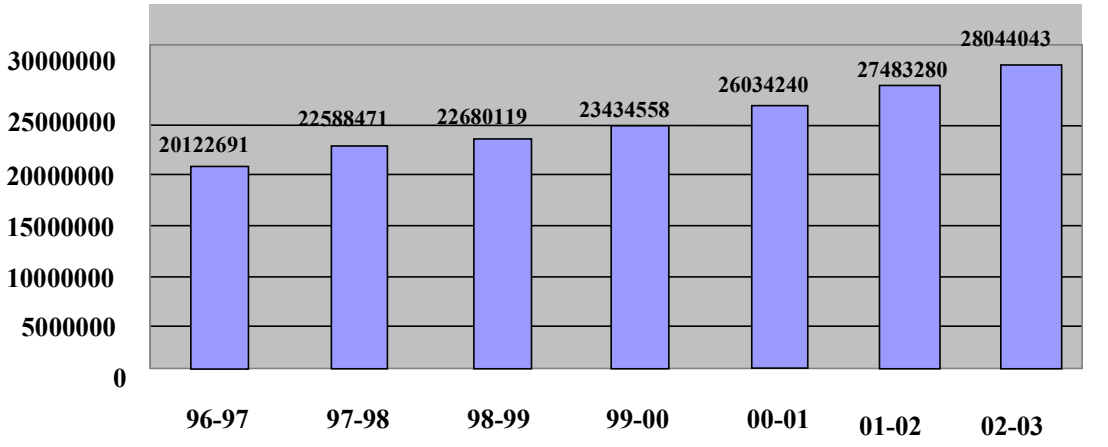

പാൽ സംഭരണം (ലിറ്റർ)

മേൽപ്പറഞ്ഞ വിഭാഗങ്ങൾ കാലിവളർത്തലിൽ ഏർപ്പെട്ടിരിക്കുന്നു. പട്ടികജാതിക്കാരുടെ തൊഴിലില്ലായ്മ പരിഹരിക്കുന്നതിനും കന്നുകാലിവളർത്തൽ ഏറ്റവും അനുയോജ്യമാണ്.

4.11 ഊർജ്ജോൽപ്പാദനം

ബയോഗ്യാസ് പ്ലാന്റുകളുടെ നിർമ്മാണത്തിലൂടെ പാരമ്പര്യേതര ഊർജ്ജസ്രോതസ്സ് ചെറിയൊരളവുവരെ ചൂഷണം ചെയ്യപ്പെടുന്നുണ്ട്. ജില്ലയിൽ ഏതാണ്ട് പതിനായിരത്തിലധികം ബയോഗ്യാസ് പ്ലാന്റുകൾ ഉണ്ടെന്ന് കണക്കാക്കുന്നു.

4.12 പരിസ്ഥിതി സംരക്ഷണം

കാലിവളർത്തൽ പരിസ്ഥിതിക്ക് ദോഷകരമല്ലാത്ത വികസന മേഖലയാണ്. തീറ്റപ്പുൽകൃഷി ചെയ്യുന്നതിലൂടെ മണ്ണ്-ജല സംരക്ഷണം വളരെയേറെ മെച്ചപ്പെടുന്നു. പുൽ വർഗ്ഗങ്ങൾക്ക് കാർബൺഡൈ ഓക്സൈഡിനെ ഏറ്റവും കാര്യക്ഷമമായി ഓക്സിജനാക്കി മാറ്റുവാൻ കഴിയുന്നു. കൂടാതെ തീറ്റപ്പുൽ വിളകൾ കൂടുതൽ ബയോമാസ് ഉൽപ്പാദിപ്പിക്കുന്നു.

4.13 ഭക്ഷ്യസുരക്ഷയും ആരോഗ്യ പോഷണവും

ഒരു സമ്പൂർണ്ണാഹാരമായ പാലിന്റെ ഉപയോഗത്തിന് ആരോഗ്യമേഖലയിൽ വൻപ്രാധാന്യമാണുള്ളത്. ഗ്രാമീണ ഭവനങ്ങളിൽ പാലിന്റെ ഉപഭോഗം സാധ്യമാകുന്നത് പാലുൽപ്പാദിപ്പിക്കുന്നതുകൊണ്ടു മാത്രമാണെന്നുള്ള വിവരം പ്രത്യേകം പ്രസ്താവ്യമാണ്.

4.14 സാംസ്കാരികം

വയനാടിന്റെ സംസ്കാരവും പശുവളർത്തലും പരസ്പരബന്ധിതമാണ്. പശു വളർത്തൽ സമ്പത്തിന്റേയും ഐശ്വര്യത്തിന്റേയും സംസ്കാരത്തിന്റേയും പ്രതീകമായി കരുതപ്പെടുന്നു.

4.15 സാമൂഹികം

ക്ഷീരകർഷകർ നിത്യേന ബന്ധപ്പെടുന്ന ക്ഷീരസഹകരണ സംഘങ്ങൾ ശക്തമായ സാമൂഹിക വികസന കേന്ദ്രങ്ങളാണ്. ജില്ലയിലെ 70 ശതമാനം കുടുംബങ്ങളും നിത്യേന ബന്ധപ്പെടുന്ന ഒരേയൊരു സ്ഥാപനം ക്ഷീരസംഘങ്ങളാകയാൽ ശക്തമായ ആശയവിനിമയ കേന്ദ്രങ്ങളായും അവ പ്രവർത്തിക്കുന്നു.

ഭാഗം 5 :

ക്ഷീരവികസനവും പോരായ്മകളും

1. പാലിന്റെ വിലക്കുറവ് :- ഉൽപ്പാദനച്ചെലവിന്റെ ദൈനംദിന വർദ്ധനവിനനുസൃതമായി ക്ഷീര കർഷകർക്ക് തൃപ്തികരമായ വില ലഭിക്കുന്നില്ല.

2. അനുയോജ്യമായ ജനുസ്സുകളുടെ പ്രോൽസാഹനമില്ലായ്മ :- വയനാട് ജില്ലയ്ക്ക് ഏറ്റവും അനുയോജ്യമായ ജനുസ്സിനെ (ജേഴ്സി) വേണ്ടവിധം പ്രോൽസാഹിപ്പിക്കുന്നില്ല. ജില്ലയിൽ സ്വിസ് ബ്രൗൺ, ഹോൾസ്റ്റെയിൻ ഫ്രീഷിയൻ തുടങ്ങിയ ഇനങ്ങളെ കൂടുതലായി പ്രോൽസാഹിപ്പിക്കുന്നു. കൂടാതെ ഇൻഡ്യയിലെ ഏറ്റവും മുന്തിയയിനം പാലുൽപ്പാദന വർഗ്ഗങ്ങളായ സഹിവാൾ, സിന്ധി എന്നിവ പോലുള്ള ഇനങ്ങൾ പ്രോത്സാഹിപ്പിക്കപ്പെടുന്നില്ല. ശരാശരി 8 ലിറ്റർ പാലിലധികം ഉൽപ്പാദനശേഷിയുള്ള നാടനിനങ്ങൾ നമുക്കുണ്ടെന്നുള്ളകാര്യം ബന്ധപ്പെട്ടവർ വിസ്മരിക്കുന്നു. കേരളത്തിന്റെ തനത് കന്നുകാലിവർഗ്ഗമായ വെച്ചൂർ പശുക്കൾക്കും വേണ്ടത്ര പ്രോത്സാഹനവും പ്രചരണവും നൽകുന്നില്ല. കൂടാതെ ലോകത്തിലെ ഏറ്റവും മികച്ച പാലുൽപ്പാദന എരുമ വർഗ്ഗമായ മുറയുടെ സാധ്യതകളെക്കുറിച്ചു നാം ചിന്തിക്കുന്നില്ല.

3. പച്ചപ്പുല്ലിന്റെ അഭാവം :- ജില്ലയിൽ തീറ്റപ്പുൽകൃഷി വേണ്ട വിധം പ്രോൽസാഹിപ്പിക്കപ്പെടുന്നില്ല. പലപ്പോഴും സുഭിക്ഷമായി പച്ചപ്പുല്ല് ലഭിക്കുന്നില്ലെന്നു മാത്രമല്ല ചിലപ്പോൾ പച്ചപ്പുല്ലിന് വളരെയേറെ ക്ഷാമം അനുഭവപ്പെടുകയും ചെയ്യുന്നു. ഈ കാലയളവിൽ വൈക്കോലാണ് പ്രധാന പരുഷാഹാരം. ഇക്കാരണത്താൽ വേനൽക്കാലത്ത് പാലുൽപ്പാദനച്ചെലവ് ഗണ്യമായി വർദ്ധിക്കുന്നു. കൂടാതെ മേൽ കാലയളവിൽ കാലികളിൽ പോഷകാഹാരക്കുറവ്, പാലുൽപ്പാദനക്കുറവ്, ആരോഗ്യക്കുറവ്, ചെനപിടിക്കാനുള്ള കാലതാമസം തുടങ്ങിയവക്ക് കാരണമാകുന്നു.

4. ക്ഷീരോൽപ്പാദനത്തിന്റെ വർദ്ധിച്ച ചെലവ്:- തീറ്റപ്പുല്ല് ഒഴികെയുള്ള ഗുരുത്വാഹാരങ്ങളുടെയും വൈക്കോൽ തുടങ്ങിയ പരുഷാഹാരങ്ങളുടേയും ക്രമാതീതമായ വിലവർദ്ധനവ്, ക്ഷീര മേഖലയെ ദോഷകരമായി ബാധിക്കുന്നു.

5. പുൽകൃഷി ജലസേചന സൗകര്യക്കുറവ് :- തീറ്റപ്പുൽകൃഷിക്കാവശ്യമായ ജനസേചന സൗകര്യങ്ങൾ വയനാട്ടിൽ വേണ്ടത്ര പ്രോത്സാഹിപ്പിക്കപ്പെടുന്നില്ല. തീറ്റപ്പുൽകൃഷിയുടെ പ്രാധാന്യം വേണ്ടത്ര ശ്രദ്ധിക്കപ്പെടുന്നുമില്ല.

6. ശാസ്ത്രീയമായ കന്നുകാലിത്തൊഴുത്തുകളുടെ അഭാവം:- പശുവളർത്തലിന്റെ പരമപ്രധാന അടിസ്ഥാന സൗകര്യമായ ശാസ്ത്രീയ രീതിയിലുള്ള കന്നു കാലിത്തൊഴുത്തുക്കളുടെ അഭാവം ഈ രംഗത്തെ വലിയ ന്യൂനതയാണ്. കാലികളുടെ ആരോഗ്യം, പാലിന്റെ ഗുണനിലവാരം, അണുനിലവാരം എന്നിവയെ ഇത് ദോഷകരമായി ബാധിക്കുന്നു. ശാസ്ത്രീയമായ പരിപാലന മുറകൾ കർഷകരുടെ ഇടയിൽ സാർവ്വത്രിക മല്ലാത്തതുമൂലം പശുക്കൃഷി ആദായകരമാക്കാൻ ക്ഷീര കർഷകർക്ക് സാധിക്കുന്നില്ല.

7. മൃഗ സംരക്ഷണ സൗകര്യക്കുറവ് :- കൃത്രിമ ബീജാധാനം, മൃഗചികിൽസ എന്നിവക്കുള്ള കേന്ദ്രങ്ങൾ ദൂരസ്ഥലങ്ങളിലായതിനാൽ പാഴ്ച്ചെലവുകൾ കൂടുന്നു, കൃത്രിമ ബീജാധാന സൗകര്യക്കുറവ്, ചെനപിടിക്കാത്ത അവസ്ഥ, ചെനപിടിക്കാനുള്ള കാലതാമസം, അവശ്യം വേണ്ട മരുന്നുകൾ ലഭ്യമല്ലാത്തത്, അകിടുവീക്കം, കുളമ്പുരോഗം തുടങ്ങിയ സാംക്രമിക രോഗങ്ങൾ, കാര്യക്ഷമവും ജനകീയവുമല്ലാത്ത രോഗപ്രതിരോധ നടപടികൾ തുടങ്ങിയവ ക്ഷീര കർഷകർ അഭിമുഖീകരിക്കുന്ന പ്രധാന പ്രശ്നങ്ങളാണ്.

8. കന്നുകുട്ടികളുടേയും കിടാരികളുടേയും അശാസ്ത്രീയമായ പരിപാലന രീതികൾ :- ശാസ്ത്രീയമായ പരിപാലന മുറകൾ അനുവർത്തിക്കാത്തതിനാൽ കന്നുകുട്ടികളുടേയും കിടാരികളുടേയും ഉൽപാദന ശേഷിയിലെ പ്രാപ്തിക്കുറവുകൾ ഈ മേഖലയിലെ സാമ്പത്തിക നേട്ടങ്ങളെ കുറയ്ക്കുന്നു.

9. ദിമുഖ വിലനിർണ്ണയ സമ്പ്രദായത്തോടുള്ള കർഷകരുടെ മനോഭാവം:- തന്റേതല്ലാത്ത കുറ്റംകൊണ്ട് പാൽവിലയിൽ കുറവുവരുത്തുന്ന ദിമുഖവില നിർണ്ണയരീതി പരിഷ്കരിക്കപ്പെടാത്തത് കർഷകരുടെ അതൃപ്തിക്ക് കാരണമാകുന്നു. വിദേശ രാജ്യങ്ങളിൽ സ്വീകരിച്ചിട്ടുള്ളതുപോലെ കൊഴുപ്പ്, കൊഴുപ്പിതര ഖരപദാർത്ഥങ്ങൾ എന്നിവയ്ക്ക് കൂടുതൽ പ്രാധാന്യം നൽകുന്നതിനുപകരം പാലിന്റെ അണുനിലവാരത്തിന് പ്രാധാന്യം നൽകണം. വയനാട്ടിൽ സംഭരിക്കുന്ന പാലിന്റെ ഗുണനിലവാരം തുലോം കുറവാണ്.

10. ക്ഷീരവികസനത്തിന് അർഹമായ ഫണ്ട് ലഭിക്കുന്നില്ല:- സംസ്ഥാനാവിഷ്കൃതം, കേന്ദ്രാവിഷ്കൃതം, ത്രിതല പഞ്ചായത്തുകൾ, അർദ്ധസർക്കാർ, സർക്കാരിതര ഏജൻസികൾ എന്നിവ മുഖേന നടപ്പിലാക്കുന്ന വികസന പ്രവർത്തനങ്ങളിൽ അർഹമായ ഫണ്ട് ക്ഷീരവികസനത്തിനായി നീക്കിവെയ്ക്കുന്നില്ല.

11. ഗുരുത്വാഹാരങ്ങളുടെ ഗുണനിലവാരക്കുറവ്:- പാലിന് ഗുണനിലവാരം നിശ്ചയിക്കപ്പെട്ടിട്ടുണ്ടെങ്കിലും, ഗുരുത്വാഹാരങ്ങളുടെ ഗുണനിലവാരം നിശ്ചയിക്കപ്പെട്ടിട്ടില്ല.

12. ക്ഷീരമേഖലയിൽ സമഗ്രവും, ശാസ്ത്രീയവുമായ ഒരു വികസനതന്ത്രത്തിന്റെ അഭാവം:- ക്ഷീര മേഖലയിൽ സമഗ്രവും ശാസ്ത്രീയവുമായ ഒരു വികസന തന്ത്രം രൂപപ്പെടുത്താത്തത് ഈ മേഖലയിലെ വികസന പ്രക്രിയയെ തടസ്സപ്പെടുത്തുന്നു.

13. വിവിധ ഏജൻസികളുടെ ഏകോപനമില്ലായ്മ:- വിവിധ ഏജൻസികളുടെന പ്രവർത്തനത്തിൽ ഏകോപനമില്ലാത്തതുമൂലം പരസ്പരബന്ധമില്ലാത്ത വികസനമാണ് ഈ മേഖലയിൽ ഇന്നുള്ളത്.

14. ക്ഷീര സംഘങ്ങളുടെ സമീപന വൈകല്യങ്ങൾ:- ക്ഷീര സംഘങ്ങളുടെ പ്രവർത്തനം സംബന്ധിച്ച കർഷകരുടെ അഭിപ്രായം ചുവടെ ചേർക്കുന്നു.

എ)	ജീവനക്കാരുടെ തെറ്റായ സമീപനം	47%
ബി)	മാനേജ്മെന്റിന്റെ കാര്യക്ഷമതക്കുറവ്	18%
സി)	ക്ഷീരസംഘങ്ങളുടെ കണക്കുകളിൽ വിശ്വാസമില്ലായ്മ	43%
ഡി)	പാൽവില നിർണ്ണയത്തിൽ ഉൽപ്പാദകരുടെ വിശ്വാസക്കുറവ്	94%
ഇ)	പാൽ അളവ് തൃപ്തികരമല്ല	42%

15. വിവിധ ഏജൻസികളുടെ ആത്മാർത്ഥതക്കുറവ്:- വിവിധ ഏജൻസികളിലെ ചില ജീവനക്കാരും ഭരണസമിതിയംഗങ്ങളും അർപ്പണബോധത്തോടെ പ്രവർത്തിക്കുന്നില്ല.

16.പാലുൽപ്പാദനത്തിലെ ഏറ്റക്കുറച്ചിൽ:- വേനൽക്കാല - വർഷക്കാലങ്ങളിലെ പാൽ ഉൽപ്പാദനത്തിലുണ്ടാകുന്ന ഏറ്റക്കുറച്ചിലുകൾ ക്ഷീര മേഖലയെ പ്രതികൂലമായി ബാധിക്കുന്നുണ്ട്.

17. വർധിച്ചുവരുന്ന കാലിരോഗങ്ങൾ:- പശുക്കളിലെ വർദ്ധിച്ചുവരുന്ന രോഗങ്ങൾ ഈ മേഖലയെ ദോഷകരമായി ബാധിക്കുന്നുണ്ട്.

18. ക്ഷീര മേഖലയിൽ പ്രവർത്തിക്കുന്നതിൽ പുതുതലമുറ

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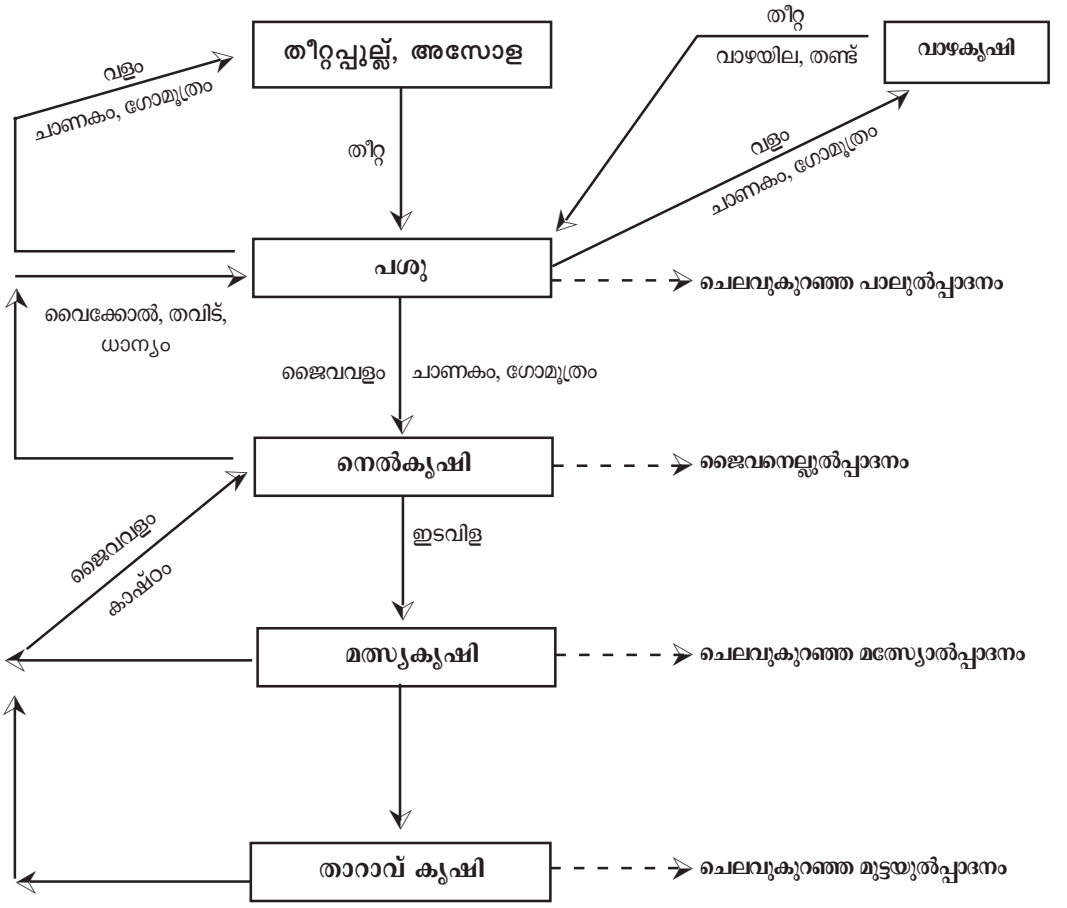
ഉദ്ഗ്രഥനം – 1



യുടെ വൈമുഖ്യം:- പുതിയ തലമുറ ഈ രംഗത്തേക്ക് കൂടുതലായി കടന്നുവരുന്നില്ല.

19. ഗവേഷണങ്ങളുടെ പോരായ്മ:- കാർഷിക വാഴ്സിറ്റി, വെറ്റിനറി കോളേജ്, വിവിധ സർക്കാർ - അർദ്ധ സർക്കാർ -സഹകരണ സ്ഥാപനങ്ങൾ എന്നിവ ഈ മേഖലയിൽ പ്രവർത്തിക്കുന്നുണ്ടെങ്കിലും ക്ഷീര മേഖലയിൽ കാര്യമായ പഠന-ഗവേഷണങ്ങൾ നടത്തുന്നില്ല. പച്ചിലകൾ, കാർഷികാവാശിഷ്ടങ്ങൾ മറ്റു പ്രകൃതിദത്ത സ്രോതസ്സുകൾ എന്നിവ വിനിയോഗിക്കപ്പെടുന്നില്ല.

20. പാൽ സംഭരണത്തിലെ അപാകത:- സംഭരണ സമയത്തിലെ അശാസ്ത്രീയതമൂലം പാലിന്റെ ഗുണനിലാവരം കുറയുന്നു. ഇതുമൂലം ലഭിക്കുന്ന പാലിന്റെ അളവിലും കുറവു സംഭവിക്കുന്നു.

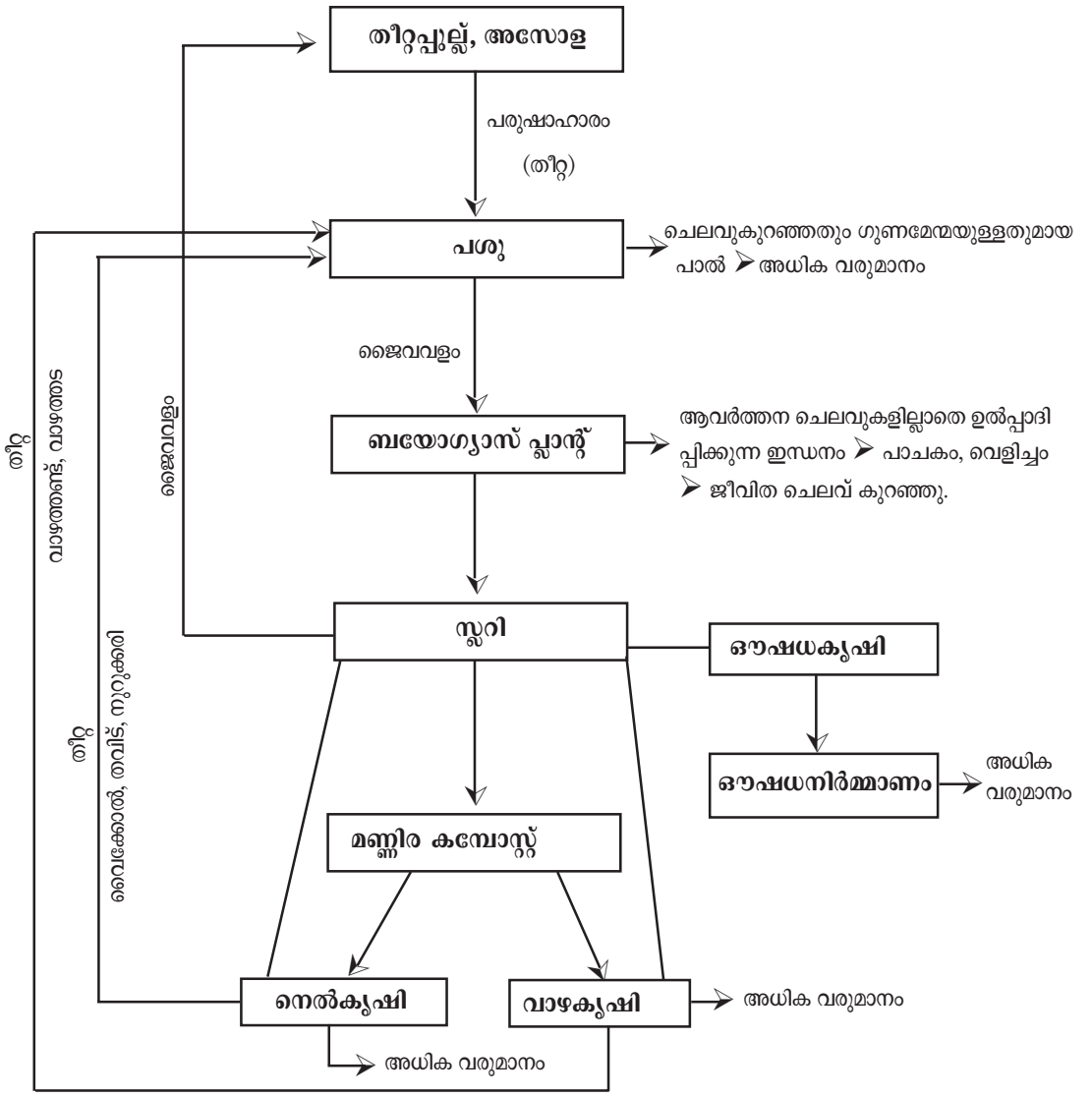
ഭാഗം – 6

ക്ഷീരവികസനവും അവസരങ്ങളും

6.1 അനുകൂല ഭൗതിക സാഹചര്യങ്ങൾ ഉപയോഗപ്പെടുത്തൽ: കാലാവസ്ഥ, ഭൂപ്രകൃതി, വർദ്ധിച്ച ആളോഹരി ഭൂമിയുടെ ലഭ്യത, ജലലഭ്യത തുടങ്ങിയ അനുകൂല ഭൗതിക സാഹചര്യങ്ങൾ ക്ഷീരവികസനത്തിന് ഫലപ്രദമായി ഉപയോഗപ്പെടുത്താം.

6.2 വർദ്ധിച്ച മനുഷ്യവിഭവശേഷി :- പൊതു-വിദ്യാഭ്യാസ മേഖലകളിൽ പിന്നോക്കം നിൽക്കുന്ന വയനാട്ടിലെ വർദ്ധിച്ച മനുഷ്യവിഭവശേഷി കാലിവളർത്തലിനായി ഉപയോഗപ്പെടുത്താം. ഒരു വരുമാനമാർഗ്ഗമെന്ന നിലയിൽ പശുവളർത്തൽ മുഖ്യമായും കേന്ദ്രീകരിച്ചിട്ടുള്ളത് സാമ്പത്തികമായി

ഉദ്ഗ്രഥനം – 2



പിന്നോക്കം നിൽക്കുന്ന ദരിദ്ര – ഇടത്തരം കുടുംബങ്ങളിലായതിനാൽ ഇവരുടെ ജീവിതനിലവാരം ഉയർത്താൻ കഴിയുന്ന ഏറ്റവും അനുയോജ്യമായ വികസനമേഖല ക്ഷീരമേഖലയാണ്. ആസൂത്രിതമായ പ്രോത്സാഹനത്തിലൂടെ യുവജനങ്ങളെ ക്ഷീരമേഖലയിലേക്ക് ആകർഷിക്കാവുന്നതാണ്.

6.3 നിക്ഷേപ വസ്തുക്കളുടെ ഉപയോഗം:– വയനാട്ടിൽ ലഭ്യമായ കാലിത്തീറ്റയ്ക്കുതക്കുന്ന തീറ്റപ്പുല്ല് തനതായ തീറ്റ വസ്തുക്കൾ, ഭക്ഷ്യയോഗ്യമായ കാർഷികാവശിഷ്ടങ്ങൾ, മുന്തിയയിനം തീറ്റപുൽവർഗ്ഗങ്ങൾ, അസോള, പീലിവാക തുടങ്ങിയ നിക്ഷേപ വസ്തുക്കൾ കാലിവളർത്തലിന് ഫലപ്രദമായി ഉപയോഗപ്പെടുത്താം.

6.4 ഉദ്ഗ്രഥന സാധ്യതകൾ:– കാർഷിക മേഖലയിലേക്ക് ആവശ്യമായ ബയോഗ്യാസ് പ്ലാന്റ്, മണ്ണിര കമ്പോസ്റ്റ്, പഞ്ചഗവ്യം, ബയോഡയനാമിക്ക് പ്രിപ്പറേഷൻ തുടങ്ങിയവ നെൽകൃഷി, മത്സ്യകൃഷി, ഔഷധ സസ്യകൃഷി തുടങ്ങിയ മേഖലകളിൽ ഉദ്ഗ്രഥനവും അനുബന്ധ വരുമാനവും സാധ്യമാകുന്നതാണ്. പശു വളർത്തൽ മുഖേനയുള്ള രണ്ട് ഉദ്ഗ്രഥന കേസ് സ്റ്റഡി ചുവടെ ചേർക്കുന്നു.

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6.5 പാരമ്പര്യേതര ഊർജ്ജോൽപ്പാദനം:- ബയോഗ്യാസ് പ്ലാന്റ് നിർമ്മാണത്തിലൂടെ ആവർത്തന ചെലവില്ലാത്ത പാരമ്പര്യേതര ഊർജ്ജോൽപ്പാദനം സാധ്യമാകുന്നതാണ്. ബയോഗ്യാസ് പ്ലാന്റിൽനിന്നും പുറന്തള്ളപ്പെടുന്ന സ്ലെറി വളരെ നല്ലൊരു ജൈവവളമായി ഉപയോഗിക്കാം. ബയോഗ്യാസ് പ്ലാന്റ് നിർമ്മാണം, കാലിത്തൊഴുത്ത് നിർമ്മാണം എന്നിവയുമായി ബന്ധപ്പെട്ട് വനിതകൾക്ക് പരിശീലനം നൽകി വനിതാ മെയ്സൺമാരുടെ ഒരു സന്നദ്ധസേന രൂപീകരിക്കാവുന്നതാണ്.

ആവർത്തന ചെലവില്ലാതെയും പാരിസ്തിതിക പ്രശ്നങ്ങളില്ലാതെയും ഊർജ്ജോൽപ്പാദനം സാധ്യമാകും ബയോഗ്യാസ് പ്ലാന്റ് നിർമ്മാണത്തിലൂടെ ചാണകത്തിന്റെ സ്വാഭാവിക അഴുകൽ മുഖേന സംഭവിക്കുന്ന മിഥേൻ മലിനീകരണം ഇല്ലാതാക്കുന്നു. ബയോഗ്യാസ് പ്ലാന്റിൽനിന്നും പുറത്തേയ്ക്കുവരുന്ന മീഥേൻ വാതകത്തെകത്തിച്ച് ഇന്ധനമായി ഉപയോഗിക്കുന്നതിനാൽ മീഥേൻ വാതകം മുഖേന സംഭവിക്കാവുന്ന അന്തരീക്ഷോഷ്മാവിന്റെ വർദ്ധന ഒഴിവാക്കാൻ കഴിയുന്നു.

6.6 ആഭ്യന്തര വിപണികൾ:- ജില്ലയിലെ മിക്ക കാർഷിക വിളകളുടെയും വിപണി അന്യസംസ്ഥാനങ്ങളെയും വിദേശരാജ്യങ്ങളെയും ആശ്രയിച്ചാണിരിക്കുന്നത്. എന്നാൽ പാലിന്റെ കാര്യത്തിൽ കേരളത്തിൽത്തന്നെ ഇനിയും വളരെയേറെ വിപണന സാധ്യതയുണ്ട്. മിൽമപോലും ഒന്നര ലക്ഷം ലിറ്റർ പാൽ പ്രതിദിനം അന്യസംസ്ഥാനങ്ങളിൽ നിന്ന് കൊണ്ടുവരുന്നുണ്ട്. ഇത്രയും പാൽ ജില്ലയ്ക്ക് ഉൽപ്പാദിപ്പിച്ച പ്രതിവർഷം കോടിരൂപയുടെ അധികവരുമാനം നേടാവുന്നതാണ്. കൂടാതെ വാങ്ങൽശേഷി കൂടുതലുള്ള നമ്മുടെ സംസ്ഥാനത്ത് ക്ഷീരോൽപ്പന്നങ്ങളുടെ വിപണനത്തിനും വളരെയേറെ സാധ്യതയുണ്ട്.

6.7 വ്യവസായിക വികസനം :- പാൽ സംസ്കരണവും, പാലുൽപ്പന്ന നിർമ്മാണവും വയനാട്ടിലെ കാലാവസ്ഥയും ഭൂപ്രകൃതിയും മറ്റ് ഘടകങ്ങളും കണക്കിലെടുക്കുമ്പോൾ അന്താരാഷ്ട്ര ഗുണനിലവാരമുള്ള പാലുൽപ്പാദനത്തിന് കേരളത്തിൽ മറ്റെങ്ങും ഇല്ലാത്ത വൻ സാധ്യതയാണുള്ളത്. വയനാട്ടിൽ പ്രതിദിനം ഒരു ലക്ഷത്തി ഇരുപതിനായിരത്തിലധികം ലിറ്റർ പാൽ സംഭരിക്കുന്നുണ്ട്. ആസന്നഭാവിയിൽ പാൽ വിപണന മേഖലയിൽ ഉണ്ടായേക്കാവുന്ന പ്രതിസന്ധി കണക്കിലെടുത്ത് ആധുനിക സാങ്കേതിക വിദ്യയിലൂടെ പാൽ സംസ്കരിച്ച് ടെട്രാപായ്ക്കുകളിലാക്കി വിപണനം നടത്തേണ്ടിയിരിക്കുന്നു. കൂടാതെ അന്താരാഷ്ട്ര ഗുണനിലവാരമുള്ള പാലുൽപ്പന്നങ്ങൾക്ക് കേരളത്തിൽ നല്ല മാർക്കറ്റാണുള്ളത്. മേൽ വ്യവസായം വയനാട്ടിൽ ആരംഭിക്കുകവഴി പട്ടികവർഗ്ഗക്കാർക്ക് സാങ്കേതികേതര തൊഴിലുകൾ നൽകാൻ കഴിയുന്നതാണ്.

6.8 പുത്തൻപാൽ വിലനിർണ്ണയം:- ദിമുഖവില സമ്പ്രദായത്തോടൊപ്പം സൂക്ഷ്മാണുക്കളുടെ എണ്ണം കൂടികണക്കലെടുത്തുകൊണ്ടുള്ള വിലനിർണ്ണയരീതി സമീപഭാവിയിൽ നടപ്പിലാക്കും. തണുത്ത കാലാവസ്ഥ, വർദ്ധിച്ച പാലുൽപ്പാദന സാധ്യതകൾ, തുടങ്ങിയ ജില്ലയുടെ പ്രത്യേക സാധ്യതകൾ പ്രയോജനപ്പെടുത്താവുന്നതാണ്.

6.9 ഭക്ഷ്യസുരക്ഷയും ആരോഗ്യ പോഷണവും:- ഒരു സമ്പൂർണ്ണഹാരമായ പാലിന്റെ ഉപയോഗത്തിന് ആരോഗ്യ മേഖലയിൽ വൻപ്രാധാന്യമാണുള്ളത്. ഏറ്റവും പോഷക സമ്പുഷ്ടവും താരതമേന്യ വിലക്കുറവുള്ളതുമായ പാലിന്റെ ഉപഭോഗം പ്രോത്സാഹിപ്പിക്കുകവഴി കുറഞ്ഞ ചെലവിൽ കാര്യക്ഷമമായ ആരോഗ്യപോഷണം സാധ്യമാവുന്നതാണ്. അമൂല്യങ്ങളായ ലാക്റ്റോസ്, മാംസ്യം, കൊഴുപ്പ്, ധാതുലവണങ്ങൾ തുടങ്ങിയ പാലിലെ ഘടകങ്ങൾ കുട്ടികളുടെ മസ്തിഷ്ക്ക വളർച്ചയ്ക്കും വിളർച്ച, ആരോഗ്യക്കുറവ് തുടങ്ങിയ പ്രശ്നങ്ങൾക്ക് പരിഹാരമായും ഉപയോഗപ്പെടുത്താം. പാൽ വിലയായി നൽകുന്ന തുക ക്ഷീരകർഷകരിലേക്ക് എത്തിച്ചേരുന്നത് ഗ്രാമീണ സമ്പദ്ഘടനയെ പരിപോഷിപ്പിക്കും. ഗ്രാമീണ ഭവനങ്ങളിൽ പാലിന്റെ ഉപഭോഗം സാധ്യമാകുന്നത് സ്വന്തമായി പാലുൽപ്പാദിപ്പിക്കുന്നതുകൊണ്ടു മാത്രമാണെന്നുള്ള വിവരം പ്രത്യേകം പ്രസ്താവ്യമാണ്.

6.10 സാമൂഹ്യ വികസനം:- പുത്തൻ സാമ്പത്തിക നയങ്ങളുടെ പശ്ചാത്തലത്തിൽ പൊതുവിതരണം, ആരോഗ്യം, സ്വദേശഉൽപ്പന്നങ്ങളുടെ വിപണനം, വിദ്യാഭ്യാസം തുടങ്ങിയ സാമൂഹ്യ മേഖലകളിൽ ഭാവിയിലുണ്ടാകാവുന്ന പ്രത്യാഘാതങ്ങൾ ചെറുക്കുന്നതിന് ക്ഷീരസംഘങ്ങളേയും, പാൽ വിപണന കേന്ദ്രങ്ങളെയും ഉപയോഗപ്പെടുത്താവുന്നതാണ്.

6.11 ക്ഷേമപ്രവർത്തനങ്ങൾ:- ക്ഷീരമേഖലയിൽ ഉൽപ്പാദകർ, സഹകരണ സംഘങ്ങൾ, മിൽമ തുടങ്ങിയ ഏജൻസികളുടെ സഹകരണത്തോടെ സംസ്ഥാന സർക്കാർ മുഖേന ക്ഷീരകർഷകർക്ക് ഗ്രാറ്റുവിറ്റി, പെൻഷൻ തുടങ്ങിയ പദ്ധതികൾ നടപ്പിലാക്കുന്നപക്ഷം പശുവളർത്തൽ ഒരു വെള്ളക്കോളർ ജോലിക്ക് സമാനമാവുകയും ധാരാളം യുവജനങ്ങൾ പശുവളർത്തലിലേക്ക് കടന്നുവരാൻ സഹായകരമാവുകയും ചെയ്യും.

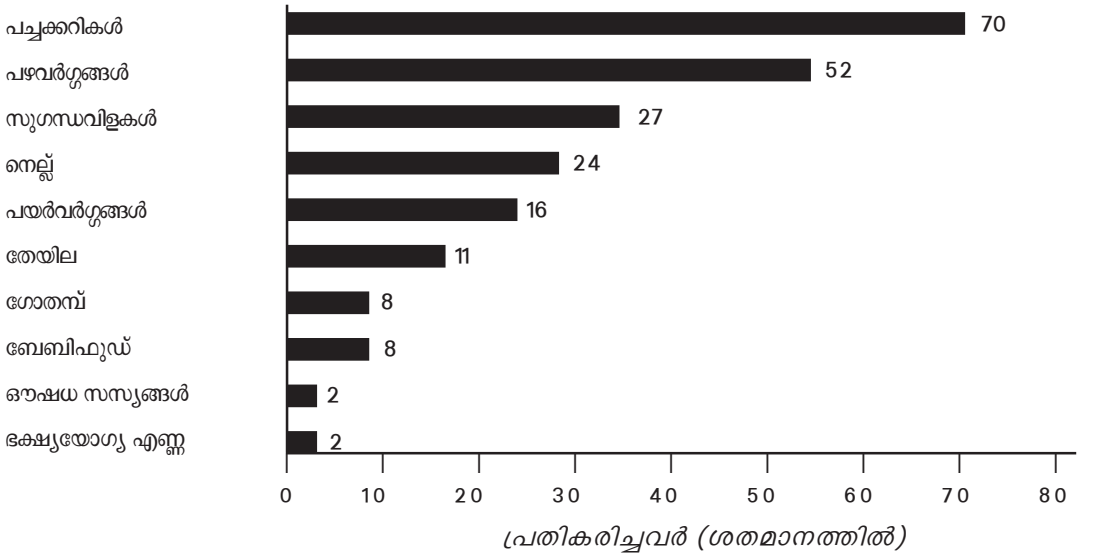
ഭാഗം - 7

ക്ഷീരവികസനവും ജൈവകാർഷികോൽപ്പാദനവും

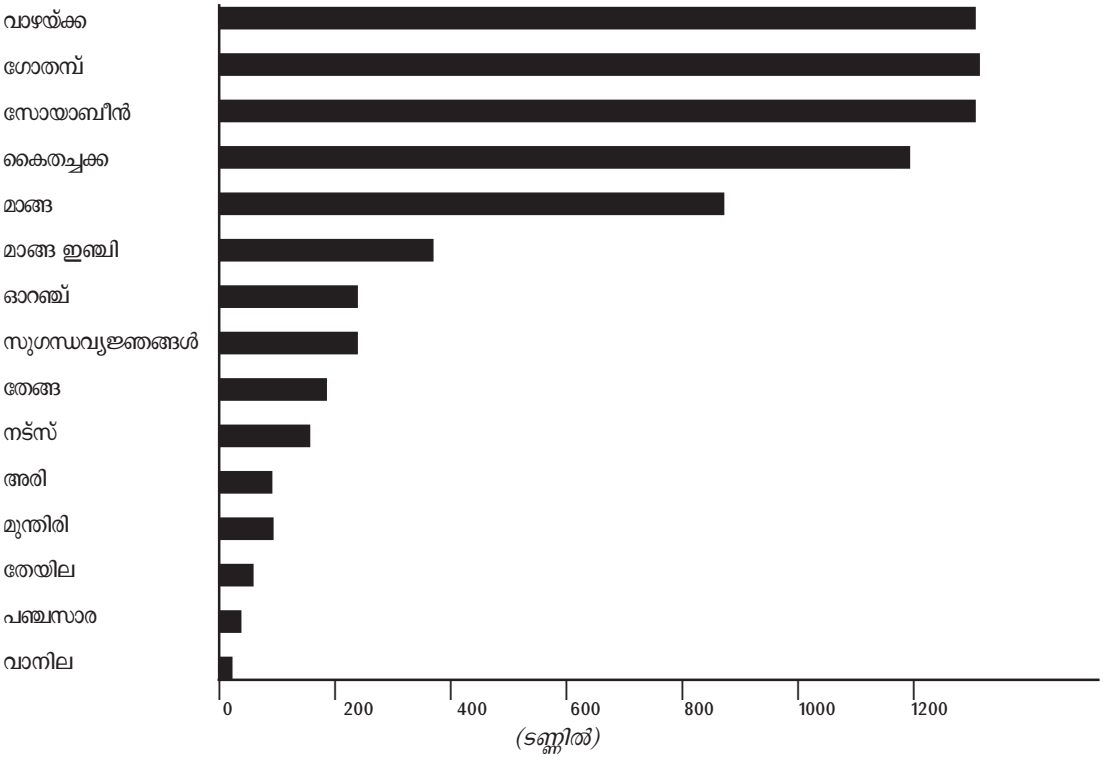
കാർഷികമേഖലയുടെ തകർച്ച, രോഗങ്ങൾ, സാമ്പത്തിക മാന്ദ്യം, ആരോഗ്യ പാരിസ്ഥിതിക പ്രശ്നങ്ങൾ തുടങ്ങിയവയുടെ പഞ്ചാത്തലത്തിൽ ജില്ലയിലുടനീളം ജൈവകൃഷി പ്രചരിച്ചുവരുന്നു. കൃഷി വകുപ്പ്, ക്ഷീരവികസന വകുപ്പ് എന്നീ സർക്കാർ ഏജൻസികളും വയനാട്ടിൽ പ്രവർത്തിക്കുന്ന സർക്കാരിതര ഏജൻസികളായ വയനാട് സോഷ്യൽ സർവ്വീസ് സൊസൈറ്റി, ബ്രഹ്മഗിരി ഡവലപ്പ്മെന്റ് സൊസൈറ്റി, ശ്രേയസ്സ്, ഹൈക്കോസ്, എം.എസ്. സ്വാമിനാഥൻ ഗവേഷണ കേന്ദ്രം തുടങ്ങിയ സർക്കാരിതര ഏജൻസികളും ഇൻഫാം എന്ന സന്നദ്ധസംഘടനയും ജില്ലയിൽ ജൈവകൃഷി പ്രചരിപ്പിക്കുന്നതിൽ പ്രധാനപങ്ക് വഹിച്ചുവരു

കാർഷികോൽപ്പന്നങ്ങളുടെ വിപണന സാധ്യതകൾ സംബന്ധിച്ച വിവരങ്ങൾ

ഇന്ത്യൻ ഉപഭോക്താക്കൾ താൽപ്പര്യപ്പെടുന്ന ജൈവ ഉൽപ്പന്നങ്ങൾ



ജർമ്മനി, പോളണ്ട്, ഇംഗ്ലണ്ട്, സിറ്റ്സർലണ്ട്, അമേരിക്ക, ജപ്പാൻ തുടങ്ങിയ വിദേശമാർക്കറ്റുകളിലെ ജൈവോൽപ്പന്ന വിപണന സാധ്യതകൾ



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വിലനിലവാര താരതമ്യപഠനം (ജൈവ ഭക്ഷ്യ വിഭവങ്ങളിലൂടെ)

ഉൽപ്പന്നം	ജൈവോൽപ്പന്നം (വില/കി.ഗ്രാം)	പരമ്പരാഗതം (വില/കി.ഗ്രാം)
അരി	32 - 110	15 - 60
ഗോതമ്പ്	35 - 40	15 - 25
കാപ്പി	475 - 1000	350 - 500
തേയില	450 - 1300	250 - 500
സുഗന്ധ വ്യജ്ഞനങ്ങൾ	400 - 1500	250 - 800
പയർ വർഗ്ഗങ്ങൾ	50 - 75	25 - 40
പഴ വർഗ്ഗങ്ങൾ	80 - 100	20 - 100

ആഭ്യന്തര വിപണിയിൽ വരുന്ന 5 വർഷങ്ങളിലുണ്ടാകാവുന്ന ജൈവോൽപ്പന്നങ്ങളുടെ വിപണന വർദ്ധന.

ഉൽപ്പന്നം	വളർച്ച (%)
സുഗന്ധ വ്യജ്ഞനങ്ങൾ	14
കുരുമുളക്	5
മഞ്ഞൾ	4.5
തേയില	13
അരി	10
പഴവർഗ്ഗങ്ങൾ	8
വാഴയ്ക്ക	15
മാങ്ങ	5
ഓറഞ്ച്	5
കൈതച്ചക്ക	5
ഔഷധസസ്യങ്ങൾ	7
പരുത്തി	7
കാപ്പി	5
എണ്ണക്കുരുക്കൾ	5
തേൻ	5
നിലക്കടല	5
ശിശു ആഹാരം	5
തേങ്ങ	5

ന്നു. ജില്ലയിൽ ഏതാണ്ട് ആയിരിത്തി അഞ്ഞൂറോളം കൃഷിക്കാർ ജൈവകൃഷി സർട്ടിഫിക്കേഷൻ ആരംഭിച്ചുകഴിഞ്ഞു. ഇതിനുപുറമെ മൂവ്വായിരത്തി അഞ്ഞൂറിലധികം കൃഷിക്കാർ ജൈവകൃഷി നടപ്പിലാക്കുവാൻ മുന്നോട്ടുവന്നിട്ടുണ്ട്.

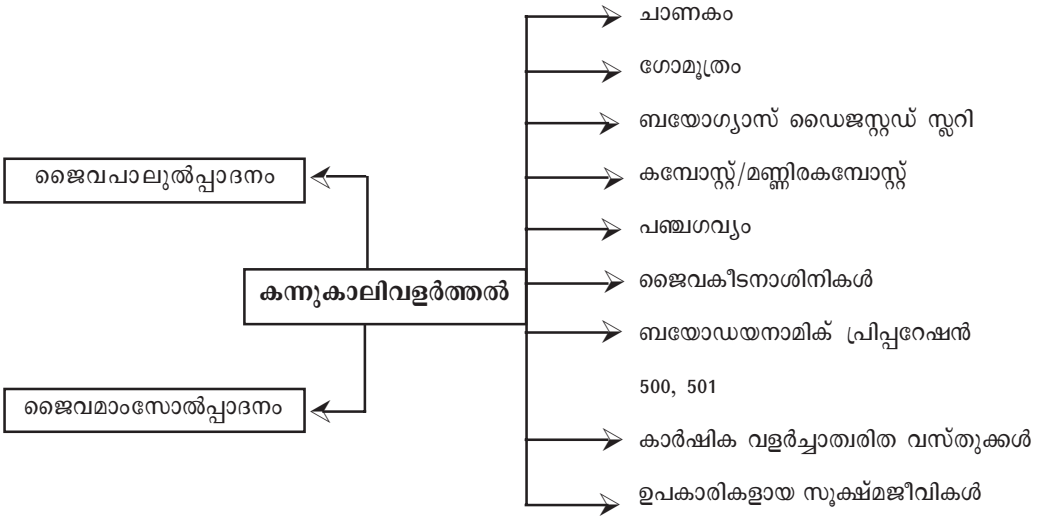
വയനാടിന്റെ പ്രത്യേകമായ കാലാവസ്ഥ, ഭൂപ്രകൃതി തുടങ്ങിയ കാരണങ്ങളാൽ കുരുമുളക്, റോബസ്റ്റ കോഫി, മഞ്ഞൾ, വാനില, സുഗന്ധ നെല്ലിനങ്ങൾ, ഔഷധസസ്യങ്ങൾ തുടങ്ങിയ കാർഷികവിളകളുടെ ഉൽപ്പാദന അനുകൂലാവസ്ഥയും സവിശേഷമായ ഗുണമേന്മയും കണക്കിലെടുത്ത് ലോകമാർക്കറ്റിൽ വൻവിപണന സാധ്യതയുണ്ട്. മറ്റ് ജില്ലകളിൽ നിന്നും ഒറ്റപ്പെട്ടുകിടക്കുന്ന വയനാട് ഒരു ജൈവ കാർഷിക ജില്ലയായി പ്രഖ്യാപിക്കുന്നതിന് ഏറ്റവും അനുയോജ്യമാണ്. ലോകപ്രശസ്തമായ നീലഗിരി ഹോട്ട്സ്പോട്ട് ബയോസ്പിയറിൽ പ്പെട്ട വയനാടിന്റെ പരിസ്ഥിതി, ജൈവവൈവിധ്യം എന്നിവ സംരക്ഷിക്കുന്നതിന് ജൈവകൃഷിക്ക് അതീവ പ്രാധാന്യമാണുള്ളത്.

ജില്ലയുടെ സവിശേഷതകൾ ഫലപ്രദമായി ഉപയോഗപ്പെടുത്തി ജൈവപാൽ, ജൈവമാംസം, ജൈവമുട്ട എന്നിവയുടെ ഉൽപ്പാദനം സാധ്യമാകുന്നതാണ് ജൈവകൃഷിയുടെ അനുകൂലഘടകങ്ങൾ ചുവടെ ചേർക്കുന്നു.

- ജില്ലയുടെ സവിശേഷമായ കാലാവസ്ഥ, ഭൂപ്രകൃതി
- പ്രതിശീർഷ ഭൂമിയുടെ ലഭ്യത
- മേന്മയേറിയ കാർഷികവിളകൾ
- ഔഷധ കൃഷിയുടെ സാധ്യതകൾ
- പച്ചക്കറിയുടെ സാധ്യതകൾ
- മനുഷ്യവിഭവശേഷി
- ജൈവരീതിയിലുള്ള പാലുൽപ്പാദനം, മാംസോൽപ്പാദനം, മുട്ടയുൽപ്പാദനം
- എന്നിവയുടെ അനുകൂലാവസ്ഥ.

- ജില്ലയുടെ പരമ്പരാഗത കാർഷിക സമ്പ്രദായം
- പരമ്പരാഗത അറിവുകൾ
- സർക്കാരിതര സംഘടനകളുടെ പ്രവർത്തനം

ജൈവകൃഷിയുടെ അതിപ്രധാനമായ ഘടകമാണ് ജൈവ വളങ്ങളുടെ ലഭ്യത. പശുവളർത്തലില്ലാതെ ജൈവകൃഷി പ്രായോഗികമല്ല. പശുവളർത്തലിലൂടെ ലഭ്യമാക്കാവുന്ന നിക്ഷേപവസ്തുക്കളെ (inputs) സംബന്ധിച്ച വിവരങ്ങൾ ചുവടെ ചേർക്കുന്നു.



കാർഷിക മേഖലയിൽ ജൈവകൃഷി, ഉൽപ്പാദനക്ഷമത വർദ്ധിപ്പിച്ചും ഒപ്പം പാരിസ്ഥിതികാഘാതങ്ങൾ കുറച്ചുകൊണ്ടുള്ള കൃഷി എന്നിങ്ങനെ ദ്വിമുഖ വികസന സമ്പ്രദായം സ്വീകരിക്കേണ്ടത് സുസ്ഥിരകാർഷിക വികസനത്തിന് അനിവാര്യമാണ്.

ഭാഗം - 8 പ്രത്യാഘാതങ്ങൾ

ക്ഷീരമേഖലക്ക് അർഹമായ പ്രോത്സാഹനവും ആസൂത്രിതവും സമഗ്രവുമായ വികസന നയവും നടപ്പിലാക്കാത്ത പക്ഷം താഴെപറയുന്ന പ്രത്യാഘാതങ്ങൾ ഉണ്ടായേക്കാവുന്നതാണ്.

- സഹകരണ മേഖലയ്ക്ക് ഇന്നുള്ള മുൻതൂക്കം നഷ്ടപ്പെടും.
- സ്വദേശത്തും വിദേശത്തുള്ള സ്വകാര്യ കുത്തകകൾ ക്ഷീരമേഖല കയ്യടക്കുന്നതോടു കൂടി സഹകരണമേഖലയിൽ തൊഴിൽ ചെയ്യുന്ന ആയിരക്കണക്കിന് തൊഴിലാളികൾക്ക് തൊഴിൽ നഷ്ടപ്പെടും.
- സഹകരണ മേഖലയുടെ തകർച്ചയോടുകൂടി ഏഴുലക്ഷത്തിൽപരം വരുന്ന ക്ഷീരകർഷകർ ഗുരുതരമായ സാമ്പത്തിക പ്രതിസന്ധിയെ അഭിമുഖീകരിക്കേണ്ടിവരും.
- അന്യസംസ്ഥാനങ്ങളിൽ നിന്നുള്ള ദ്രവമിൽക്കും പാലുൽപ്പന്നങ്ങളും കേരളത്തിന്റെ സമസ്ത വിപണികളും കയ്യടക്കും.
- പാലുൽപ്പന്നങ്ങളുടെ ഇറക്കുമതി നിയന്ത്രണം ഒഴിവാക്കിയ സാഹചര്യത്തിൽ പാൽപ്പൊടിയും ബട്ടർഓയിലും വിദേശരാജ്യങ്ങളിൽനിന്നും ഇറക്കുമതി ചെയ്ത് സംയോജിപ്പിച്ച് ഉയർന്ന സാങ്കേതികവിദ്യയുടെ മറവിൽ ഇന്ത്യയുടെ ദ്രവ മിൽക്ക് വിപണി കയ്യടക്കാൻ കഴിയും.
- ഉയർന്ന വൈദേശിക സാങ്കേതിക വിദ്യ ഉപയോഗിച്ച് നിർമ്മിക്കുന്ന വൈവിധ്യങ്ങളായ മൂല്യവർദ്ധിത ക്ഷീരോൽപ്പന്നങ്ങൾക്ക് ഇന്ത്യയുടെ അർബൻ മാർക്കറ്റുകൾ വളരെപെട്ടന്നുതന്നെ കീഴടക്കാൻ കഴിയും.
- ക്ഷീരമേഖലയുടെ തകർച്ചയോടുകൂടി നമ്മുടെ കാലിസമ്പത്തിന് ഗണ്യമായ കുറവ് അനുഭവപ്പെടുകയും തദ്വാരാ ദരിദ്ര ഗ്രാമീണ ജനവിഭാഗങ്ങളുടെ പാലിന്റെ ഉപഭോഗം കുറയുകയും വമ്പിച്ച ആരോഗ്യ പ്രശ്നങ്ങളെ നേരിടേണ്ടിവരുകയും ചെയ്യും.

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- കാലിസമ്പത്തിന്റെ കുറവ് കാർഷിക മേഖലയിലെ ജൈവവളങ്ങളുടെ ലഭ്യതയിൽ വൻഇടിവ് വരുത്തുകയും ജൈവകൃഷിയെന്ന അനിവാര്യതയെ തകിടംമറിക്കുകയും ചെയ്യും.
- കന്നുകാലികളുടെ എണ്ണം കുറയുന്നതോടുകൂടി മാംസത്തിന്റെ ലഭ്യതയിൽ വമ്പിച്ചകുറവ് ഉണ്ടാക്കും. ഇത് മാംസത്തിന്റേയും മാംസോൽപ്പന്നങ്ങളുടേയും ഇറക്കുമതിക്ക് വഴിവയ്ക്കും.
- കന്നുകാലികളുടെ എണ്ണം കുറയുന്നതോടെ ഉഴവിനും, ചരക്ക് കടത്തുന്നതിനും മറ്റും ഉപയോഗപ്പെടുത്തുന്ന ചെലവുകുറഞ്ഞ ഊർജ്ജത്തിനുപകരം ഭാവിയിൽ വിലകൂടിയ മറ്റ് ഇന്ധനങ്ങൾ കൂടുതലായി ഉപയോഗപ്പെടുത്തേണ്ടിവരും.
- ഏറ്റവും ചെലവുകുറഞ്ഞ പാരമ്പര്യേതര ഊർജ്ജസ്രോതസ്സിന്റെ അക്ഷയഖനിയായി ചാണകവും ഗോമൂത്രവും ഉപയോഗപ്പെടുത്തുന്നതിനുള്ള സാധ്യതകൾ ഇല്ലാതാകും. ഇത് വമ്പിച്ച പാരിസ്ഥിതിക പ്രത്യാഘാതങ്ങൾക്ക് വഴിതെളിക്കും.
- കന്നുകാലിസമ്പത്തിൽ വരുത്തിയേക്കാവുന്ന കുറവ് മൂലം തീറ്റപുൽകൃഷി കുറയാനും അതുവഴി മണ്ണൊലിപ്പ് വർദ്ധിപ്പിക്കുന്നതിനും, പാരിസ്ഥിതിക പ്രശ്നങ്ങൾ വർദ്ധിക്കുന്നതിനും കാരണമാകും.

ഭാഗം – 9 ഉപസംഹാരം

ജില്ലയുടെ ഭൗതിക സാഹചര്യങ്ങൾ, വികസന സാധ്യതകൾ, ഭക്ഷ്യസുരക്ഷ, പരിസ്ഥിതി സംരക്ഷണം, വ്യാവസായിക വികസനം, പ്രാദേശിക വിപണന സാധ്യതകൾ, കാർഷിക വികസനം തുടങ്ങിയ കാര്യങ്ങൾ പരിഗണിക്കുമ്പോൾ ക്ഷീരവികസനത്തിനന് വൻ പ്രാധാന്യമാണുള്ളത്. വർദ്ധിച്ചുവരുന്ന തൊഴിലില്ലായ്മ പരിഹരിക്കുന്നതിനും ഈ മേഖലയെ വളരെയധികം ഉപയോഗപ്പെടുത്താൻ കഴിയും. സാമൂഹ്യ വികസനത്തിനും ക്ഷീരമേഖലയെ ഫലപ്രദമായി ഉപയോഗപ്പെടുത്താൻ കഴിയുന്നതാണ്. വിവിധ ഏജൻസികളെ ഏകോപിപ്പിച്ചുകൊണ്ട് ജനപങ്കാളിത്തത്തോടെയുള്ള സുസ്ഥിര ക്ഷീരവികസന പ്രവർത്തനങ്ങളിലൂടെ വയനാടിന്റെ സമഗ്രവികസനവും സ്വാശ്രയത്വവുമെന്ന സുന്ദരസ്വപ്നം സാക്ഷാത്കരിക്കാൻ കഴിയും.

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PHYSICAL/CHEMICAL SCIENCES

CIS-TRANS ISOMERISM AND HYPERCONJUGATION *VIS-À-VIS* AUTOXIDATION OF GROUNDNUT OIL

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Abstract

A study was carried out to examine the transformation of cis-trans isomerism and hyperconjugation in fatty acid molecules during rancidification/autoxidation of groundnut oil. Oil samples were autoxidized by various methods and subjected to analysis by IR spectra and UV spectra. A peak at 690 cm^{-1} (14.5 m) in IR spectra and absorption at 1658 cm^{1} due to CH stretching vibrations indicated existence of cis configuration and there was no peak to indicate trans configuration of fatty acids proving cis configuration remained intact in fatty acids during autoxidation of oils. In UV spectra, absorption peak pertaining to conjugation of molecule to appear at above 300 nm was not seen in autoxidized fatty acid molecules prooving hyperconjugation not taking place.

Introduction

Several chemical phenomena are known to occur in fats and oils. One such phenomenon is the occurrence of cis-trans isomerism and hyperconjugation. Oleic, linoleic and linolenic acids were found to give an equilibrium composition of cis and trans isomers with selenium and nitrous acid and the oleic/elaidic equilibrium mixture was found to contain 75-80% elaidic acid (Litchfield *et al.*, 1963).

Cis-trans isomerisation is known to be accompanied by conjugation polymerisation (Subramanian and Quakenbush, 1962). In this study, an attempt was made to study cis-trans isomerism and hyperconjugation during autoxidation/rancidification of groundnut oil.

Materials and Methods

Oil sample and autoxidation: Refined groundnut oil in packed container available in the local market was procured and used in the study. Oil samples were autoxidized by following modes: i) required quantity of oil sample in a round bottom flask was heated using a water bath maintained at 98°C for 10 hr while a brisk bubbling current of air was passed through. Air from vaccum pump was purified by passing it through a series of wash bottles of water, 2% potassium permanganate, 1% sulphuric acid and an empty bottle to capture stray droplets. ii) for oven-heating, required quantity of oil was heated in an oven at 200°C with occasional shaking for 20 hr. iii) for flame-heated oil, the groundnut oil in an aluminium vessel was heated over the flame for 10 hr and iv) oil was also stored in air tight glass containers with 5% moisture level at 37°C for 24 weeks.

Infrared (IR) spectroscopy of oil: The raw and oxidised groundnuts oil samples were dissolved in carbon tetrachloride (Christie, 1991). The infra-red spectra of oils were recorded on Shimadzu IR-435 model IR grating spectrophotometer as neat film in 0.1 mm cell or in KBr pellets and absorption bands were reported as wave number in cm^{-1}. Interpretation of spectra was carried out according to John (1978).

Ultraviolet (UV) spectroscopy of oil: The method adopted was essentially of John (1978). The raw and oxidized groundnut oil samples were dissolved in alcohol and studied. The UV spectra of oils were recorded on Perkin-Elmer model-554 UV spectrophotometer. The absorption characteristics of normal and oxidized soil samples were reflected in different peaks and were identified from l max (nm). Interpretations regarding influence of molecular geometry on the molecular structure were carried out according to John (1978).

Results and Discussion

It is of great interest to look into the changes of cis-trans transformation and hyper conjugation occurring in the autoxidised fatty acid molecules of oil during long-term storage or heating/cooking/frying of oils at high temperature. Analysis of raw groundnut oil by IR and UV spectra showed normal properties of cis configuration without hyperconjugation in fatty acids. In all the autoxidized groundnut oil samples, a significant peak was observed at about 690 cm^{-1} (14.5 m) and absorption at 1658 cm^{-1} due to CH stretching vibrations of a multiple bond in IR spectra, which indicates the existence of cis configuration in fatty acids (Fig.1). Moreover, four peaks around 895-885 cm^{-1}, 970-960 cm^{-1}, 1310-1295 cm^{-1} and at 1675 cm^{-1} could be observed in IR spectra in the study, which is the confirmation of non existence of trans configuration in autoxidised fatty acids. Therefore, the results obtained from this study prove that cis configuration remained intact in fatty acids during autoxidation/rancidification of oil.

In UV Spectra, no peak was observed at or above 300 nm in raw groundnut oil and in all the autoxidised oil samples to indicate occurrence of hyperconjugation in fatty acids (Fig. 2). Occurence of cis-trans transformation accompanied by hyperconjugation gives a peak at or above 300 nm (John, 1968). Therefore, it is concluded that process of rancidification or autoxidation does not bring about any such change in poly unsaturated fatty acids under the conditions of the experiments in this study. Thus, the occurrence of cis-trans transformation accompanying with hyperconjugation in fatty acid molecules is not a common phenomenon as observed earlier during oxidation of fatty acids by selenium and nitrous acids (Subramanian and Quakenbush, 1962; Litchfield *et al*., 1963).

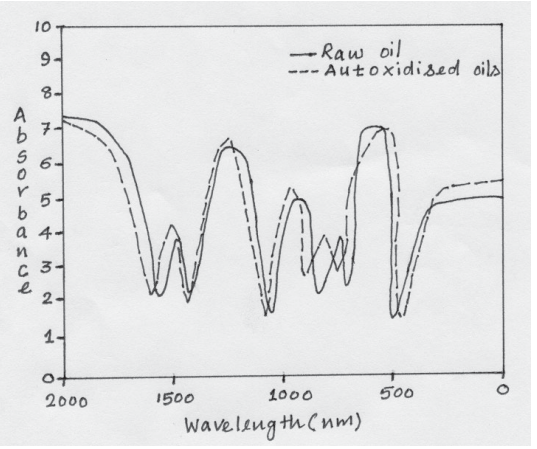

Fig. 1. IR spectra of raw and autoxidised groundnut oils.

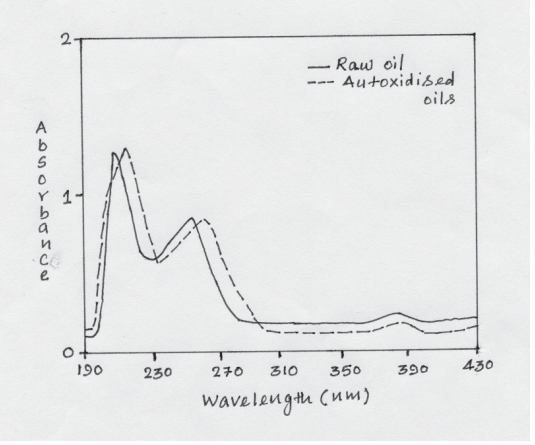

Fig. 2. UV spectra of raw and autoxidised groundnut oils.: Position isomerism is to be added

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RANCIDIFICATION OF GROUNDNUT OIL AS INFLUENCED BY MOISTURE DURING STORAGE

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Abstract

Rancidification, in terms of formation of hydroperoxides and 4-hydroperoxy-2-alkenal, of groundnut oil prepared from fresh kernels stored with 5% added moisture for 24 weeks at 4°C, 25°C and 37°C were investigated. Peroxide value (PV) increase coupled with iodine value (IV) decrease in oil stored with moisture at elevated temperature (37°C) was more rapid than in oils stored at room temperature (25°C) and low temperature (4°C). PV of oil samples stored at all temperature tended to rise steadily to a maximum, declining there after. On the other hand, the carbonyl values (CV) increased gradually, the increase being highest in oil stored with moisture at 37°C. Estimation of 4-hydroperoxy-2-alkenal in oil samples showed higher amount in oil stored with moisture at 37°C followed by the one stored at 25°C. In general, the decline in IV and corresponding increase in PV and CV and hydroperoxy alkenal were higher in oil samples stored with moisture than oil samples stored without moisture.

Introduction

Spoilage of oils by rancidification during storage is of great importance from nutritional point of view. Vegetable oils rich in unsaturated fatty acids undergo oxidative deterioration (rancidification) during storage. A prolonged exposure of edible oils to moisture and high temperature results in the development of unpleasant odour and flavour rendering them even toxic (Lea, 1963). Lipid hydroperoxide is the primary product formed in the rancid oil during the oxidative process. From the hydroperoxides, secondary oxidation products such as hydroxyl and carbonyl compounds are generated, which are more toxic than lipid hydroperoxides (Kaneda and Miyazawa, 1987). The 4-hydroperoxy-2-alkenal is the main carbonyl compound identified as the most toxic substance generated in the oxidized oils (Yoshioka and Kaneda, 1974). Although, there are several reports available on these aspects, no precise informations are available on the progressive development of hydroperoxides and hydroperoxy alkenals in vegetable oils during storage with moisture under varying temperature. Hence, the present investigation was taken up using groundnut oil.

Materials and Method

Sample preparation: The groundnut sample, variety ICGS-11 for the present study was procured from National Research Centre for Groundnut, Junagadh, Gujarat. Oil was extracted from fresh kernels by cold percolation method using hexane (Kartha and Sethi, 1957). The oil samples were properly packed with moisture at 5% level and without moisture in airtight plastic containers and stored for a period of 24 weeks at 4°C, 25°C and 37°C. Two BOD incubators were used for storing the oil samples at 25°C and 37°C. For 4°C, sample was stored in a cold room maintained at 4°C. One-third of the oil samples was withdrawn after 8, 16 and 24 weeks of storage and subjected to analysis.

Analysis of chemical parameters: The chemical parameters viz, iodine value and peroxide

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value of oil samples were estimated according to AOAC (1984). The carbonyl compounds (carbonyl value) were estimated colourimetrically (Henick *et al*., 1954). Briefly, precisely weighed oil was dissolved in carbonyl-free benzene in stoppered flask and 3 ml of 4.3% trichloro acetic acid and 5 ml of 0.05% 2, 4 – dinitrophenyl hydrazine were added. The mixture was heated in water bath at 60°C for 30 min and cooled to room temperature. The colour was developed by adding 10 ml of 4% KOH solution. After 10 min, absorbance reading was taken at 430 and 460 nm against blank prepared without oil sample using UV-visible spectrophotometer. Calculations were made using the following equations-

Unsaturated carbonyl value (mmol/g) = $3.067A_{460} - 2.381A_{430} / 0.707$

Saturated carbonyl value (mmol/g) = $3.067A_{460}$ – 1.724 X Unsaturated carbonyl value.

The 4-hydroperoxy-2-alkenal contents in the oil samples were estimated according to Yoshioka and Kaneda (1974).

Results and Discussion

The raw groundnut oil had initially iodine value (IV) of 87.5, peroxide value (PV) of 2.56 meq/kg, total carbonyl value of 1.88 mmol/gand 4-hydroperoxy-2-alkenalcontent 0.02mmol/g The changes in IV and PV in oil samples stored with moisture at varying temperature for 24 weeks are summarised in table-1. As is evident from data, the IV of oils decreased steadily during storage at all temperatures stored with or without moisture. However, in oil samples stored with moisture, the progressive decrease of IV was higher than oil samples stored without moisture. This decrease was more conspicuous in oil samples stored with moisture at 37°C followed by in oil sample stored with moisture at 25°C. The IV decrease in oil stored with moisture at 37°C was from 87.5 in zero time to 56 in 24 weeks. The least IV decrease was in oil stored without moisture at 4°C to 79 at 24 weeks of storage.

Peroxide values of the oils increased steadily to peak values in 16 weeks, which was in commensurate with decline in IV and declined there after in 24 weeks. The oil sample stored with moisture at 37°C showed highest increase in 8 weeks (181 meq/kg) and 16 weeks (224 meq/kg). The least increase in PV was observed in oil sample stored at 4°C without moisture. In general, the oil samples stored with moisture generated more peroxide compounds than oil samples stored without moisture. The results are substantially in agreement with earlier studies in groundnut pods and kernels (Mayilvaganan *et al*., 2003). The decrease in PV in 24 weeks period in all samples could be easily explained that vigorous secondary reactions taking place at later stage producing carbonyl compounds (table-2). Similarly, increase in carbonyl values of oils was observed in all oil samples (table-2). From the data, it is clear that oil stored with moisture at 37°C had accumulated more carbonyl compounds followed by in oil stored with moisture at 25°C. In general, as in the case of PV, generation of carbonyl compounds was more in oil samples stored with moisture. Observation of carbonyls from beginning implies that both peroxidation and production of carbonyl compounds are simultaneous processes. The spurt in carbonyl compounds production from hydroperoxides in later stage is the reason why PV declined at 24 weeks (table-1). The content of unsaturated carbonyl compounds was more than that of saturated carbonyl compounds as observed in earlier studies (data not shown) (Henick *et al*., 1954; Mayilvaganan *et al*., 2003).

The content of 4-hydroperoxy-2-alkenal in stored oil samples are presented in table-3. The hydroperoxy alkenal content of all oils increased steadily. This increase was more conspicuous in oil stored with moisture at 37°C followed by oil stored with moisture at 25°C and was lowest in oil stored without moisture at 4°C. The increase in hydroperoxy alkenal in oil samples was in commensurate with decline in iodine value and increase in peroxide value and carbonyl values. From the results of the study, it is clear that moisture

Table–1. Effect of moisture on iodine value (IV) and peroxide value (PV) (meq/kg) of groundnut oil

Storage condition	Iodine value IV			Proxide valuePV		
	8 weeks	16 weeks	24 weeks	8 weeks	16 weeks	24 weeks
Oil – moisture, 4°C	85	83	79	32	46	46
Oil + moisture, 4°C	83	74	69	102	200	43
Oil – moisture, 25°C	80	76	68	131	172	68
Oil + moisture, 25°C	75	70	62	160	210	53
Oil – moisture, 37°C	73	70	62	165	210	143
Oil + moisture, 37°C	70	69	56	181	224	178

without moisture; + with 5% added moisture, (Values are the mean of two determinations)

acting as a pro-oxidant and elevated temperature (37°C) had accelerated the process of rancidification. This has relevance to the oils, particularly salad oils, which are normally stored with moisture. The results of the present study clearly prooves the presence of moisture leads to the development of rancidity and oily flavours, which lower the quality of oils and even oils become toxic due to generation of lipid hydroperoxides and carbonyl compounds like hydroperoxy alkenal.

Table- 2. Effect of moisture on the carbonyl value (CV) (mmol/g) of groundnut oil

Storage condition	Carbonyl value(CV)		
	8 weeks	16 weeks	24 weeks
Oil – moisture, 4°C	6.7	18	42
Oil + moisture, 4°C	17	47	122
Oil – moisture, 25°C	20	43	120
Oil + moisture, 25°C	22	55	134
Oil – moisture, 37°C	27	61	146
Oil + moisture, 37°C	31	79	226

- = without moisture; + = with 5% added moisture

(Values are the mean of two determinations)

Table- 3. Hydroperoxy alkenal content (mmol/g) of groundnut Storage condition

Storage condition	Hydroperoxy alkenal content		
	8 weeks	16 weeks	24 weeks
Oil – moisture, 4°C	1.1	1.8	2.5
Oil + moisture, 4°C	2.8	4.0	6.3
Oil – moisture, 25°C	3.1	3.4	4.6
Oil + moisture, 25°C	4.1	5.3	8.4
Oil – moisture, 37°C	4.4	6.8	9.5
Oil + moisture, 37°C	7.6	12.1	19.5

– = without moisture; + = with 5% added moisture

Values are the mean of two determinations

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DEVELOPMENT OF MINI MECHANICAL HAMMER FOR STONE CRUSHING WORKERS

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Abstract

In a few decades back, new mechanised heavy-duty crushers were introduced for crushing stone at different sizes like 1.5", 1" and ½, but still manually crushed stone has good market because of the cost and the quality. Through this project, we conducted a preliminary study about the women stone crushing workers in various quarries situated in Trivandrum district. In many part of Kerala those who are living in and around quarries, a large number of rural women are involved in manual stone crushing work. We concentrated on women workers those who are crushing small sizes like ½ from 1 1/2" rock rubbles. During manual hammering, they pose several problems like handpain, shoulder pain and health hazards due to continuous beating by single hand during full working time (8hrs) and poor working environment. In this manual crushing method, woman workers were exploited due to unemployment and poverty. Their average income per day is below Rs 50/- for 8 hrs hard work. Based on the field study we developed a machine called mini 'mechanical hammer' for manual stone crushing work. The technology is that instead of hand hammering, force is applied by foot pedal through mechanical linkages. Loading and unloading of job is done by hands. Thus, two hands share the work equally and both legs share equal hammering loads, which leads to reduction in duty cycle of operation and pain in the hand and shoulders. This will also reduce fatigue. The prototype has been developed in Mitraniketan and tested in the field. From test result, we found that productivity increases from 100% to 150% with better quality and consequent income. We conclude that this machine can rectify their problems in manual hand hammering and improve the production rate and reduce the drudgery.

Introduction

Crushed stone aggregate of different sizes contribute towards major raw materials required for construction industry and roadwork. It is available both manually crushed and machine crushed. A group of people in stone crushing related activities in different parts of Kerala. This is a tedious job. Due to unemployment and poverty in these areas, these peoples are forced to engage in this occupation. Some families are fully engaged in this work for the past 20 years. The field study conducted on the problems of stone crushing workers in 2 Panchayats and a Municipality in Trivandrum District, the study report reveals that people living in and around quarries are mainly engaged in activities like rock blasting, stone crushing, loading of materials in lorries etc. We concentrated on stone crushing work particularly women workers. In the work, 80% of women are engaged in crushing small sizes like ½" from 1 ½" rock rubbles. Manually crushed metal costs 25% less than that mechanized crushed but the quality of crusher metal is better in terms of uniform size. The demand of manually crushed metal is moderate due to its cost and good gripping property compared to crusher metal. The field study report shows that, related to their health hazards, 84.6% of workers have joint pain due to continuous beating by a hand during full working period, 69.23% have back pain due to continuously sitting on the ground for

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hammering and 53.64% are suffering from cough and related health problems. In the productivity point of view they are paid Rs.5/- per basket. Their normal output per day (8 hours) is 7 to 8 baskets only. That is Rs.35 to Rs.40 only. The other problem is related to the poor working environment. Mostly they are working in the roadside without any shade. Based on the above problems, we developed a machine called 'Mini Mechanical Hammer, which is operated by manual foot pedal operation and which rectifies the problems and improve the productivity.

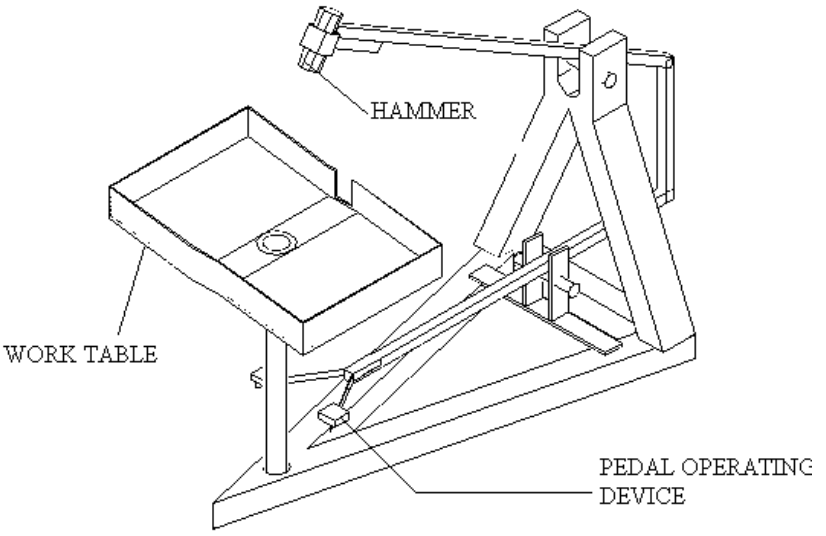

Fig.1. Mini Mechanical Hammer

Materials and methods

The technology used in the development of the machine was that to replace the method of doing work of manual hammering of traditional tool hammer. By applying work-study principle and leverage principle, the method of manual hammering was studied and the methods of doing work is changed. In this proposed design foot pedal operated mechanism is used for developing hammering force. The input force applied by foot is converted into hammering force by leverage mechanisms. The force applied by the mechanical hammer is proportional to the pedal force applied by the workers. So the workers can adjust the force based on the size of the stone. The hammer fixing in the machine is replaceable so far the workers can replace as per requirement. The loading and unloading method was changed. In this method, loading and placing are done by left hand while grading and unloading the job is done by right hand. Therefore, the two hands share workload equally. Similarly, the two legs also share the hammering load which leads to the unwanted delays are eliminated in an operation. The workitable is designed in such a way that we can load a basket of rock rubbles in left side. Then the hammering process is done at the centre and unloading facility is provided at the right end. Initially the worker can load a basket of metal and sit in front of machine then operate by foots through pedal. Since the hammering impulse in the same point on the table, the worker can easily load at correct place and hold the work that ensure the equality in crushed metal. These will leads to reduce the cycle of operation and reduction of fatigue, which will ensure the increase in productivity compare to manual hand beating method with consequent increase in income.

Results and Discussion

We have developed a prototype of mini mechanical hammer and tested in the field as well as in the laboratory. Then we continuously tested 6 days by a women worker and made observations.

Table-1. Working efficiency of Mini Mechanical Hammer for stone crushing

Sl.No.	Labour hours	Production rate and Income	Productivity (%)
1	1st day 4 hours	3 basket 3x5=Rs15/-	75 %
2	2nd day 4 hours	3.5basket=3.5x5=Rs.17.5/-	87.5 %
3	3rd day 4 hours	4 basket 4x5=20/-	100 %
4	4th day 4 hours	4.5basket=4.5x5=Rs.22.5/-	112.5 %
5	4th day 4 hours	5basket =5x5=Rs.25/-	125 %
6	4th day 4 hours	5basket =5x5=Rs.25/-	125 %

(Normal manual working method productivity is consider as 100%)

From the above the results it is made clear that the productivity increases from 100% to 125%. From the continuous practice and usage of the machine, we can improve the productivity to 150% with consequent income 1.5 times compare to manual hand beating method. The improvement of productivity is purely practice only but initially they will not accept the machine. Therefore, we have to impart training programme about the operation of the machine and its advantages. We are continuously working in this project for further modification and development.

Conclusion

We believe that the technology to be developed is user friendly and cost effective. The machine can improve the productivity in addition to improved product quality and safety. Therefore, improvement in their income, health and living condition are expected. We conclude that once the machine has become viable, it will create employment to rural artisans especially women living around quarries through out India.

ENERGY EFFICIENT IMPROVED POTTERY WHEEL

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Abstract

In South India, Potter's wheel manufactured by Centre for Appropriate Technology, Nagercoil uses Induction Motor with Friction Clutch Mechanism. In Friction Clutch Mechanism slip power losses are high. Induction motor has a disadvantage that its speed can be varied only from 70% to 100% of full load speed by applying variable voltage. So we used an AC-series motor with an auto transformer for varying the speed. Advantage of this method is that input voltage to the motor can be varied by using the autotransformer and hence the power input to the motor varies. Moreover, we can vary the speed from 1.0% to 100% of full load speed. We used a gear wheel drive for transmitting the power from the motor shaft to flywheel.

Introduction

The potter's wheel is a flat disc that revolves horizontally on a pivot. It was invented in the 4th Millennium B.C. A ball of clay is placed at the centre of the rotating wheel head and both hands are used to shape the pot. Some wheels are set in motion by a stick that fits in to a notch in the wheel called a hand wheel. This is the classical wheel of Japanese believe potter's. In the 16th century, Flywheel was added to potter's wheel separate from wheel head and mounted in a frame. This alteration made the potter control his wheel by kicking the flywheel. A kick bar or foot treadle, was added in the 19th century. In the 20th century, motorised wheel came in to existence. After motorised wheel, various models of wheels using different types of motor were manufactured mainly in Germany. In India Pottery wheel, set uses induction Motor for rotating the wheel head. Induction motors suffer from the problem of limitation in speed variation. So at Mitraniketan we have developed a motorised potter's wheel set using series motor to improve the efficiency of wheel and to save energy.

Materials and Methods

Mitraniketan is an NGO working in rural development sector. We have a pottery section in our campus. On interaction with the potter's in our section we found that the whole set is bulky and the motor is running full time with nearly constant power. So we thought about making a compact unit with the following objectives.

1) To reduce slip power
2) To develop energy efficient pottery wheel and,
3) To increase productivity by reducing input power.

As per our idea a Potter's wheel was fabricated with a motor having same power rating of existing wheel but using another type of motor. Technical details of the pottery wheel is ½ HP, 6000 rpm, 1Ö AC series motor, auto transformer of 0-230v/270V, spur gear with a gear ratio of 14:1.

A comparison of the existing wheel with the designed one is shown below.

Existing wheel	Improved Pottery wheel
1. Use friction power transfer with clutch mechanism	1. Use gear drive for power transfer
2. 10, ½ HP, 1440 rpm A Induction motor	2. 1Ö, ½ HP, 600o rpm Ac series motor
3. Motor runs with uniform speed and power consumption is constant.	3. Motor runs with variable speed and power consumption also varies

Results and Discussion

We conducted power consumption test's with the existing wheel and developed wheel. A comparison chart for making 8" plant pot is given below.

Existing wheel	Improved wheel
Power consumption varies between 192-210 watts	Power consumption varies between 5-180 watts
Time taken : 3 minutes	3 minutes

Later on, we interacted with potter's residing at Thozhukkal area in Trivandrum district. It was field tested there and found that it took 3 days for a potter to learn speed control with the improved wheel. After field test and laboratory test we found that this machine has the following advantages.

1) Less input power for the same job
2) Conservation of energy
3) Compact unit
4) It can with stand momentary heavy loads
5) Incremental increase in income

Conclusion

With reference to the above facts we came to the conclusion that this wheel can be used as an alternate to existing pottery wheel. The improved one is costlier than the existing one but in the long run it will be economical since the machine not only saves power but also improves their income for same job. We are still in the process of improving the wheel according to the feed back from potters.

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D.C. CONDUCTIVITY STUDIES OF FLEXIBLE THIN FILMS BASED ON PRE-VULCANIZED NR LATEX-STARCH-CB COMPOSITES

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Abstract

Electrically conductive flexible thin films based on composites of pre-vulcanized natural rubber (NR) latex and carbon black (CB) have been developed via the wet mixing processing technique. The solution was stabilized using starch (15wt%) as the sterric stabilizer. The films can ensure good mechanical properties, processibility and electrical conductivity for use in various electronic devices. The electrical conductivity changes from 10^{-13} to 10^{-4} S/cm depending on the percentage of CB in the composite. The experiment demonstrates the possibility of utilizing NR latex for various microapplications aiming the development of cost effective and efficient electrical and electronic devices.

Introduction

Much of our modern industrial progress has been based on the use of metals such as Cu, Al, Ag and Hg as conductors and of organic polymers such as polyethylene and polystyrene as non-conductors, they store electrostatic charges. The tendency for polymer to store electrostatic charges were overcome in the past by addition of CB or Acetylene black to natural rubber and metallic powders to plastics and by blending of metallic fibers or metal coated fiber, with organic fibers, polymeric composites that were fair conductors of heat and electricity were produced by adding large amounts of conductive materials of elastomers and plastics [1-3].

The conductive rubber composites, produced using carbon black are still attracting attention due to the effectiveness in application such as electromagnetic shielding electrostatic charge dissipating sensor of vehicle weight to collect tolls in the highways, pressure sensor and selective gas sensor [4-7]. The electrical conductivity of the composites depends on several factors such as the nature of the polymeric matrix and type, size, geometrical structure, surface and dispersion of the particle#[8].

In spite of high conductivity achieved using CB as the conductive filler, it has been found that increase in the weight percentage of CB decreases the mechanical strength of the composites which limits its practical application [9]. In this work, we experimentised prevulcanised NR latex as the polymeric matrix which can ensure enough flexibility for the composite films.

Experimental

1.1 γ

The γ –irradiated NR latex was supplied from RRI, Kottayam and the irradiation condition are tabulated in table-1. The percentage of solid rubber in the latex was in the order of 45% as determined by the thermogravimetry.

Table-1. Irradiation condition used for Vulcanization

NR latex	RVNRL
Radiation Source	60C, 7.38x10-15 Bq
Irradiator	Rotating vessel system
Rotating speed (rev min-1)	10
Temperature[OC] rate Dore [KGgh-1]	25.565
Total dose (Kgy)	12
Sensitize	a) 2-ethylhexyle acrylate b) CCl_4 1 phr

2 Carbon black

The carbon black [lamp black type] from Degauss AG company was used as received. The particles size and specific surface area of CB was between 60 to 200 mm and 16-24 m^2/g.

1. Composite preparation

Composites of pre-vulcanized NR latex/CB were prepared by wet mixing technique followed by casting. A 90ml stabilized colloidal solution of latex with water (20.52g/m1) by the addition of 15-wt.% of starch was prepared under stirring during 15 minutes. Then, 10ml of the stabilised latex was mixed to carbon black under stirring during 10 minutes. Finally, composites were prepared by casting the solution onto a glass substrate and then heated at 65^0C, for 6 hour, for evaporation of volatile components. Films with thickness in the order of 0.5 mm were obtained for composites with NR/CB proportions of 90/10, 80/20, 70/30, 60/40, 50/50, 40/60, 30/70 (wt.%)

4. Electrical Conductivity Measurements

The D.C conductivity of the prepared samples were measured by four method using Keithley 2000 Multimeter and Keithley 6514 system electrometer. Silver paste was used to have good contacts.

Results and Discussion

Figure 1 shows the dependence of electrical conductivity of the composites on the CB content. The electrical conductivity as high as 10^{-4} S/cm could be obtained for our samples with 20% CB content. For CB contents above 20wt. %, the conductivity tends to be a constant value for higher weight % of CB (upto 60%) the composites films shows enough flexibility while literature reports that, higher weight % of CB in elastomer/CB composites causes a decrease in the mechanical strength of the polymeric matrix [10]

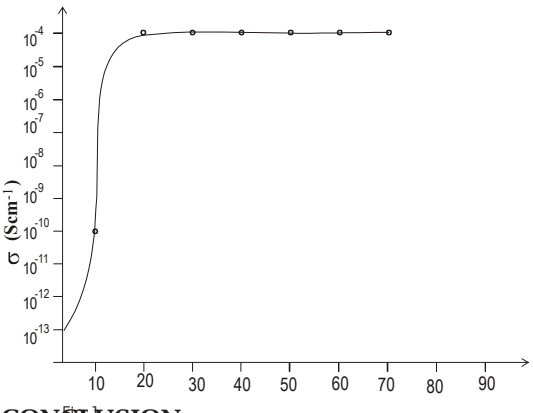

Fig. 1

CONCLUSION

Our samples afford the opportunity to explore the full mechanical characterization of vulcanized rubber along with the high electrical conductivity and thus completely characterise the polymeric thin films for novel application in the electronic industry. The main advantages of these polymeric thin films are that they can be prepared easily and cheaply, that they are stable and flexible and can be moulded into any form.

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SYNTHESIS AND CHARACTERIZATION OF CONDUCTING THIN FILMS BASED ON NR/PAN(HCL) COMPOSITES

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Introduction

Plastics and elastomers are generally considered as intrinsic insulators. The development of intrinsic electrical conductivity in these polymers was considered as next to impossible. But during the last two decades, some techniques have been used to permit traditional polymers to become conducive polymers: coating with conductive materials such as nickel and zinc; conductive fillers either in particulate or filler form, have been introduced to produce conducting polymer matrix composites (1-3); other polymers so called conducting polymers can be made more conducive by dopping or processing technique (4). When such conjugated polymers with p - electrons delocalised along the polymer chain are dopped with donor-acceptor agents, electrons are able to jump freely from one atom to another along the backbone of the chain, thus increasing the conductivity near the range of metals (5).

In recent years, conducting polymers have been widely used in many different applications from electromagnetic shielding, microelectronics and photovoltaic. They are being used and projected as a strong candidate for use as plastic solar cells, light emitting diodes, electromagnetic and optical devices, corrosion protecting materials, chemical and biological sensors and many more (6-9).

However, currently known and widely used intrinsically conducting materials like polypyrrole, polyaniline, polythiophene, polyparaphenylene etc are not only costly but also different to process because of the insoluble and infusible nature of the backbone (10).The incorporation of these conductive polymers in various plastics or elastomers forming a blend, composite or interpenetrated network composites have been proposed as a suitable approach in developing conductive polymeric systems (11-13). Blends of PAN and PPy with various thermoplastics such as PVC, PMMA, PS etc have been already used in various potential applications. Most of them showed good values of electrical conductivity even with low weight fractions of the conducting filler (14-15). The conductive composites of these polymers with elastomers have also been gaining importance. Incorporation of intrinsically conductive polyaniline or polypyrrole with elastomers such as natural rubber allows the tailoring of the mechanical characteristics of the conductive polymer along with fairly good electrical conductivity. These composites are superior to conductive polymer composite materials (CPCM) generally prepared using carbon black or acetylene black as the organic filler (16).

In this work, we have developed conducting elastomeric thin films using natural rubber as the matrix and PAN (HCl) as the conductive filler through the wet mixing process. A high value of conductivity with reinforcement of the matrix was obtained.

Materials and Methods

Aniline (Merck) was thrice distilled under reduced pressure and stored under nitrogen at 4^0 C. Ammonium per sulphate (APS) (Nice Chemicals) as oxidant and Hydrochloric acid

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(36.46 %) as dopant was used as received. Natural rubber was supplied from RRI, Kottayam (mol wt: 2.5 x 10^5) and used as received. Toluene, methanol and acetone were used without further purification.

Preparation of HEL Doped Polyaniline :

20 g of aniline hydrochloride (16.373 ml or 0.15 mol) is dissolved in about 200 ml of 1.5 M HCl. 8.166g of Ammonium Persulfate is dissolved in excess (50 ml) of 1.5 M HCl and added dropwise to the stirred solution. After reacting for 4 h, the solution was filtered and the precipitate is washed repeatedly with 1 N HCl, and distilled water and then using methanol and acetone. The powder was dried overnight at 60^0C under dynamic vaccum to constant mass. The resulting form is emeralidene hydrochloride (9-12).

Preparation of NR- Pan (HCL) Composites:

Wet mixing method: A viscous solution of natural rubber in toluene was prepared (Conc: 0.015 g/ml). The dopped PAN (HCl) at different weight fractions are slowly stirred with the rubber solution for about 8 hours. The homogenous solution is spin casted on quartz plates, dried under dynamic vacuum at 60^0 C for 12 hours. The dried films are directly used for conductivity measurements.

Conductivity Measurements:

Electrical conductivity measurements were performed using the standard four-probe technique (with Ag contacts) for pure PANI (HCl) powder as pellets (14 x 1.5 mm) and for PANI composites as thin films (1.5 x 1.5 mm). Samples were connected to a Keithley 6514 electrometer and Keithley Multimeter 2000. For bulk measurements the contacts were given at the opposite faces and the conductivity was calculated using the Van der Pauw equation (13).

$$S = \frac{2 \ln 2}{(R_1 + R_2)\, pdf}$$

Where, S is the conductivity (Scm^{-1}), R_1 and R_2 are resistances of the sample in two adjacent configurations, d is the thickness of the sample (cm), and f is geometric correction factor (approximately 1.00 for circular pellets or square shaped plaques).

Swelling Studies

The films were peeled out from the glass plates and were weighed and swelling experiments were performed by immersing them in solvents contained in test bottles having air-tight stoppers. The samples were periodically removed from the solvent and weighed quickly on an electronic balance (Sartorius) to an accuracy of 0.1 mg. The procedure was repeated until equilibrium was attained.

The swelling ratio $= \frac{W - W_0}{W_0}$

Where W is the swollen weight of films, W_0 is the weight of films before immersing in solvent.

Results and Discussions

The conductivity of the films was found to increase with the increase in the weight fraction of the conducting fillers. Fig 1 shows the variation of resistivity of the PAN films with weight fraction of the conducting PAN (HCl). A conductivity of 10^{-3} S/cm was obtained for samples containing 0.9 w/w of PAN (HCl). Fig2 corresponds to the bulk conductivity of the samples. Fig. 3 shows the swelling ratio of composite films in toluene as a function by weight fraction of PAN(HCl) in the composite. The figure indicates an increase in the swelling ratio from 2 to 55 with an increase in the weight fraction from 0.1 to 0.9. This indicates that the conducting polymer effectively get crosslinked to the matrix system and thus reinforces the rubber just as vulcanization of rubber, through chemical or physical means.

Conclusion

PAN (HCl) acts as reinforcement and conductive filler in blends with NR, contributing to the formation of a network, which inhibits NR solubilisation. Thus, conductive flexible composite films have been synthesized without using a cross linking agent. These cross-linked conductive thin films based on natural rubber can be directly integrated into various appliances as it ensures

reliable conductivity and suitable mechanical properties.

Fig. 1. The change in the log (r/W- cm) of the composite films with the weight fraction of the conducting filler

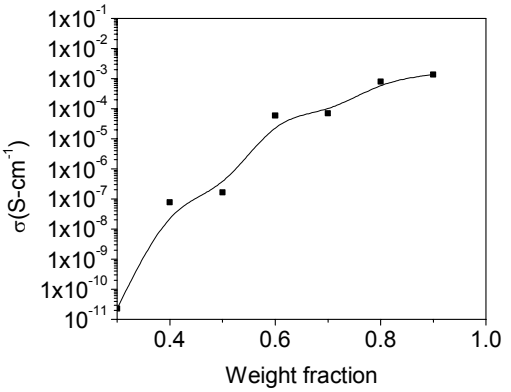

Fig. 2. The change in the s (S cm^{-1}) of the composite films with the weight fraction of the conducting filler.

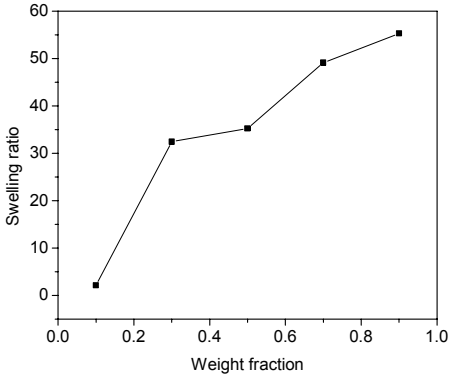

Fig. 3. The change in the swelling ratio of the composite films with the weight fraction of the conducting filler.

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CONDUCTIVE COMPOSITES OF NBR/ CB AS SEMICONDUCTING MATERIAL

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Abstract

Composites of elastomer and carbon black (CB) have attracted great interest due to there technological applications. In this work, electrically conducting thin films based on nitrile rubber NBR and CB was developed for use as semiconductors in various electronic devices. The electrical conductivity changes from 10^{-13} to 10^{-2} S/cm depending on the % of CB in the composite. The experiment projects out the possibility of developing a number of conducting thin films based on elastomers through a cost-effective technique.

Introduction

The electrical characterisation of conductive polymer composites is an interesting subject of many research reports (1-4). They are generally prepared by incorporating conducting particles such as carbon black or acetylene black or metallic fillers such as Al, Fe etc within the polymer structure and thus the polymer may be given interesting electronic properties. These groups of conducting polymeric systems are generally referred to as Conducting Polymer Composite Materials (CPCM). This group of polymers are widely used as antistatic coating, for EMI shielding, as fuse meterials, as low temperature heater etc. Electrical properties of CPCM have been widely studied during the last 20 years, most works are concerned with carbon–polymer composites. Such filled polymer are usually referred to as random heterogeneous materials owing to the position and composition disorder that characterise them. They generally present an insulator conductor transition with the increase in filler concentration.This phenomena can be interpreted with the percolation theories based on statistical, thermodynamic structure oriented or fractal percolation networks. These models attribute the sharp increase of macroscopic conductivity with the filler amount . As the majority of materials used are typical insulator, the current conduction between the two conductive clusters occur by electron tunneling with an exponential function of gap width. Thus, not the length of the particle chains, but the average gap width detemines the electrical conductance of the dispersion. The main notion of the percolation theory is the so-called percolation threshold Cp.-minimal concentration of conducting particles at which a continuous conducting chains of macroscopic length appear in the system. The recent research papers report the possibility of developing synthetic rubber /CB Composites so as to be applicable in novel areas of industrial importance. The electrical properties of these systems can be analysed by taking in to consideration their physical significances such as good mechanical strength, flexibility, easy availability, and effective chemical resistance etc. This work concentrates on the development of semiconductive thin films of Acrylonitrile butadiene rubber (NBR)-CB composites by means of wet mixing process.

Materials and Methods

NBR was supplied from RRI, Kottayam and used as received . CB was from Degussa AG Company was used as received .The particle

size and specific surface area of CB was between 60 to 200 nm and 16-24m^2 /g respectively. Composite preparation A 50ml viscous solution of NBR in chloroform (0.025g/ml) was prepared and 5ml of the solution was stirred with carbon black of definite weight fractions for about 3 hours.The solution was casted onto glass substrates and dried film of 0.5mm thickness were prepared for composites of weight fractions of 0.1, 0.2, 0.3….,0.9. The dried films were directly used for conductivity measurements

Conductive Measurements:

The DC conductivity of prepared samples were measured by four probe method using KETHELEY 2000 multimeter and KETHELEY 6514 system electrometer silver paste was used for good contact.

Results and Discussion

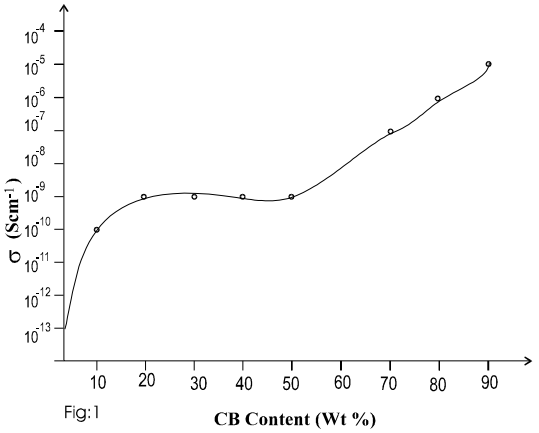

Fig:1

Fig.1. shows the dependence of electrical conductivity of NBR/CB composites on the weight faction of carbon black. The percolation threshold was obtained at 0.2 weight fraction and the conductivity was found to increase with the increase in CB content.

Conclusion

We prepared NBR/CB composites with high electrical conductivity and therefore practically useful as conductive thin films for various novel applications.

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D.C. CONDUCTIVITY STUDIES IN ACRYLO NITRILE BUTADIENE RUBBER (NBR) - POLYANLINE COMPOSITE

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Abstract

A simple and convenient method was adopted to synthesis conducting thin films of Acrylonitrile Butadiene Rubber using an intrinsically conducting polymer (PAN). PAN was synthesised by chemical polymerization using HCl as the dopant. The D.C conductivity studies shows a high value of 10^{-2}S/cm for these composite films which can ensure novel applications in the electrical industry.

Introduction

The field of conductive polymers deserves a prominent position in modern science and technology. Elastomers and plastics which consists of extremely large molecules were known as perfect insulators protecting us from electric current and not carrying them. However the discovery of conductivity in polyacetylene on dopping just as in the case of inorganic semiconductor resulted in the emergence of a new group of charge carriers. Conducting polymers such as polyacetylene, polyaniline, polypyrrole, polythiophene etc are promising materials for potential applications of LEDs, organic semiconductors, conductive coatings or adhesives, gas seperation membranes and EMI shielding (1). The ability to tailor the electrical properties of these systems is one of their most attractive features and if coupled with improved stablility and processibility, new applications are surely on the horizon.

Polyamiline is probably the most celebrated intrinsically conductive polymer with a large number of potential applications utilizing its excellent electrical, magnetic and optical properties. Polyaniline is particularly challenging because its conductivity depends not only on the oxidation state but also on the degree of protonation and dopant (2). However, one of the important drawback is their total insolubility in many of the usual solvents and also the poor mechanical properties preclude their utilization in the polymer industry (3).

The use of blends in the rubber industry is important because it allows tailoring of the characteristics of a material by using two or more polymers with different properties in the composition. Since their first preparation in 1984(4-6), Conductive polymer blends became the most used way to improve the mechanical properties of the conductive polymers(7). In this work, we prepared blends of NBR and PAN-HCl employing the wet mixing technique. NBR rubber was chosen in this work because of its good resistance to attack by heat, light, oxygen, acid and ozone. The properties of NBR can be controlled by varying the ACN content. On the other hand, polyaniline is one of the most studied conducting polymers due to its high electrical conductivity associated to good stability, facility of preparation and low cost of monomer..

Materials and Methods

Aniline [E. Merck, India] was purified by double distillation under reduced pressure. Ammonium per sulphate [E-Merck, India]

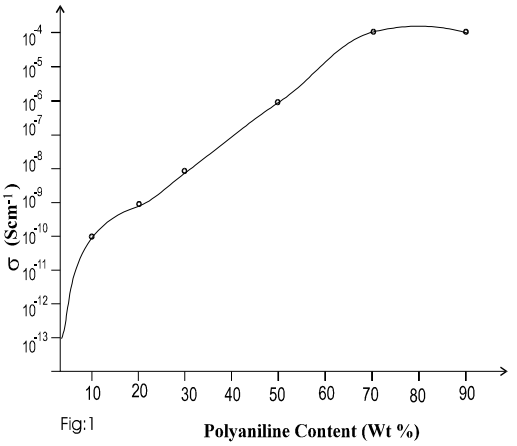

Fig:1

Methanol, Acetone, Toluene etc. were distilled before use. NBR was supplied from RRII, Kottayam and used as received.

Synthesis of HCl Polyaniline: About 100ml of 1.5 M HCl was prepared. 13 ml of double distilled Aniline was made up to100 ml using 1.5 M HCl. 20 g of Aniline hydrochloride (16.373 ml or 0.15 mol) was dissolved in about 200 ml of 1.5 M HCl. After stirring this mixture for 2 hrs, 8.166 g of Ammonium persulphate dissolved in excess of 1.5 M of HCl was added dropwise to the stirring solution. After 4 hrs, polymerization of polyaniline with 50% oxidization along with HCl doping occurred giving dark green emarldine form of precipitate. This is fillered, washed with HCl, distilled water and methanol and the filtrate is made dry after few days. Thus polyaniline is prepared .

Making OFPAN – NBR Composite: We made the NBR-PAN composite by wet mixing method. A solution of NBR chloroform was prepared [0.025g/ml]. The composites of different weight fractions of PAN was prepared by stirring the PAN powder in the above mixture for 5 hrs. The NBR-PAN composite films were fabricated on the glass by casting method. The composite solution of NBR-PAN gave thin films with uniform thickness and high dispersion (8).

Conductivity Measurements: The D.C conductivity of the prepared NBR-PAN composite films, was measured using a KEITHLEY 6514 electrometer and KEITHLEY multimetre. Inorder to avoid any chance of variations form original conductivity during measurement, the materials were kept at constant temperature. For getting good contact during measurements silver paste was used .

Results and Discussion

Fig.1 shows the dependence of electrical conductivity on the weight content of PAN [HCl]. As expected, the conductivity of the composite increases as the concentration of PAN-HCl is increasing. A change in value from 10^{-13}S/cm [corresponds to NBR matrix] to 10^{-7} S/cm for 20 wt% of PAN [HCl] was observed. For low concentration, the conductivity remains to low levels. This may be due to the encapsulation of the polymeric filler to limited points, resulting in large energy gap. By increasing the PAN-HCl content, the continuous conductive pathways are allowed to be formed, leading to a steady rise of conductivity values.

Conclusion

NBR based conductive composites containing PAN [HCl] as the conductive material can be projected as the appropriate candidates for various micro application in electrical and electronic industry. The experiment focuses on developing cost-effective conductive thin films based on elastomers so as to be interpreted into various low cost electronic device. The ability to tailor the electrical properties of these systems is one of their most attractive features coupled with improved stability and processibility resulting in highly conductive flexible thin films.

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CRYSTALLIZATION KINETICS OF SE, SB, TE TERNARY CHALCOGENIDES USING NON-ISOTHERMAL ANALYSIS

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Abstract

The crystallization kinetics of Se, Sb, Te chalcogenide glass has been discussed under non-isothermal conditions using differential scanning calorimetry (DSC). DSC thermogram of the composition exhibits double stage glass transition and crystallization. From the heating rate dependence of glass transition temperatures (T_{g-1}&T_{g-2}) and the crystallization temperatures (T_{p-1} &T_{p-2}), the values of the activation energies for glass transition(E_{g-1}&E_{g-2}) and that of crystallization (E_{p-1}&E_{p-2}) are evaluated using different theoretical models

Introduction

Thermal analysis using DSC is widely used in investigating the crystallisation kinetics of glasses [1,2,7,11]. Kinetic studies are always connected with the concept of activation energy, which is associated with the nucleation and growth processes. Two thermal analysis methods are generally used for the study – isothermal & non-isothermal methods. Usually isothermal experiments are much time consuming than non-isothermal but isothermal experimental data can be interpreted by the well-established Johnson-Mehl-Avrami equation (5-8). On the contrary, there is no uniquely accepted equation for non-isothermal method. While several equations based on JMA equation for interpreting non-isothermal data have been proposed and used [9-13].

The present work is concerned with the study of the crystallization kinetics using DSC and evaluation of the activation energies for glass transition (E_{g-1}&E_{g-2}) and that of crystallization (E_{p-1}&E_{p-2}) of the composition, $Se_{79.6}Sb_{0.4}Te_{20}$ using different theoretical models based on non-isothermal method.

Materials and Methods

Bulk material was prepared by the conventional melt-quenching technique. The five number purity samples from National Fuel Complex, Hyderabad are weighed and sealed into fused quartz ampoules (17 mm x16 mm) under a vacuum of 10^{-6} Torr and heated to 913 K for 12 hours for the ternary series Se-Te-Sb. The melts were periodically shaken to avoid bubble formation and to obtain complete homogenisation: subsequently the molten samples were quenched in ice water. Quenching allowed the glasses to retain, as much as possible, a definite structure corresponding approximately to the structure of the melt of the synthesis temperature. The quenched sample of the glass is removed from the ampoule by breaking the ampoule. The amorphous nature of the sample has been confirmed by X-ray diffraction (fig.1) .

DSC thermograms of $Se_{79.6}Sb_{0.4}Te_{20}$, scanned in the temperature range of 50 – 300^0 C for different heating rates 5, 10, 15, 20 ^{0}C/min. were obtained and plotted in figure 2 .

Results and Discussions

DSC thermograms of the composition $Se_{79.6}Sb_{0.4}Te_{20}$ scanned in the temperature range of 50 – 300^0 C exhibit two glass transition temperatures (T_{g-1}&T_{g-2}) and two crystallization temperatures (T_{p-1}& T_{p-2}) for

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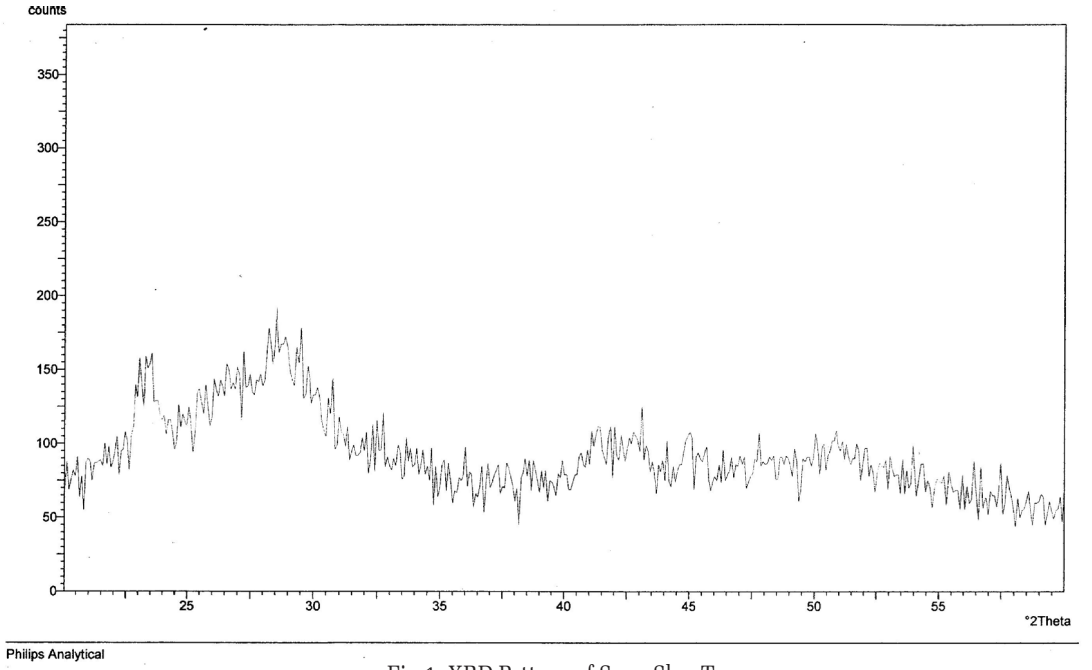

Fig.1. XRD Pattern of $Se_{79.6}$ $Sb_{0.4}$ Te_{20}

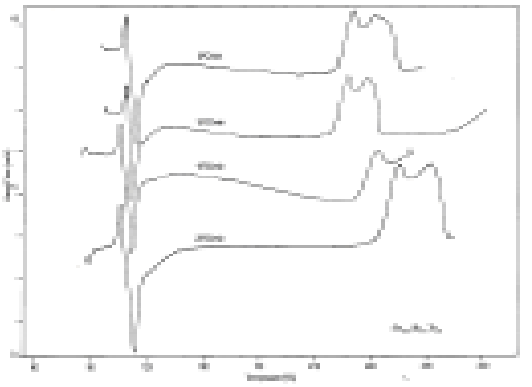

Fig.2. DSC thermograms of $Se_{79.6}$ $Sb_{0.4}$ Te_{20}

different heating rates 5, 10, 15, 20 ^{0}C/min. were obtained and plotted in figures 1 and is tabulated in table- I. Thus double stage glass transition and crystallization are observed in the composition. Similar cases are reported in the cases of Ge-Se binary alloy, Se_{85} S_{15-x} Sb_x & Se-In-Pb ternary and quaternary alloy of Se-Te-Ge-Sb glass13, 14. Specifically for Ge-Se-Te glass, two glass transition and crystallization exotherms were reported (15).

Kissinger equation and other approximations for the evaluation Activation energy.The activation energy for crystallization can be calculated using Kissinger equation [5&6] which is given as:

$$\ln(\frac{\alpha}{T_p^{\,2}}) = -(\frac{E_c}{RT_p}) + cons\tan t \qquad (1)$$

where T_p is the maximum temperature at which the rate of increase of X reaches its maximum.

Since the variation in $\ln(1/T_p^{\,2})$ with ln a is much slower than that of ln $(1/T_p)$ with lna, [9&10] the Kissinger equation is modified and simplified using the approximation proposed by Mahadevan etal as:

$$\ln a = E_c/RT_p + \text{constant} \qquad (2)$$

In the Augis and Bennet approximation the relation [3] is of the form

$$\ln (a/T_p) = E_c/RT_p + \text{Constant} \qquad (3)$$

The method of Takhor [10] can also be applied to evaluate the activation energy. The Takhor relation can be written as:

$$\ln [\alpha/(T_p - T_o)] = -(m/n)\, E_c/RT_p + \text{constant} \qquad (4)$$

HEALTH SCIENCES

NUTRITIONAL AWARENESS AND ENERGY EXPENDITURE PATTERN OF WOMEN AGRICULTURAL LABOURERS

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Abstract

The present investigation was carried out to study the Energy Expenditure Pattern and Knowledge, Attitude and Practice (KAP) regarding health and nutrition of women agricultural labourers of Thrissur district, Kerala. The sample selected for the study was 150 women agricultural labourers within the age group of 18 to 45 years. From the selected sample 30 women agricultural labourers were randomly selected as subsample and among them the energy expenditure and KAP studies were carried out. The mean energy intake (1958.99) was very much lower than the mean energy expenditure (2341.79). The difference between energy intake and energy expenditure ranged from -300 to -800 with a mean difference of -429.63. Majority of them showed the energy difference of -300 to -600. KAP tests on the aspects of health and nutrition indicated that majority of the respondents obtained medium scores in knowledge and attitude tests where as low scores were obtained in the practice test. Hence, in energy expenditure studies majority of the respondents showed negative energy balance and in KAP tests it was revealed that eventhough the knowledge and attitudes on the aspects of health and nutrition were satisfactory the practices existing among them were unsatisfactory.

Introduction

Women constituted 48.16 per cent of India's total population and 83.00 per cent of women were engaged in agriculture as cultivators and labourers (Census of India, 1991). Women agricultural labourers undergo nutritional stress because of low dietary intake and high energy output for wage earning, child bearing and child rearing. The extremely high work load of women and inadequate intake of the nutritional foods has deleterious effects on her own health and nutritional status. By considering the above facts the present investigation was carried out to assess the energy expenditure pattern and knowledge, attitude and practice regarding health and nutrition of women agricultural labourers.

Materials and Methods

The procedures and techniques followed during the study are listed below:

1. Location of the area and selection of sample
2. Selection of suitable tools and techniques
3. Conducting the study and statistical analysis of data

1. Location of the area and selection of sample

The locality selected for the study was Ollukkara block of Thrissur district, Kerala. Three panchayats with maximum agricultural operations were selected from the block. From each panchayat one ward was randomly selected. From each ward 50 women agricultural labourers with in the age group of 18-45 years were randomly selected with the help of lists of agricultural labourers available in the block office. Thus, total of 150 women agricultural labourers were selected. Ten respondents were randomly selected from each

50 women agricultural labourers selected from each ward. Thus a total of 30 women agricultural labourers were selected as subsample. Energy expenditure and knowledge, attitude and practice (KAP) studies were carried out among the subsample.

2. Selection of suitable tools and techniques

Interview method is a systematic approach by which a person enters more or less imaginatively into an inner life of a comparative stranger. (Devadas and Kulandaivel, 1975). According to Bass *et al*. (1979) interview method is the most suitable way since it proceeds systematically and record the collected information quickly. In the present study also direct interview method was used with the help of structured and protested schedules.

3. Conducting the study and statistical analysis of data.

Knowledge: To develop an effective and standardised knowledge test 30 questions or items which were related to health and nutrition and relevant to the study were formulated. Item discrimination and item difficulty indices were calculated. Item discrimination index discriminates the well informed labourers from the poorly informed labourers and item difficulty index tells about the difficulty as an item.

Thirty six women respondents were selected who were different from the sample selected for the study but had identical characteristics of the main sample. Questions which were prepared earlier were asked to them. A score of one was given to the correct answer and zero was given to the incorrect one. The scores obtained by 36 respondents were arranged in descending order. The respondents were then divided into three equal groups. G_1, G_2 and G_3 with 12 respondents in each group. For the item analysis the middle group was eliminated and groups G_1 and G_3 were retained which included the respondents who had got high and low scores respectively.

Calculation of Discrimination Index:

Discrimination index (E 1/3) was calculated using the following formula.

$$E\ 1/3 = \frac{S_1 - S_3}{N/3}$$

Where

S_1 - Number of correct answers in the group G_1

S_3 - Number of correct answers in the group G_3

N - Total number of respondents

In this study the items with E 1/3 values above 0.4 were selected for the knowledge test among the selected sample.

Calculation of Item Difficulty Index:

The item difficulty index (P) refers to the percentage of respondents answering an item correctly. Items with high P value were considered for the knowledge test among the selected sample. Thus, ten items were finally selected. The selected questions were asked to the respondents. Scores of one and zero were given to the correct and incorrect answers respectively. Then the total score of each respondent was calculated.

Attitude: Thirty statements regarding health and nutrition were formulated to do the attitude test among the primarily selected 36 women respondents with the identical characteristics of the selected sample. The statements were both positive and negative type. The statements were asked in a five point Likert's scale i.e., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree (SDA). Item analysis of the statements was worked out to examine to which extent each statement differentiate among the respondents.

Item Analysis: The attitudes like SA, A, UD, DA and SDA were scored as 5, 4, 3, 2 and 1 respectively for the positive statements and

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reversing the order of scoring for the negative statements. Then, the total score of each respondent was calculated. The respondents were arranged in descending order of the total scores and then divided into four equal groups. For the item analysis the groups with highest and lowest scores were selected and the middle two groups were eliminated. As suggested by Edwards (1957) t value was calculated to differentiate the attitudes of high and low groups to each statements.

t value was calculated as follows:

$$t = \frac{X_H - X_L}{\sqrt{\frac{S_H^2}{n_H} + \frac{S_L^2}{n_L}}}$$

X_H - The mean score on a given statement for the high group

X_l - The mean score on a given statement for the low group

S_H^2 - The variance of the distribution of responses of the high group to the statement

S_L^2 - The variance of the distribution of responses of the low group to the statement

n_H - Number of subjects in the high group

n_L - Number of subjects in the low group

The statements with t value greater than 1.75 were considered. The selected statements were then arranged in ascending order of t value. Ten statements (five positive and five negative) with maximum t value were finally selected for the attitude test among the selected sample.

Materials and Methods

To know the practices related to health and nutrition ten questions were formulated and directly asked to the selected sample. Scores of 1 and 0 were given to the correct and incorrect practices respectively. Then the total score of each respondent was summed up.

Energy expenditure pattern

One day food weighment survey was carried out to assess the daily intake of each specific food groups like cereals, pulses, other vegetables, fats and oils etc. of each respondent. The details about food intake helped in the calculation of daily energy intake.

Using the prediction equation proposed by ICMR Expert Group for Indians, the value of one Basal Metabolic Rate (BMR) unit in terms of kilocalories was computed for each individual. The prediction equation for the particular age group is 8.3 x body weight (kg) + 7.88. By substituting body weight of each individual in the prediction equation the value of one BMR unit in terms of kilocalories was calculated. Agricultural labourers are grouped in the category of moderate workers. For a moderate worker the energy expenditure in terms of BMR units for 24 hours is 1.0 for sleep, 2.8 for occupational activity and 2.0 for non occupational activity. The BMR units for a whole day was calculated by activity break up methods i.e., hours spent for sleep, occupational activity and non occupational activity were multiplied with the particular BMR units suggested for a whole day and it was then divided by 24. The three computed BMR units (sleep, occupational and non occupational activity) were then summed up. This BMR unit was then multiplied with the kilocalories obtained for one BMR unit for each individual. Thus the total energy expenditure for a whole day was obtained. The daily energy expenditure was then compared with the daily energy intake.The collected data was consolidated and statistically analysed.

Results and Discussion

Details of the knowledge, attitude and practice (KAP) studies are shown in the table 1 and 2.

Table-1. Mean scores of Knowledge, Attitude and Practice (KAP)

KAP	Mean ± SE
Knowledge	6.033 ± 0.265
Attitude	22.77 ± 1.268
Practice	3.0 ± 0.292

Table-2. Classification based on scores obtained in KAP

	Scores interval	No. of respondents	Percentage
Knowledge	0-5	4	13.34
	5-10	26	86.66
	Total	30	100.00
Attitude	0-10	1	3.33
	10-20	10	33.33
	20-30	15	50.00
	30-40	4	13.34
	40-50	0	0.00
	Total	30	100.00
Practice	0-5	26	86.66
	5-10	4	13.34
	Total	30	100.00

Knowledge: The mean knowledge score (table 1) indicated that to some extent the women labourers were aware about the nutrition and health related aspects. Maximum score was 10 and table 2 shows that majority of the labourers (86.66%) were included in the score interval of 5 to 10.

Attitude: The attitude mean score (table-1) also indicated that to some extent the women labourers had healthy and positive attitudes regarding health and nutrition. Maximum score was 50 and Table-2 shows that majority of them (50%) were included in the score interval of 20-30. None of them obtained above 40.

Practice: The mean score of practice (table 1) indicated that the nutrition and health related practices existing among them were unsatisfactory. Maximum score was 10 and majority of the labourers (86.66%) were included in the score interval of 0 to 5 (table

2) Energy expenditure pattern

Energy expenditure studies indicated that all the respondents were deficient in energy intake when compared with the energy expenditure. The mean energy intake (1958.99 Kcal) was very much lower than the mean energy expenditure (2341.79 Kcal). The difference between energy intake and energy expenditure also indicated that the mean difference was (-429.63) very low. The respondents were classified based upon the difference between energy intake and energy expenditure. Majority of them showed the energy difference of -300 to -600 (table 3).

Table- 3. Classification according to the difference of daily energy expenditure from daily energy intake

Difference	No. of respondents	Percentage
0 to -100	2	6.67
-100 to -200	0	0
-200 to -300	4	13.33
-300 to -400	6	20.00
-400 to -500	6	20.00
-500 to -600	9	30.00
-600 to -700	2	6.67
-700 to -800	1	3.33
Total	30	100.00

CONCLUSION

In energy expenditure studies all the women agricultural labourers showed negative energy balance. KAP studies showed satisfactory results in knowledge and attitude whereas practices existing among them were unsatisfactory.

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DEPRESSION IN PATIENTS UNDERGOING MASTECTOMY

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Abstract

The study was done to assess the extent of depression in patients undergoing mastectomy (removal breast following breast cancer), to study the effect of conselling and to develop an interview schedule for measuring the depression. 250 mastectomy patients were studied using a structured proforma. The patients were grouped to control group (125) and experimental group (125). The experimental group of patients underwent psychological councelling before mastectomy. The result of the study showed that in the control group depression level showed to be more or less same. But the difference between mean depression scores before and after intervention in the experimental group was significant.

Introduction

Breasts are exalted as the epitome of all that is most feminine and desirable in a woman (Faulder, 1979). In our culture, breasts represent more than a provider of nourishment for babies. It has come to be portrayed as symbol of femininity and sexuality. The diagnosis and treatment of breast cancer therefore carries implications of threat, disfigurement and loss of intactness and hits at the roof of an individual construction of her sexuality.

Patients undergoing mastectomy face a lot of psychosocial problems. Among them depression tops the list. Some patients undergoing mastectomy manifest with more intensive depressive disorder, which becomes coincident in the form of psychological symptoms like a low mood, thoughts of guilt, hopelessness, loss of interest in surroundings, psychomotor agitation or retardation, irritation, social withdrawal and suicidal thoughts. These patients often show characteristic physical symptoms like anorexia, weight loss, insomnia and tiredness.

Psychological problems of mastectomy patients are provoked by of prognosis, guilt about casualty, stigmas of cancer and fear of painful death. Surgery, mutilation and loss of self-esteem, loss of libido and rejection by partner trigger these problems. These lead to economic, sexual and social disruption leading to depression and anxiety decline in quality of life.

The objectives of the present study are to develop an interview schedule for measuring the depression of patients undergoing mastectomy and to assess the effect of counselling on depression of patients undergoing mastectomy.

Psychosocial Problems of Patients Undergoing Mastectomy Provoked by Knowledge of having a life, Coping with Treatment, Threatening disease, Inadequate Information Surgery, Uncertainty of prognosis, Mutilation, Guilt about casualty, Loss of self esteem, Stigma of Cancer, Rejection by partner, Fear of painful death. These lead to Economic / Sexual / Social disruption, Depression, Anxiety and Decline in quality of Life.

This is a prospective experimental study. The study was conducted in the Department of

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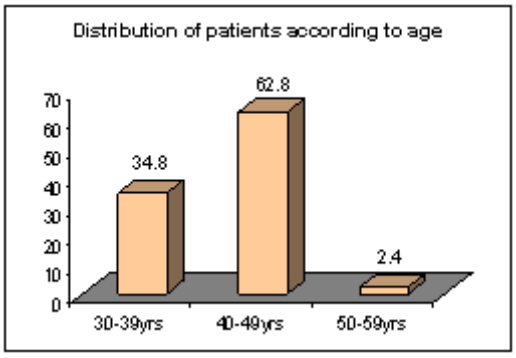
Surgery, Medical College Hospital, Thiruvananthapuram during the period, January 2001 to December 2002. The patients underwent mastectomy for cancer breast during the period were included in the study. The study was conducted in two stages. During the first stage an educational tool to assess depression was developed and validated. In the second stage patient couseling and teaching was given. The patients were assessed in the pre-operative period and postoperative period. The sample size was 250, 125 patients as control and 125 patients as experimental. Counselling was given to 125 patients only.

Results

The present study showed that the largest number of patients belonged to the age group of 40-49 years (63%) followed by 50-59 years (35%) and 30-39 years (2%) as shown in Fig.1.



Majority of the patients (62.8%) belonged to Hindu religion. Out of 250 patients 51.6% belonged to the urban area. It was seen that majority of the patients (72.4%) had high school education. Majority of the patients had unskilled occupation and most of them were non-vegetarians. 65% of patients belonged to the average income group.

Table-1. Mean, standard deviation and level of significance of depression score before and after in the control group

Type of assessment	Depression		T value	P value
	Mean	S.D		
Before Operation	35.38	9.04	0. 418	NS
After Operation	35.02	9.02		

The mean depression scores in the group in the initial assessment were 35.38 and after invention were 35.02. The difference was not statistically significant.

Table-2. Mean, standard deviation and level of significance of depression score before and after invention in experimental group.

Type of assessment	Depression		T- Value	P– Value
	Mean	S.D		
Before	43.9	8.3	22.4	P<. 001
After	24.2	8.4		

The mean depression score in the experimental group before intervention was 43.9 and after intervention it was reduced to 24.2. The difference turned out to be significant statistically. Thus the counseling was found to be effective for reducing depression of these patients.

Table-3. Correlation coefficient between depression and other psychosocial problems.

X	Y Co-efficient	Correlation Significance	Level of
Depression	Social	0.536	P<0.01
Depression	Social adjust	0.425	P<0.01
Depression	STA	0.299	P<0.01
Depression	Sexual problem	0.412	P<0.01

From Table-3 it was clear that the correlation between depression and social problem is 0.536, which was significant at 0.01 at 0.01 level. Thus the correlation was interpreted as substantial or marked correlation.

The correlation between depression and social adjustment score was found to be 0.425, which was significant at 0.01 level. The correlation was interpreted as marked. The correlation between depression and state-trait anxiety score was found to be 0.299, which is significant at 0.01 levels. The correlation was interpreted as low.

Discussion

Psychosocial problems following mastectomy generally comprise of various aspects related

to mental health, social status to functional capacity within the community. In the present study depression is studied separately. Depression was present in all women who had undergone mastectomy and counseling helped to lower the problems.

Heeringen *et* al., (1991) opined that the grief reaction following mastectomy has two components, a depressive reaction to the loss of the breast and anticipatory grief for anticipation of potential lethal outcome. De Leo *et* al., (1991) analyzed the suicide attitude in a group of thirty-four post mastectomy patients and seem much more marked than in two control groups consisting of 103 medical patients and in forty healthy subjects respectively. In a limited sample comprising 23 subjects obtained by excluding the extreme percentile values, certain psychosocial variables were observed to be significantly associated with the suicide attitude in post mastectomy patients.

The present study revealed that mean depression scores in the control group before and after assessment remained same. But the mean depression scores in the experimental group before counseling was 43.9 and it decreased to 24.9 after intervention. Thus it is clear that counseling was very much effective in reducing depression for these patients.

Parker *et* al (1995) evaluated the effectiveness of pre operative psychotherapeutic intervention with breast cancer patients in a randomized control trial psychological measures included anxiety, depression, body image distress, social support and coping psychological morbidity in the sample was high pre-operatively (59%) and at one year (39%), but detection of morbidity by health professional was poor.

Bartmann and Associates (1996) examined the types of coping strategies used and the level of depression they experienced. The result revealed that the type of coping strategies used was not associated with depression level of middle-aged woman. Fries *et* al (1996) in their study dealt with effect of mastectomy on psychosocial experience of women. The stressed that psychosocial support experienced post surgery was reported to have primarily come from the circle of family and friends, and less so been extended by self-help groups or medical staff. They suggested the need for integrated rehabilitative measures.

Conclusion

It is concluded from the study that depression is found to be one of the important psychosocial problems of patients undergoing mastectomy. Counselling was found to be effective in reducing depression among patients undergoing mastectomy.

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IN VITRO CONSERVATION OF DECALEPIS HAMILTONII: A GLOBALLY ENDANGERED SPECIES OF MEDICINAL IMPORTANCE

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Abstract

Decalepis hamiltonii Wight & Arn. is facing different degrees of threat due to unsustainable harvesting and commercial exploitation. The distribution of this species has been recorded in the dry and moist deciduous forests of Karnataka, Andhra Pradesh Kerala and Tamil Nadu. The species is endemic to peninsular India and is endangered globally. Roots are of high medicinal value, which are pickled and eaten. There is an urgent need to optimize integrated conservation strategies in order to prevent this malady. *Decalepis hamiltonii* was collected from Karnataka and established *ex situ* in the field gene bank at IIHR, Hessaraghatta. Tissue culture techniques are of great support for conservation of this species, besides serving of a back up to material maintained in FGB, simultaneously preserving genetic variability of the conserved plant material. Regeneration was accomplished from single nodal cuttings and shoot tips. MS medium with different concentrations and combinations of NAA and BAP were used to induce multiple shoots. Multiplication rate of 5-8 shoots per explant were obtained without rooting, which was obtained on half strength MS basal media devoid of growth regulators. In vitro plantlets established well *extra vitrum*, which when transferred into polythene bags, held at a controlled temperature and humidity produced high survival rates. Attempts to conserve the regenerated vitroplants by lowering the incubation temperature, media constituents and osmoticum resulted in development of protocols, which could be used to conserve this species *in vitro*. Intervening sub-culture or transfer frequencies could be considerably reduced, saving time and material resources. Large number of vitroplants could be regenerated, maintained and conserved in a relatively small area, under controlled conditions in an IVAG. The results will be discussed along with the implications of using the protocols for endangered plant species.

Introduction

Decalepis hamiltonii Wight & Arn. commonly known as 'Swallow root' is a monotypic genus belonging to family Asclepiadaceae. This twining shrub is endemic to the rocky forests of peninsular India (Santapau & Henry, 1973). It is largely a wild species whose aromatic roots have been used in the preparation of pickles (Jacob, 1937) and several ayurvedic drugs (WOI, 1952) with out any toxic effects reported in humans. It finds use as a culinary spice due to its highly priced aromatic roots (WOI, 1990). Roots of *D. hamiltonii* are used as a flavouring principle (Murthi & Sheshadri, 1947), appetizer & blood purifier (Jacob, 1937) and preservative (Phadke *et* al, 1994).

Over exploitation of this highly aromatic root by destructive harvesting has endangered the survival of this plant in its wild habitat, hence their dwindling number. Moreover, the absence of any organized cultivation of this plant calls for immediate conservation measures. *D. hamiltonii* is among the red listed species of South India and is recorded as endangered (FRLHT, 2000). Tissue culture mediated conservation is one of the panaceas to this threat.

George *et al.,* (2000) were able to regenerate plantlets of *D. hamiltonii* from leaf callus. George (1998) also reported *D. hamiltonii* to be a potent bioinsecticide at lethal and sub-lethal levels, on storage pests (Indian patent no. 1301/Del/98). Harsh pal *et al.,* (2000) reported the use of silver nitrate ($Ag NO_3$), a potent ethylene action inhibitor, for promoting i*n vitro* rooting in the woody climber. George *et* al. (1999) further reported the super critical extracts of these roots to be a potent antimicrobial agent. Reddy *et al.,* (2001) reported *in vitro* rooting of *D. hamiltonii* using auxin and other root promoting agents.

In the present investigation, an *in vitro* conservation protocol through direct regeneration and slow growth was attempted to conserve this rare species, *D. hamiltonii.*

Materials and Method

D. hamiltonii was collected from the hills of Devarayanadurga, established at the IIHR campus in Field Gene Bank. This was taken as an explant source for initiating cultures *in vitro.* Actively growing shoot apices & nodal meristem were excised and used as explants. Prior to inoculation in the sterile autoclaved Murashige & Skoog (1962) media, these explants were sterilized.

Primary sterilization was the major step in excluding surface dirt, dust & micro flora. This was achieved by washing the plants with tap water (under pressure) for 20 minutes followed by washing the explants with dilute soap solution (1% Cleansol) and finally rinsed with tap water. Secondary sterilization further rendered the explants micro flora & grime free via treatment with 70 % alcohol for 90 seconds followed by mercuric chloride treatment (0.05%) for 8 minutes after which the explants were thoroughly washed with sterile double distilled water 3-4times before inoculation.

The explants were then inoculated on to half strength MS media supplemented with 0.5mg/l BAP and 1.0 mg/l BAP. Cultures were initiated & multiplied using this media under 26+2°C with 18h light/6 h dark photoperiod.

Since rooting was fastidious, half strength MS media devoid of growth regulators was attempted.

In vitro shoots were also relocated to 10°C chamber with reduced light conditions of 2.97 $mm^{-2}s^{-1}$ light intensity ('0'candle watt) to encourage slow growth and intercept frequent subcultures. Rooted cultures were established *extra vitrum* on 'Soilrite' in polybags under glasshouse conditions.

Table-1. Explant response to different media compositions

Sl.No.	Media	No. of Shoots	Presence of callus	Presence of rooting	Sub-culture frequency per month
1.	MS BASAL	2	+	-	2 / month
2.	½ MS BASAL	2	-	-	2 / month
3.	½ MS+2BAP+0.1 NAA (mg/L)	1	+ + + + +	-	2 / month
4.	½ MS+1BAP +0.1 NAA (mg/L)	1	+ + +	-	2 / month
5.	½ MS+0.5BAP(mg/L)	6-8	-	-	2 / month
6.	½ MS+1.0 BAP(mg/L)	5-6	+	-	2 / month
7.	½ MS+2.0BAP(mg/L)	3	+ +	-	2 / month

+ Presence of callus/roots - Absence of callus/roots

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Table-2. Medium- term storage of D.hamiltonii

Sl. No.	Media Composition	No. of shoot	Presence of Callus	Presence of Rooting	Subculture frequency per month
1.	Basal	2	+	-	1 / 4 months
2.	½ Basal	2	-	-	1 / 4 months
3.	½ MS+0.5 BAP	3	-	-	1 / 4 months
4.	½ MS +1.0 BAP	2	-	-	1 / 4 months

+ Presence of callus/roots - Absence of callus/roots

Results and Discussion

Lower concentrations of the cytokinin BAP (Benzyladeninepurine), was observed to be the most suitable growth regulator, which brought about optional multiplication of 5-8 shoots per explant. Slight callusing was observed at the base, which was excluded during further subcultures. When concentration of BAP was increased to 2mg/l or when auxins were incorporated in combination BAP, callusing became more pronounced. Callus is not desired for *in vitro* conservation, which is reported to cause somaclonal variation (Scowcroft, 1984; Karp, 1994) hence this had to be excluded in further sub cultures. Therefore, half strength MS +0.5 mg/l BAP and half strength MS+1.0mg/l BAP were selected for multiplication. (refer rable-1)

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ENVIRONMENTAL SCIENCES

LEGAL AND POLICY ENVIRONMENT OF WATER RESOURCES MANAGEMENT

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Abstract

In countries with planned economies, natural resources are generally recognized as national property and a network of mutually complementary and sufficiently effective legal and organizational institutions govern their development and management. In India, the Constitution provides the basic framework for protection, utilization and conservation of her natural resources. The objects of this jurisprudence are embodied in the Directive Principles and several other specific Articles of the Constitution. The concept was further followed up by a system of enactments by the Parliament. The statutory instruments were translated into their logical conclusion by the regional Governments and State Legislature, through agencies and institutions set up for the purposes. Water resources by nature, do not honour man-made political boundaries and hence are to be husbanded with rigid legal instruments. Water as we see, is increasingly emerging as a point for international, national and regional conflicts the world over. Also, projections to the future indicate a tripling of water use by the next thirty years parallel to a doubling of population, as far as India is concerned. And this is to bring in severe shortages of water available for various sectors of its demand. Access to safe drinking water and related health issues loom large before the country. Irrigation for food production is the largest sector as far as water use is concerned in India, and amounts to around ninety per cent of the total water use in the country. The role and rule of Law is of great significance in this regard. This paper attempts to analyse the legal and policy framework existing in India with regard to natural resources management with special reference to water resources.

Introduction

1. Indian Legacy in Water Resources Management: The evolutionary path of human civilization through the pre-historic millennia has been strongly controlled by a few technological innovations that had had happened from time to time. The evolution of the knowledge to manage the water resources for producing food was perhaps the most prominent among them[1]. This is remarkably corroborated by the findings from the Neolithic sites along the banks of the Tigris and Euphrates rivers in Iran, Iraq and Jordan, the locations considered to be where the earliest Mesopotamian civilization originated and flourished during the period from 6500 BC to 7000 BC. These sites still bear the marks of the civilization, which had evolved better ideas and techniques regarding natural resources management, especially the river water resources development and management. In the Indian subcontinent, evidence to river channel training and water development dates back to the Chalcolithic period (3000 – 1000 BC). The ruins of the once prosperous Indus Valley civilizations of Harappa, Mohenjodaro (now in the Sindh Province of Pakistan), Lothal (in Gujarat) and Inamgaon (in Maharashtra), indicate a rich past when the water management technology was cleverly practised with the main objective of food security.

In India, a strong system for water resources management evolved over the later centuries.

During the *Mauryan* Era (600 to 200 BC), the canal system of irrigation was extensively practised. *Arthasastra* written during the period gives extensive references as to how the irrigation water distribution systems was managed effectively using an organizational set up supported by effective rules and regulations providing for a user tax system. The Southern India presents quite a different scenario where the irrigation systems were dependent on systems of tanks and ponds. The villages evolved their own systems for local management of irrigation water based on location specific distribution schedule. It has been noted that there is a marked difference between the North and South Indian systems of water management in the sense that the latter always were mainly based on people's participation with tolerant patronage from the Kings, while the former was generally owned and operated by a central authority in the form of the Emperors and Sultans. The South Indian rulers of the *Pandya*, *Chera* (100 to 300 AD), *Pallava* (early 6th Century AD), and *Chola* (985 to 1205 AD) dynasties remarkably encouraged irrigation and agriculture in South India, mainly based on tanks and ponds, as indicated above. However, during the 19th century which ushered in an era of colonization by the Europeans, the impetus shifted to canal irrigation connected to large-scale water resources development projects comprising huge structures and extensive impoundments. Also, a strong centralized system for irrigation management was brought into place, which was particularly concerned with collecting revenue for the colonial rulers. The latter almost completely replaced the thereto-existed system of community-managed irrigation development and distribution systems which were closely intertwined with the pastoral culture of the Indian villages. The water management framework introduced by the colonial rulers still exists in India, apparently immune to major paradigm shifts, even after the Independence[1]. It should also be noted that the Indian achievement in the irrigation development and food production, since the Independence in 1947, is something unparalleled in the history of agriculture anywhere else in the world: now the country has become self sufficient as far as food production is concerned. The success story owes much to the water resources development projects commissioned during the post-Independence decades.

2. Water Resources Management In India-Basic Issues: Although the country has made great strides in the field of food production, water resources planning is gaining greater significance and relevance in India, as the requirement pattern of water does not bear a direct relationship with its spatial and temporal availability. Studied projections[2] of the current state of affairs with regard to demand for food, power and protected drinking water consistently indicate a future scenario wherein the pressure on the freshwater resources accessible is bound to increase. Many of our present efforts in the filed of water resources management are aimed at synchronizing the demand with availability. This underlines the need for formulation and implementation of integrated land and water management policy frameworks so as to put these critical resources to their best and sustainable use. As the pressure on the available freshwater resources increases, a re-prioritization of the present water use regime may be rendered inevitable ultimately leading to a fall in the food production and accessibility to safe drinking water. Other issues such as floods and droughts, environmental degradation, reservoir siltation, coupled with groundwater pollution and aquifer depletion are also to be addressed[3]. This paper discusses some of the basic tenets of this developmental paradigm with reference to the Indian legal and policy environment governing the water resources management sector.

3. Water Resources Management - Legal and Policy Background: The above discussion essentially underscores the fact that management of water resources has two major components viz., (a) ***Management of Quality***, and, (b) ***Management of Consumption***. The

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former is obviously, synonymous with pollution management; while, the latter is concerned with storage and distribution of water for various purposes. The character of the legal framework is mainly protective in nature with the objective of conservation of the quality of the naturally occurring water in its various natural manifestations. The law also ensures a reasonable amount of freedom for its use by the society. Policy framework, on the other hand, mainly concerns itself with suggesting the best ways for management of storage and distribution of water as a natural resource for the welfare of the society, the state and the country in general. We shall discuss these aspects at some length in the following sections.

3.1. Management of Quality-Present Legal Framework: Management of water quality is concerned with quality aspects of not only water but also the environment in which the water exists on the Earth in a specific hydrologic phase. In this context, it may be mentioned that India has a long history of jurisprudence with a string of specific enactments such as *The Indian Penal Code of 1860, The Criminal Procedure Code, The Bengal Smoke Nuisance Act of 1905, The Indian Motor Vehicle Act, The Factories Act, The Indian Forest Act, The Mines and Minerals (Regulation and Development) Act, The Industries (Development and Regulation) Act, The Forest (Conservation) Act, The Merchant Shipping Act* etc. The major objective of these legislation was to provide necessary legal back up for protecting the quality of water in its natural environment in particular, and that of the environment in general. *The Indian Penal Code of 1860* provides for proceeding against persons responsible for causing defilement of water of a public spring or reservoir. *The Indian Forest Act of 1927* granted the government uncontested rights over natural resources discriminating against personal interference. *The Factory Act* is concerned with safe discharge of water and effluents by factories, calling for effective arrangements for disposal at the plant-level so as to avert any public health problem. Also, during the 1950's and early 1960's, several states had taken legal steps for the conservation of water resources at their own level of state legislature. Some of the examples that may be cited are: *The Orissa River Pollution Act of 1953, The Punjab State Tubewell Act of 1954, West Bengal Notification No. 7 Regulation - Control of Water Pollution Act of 1957, Jammu and Kashmir State Canal and Drainage Act of 196,*and *The Maharashtra Water Pollution Prevention Act of 1969.*

After Independence, the fundamental law of the land viz., the Constitution of India, came into existence. This empowers the federal states to take necessary steps to protect and improve the environment, forests and wildlife for safeguarding public health (ref. the *42nd Amendment, 1976)*. The *Directive Principles of State Policy (Article 47)* which requires not only a protectionist stance by the state but also directs the state to seek the improvement of the environment when polluted. This allows the government to impose restrictions on processes and activities related to potentially harmful industries. A significant feature of the *Article 47* is the provision that it *"shall not be enforceable by any court, but it shall be the duty of the State to apply these principles in making laws."* This allows the directive to be a constitutional instrument of guidance for the governments in enactment and enforcement of law with regard to water quality management and environment protection[4].

In addition to the *Directive Principles*, the *Article 253* of the Indian Constitution provides the Central government with sweeping powers to legislate for any part of India with regard to international treaties, covenants and agreements in which our country is one of the signatories. For internal environmental matters, the constitution provides for a distribution of legislative powers between the union, the states and the Union Territories. This was done by the creation of two distinct jurisdictional domains, viz., *Union* and *State* listing various subjects, supported by a *concurrent* list to take care of areas of overlapping interests. The central government can enact a law on any item on the union and

concurrent lists. *Water* comes under the state list, and to legislate on water and water related issues, the *Article 252* requires that, at least two or more state legislatures pass resolutions empowering the Parliament to pass water-related legislation. In the light of the provisions under the *Article 252*, the Indian Parliament passed the country's first major water legislation, viz., *The Water (Pollution and Control) Act of 1974.* This Act was followed by *The Water Cess Act of 1976* which was promulgated to control the water use by the industrial sector. *The Environment (Protection) Act of 1986* completes the trilogy of legislation in India, that function as the watchdog of the environment.

3.1.1. The Water (Prevention and Control of Pollution) Act of 1974: The genesis of the Act relates to the recommendations of the committee constituted by the Ministry of Health, Government of India in 1962. The Act was a major step in the Water quality management as it institutionalized a regulatory agency for controlling water pollution and this marked the first true commitment on the issue by the Indian Parliament. *The Water Act* established the Pollution Control Boards at central government and state government levels. Main responsibilities of the Central Board include coordinating the activities of state boards in pollution control, providing technical assistance to agencies and organizations in pollution control measures and working with state boards to set WQ Standards and WQ Criteria. The state Boards have similar responsibilities, although they also play an important subsidiary role of doing plant-level inspections and monitoring. Plants can be required to provide the state with information on their pollution control technologies, and the state may acquire effluent samples, which are admissible in court. In situations where a state Board believes immediate action is necessary, it has the authority to prevent further discharges, and can also apply to a Judicial Magistrate for a restraining order. It is mandatory that any water consuming industry or enterprise should get the must receive the consent from the state Pollution Control Board.

3.1.2. The Water (Prevention and Control of Pollution) Cess Act of 1977: In consolidating the position of the legal instruments in controlling the pollution, the *Water (Prevention and Control of Pollution) Cess Act of 1977 was enacted.* The Act provided the Central and State Boards (except the State of Jammu & Kashmir), with the authority to levy and collect a tax on industries using water. The Act became inevitable in the light of the fact that fresh water was extensively used by the industrial units to dilute their effluents to bring down the concentration of pollutants therein.

The Air (Prevention and Control of Pollution) Act of 1981 was also an important piece of legislation aimed at environmental pollution management. However, the legal provisions go to help the water quality management efforts as the atmospheric pollutants eventually find their way into the surface water bodies through the rainwater and modify their chemical quality. The acid rains that frequent the highly industrialized European countries and the '*coloured rains*' that happened during 2002 monsoons in a few places in Kerala state, amply illustrates this point.

3.1.3 The Environment (Protection) Act of 1986: The objective of this legislation was to rein in the fast falling environment quality in the country. Under this measure, the central government has the responsibility for specifying standards, laying down procedures and safeguards for handling of hazardous waste, on-site inspections, establishment of laboratories, and collection and dissemination of information. The Department of Environment, Forests and Wildlife, which is within the Ministry of Environment and Forests (MoEF), was designated as the lead agency for administration and enforcement. The bill also sets standards on specific pollutants in specific industrial sectors. The measure provides guidelines for location of industries and mining areas, for permitting and restricting industries in environmentally sensitive areas, coastal zone regulations and environmental impact assessments of

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development projects. Committees convened to conduct EIA's must have disciplines in eco-system and water resource management, air and water pollution control, flora and fauna conservation, land use planning, social sciences, ecology and environmental health.

Another important feature of the legislation is that, for the first time, private citizens were given the right to file cases against polluting industrial units, after giving notice of at least 60 days. Thus, the law seek to extent the powers and responsibilities of the citizen to check the degradation of the environment to which he had only a passive role. It was also an answer to the major complaint that *the Water Act of 1974* prohibited public intervention in pollution issues, a fact which had drawn flak from the general public, especially public interest groups and NGOs.

3.2 Management of Consumption: Policy Initiatives

3.2.1 National Water Policy of 1987: The development of water resources and their distribution amongst various user sectors comprises this component of the Water resources management viz., Management of Consumption. The latter should be executed in accordance with the guidelines provided by an appropriate policy evolved keeping in perspective the priorities of the country[5]. In India, the *First National Water Policy of 1987* was evolved by the National Water Resources Council (NWRC) set up in 1983, with the Prime Minister as the its Chairman, Union Minister of Water Resources as the Vice-Chairman and concerned Union Ministers, Chief Ministers of States and Administrators/ Lt. Governors of the Union Territories as the Members; Secretary, Ministry of Water Resources was the Secretary of the NWRC. The latter functions as the *apex policy-making body* for the water resources development in India. Also, the activities of NWRC *viz-a-viz* various issues related to the development of water resources of the country as well as the progress achieved in the implementation of the National Water Policy (NWP) are being assessed, reviewed and reported to the NWRC from time to time, by another setup viz., the National Water Board (NWB).

3.2.2 National Water Policy of 2002: Evaluation of the First NWP and the activities related to its implementation led to the revised NWP or the *Second National Water Policy of 2002*. The basic consideration of the NWP may be described in brief as maximizing availability of water resources for different purposes by implementing various programmes for conservation and by maximizing retention and minimizing losses. Programmes should also be initiated 'for maintaining ecological balance and for economic and developmental activities of all kinds, and considering its increasing scarcity, the planning and management of this resource and its optimal, economical and equitable use'[7]. The success of the National Water Policy will depend entirely on evolving and maintaining a national consensus and commitment to its underlying principles and objectives. The NWP also had suggested that *State-level Water Policies* (SWPs) also should be evolved. Accordingly a few states have come out with respective SWPs in due consideration of the resources status and demand. Kerala State was the first among the states to bring out a SWP in 1992.

In addition to the guidelines set out in the NWP, the Kerala State Water Policy has identified certain thrust areas where the state needs extensive S&T inputs to address its problems in the following sectors in water resources management[8,9],

1. Drought and flash flood management
2. Salinity prevention in coastal wells and rivers
3. Estuary and backwater management
4. Landuse-erosion-sedimentation-infiltration-evaporation relationships
5. Hydropower generation through mini and micro hydel projects, etc.

Modern technologies like Space Remote Sensing offer great promise in collecting vital information on our natural resources including

water, which can greatly improve the basic processes of resources management in the country[10].

4. Inter-State and International Issues: A discussion on this topic is beyond the scope of this paper, and hence it suffices to mention that several agreements and covenants and protocols have been evolved among various countries and under the instance of the United Nations. As issues related to interstate and international river basins and water links are generally highly sensitive, they pose a special set of problems that are to be dealt with within the backdrop of appropriate national/ international agreements and conventions such as *Helsinki Rules* and *Recommendation 51* of UN Convention of Human Environment[11].

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ESTIMATION OF A SAFE LEVEL OF MINING OF RIVER SAND A CASE STUDY IN ERAMALA GRAMA PANCHAYAT

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Abstract

Mining of river sand forms an important income generating activity in about 200 local bodies in Kerala State. Indiscriminate mining of river sand can however lead to several environmental problems associated with slumping of river banks and erosion of river bed. Uncontrolled mining of river sand can also lead to a depletion in the available surface water and groundwater. There is therefore a need to control and regulate mining of river sand. This requires all local bodies to estimate a safe level of mining of river sand from all the sites within their respective jurisdiction from where sand mining is practiced. A rational approach to fulfill this task is presented in this paper. The implementation of the methodology is conveniently achieved through a spread sheet program on windows platform. The utility of the approach is also demonstrated by applying it to the Eramala Grama Panchayat in Kozhikode District which is a typical local body in Kerala State where mining of river sand is practiced. A 6 Km stretch of Mahe river falls within the jurisdiction of this Grama Panhayat and, there are three Kadavus from where mining of river sand is practiced in that stretch. The results indicate that a safe level of mining of river sand from all the three Kaduvus within the Grama Panchayat can be fixed as 20 lorry loads per day for 250 days in a year as against the currently practiced level of 26 lorry loads per day. It is further shown that such a recommendation also protects the socio-economic and developmental needs within the Grama Panchayat adequately well.

Introduction

River sand is a renewable natural resource that forms an important raw material for the construction industry. Consider for instance, Kozhikode District in Kerala State. Preliminary estimates indicate that about 0.4 million lorry loads (each lorry load occupying a volume of 4.0 m^3) of river sand are quarried every year from the river beds in Kerala. Considering that the market value of one lorry load of river sand is about 1,000 rupees, the total value of river sand quarried in Kozhikode District every year is about 40 crores of rupees. Assuming that sand forms about 4.0 per cent of the value of the construction activities in which it is used, it can be inferred that, the quarrying activity of river sand in Kozhikode District supports a construction activity valued at about 1,000 crores of rupees annually.

River sand is quarried from the lower reaches of the river. Consider for example the Kuttiyadi river in Kerala State which has a total length of about 75 Km along its main course. Quarrying of river sand takes place in this river within a stretch of about 30 Km falling between 5 and 35 Km from the river mouth. In Kerala, river sand is first manually scooped from the river bed below the flowing water and collected in a country boat anchored in the river. The sand thus collected is then brought to the river bank and stored in a stacking yard close to the bank. Such sites in the river are locally referred to as 'Kadavus'. The sand thus stacked is finally taken to the construction site in a lorry. A group of 'Kadavus' fall within the jurisdiction of an administrative local body (Grama Panchayat / Municipality / Corporation). These local bodies are empowered to regulate

and control the quarrying of river sand from within their respective jurisdiction.

Till a few years back, the local bodies used to annually auction the quarrying of river sand from all the 'Kadavus' under their jurisdiction. This was probably a very convenient arrangement for the local bodies since there was a one time income from the auction every year and that too a pretty substantial one. However, there were many problems in this type of practice. For example, quarrying of river sand was indiscriminate since the annual demand for river sand was always far greater than its annual replenishment, and the person who had taken the annual contract through the auction was solely interested in maximising his profit with little concern for the health of the river. This resulted in many environmental problems associated with scouring of river bed and slumping of river banks. Uncontrolled quarrying of river sand was also found to lead to a depletion in the available surface water and groundwater. Salinity intrusion in the rivers was also found to advance more and more upstream during the lean flow summer months. In recent years several 'River Protection Committees' have been in the forefront to sensitise these environmental concerns.

Giving due considerations to all the environmental concerns discussed above, the Government of Kerala has formulated and put into practice a number of measures for the control and regulation of quarrying of river sand. Foremost among them is the abolition of the practice of annual auction of river sand. Today, the sale of river sand at the 'Kadavus' by all the concerned local bodies is strictly on a quantitative basis in terms of lorry loads with proper passes issued for each lorry load. Severe fines are also imposed whenever illegal quarrying of river sand is detected. A set of labourers are registered for each 'Kadavu', and only such registered labourers can engage in sand quarrying activities in that particular 'Kadavu'. The permitted quantum of quarrying of river sand from each 'Kadavu' is based on the recommendations of an expert committee consisting of both officials and local level experts. The price of a lorry load of sand which is to be collected at the 'Kadavu', and the manner in which that amount is to be apportioned among wages to labourers engaged in sand quarrying, royalty to the Mining and Geology Department of the Government of Kerala, credit to the River Management Fund and income to the local body are all collectively decided by the local bodies within a District.

A safe level of quarrying of river sand from the 'Kadavus' located along a river can be arrived at only on the basis of a proper understanding of the process of sand generation in the river system, and its transport as bed load material along the river course gained through detailed scientific studies. However, such studies have not yet been carried out for the rivers in Kerala. There is therefore a need to develop a rational approach which is simple to implement and also adequately sound in theory. This paper is an attempt to fulfill such a need.

Methodology

There are a little more than 1,000 local bodies in Kerala. Grama Panchayats form nearly 95 per cent of them. Corporations and Municipalities form the remaining 5 per cent. Quarrying of river sand is practiced in about 100 local bodies, and almost all of them are Grama Panchayats. These local bodies are empowered to control and regulate the quarrying of river sand from all the 'Kadavus' which fall within their respective jurisdiction. A simple methodology which can be employed by these local bodies to periodically fix a safe permissible level of quarrying of river sand (say once a year) is presented here.

The currently permitted quantity of river sand in lorry loads per day that can be quarryied from all the "Kadavus' within the local body is obtained. Sand quarrying is practiced in Kerala for about 250 days in a year. A standard lorry load has a volume of 4.0 m^3. These data are made use of to estimate the annual volume of river sand that is currently extracted.

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Table 1 Information on Current Practice of Quarrying of River Sand

1	Name of Grama Panchayat (GP)		:	**Eramala**			
2	Block in which the GP is located		:	Vadakara			
3	District in which the GP is located		:	Kozhikode			
4	Area of the GP in Sq. Km		:	19.06			
5	Population in Million as per 1991 Census		:	30,050			
6	Current Financial Year		:	**2002 - 03**			
7	1 Lorry Load is equal to	**5.0**	Tonnes and also		**4.0**	Cubic Metres	
8	No. of days river sand is quarried in a year in the GP		:	250			
9	Rate collected at the Kadavus in the GP in Rupees per lorry load of sand					:	**900**
10	The above amount of 900 Rupees is apportioned as,						
11	Wages paid to labourers engaged in sand quarrying				:	600	
12	Royalty paid to the Mining and Geology Department				:	50	
13	Amount retained by the GP to cover administrative expenses related to control and regulation of sand quarrying activities				:	20	
14	Amount credited to the River Management Fund				:	115	
15	Income to GP for undertaking development activities				:	115	
16	Data on sand bed in the Mahe river flowing within the jurisdiction of the GP as obtained from field investigations						
a	Average width of sand bed in metres			:	40		
b	Total length of the river in Kilometres			:	5.00		
c	Stretch where sand quarrying is feasible						
a)	* as a % of the total length of the river			:	50.0		
b)	* in Kilometres			:	2.50		

Sl. No.	Name of Kadavu	Number of Registered labourers Engaged in Quarrying of River Sand	Equivalent Number of Boats Each Having One Lorry load Capacity	Currently Permitted Level of Quarrying of River sand		Average Earning per Labourer in Rupees per Day
				in Tonnes per Day	in Lorry Loads per Day	
1	Kurichikara Kadavu	56	11	90	18	193
2	Kanjhira Kadavu	27	4	30	6	133
3	Thurutimukku Kadavu	10	2	10	2	120
Total for the GP		93	17	**130**	**26**	168

*	Volume of river sand in cubic metres which will be quarried per year from the portion of the river within the jurisdiction of the GP at the currently permitted level of quarrying of river sand		:	**26,000**

The total length of the river flowing within the local body is obtained. Sand quarrying is usually not possible in that full length. For example, there may be stretches where sand is not available because of exposed basement rock or presence of silt and clay. Also, sand quarrying is prohibited close to engineering structures like bridges, intake wells of water supply schemes etc. The full river length within the local body can be traversed, and reasonable estimates of the width of the river and the percentage of the river length from which alone river sand can be extracted are obtained. Wherever two local bodies are situated on either side of the river, only half the width of the river is taken for each of them. This information can be then made use of to estimate the annual average depth of river sand that is extracted currently.

An appraisal of the environmental degradation if any within the area in terms of loss of productive land due to bank erosion, lowering of bed level, reduction in the availability of surface water and groundwater, saline water intrusion etc., is made. Such an appraisal is then used as the basis to arrive at a reasonable estimate of the annual average depth of river sand that can be safely extracted in the future. This estimate can be then made use of to fix for the local body as a whole, a safe quantum of quarrying of river sand for the future in terms of lorry loads per day. The total quantum for the local body as whole can be finally allocated among all the 'Kadavus' based on a weight assigned to each 'Kadavu' with the sum of the weights being equal to unity. Factors like past allocations, infrastructure facilities (boats, stacking yard, access roads etc.) and labour force present can be suitably made use of to arrive at the weight to be assigned to each 'Kadvu'.

The above scheme is very conveniently implemented using a spreadsheet workbook. Two worksheets linked to each other are there in that workbook for each local body. The first worksheet is on the current practice of river sand quarrying and the second one is on the recommended level of quarrying of river sand to be followed in the future. These worksheets are also designed to present other useful information on wages earned by the labour force, royalty received by the Government, income to the local body, credit to the river management fund etc., as a result of adopting the recommended level of quarrying of river sand.

Application to a local body: Eramala Grama Panchayat having a geographic area of 19.06 Km^2 is a typical local body in Kozhikode District of Kerala State. The population in this local body as per the 1991 census was 30,050. A 6.0 Km stretch of the Mahe river forms part of the boundary of this local body. Quarrying of river sand forms a very important activity in this local body and it contributes nearly 30 per cent of the total income. The methodology described in Section 2.0 has been applied to the Eramala Grama Panchayat, and the results are presented in tables 1 and 2.

It can be seen from table 1 that, the current practice of sand quarrying at the rate of 26 lorry loads per day in all the "Kadavus' as a whole will imply an average depth of sand bed extraction of 0.26 metres. A field appraisal of the environmental conditions showed that there has been a loss of productive land due to bank erosion in some stretches of the river. There is therefore a need to reduce the current level of quarrying of river sand. The average earning at present of labourers engaged in sand quarrying activities as seen from table 1 is found to be Rs. 168 per labourer per day. This is not too low, and there is therefore some scope to reduce the current level of quarrying of river sand without adversely affecting the earnings of the labourers. Taking all these factors into consideration, the average annual sand bed reduction for the future was adopted as 0.20 metres in place of the present value of 0.26 metres. The recommended level of sand quarrying arrived at on the basis of the above consideration is shown in table 2. It can be seen from table 2 that, the total recommended level of sand quarrying from all the 'Kadavus' within the Eramala Grama Panchayat is 20 lorry loads per day as against the current practice of 26 lorry loads per day. The

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implications of adopting this recommendation have also been presented in table 2.

Conclusions

A relatively simple methodology that can be employed to arrive at a safe level of quarrying of river sand to be adopted by local bodies in Kerala has been presented. The implementation of the methodology has been very conveniently achieved through a spreadsheet program on windows platform. The practical utility of the methodology has been demonstrated by applying it to the Eramala Grama Panchayat which is a typical local body in Kerala.

The methodology as presented now no doubt fulfills the immediate practical requirements of the local bodies. However, there is a need to refine the methodology in due course after gaining a better understanding of the process of generation of river sand and its movement as bed load material in the rivers of Kerala.

It is to be also clearly understood that, the quarrying of river sand from the rivers of Kerala will have to be significantly curtailed in the future if the environmental condition of the rivers will have to be protected well. This raises two important issues. The first issue is to plan other employment opportunities for the labourers presently engaged in sand quarrying and to train them to take to those jobs. The second issue is to find an alternative to river sand which is acceptable to the construction industry. There is a need to address these two issues with a much greater focus than what is done till now.

Acknowledgement

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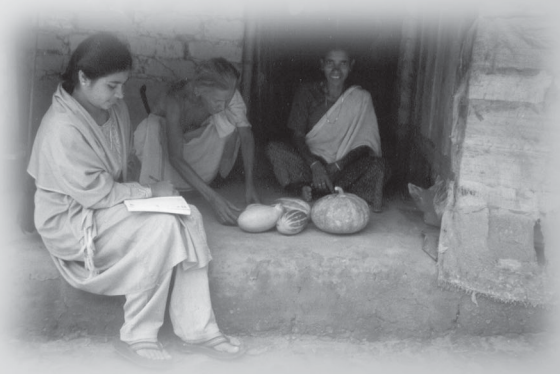

YOUNG SCIENTIST CONTEST

CULTIVATION OF *GLOMUS MICROCARPUM* VAR *MICROCARPUM* IN RI -TDNA TRANSFORMED ROOTS OF *IPOMOEA BATATAS*

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Abstract

Arbuscular Mycorrhizal (AM) symbiosis is the most common example of symbiosis between plant and fungus, which represents 80 % of terrestrial plants. AM fungal hyphae absorb nutrients like phosphorus and micronutrients such as copper and zinc from soil and share it with the host plant and in return the fungi gets carbohydrates and necessary growth factors from the plants. This association benefits the plants in many ways such as increase in overall fitness of the plants, uptake of minerals from soil, overcoming drought stress and resistance against infectious pathogens.

AM fungi is an obligate biotroph and this character makes it difficult to grow in synthetic media. Many attempts were made to grow these fungi in hairy roots to develop monoxenic culture of AM fungi, we were successful in raising hairy roots of *Ipomoea batatas* (sweet potato) using *Agrobacterium rhizogenes* ATCC 15834 strain. The roots were grown in modified Murashige and Skoog (1962) media under controlled conditions. Growth conditions such as light, pH and temperature were optimized for better hairy root production. Spores of *Glomus microcarpum* var *microcarpum* were isolated from pot cultures and the surface sterilized spores were used for infecting the hairy roots of *Ipomoea batatas*. Co culturing was performed and various stages of process of infection such as initiation infection, formation of vesicles and arbuscules were studied.

Introduction

AM fungi colonize or infect the fine roots of plant and extend thread like feeding structures called hyphae into the soil and absorbs inaccessible nutrients primarily phosphorus and transports them to the plant roots. This fungus produces extra cellular enzymes that break down organic matter enabling the plant to assimilate nutrients mineralized from organic compounds. These nutrients have a prominent role in increasing plant uptake of phosphorus and other poorly mobile nutrients (O' Keafe and Sylvia, 1991).

AM fungi produces highly branched or tree like structures called arbuscules and vesicles within the root cortical cells of many herbaceous and woody plants. Arbuscules are highly branched haustoria-like fungal organs invading the cortical cells, and the plant-derived periarbuscular membrane surrounding them is regarded as the key sites for this bi-directional nutrient exchange.

Monoxenic culture of arbuscular mycorrhizal fungi (AMF) has a great significance, as this biotroph is a good biofertilizer. Monoxenic culture avoids the effect of other rhizosphere microorganisms and this is the most important technique in mycorrhizal research and this leads to the practice of Root Organ Culture (Mosse and Hepper, 1975) for *in vitro* dual culture of mycorrhizal spores. Later many researchers, Mugnier and Mosse (1987), Becard and Fortin (1988) and Declerck *et* al., (1996) used Ri-TDNA transformed roots carrot or tomato (hairy roots) for cultivating mycorrhizal fungi.

Hairy roots are obtained by infecting the plant material with a gram negative soil bacterium called *Agrobacterium rhizogenes*. Root induction is due to the transfer, the integration and the subsequent expression of a portion of bacterial DNA (T-DNA) from a little ring of bacterial DNA named Ri (root inducing) plasmid, to that of the plant cell nucleus and stably integrate with the plant chromosome. In fact this portion of DNA contains the necessary information to change the normal cell growth programme towards the roots production. The process occurs naturally and is called transformation.

Hairy root cultures are of particular interest for the production of high value plant secondary metabolites (Hamil *et* al*.,* 1987) because these cultures are genetically stable, grow rapidly and produce a spectrum and quantity of secondary metabolite similar to that of the parent plant. (Hamil *et al*., 1986). Potty and Pratap Chandran (2001) successfully grown *Glomus microcarpum* var *microcarpum* in Ri-TDNA transformed cassava roots. Chandran and Potty (2002) proved that Hairy Root Technology (HRT) is the best alternative to grow arbuscular mycorrhizal fungi and it can be used for the production of monoxenic inoculum. In this present study we report the growth and cultivation of *Glomus microcarpum* var *microcarpum* in transformed hairy roots of *Ipomoea batatas* and its various growth parameters. This information can lead to large-scale production of low cost high quality of arbuscular mycorrhizal fungal inoculum for agricultural purposes.

Materials and Methods

Tuber crop *Ipomoea batatas* (sweet potato*)* variety S 1010 from germ plasm collection of Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram was chosen for hairy root induction. Stem cuttings were collected and surface sterilized for root induction.

Surface Sterilization of Biological Materials: *Ipomoea* stem cuttings were surface sterilized with 0.1 percent mercuric chloride (0.1 % $HgCl_2$) for 5- 10 minutes and washed with sterile distilled water twice and dipped in 1 percent sodium hypochlorite solution (1 % $NaOcl_3$) for 5 minutes and washed well with sterile distilled water.

Hairy Root Induction: The process of hairy root initiation needs several stages, which include the preparation and maintenance of cultures, standardization of culture media, and various growth parameters.

Bacterial Culture: *Agrobacterium rhizogenes* ATCC 15834 kindly donated by Dr. Usha Mukundan, Head, Department of Plant Biotechnology R.J. College, Mumbai were used for the induction of hairy roots. *Agrobacterium rhizogenes* ATCC 15834 were grown in YEB (Vervliet *et al.,* 1974) broth at 24^0C in shaker at 60 rpm for 12hours. Overnight cultures were used for hairy root infection and cultures were preserved in YEB agar slants at 4 ^{o}C for further studies. The media composition includes Beef Extract – 5 g, Yeast Extract - 1 g, Peptone - 5 g, Sucrose- 5 g, MgSO4 7H2O 0.49 g, Bacto agar – 12 g, Distilled water 1000 ml and pH = 7.2.

Transformation Protocol: Rech *et* al., (1988) proposed this technique. The plant organs such as stem, leaf, hypocotyls segment and cotyledons were punctured with hypodermic needles attached to a syringe containing an overnight culture of A. *rhizogenes.*

Morphological Markers: The morphological marker mainly denotes the morphological characters of hairy roots which when grown on culture media. By analyzing these characters we can conclude the character of root sample. The typical morphological characters of hairy roots are profusion of rapid growth, lateral branching and plagiotropism (negatively geotropic).

Isolation of VAM Fungal Spores: VAM spores were isolated by Wet sieving and decanting method (Gerdemann and Nicolson, 1963).

Sterilization of Fungal Spores: Mycorrhizal spores of *Glomu s microcarpum* var *microcarpum* were surface sterilized according

to Mertz *et al.,* (1979). The spores were kept in a solution containing 2% Chloramine T containing 1-2 drops of Tween 20 for 10 minutes and rinse it with sterile distilled water and repeat treatment with an additional portion of Chloramine T for 10 minutes and rinse it with sterile distilled water. The spores were transferred to sterile solution containing 200 mg/l Streptomycin and 100 mg/l gentamycin and stored this solution at 4°C.

Staining of Mycorrhized Hairy Roots: Mycorrhized hairy roots were stained according to the method of Phillips and Hayman (1970). Collected the roots from the soil and washed it well with tap water and process either fresh or after storing in FAA fixative (formalin 13 ml, glacial acetic acid 5 ml, 50 % (v/v) ethanol, 200 ml). Place the roots in 10 % KOH in test tubes and heated it at 90°C in a water bath for one hour to clear and soften. Rinse roots with water three times on a fine sieve or using a mesh and forceps. Rinsed for about 2 minutes in 2 % (v/v) Hcl. Boil in 0.05% (w/v) trypan blue in lactophenol for 3 minutes. Stand in clear lactophenol to destain. Mounted in lactophenol, lactic acid or 50% (v/v) glycerol for observation under microscope.

Optimization of Factors: The role of factors such as temperature, light and pH were studied for optimum production of hairy roots.

Co - cultivation studies: Surface sterilized mycorrhizal spores were used to infect hairy roots. Nutrient media supports the growths of hairy roots were prepared and poured in petriplates. Fresh transformed roots of approximately 3 to 4 cm long were placed in nutrient media. In order to obtain dual culture of AM fungi in transformed roots, fungal inoculum consisting of sterilized spores along with agar and mycorrhized roots were placed near the transformed roots at a distance of 5 millimetre.

Results and Discussion

Stem cuttings of *Ipomoea batatas* variety S 1010 were surface sterilized using 0.1 % mercuric chloride (0.1 % $HgCl_2$) for 5 – 10 minutes and dipped in 1 percent sodium hypochlorite solution (1 % $NaOcl_3$) for 5 minutes and washed with sterile distilled water and placed in plain MS media.

Overnight cultures of *Agrobacterium rhizogenes* ATCC 15834 were prepared and taken in a sterile syringe and using a hypodermic needle punctures were made on the stem bits and kept it in dark for two days for transformation at 24°C in an incubator.

After 2 days of incubation at dark, the stem bits were taken out and kept in MS media supplemented with 500 mg/liter of Cefataxim to eliminate bacterial growth. Hairy root initiation was observed after 6 to 8 days in certain instances there would be tumour formation followed by root proliferation (Fig.1). The typical morphological characters of hairy roots such as profusion of rapid growth, lateral branching and plagiotropism (negatively geotropic) were seen in these roots. These characters were perfectly matched with the observations made by Hamill *et al.,* (1987).

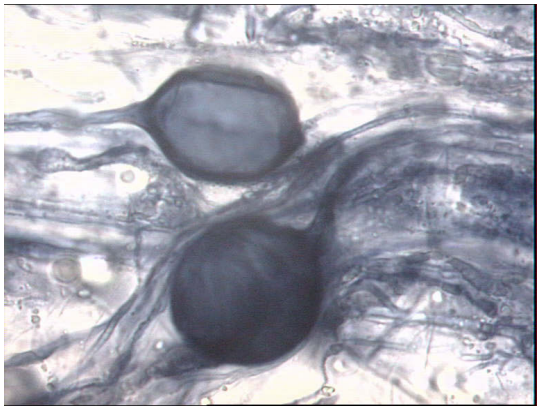

Fig.1. Indicates tumor formation followed by hairy root proliferation

Hairy roots produced were successively transferred in modified MS media with antibiotic in combination with 250 mg/liter of Cefataxim and 250 mg/liter of Ampicillin. Three to four successive transfers were made to get bacteria free hairy roots.

Various strengths of media are tested for optimum production of hairy roots and found

that 1/5 strength of MS media substituted with B5 vitamin (Gamborg *et al.*, 1968) instead of MS vitamins. The other constituents of media are sucrose 15 g/l and Cystein HCl were added to reduce free phenol in the medium. The optimum pH range was between 5.8-6.0 with 16 hours of photoperiod at 24^{0}C.

Co - cultivation experiment was done for growing mycorrhizal fungi in transformed roots. For this purpose 3 to 4 cm long hairy root pieces were kept in above mentioned media plates. Spores isolated from pot cultures were surface sterilized and placed near the hairy root bits and kept it for further incubation. Mycorrhizal infection was begun after 6th day onwards. The different stages of infection such as pre-penetration, penetration, arbuscule/ vesicle formation and colonization were checked in every two days and results were given in table 1.

Table- 1. Observation of different stages of mycorrhizal infection in hairy roots

Days	2	4	6	8	10	12	14	16	18	20
Pre penetration	-	-	+	+	+	+	+	+	+	+
Penetration	-	-	-	+	+	+	+	+	+	+
Vesicle formation (No. of vesicles)	-	-	-	-	+(2)	+(4)	+(5)	+(6)	+(8)	+(9)
Colonization	-	-	-	+	+	+	+	+	+	+

The numbers of vesicles found per microscopic field were counted for five replicates of stained root samples and the average value was taken for each day. The number of vesicles produced during 20 days of study was given in Fig. 2.

Vesicles and intracellular mycelia were found in the cortical region of the roots and this confirms the mycorrhizal colonization in Ri-T - DNA transformed *Ipomoea batatas* hairy roots. The presence of mycorrhizal hyphae and vesicles in stained hairy of *Ipomoea batatas* were shown in figure 3. These results showed similarity with that of Abdul Khaliq and Bagyaraj (2000).

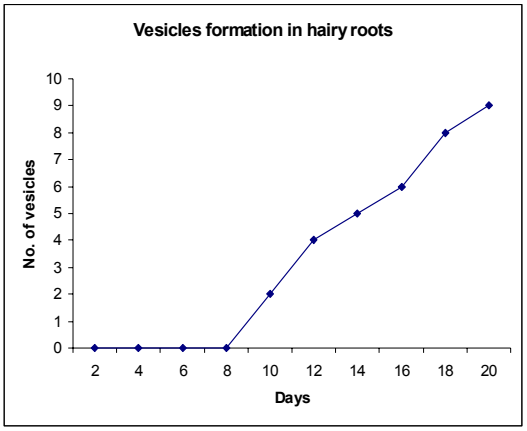

Fig.2. Production of vesicles in hairy roots

The colonization of this AM fungi in Ri - T - DNA transformed roots will be helpful in culturing this fungi in pure culture and may lead to the development of cheaper methods of producing high quality of mycorrhizal inoculum.

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RECALCITRANT POLYCHLORINATED BIPHENYLS (PCBS) FROM SOILS AFFECTED BY TRANSFORMER OIL SPILLS IN TRIVANDRUM CITY, SOUTH INDIA

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Abstract

Specific congeners of Polychlorinated Biphenyls (PCBs) were estimated in seven soil samples collected from the area of electrical substations of Trivandrum City, South India. Sampling locations selected were having transformer installations of 15-25 years old and surrounding environment especially soils were exposed to oil spills for quite long period. In order to quantify the extent of PCBs contamination in the vicinity of those electrical substations, soil samples were collected, air dried, homogenized, extracted, concentrated and analysed for specific PCB congeners 8, 28, 52, 138, 153 and 180 using HRGC-ECD, after sulphuric acid and permanganate cleanup. Analytical result shows high contamination of PCBs in all seven samples collected. PCB congener concentrations determined in the samples were in the range of 0.716 - 256.50ng/g on a dry weight basis. Among 6 congeners targeted, 2,2',5,5'-tetrachlorobiphenyl(PCB52) contamination dominated and found to be significant as PCB52 has been reported to induce DNA strand breaks in mouse cells in vitro and respiration problems in experimental animals.

Introduction

Polychlorinated biphenyls (PCBs) are one of the endocrine disrupting, ubiquitous persistent organic chemicals found in various matrices of the environment (**1-5**). Since they are stable, inert and have excellent dielectric properties and high resistance to fire, PCBs are widely used as insulators, additives in electrical equipments such as transformer, ballasts, capacitors etc. and especially their usage in transformer and capacitor accounts to about 63% of the total commercial uses. Though the production has been stopped and phase out of these chemicals is being implemented across the globe, currently, used electrical equipment disposal sites and leaking of PCB containing oils continue to be anthropogenic sources for PCBs in the environment. PCBs also enter into the atmosphere from high degree heating of transformer oil and spillage contributes much to soil contamination. Through contamination of soils, PCBs moves up in the food chain and bioaccumulate in human and animals. Mostly, it reach human through animals that have access to contaminated soil and herbage and can ingest considerable quantity, especially as they need to forage in soil to obtain their grit. Persistent Organochlorine Chemicals like PCBs tend to accumulate in fatty tissues of animals and human due to their lipophilic nature (**6**). They are not easily digested or excreted but biomagnified if exposed long-term which leads to many problems such as cancer, reproductive and neural. Neurotoxic effects were reported on workers exposed to thermally degraded PCBs. The main risk to human is from repeated exposure resulting in discolouration of skin and special skin condition called chloracne along with eye irritation (**7**).

In the Indian Context, although there have

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been lot of reports on pesticide contamination in soils across the country, there are limited literature available with respect to PCBs in environmental matrices (**8-11**). This paper deals with sampling surveys performed in a large area of the Trivandrum City, South India during June 2002 and shows the most significant findings relevant to the presence and the distribution of PCBs in several soil samples.

Materials and Methods

All reagents including solvents were of analytical and HPLC grades from sigma, USA. Standard PCB congener mix procured from Supelco, USA which contains 10μg/ml of each 2,6-dichlorobiphenyl (PCB8), 2,4,4'-trichlorobiphenyl (PCB28), 2,2', 5,5'-tetrachloro biphenyl (PCB52), 2,2',3,4,4',5'-hexachlorobiphenyl (PCB138), 2,2',4,4',5,5'-hexachlorobiphenyl (PCB153), 2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB180) in isooctane has been used as external standard calibration solution for identification and quantification. Calibration curves and limits of detection were determined by diluting the above stock solution. Quantification of PCBs was carried out using Fissions HRGC 8000 series gas chromatograph fitted with ^{63}Ni ECD. A 60m length and 0.32mm ID fused silica, coated with highly polar cyanosilicone phase, capillary column SP-2331 (Supelco, USA) with helium and helium-argon mixture as carrier and makeup gas respectively was employed for PCB estimation. The oven temperature was programmed as follows: initial temperature 50^{o}C held for 2 min, increased by 4^{o}C/min to 280^{o}C, and held for 10 min. The temperature of injector and detector were set to 300^{o}C and 350^{o}C, respectively. A 2ml sample was injected to the chromatograph with split less injection. Data acquisition was accomplished through a Shimadzu Chromatopac C-R3A. Blank analysis showed no interference peaks with the individual PCB congener analysis.

Description of the study area: Trivandrum, a South Indian city with an area of 75 km^2 lying on the Southwest coast, is the capital to the state of Kerala. The city extends from latitude 8°29'N to 76°59'E. Though there are many transformer installations across the city, sampling has been carried out at the vicinity of older and comparatively higher capacity transformers and sampling locations are marked in the map (Fig.1). This survey is to show that a range of concentrations of PCBs can be expected in soils due to transformer oil spill and to provide useful background data.

Sample extraction: The analytical procedure for PCBs in soil is described in detail elsewhere and briefly described here. 10g soil sample was weighed, thoroughly mixed and ground with anhydrous sodium sulphate to flowing powder. Soxhlet extractor was used to extract PCBs from the samples with 250-ml hexane and acetone 1:1 v/v for 16 hours. The combined extract was concentrated to approximately 3 ml by K.D. concentrator with a three-ball Snyder column on a steam bath. Details of analytical procedures have been reported elsewhere **(12)**.

Clean up: The extract was shaken with concentrated H_2SO_4 in a test tube, after centrifugation the acid layer was discarded. This treatment was repeated several times until the hexane layer was clean. The hexane layer was washed with 2% NaCl aqueous solution, dried with anhydrous sodium sulphate and then concentrated to approximately 1ml for column chromatographic clean up. Alumina Al_2O_3-Ag 10% silver nitrate modified silica gel column chromatography separation was used in the second clean up step. The column, 300mm length and 10 mm i.d. glass column with Teflon stopcock, was packed with 8g basic alumina deactivated by 2% water and 5g silica gel 10% $AgNO_3$, with 1g anhydrous Na_2SO_4 placed at the top. After the sample was introduced, the column was eluted with hexane. The first 120-ml hexane fraction was collected and concentrated to 0.2 ml for gas chromatographic analysis.

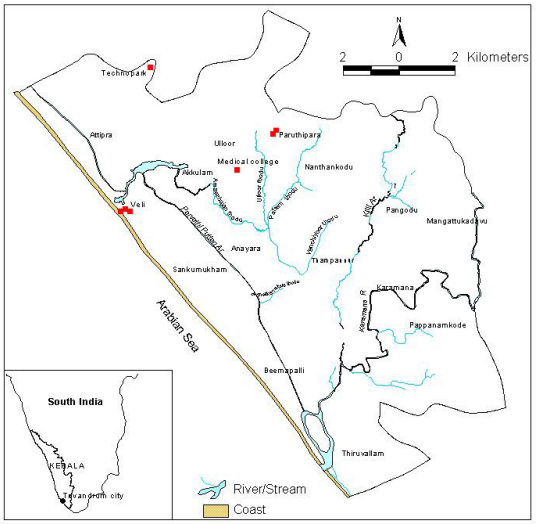

Fig.1. Map of sampling locations across Trivandrum at which soil samples were collected

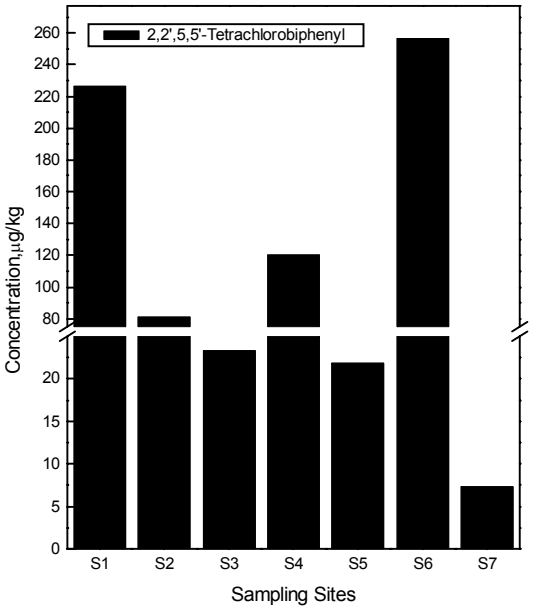

Fig.2. Distribution of PCBs Across theTransformer oil Spilled Area Fig.3. Distribution of 2,2',5,5'-tetrachlorobiphenyl in selected sites

Results and Discussion

Congeners specific analysis of soil samples collected across the Trivandrum city, South India were carried out as described in the previous section. Ultra trace levels of PCB congeners were present in all samples and the distribution levels found to vary greatly with the age and background locations of the transformers (Fig. 2). Contamination levels are expressed as ng/g in table 1. Among six congeners targeted, four were present. The concentrations of 2,2',5,5'-tetrachlorobiphenyl congener in most of the samples were very high and above the permissible limit (Fig. 3).

The field trials at various sites have demonstrated that the oil spill from the transformers has contaminated the soils and introduced Polychlorinated biphenyl (PCB) congeners into it and then to the environment. This survey has also shows that a range of concentrations of PCBs can be expected in near by environment such as soil, river, lake, sea etc. Even small droplets of PCBs trapped in soils can contaminate a large volume of water through run-off. Though the usage of PCB containing transformer oil has been banned

Table- 1. Levels of PCBs in Soils Collected from Various Transformer Oil Contaminated Sites (ng/g).

Chlorinated biphenyls	S1	S2	S3	S4	S5	S6	S7
2,6-dichlorobiphenyl (PCB-8)	-	-	-	-	-	-	-
2,4,4'-trichlorobiphenyl (PCB-28)	-	-	-	-	-	-	-
2,2',5,5'-tetrachloro biphenyl (PCB-52)	226.19	80.98	23.28	120.2	21.82	256.50	7.34
2,2',3,4,4',5'-hexachlorobiphenyl (PCB-138)	0.716	-	-	-	4.60	-	-
2,2',4,4',5,5'-hexachlorobiphenyl(PCB-153)	-	1.84	-	4.13	-	4.41	-
2,2',3,4,4',5,5'-heptachlorobipbenyl (PCB-180)	1.98	1.25	-	-	5.97	3.15	-

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in India, age old transformer installations with PCB containing oils are expected to contribute PCBs to the surrounding environment through oil spill. The results obtained are evident of the above observations.

Acknowledgement

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BRYOPHYTE DIVERSITY OF WAYANAD DISTRICT, KERALA
A PRELIMINARY REPORT

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Abstract

A preliminary checklist of the bryophytes of Wayanad consisting of 99 species including 72 mosses, 25 liverworts and 2 hornworts is presented.

Introduction

The Wayanad district of Kerala, situated in the Western Ghats of Kerala is well-known for its rich biodiversity and various vegetation types ranging from West coast tropical wet evergreen, West coast tropical semi-evergreen, Southern tropical moist deciduous, Southern montane wet grasslands to Paddy fields and Plantations. The vascular flora of the area was subjected to detailed explorations by many botanists, though a comprehensive flora of Wayanad is still lacking. However, the non-vascular plants, including bryophytes were not subjected to detailed documentation.

Eventhough the congenial climate and varying habitat availability largely support rich bryophyte diversity, the documentation for this group from Wayanad is very poor. Except for a few records, the literature on the bryological wealth of the area is scanty. Asthana *et al.,* (1995) in their well illustrated morpho-taxonomic account of the genus *Cheilolejeunea* reported two species *viz., C. serpentina* (Mitt.) Mizut. and *C. imbricata* (Nees) Hatt. from the Lakkidi of Wayanad district. Nath and Asthana (1998) recorded *Frullania squarrosa* (R.Bl. & Nees) Dum., from Wayanad. Awasthi *et al.* 2000 recorded 3 species of *Lopholejeunea viz., L. abortiva* (Mitt.) Steph., *L. indica* Udar & Awasthi, *L. sikkimensis* Steph. and *L. subfusca* (Nees) Steph. from the Lakkidi.

Our recent bryological explorations in the Kerala State yielded many interesting finds (Nair and Madhusoodanan, 2001; Madhusoodanan and Nair, 2003; Madhusoodanan *et al.,* in press). One among which, *Ricciocarpus natans* (L.) Corda from the Tholpetty range of Wayanad Wildlife Sanctuary turned as a new record for South India (Madhusoodanan and Nair, 2003).

The Area

Wayanad is situated in the northern part of Southern Western Ghats and falls within the Nilgiri Biosphere Reserve (NBR). The area lies between north latitudes $11^0$40' and $12^0$40' and east longitudes $75^0$5' and $76^0$10'. A major part of the boundary of the study area, on the north east and east is shared by Karnataka and Tamil Nadu states respectively. The northern part of the area is bordered by Aralam Wildlife Sanctuary and Kottiyur range of Kannur district. The west is bordered by Thamarassery and Peruvannamuzhi of Kozhikode district. The southern part is continuous with Kuttiady range and Vazhikadavu of Kozhikode and Malappuram district respectively. The forest area in the tract is divided into Wayanad Wildlife Sanctuary and Reserved forests.

The total extent of the Wayanad Wildlife Sanctuary is 344.44 km^2 and is divided into two discontinuous portions with revenue lands in between. The north west portion of the sanctuary has one range *viz.*, Tholpetty

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(between $11^0$50' and between $11^0$59 N and $76^0$2' and $76^0$7 E) and having an area of 77.67 km^2. This range is contiguous to Rajiv Gandhi National Park in Nagarhole of Karnataka State in the northeast, Kakkenkotte Reserved Forest in the north and Brahmagiri Hills of North Wayanad Division in the east. The southern portion of the sanctuary (between $11^0$35' and $11^0$49' N and $76^0$13' and between $76^0$27' E) consists of three ranges *viz*., Kurichiad, Bathery and Muthanga.

The Reserved forest is under two administrative divisions *viz*., Wayanad north and south divisions. North divisions constitute Mananthavady, Periya and Begur ranges; south forms Kalpetta, Chedaleth and Meppadi ranges. The area of Reserved forest falls between north latitudes $11^0$40' and $12^0$40' and east longitudes $75^0$5' and $76^0$10'.

The altitude of the reserved forest ranges from 50 m to 1,792 m above sea level and the highest peak is the Brahmagiri in Tirunelli Reserve. In the Wildlife sanctuary the lowest elevation is 850 m and the highest at the Kurichiad range (1,147 m).

The climate of the Ghat region and the plateau varies greatly and which strongly influence the distribution of the plants. The minimum temperature is 14^0 C during December and the maximum temperature goes upto 31^0 C during March. The average relative humidity range between 60% in January and 88% in June. The southwest monsoon which brings the greater part of the total rain fall bursts normally about the first week of June preceded by a few showers in April and May. The heaviest rainfall occurs in July and August. The northeast monsoon brings some rain during October and November.

Bryophytes of Wayanad district

The specimens from the area were collected during 2001-2003 in different seasons. All the materials were processed according to standard techniques and are deposited in the Calicut University Herbarium (CALI).

Here we report 99 species comprising of 72 mosses, 25 liverworts and 2 hornworts. The mosses and leafy liverworts dominate in the area than the thalloid liverworts and hornworts. The most diverse genera in the area include *Bryum* Hedw., *Fissidens* Hedw., *Philonotis* Brid., *Frullania* Raddi., *Cheilolejeunea* (Spruce.) Schiffn. and *Lejeunea* Libert. The most frequent and diverse family in the area is Bryaceae, Meteoriaceae, Lejeuneaceae and Pottiaceae. *Octoblepharum albidum* Hedw., *Calymperes afzelii* Sw., *Trachypus bicolor* Reinw. & Card., *Macromitrium sulcatum* (Hook.) Brid., *Cryptopapillaria fuscescens* (Hook.) A.Jaeger, *Meteoriopsis squarrosa* (Hook.) Fleisch., *Garckea comosa* Doz. & Molk., *Bryum wightii* Mitt., *Heteroscyphus argutus* (R.Bl. & Nees) Nees, *Riccardia multifida* (L.) Gray., *Lopholejeunea subfusca* (Nees) Steph., *Frullania squarrosa* (R.Bl. & Nees) Dum. and *Riccia fluitans* L. are some of the common species in the area.

Checklist of the Bryophytes of Wayanad

Mosses

Bartramiaceae

Philonotis thwaitesii Mitt., *Philonotis hastata* (Duby) Wijk & Margad., *Philonotis secunda* (Dozy & Molk.) Bosch & Sande-Lac., *Philonotis mollis* (Doz. & Molk.) Mitt., *Philonotis fontana* (Hedw.) Brid.

Brachytheciaceae

Eurhynchium vagans (A.Jaeger) Bartr.

Bryaceae

Anomobryum auratum (Mitt.) A.Jaeger, *Bryum coronatum* Schwaegr., *Bryum wightii* Mitt., *Bryum cellulare* Hook., *Bryum argenteum* Hedw., *Bryum pseudotriquetrum* (Hedw.) Schwaegr., *Bryum* sp., *Brachymenium exile* (Dozy & Molk.) Bosch & Sande-Lac., *Rhodobryum giganteum* (Schwstegr.) Par.

Calymperaceae

Calymperes afzelii Sw., *Calymperes erosum* C.Muell.

Cryphaeaceae

Schoenobryum concavifolium (Griff.) Gangulee

Dicranaceae

Leucoloma amoene-virens Mitt., *Campylopus flexuosus* (Hedw.) Brid., *Campylopodium khasianum* (Griff.) Par.

Ditrichaceae

Garckea comosa Doz. & Molk.

Entodontaceae

Entodon flavescens (Hook.) A.Jaeger & Sauerb., *Erythrodontium julaceum* (Schwaegr.) Par.

Fissidentaceae

Fissidens asperisetus Lac., *Fissidens biformis* Mitt., *Fissidens ceylonensis* Doz. & Molk., *Fissidens crenulatus* Mitt., *Fissidens crispulus* Brid., *Fissidens flaccidus* Mitt., *Fissidens maceratus* Mitt., *Fissidens subbryoides* Gangulee

Funariaceae

Funaria hygrometrica Hedw.

Hookeriaceae

Callicostella papillata (Mont.) Mitt.

Hypnaceae

Ectropothecium compressifolium (Mitt.) A.Jaeger, *Ectropothecium sikkimense* (Renauld & Cardot) Renauld & Cardot, *Taxiphyllum taxirameum* (Mitt.) Fleisch., *Vesicularia vesicularis* (Schwagr.) Broth.

Hypopterigiaceae

Hypopterygium tamarisci (Sw.) Brid. ex Muell.

Leucobryaceae

Octoblepharum albidum Hedw., *Leucobryum bowringii* Mitt.

Meteoriaceae

Aerobryum speciosum (Doz. & Molk.) Doz. & Molk., *Cryptopapillaria fuscescens* (Hook.) A.Jaeger, *Floribundaria walkeri* (Renauld & Cardot) Broth., *Meteoriopsis squarrosa* (Hook.) Fleisch., *Meteoriopsis divergens* (Mitt.) Broth., *Papillaria crocea* (Hampe) A.Jaeger

Mniaceae

Mnium rostratum Schrad.

Neckeraceae

Himantocladium plumula (Nees) Fleisch., *Homaliodendron exiguum* (Bosch. & Lac.) Fleisch., *Homaliodendron flabellatum* (Sm.) Fleisch., *Homaliodendron javanicum* (C.Muell) Fleisch., *Neckeropsis fimbriata* (Harv.) Fleisch.

Orthotrichaceae

Macromitrium sulcatum (Hook.) Brid., *Macromitrium assamicum* (Griffith) Mitt., *Macromitrium ferrei* Card. & Ther.

Polytrichaceae

Pogonatum sp.

Pottiaceae

Barbula indica (Hook.) Spreng., *Barbula* sp., *Hydrogonium* sp., *Hymenostylium recurvirostre* (Hedw.) Zant., *Hyophila involuta* (Hook.) A.Jaeger, *Hyophila nymaniana* (Fleisch.) Menzel, *Scopelophila cataractae* (Mitt.) Broth., *Semibarbula orientalis* (Web.) Wilk & Marg.

Pterobryaceae

Garowaglia plicata (Brid.) Bosch & Lac., *Duthiella declinata* (Mitt.) Zant.

Racopilaceae

Racopilum orthocarpum Wils. & Mitt.

Trachypodaceae

Trachypus bicolor Reinw. & Card., *Diaphanodon blandus* (Harvey) Renauld & Cardot.

Thuidiaceae

Herpetineuron toccoae (Sull. & Lesq.) Card., *Thuidium* sp.

Liverworts

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Aytoniaceae

Asterella khasiana (Griff.) Mitt.

Fossombroniaceae

Fossombronia cristula Aust.

Frullaniaceae

Frullania acutiloba Mitt., *Frullania ericoides* Nees, *Frullania squarrosa* (R.Bl. & Nees) Dum., *Frullania muscicola* Steph.

Geocalycaceae

Heteroscyphus argutus (R.Bl. & Nees) Nees, *Heteroscyphus coalitus* (Hook.) Schiffn.

Jungermanniaceae

Jungermannia (*Plectocolea*) *macrocarpa* Steph.

Lejeuneaceae

Cheilolejeunea intertexta (Lindenb.) Steph., *Cheilolejeunea giraldiana* (Mass.) Mizut.,

Cheilolejeunea serpentina (Mitt.) Mizut., *Lejeunea obfusca* Mitt., *Lejeunea tuberculosa* Steph., *Lejeunea discreta* Lindenb., *Lopholejeunea subfusca* (Nees) Steph.

Marchantiaceae

Targionia hypophylla L., *Marchantia linearis* L. & L., *Dumortiera hirsuta* (Sw.) Nees

Rebouliaceae

Reboulia hemispherica (L.) Raddi.

Riccardiaceae

Riccardia multifida (L.) Gray., *Riccardia tenuicostata* Schiffn., *Riccardia levieri* Schiffn.

Ricciaceae

Riccia fluitans L., *Ricciocarpus natans* (L.) Corda

Hornworts

Anthocerotaceae

Anthoceros sp.

Notothylaceae

Notothylas levieri Schiffn. ex Steph.

Conclusion

This paper aims to throw light on the rich bryophyte diversity of Wayanad. The general trend observed was the dominance of mosses and leafy liverworts. Among the enlisted species, 6 species *viz*., *Entodon flavescens* (Hook.) A.Jaeger. & Sauerb., *Eurhynchium vagans* (A.Jaeger) Bartr., *Floribundaria walkerii* (Ren. & Card.) Broth., *Heteroscyphus coalitus* (Hook.) Schiffn., *Marchantia linearis* L. & L. and *Ricciocarpus natans* (L.) Corda are new records for South India and 12 species *viz*., *Aerobryum speciosum* (Doz. & Molk.) Doz. & Molk., *Ectropothecium compressifolium* (Mitt.) A.Jaeger, *Ectropothecium sikkimense* (Renauld & Cardot) Renauld & Cardot, *Hymenostylium recurvirostre* (Hedw.) Zant., *Hyophila nymaniana* (Fleisch.) Menzel, *Jungermannia* (*Plectocolea*) *macrocarpa* Steph., *Lejeunea obfusca* Mitt., *Macromitrium ferrei* Card. & Ther., *Meteoriopsis divergens* (Mitt.) Broth., *Neckeropsis fimbriata* (Harv.) Fleisch., *Papillaria crocea* (Hampe) A.Jaeger and *Schoenobryum concavifolium* (Griff.) Gangulee are new for Kerala. Extensive survey of the area may bring addition to this list. A detailed documentation of the bryophyte diversity is progressing.

Acknowledgements

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DEVELOPMENT OF A COST EFFECTIVE SOLAR DRYER FOR SMALL-SCALE APPLICATIONS

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Abstract

Solar drying is a cheap and hygienic way for drying the agricultural products. It also increases the value of the product thereby fetching the farmers' better price for their products. The solar mini dryer that we have developed consists of a 2m by 1m insulated fiber bed covered with glass. The products to be dried are kept over a wire mesh of 1.2 sq. m fixed on to an aluminum frame. This tray can hold around 10Kg of wet products. The cool air coming from the air inlet at the bottom sides of the dryer is heated when it passes over the collection area of the dryer. This hot air flows towards the outlet at the top of the dryer. The drying area is so placed that the hot air passes through it on its way to the outlet. Thus the products kept in the drying area are always in a stream of hot air. This hot air collects the moisture from the products hence drying them. In order to effectively use the solar radiation we have provided at the outlet an arrangement to control area of the outlet opening. In general the dryer dries the products 1/3 times faster than in open air conventional solar drying. Products could be dried in the dryer even on cloudy days, while the products that were dried in the conventional way were not properly dried and were infected with fungus.

Introduction

Agricultural and other products have been dried by the sun and wind in open air for thousands of years. The purpose is to preserve them for later use as in the case of food or as an integral part of the production process in tobacco or rubber.

In the industrial sector this conventional drying has been replaced by mechanical drying, wherein air is heated using fuel or electricity and blown over the produce to be dried. Mechanical drying is generally faster than conventional drying and also gives a better quality of the product. They also require much less land. But they are costly equipments and require large amount of fuel or electricity. Where feasible, solar drying provides the most cost effective drying technique. They use energy from the sun for heating air which in turn flows (either by natural or forced convection) over the produce to be dried. In addition the heat could be stored for use during cloudy periods or during night hours.

Solar dryer cost much less than mechanical dryers and since they use energy from the sun for heating air are much cheaper to operate.

We report the fabrication of a cheap passive solar

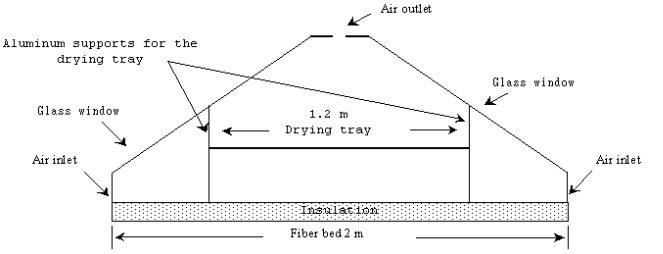

Fig. 1. Schematic diagram of the Solar Mini Dryer developed at Renewable Energy Research Centre, Sacred Heart College, Thevara

dryer, which can be used by a small household or a community for drying about 10 – 15 kg of products like pepper, fish, grains, nutmeg, nutmeg mace, coconut, etc,. Fruits like mango or banana can also be dried by using this dryer.

Methodology

In the present model of the solar dryer, the 'Solar Mini Dryer', the schematic diagram is shown in fig. 1.

The mini dryer consists of a 2m by 1m insulated fiber bed covered with glass. The products to be dried are kept over a wire mesh of 1.2 sq. m fixed on to an aluminium frame. This tray can hold around 10-15 Kg of wet products. The ambient air coming from the air inlet at the bottom sides of the dryer is heated when it passes over the collection area of the dryer. This hot air flows towards the outlet at the top of the dryer. The drying area is so placed that the hot air passes through it on its way to the outlet. Thus, the products kept in the drying area are always in a stream of hot air. This hot air collects the moisture from the products, hence drying them.

The tray for placing the products to be dried can easily slid open and the products loaded. The operation of the dryer requires no special skill and can be operated by a layman easily. The mounting of the dryer too is quite easy, as it need only a flat surface of approximately 2 m^2 at a place where we get sunlight throughout the day. A mason can easily erect four pillars of brick and place over it a concrete slab on which the mini dryer can be installed.

The general features of the products to be dried are

1) High initial moisture content
2) High temperature sensitivity (i.e. color, flavour, texture, nutritional value subject to thermal deterioration)
3) High susceptibility to microbial attack
4) Presence of a 'skin' (eg. Fruits like grapes) which has a poor permeability of water or moisture.

Open air drying or conventional drying is the cheap way of drying. But it requires large area. The conventional drying is generally a slow process. This process is extremely weather dependent. If the temperature drops intermittently then there is a chance for the produce to reabsorb moisture. Also there is a chance for contamination, infestation, microbial attack etc.

There are three major factors affecting the drying process.

1. Temperature
2. Humidity
3. Airflow.

The drying process can be described as follows, when air flows around the product to be dried it will absorb the water from the produce and carry it away. Thus, the faster the airflow, moisture will be removed from the products more quickly. For a given temperature, there is a limit to the moisture air can hold. Table- 1 shows the maximum moisture content of air for a few temperatures. Thus, it is clear that higher the temperature higher is the moisture absorbed by the air.

Table-1. The moisture absorbing capacity of air initially at 20° C and a final relative humidity of 80%.

Initial relative humidity	Moisture absorption capability (Grams of water/m^3 of air)		
	Not heated	Heated to 40° C	Heated to 60° C
40%	4.3	9.2	16.3
60%	1.4	8.2	15.6
80%	0	7.1	14.9

However, there is a limit for increasing the temperature since many properties of the products like nutritional value, color, flovour etc. are adversely affected if we increase the temperature above a certain limit. Usually the ideal maximum temperature for foodstuffs is about 55° C. For optimum drying, initially when the products have higher moisture content we need larger airflow and during the later stages of drying, when the moisture has to be driven out of cells, a higher temperature is desirable.

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In view of the heat consumption we can describe the connective drying process by the relation

$$Q_L = Mc(t_d - t_a) \quad (1)$$

'M' is the mass of the air, 'c' the specific heat capacity and 't_d' is the drying temperature and 't_a' is the ambient temperature.

From the equation-1, for a given input energy, it is clear if we increase the mass flow in the dryer, the drying temperature decreases. While if we decrease the mass flow rate, the drying temperature increases.

In the mini dryer we have an arrangement for adjusting the airflow by adjusting the outlet slit area. Initially the outlet slit is kept wide open, thus maximizing the air flow and later on as the product is dried, the slit is partially closed thereby increasing the temperature in the Mini Dryer.

Since the dryer is fabricated using fibre, aluminum and glass, it requires little maintenance. The only maintenance it needs is the occasional cleaning of the glass covers. The products kept inside the dryer are not contaminated with foreign particles or by animals and birds and need be removed only after the completion of drying process

Results and Discussion

A low cost solar dryer was fabricated for small-scale applications.

The variation of the temperature of the dryer at the drying area is shown in the graph (fig.2)

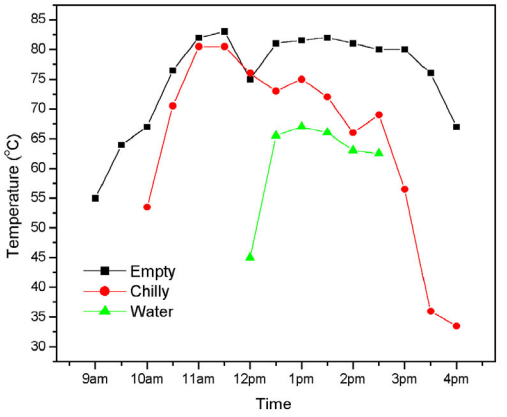

Fig.-2. Variation of the temperature at the center of the dryer with time for different loads.

The time of drying of some materials are given below.

Product	Initial weight (gm)	Final weight (gm)	Time (Hours)
Pepper	300	100	8.5*
Cardamom	500	100	8*
Green Chilly	1650	400	7

*The products were removed from the dryer at evenings and reloaded into the dryer at 9 am the next day. The time calculated is the time when the product was kept in the dryer.

The dryer is a versatile one since we can obtain a high temperature by controlling the area of the outlet slit, up to 82°C was obtained by closing the outlet area completely.

We had baked Rusk in the dryer, which was found to have a better color and taste than those obtained by traditional method.

The dryer can be adapted for larger quantity since larger drying area can be obtained by joining together individual beds. Photovoltaic panel can be used to blow air. Supplementary heating can be provided for industrial use.

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ENVIRONMENT DEGRADATION AND THE POPULATION DECLINE OF BIRD SPECIES IN WAYANAD DISTRICT OF KERALA

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Abstract

The paper presents the results from systematic field study and observations conducted in the Wayanad district for a period ten years. Data was collected by conducting transect walks using Line Transect Method in different selected habitats by direct sightings, conducting interviews with various village communities, tribal leaders, bird watchers. The bird life in Wayanad is facing severe threat of extinction from various actions primarily by human beings especially the habitat destruction, intensive application of pesticides, conversion of wetland paddy ecosystem for Banana cultivation. The changes in the climatic factors also have contributed for the decline of population. Around 30 species of birds including Wayanad Laughing thrush (*Garrulax delesserti*), White bellied blue flycatcher (*Cyornis pallipes*), Malabar Grey hornbill (*Ocyceros griseus*), small sunbird (*Nectarinia minima*), Nilgiri Pipit (*Anthus nighiriensis*), Fairy blue bird (Irena puella puella), seen in Wayanad are facing severe threat of local extinction.

Introduction

The Wayanad district lies along the crust of Western Ghats, one of the endemic Bird Areas (EBA) of India, harbors nearly 300 species of birds. The district is a biodiversity hotspot hosting a wide range of flora and fauna. Wayanad till the beginning of eighties, with its varied forest types, typical valleys called *Vayals* and rich homesteads were a paradise for many rare and endemic birds. But the richness has been gradually declined with the ever-increasing pressure put by the human population. Wayanad has observed the highest rate of decadal human population growth. The forest as well as the natural wetlands and the paddy fields have been gradually cleared and converted for cash crops. This has adversely affected the life of other species. Being a backward district, no systematic records and studies have been conducted in this region to look at the detrimental impact of environmental degradation on other species. The author conducted a study during the last 10 years to critically evaluate the impact of environmental degradation on the bird life of Wayanad.

Topography and background

The Wayanad district of Kerala is situated in north east of Kerala adjoining to Tamilnadu and Karnataka. It lies between 11°27' N and 12°58' N latitudes and 74°52' E and 76°07' E longitudes. Wayanad's geographical area is about 2132 sq km situated at a height of 700 to 2100 M above MSL. Wayanad enjoys very nice weather throughout the year. Total human population of the district stands now slightly above 7 lakhs. 53.6% of the total land area is cultivated under various crops. Wayanad has a wide range of forest habitats (37%), which are the major supporters of its diversified flora and fauna. The annual temperature of the district varies from 10 degree in winter to 34 degrees in summer. It receives an annual rainfall of 3000 mm from both the monsoons.

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Relative humidity varies from 90% to 70% in monsoon and summer respectively. This border world of greener part of Kerala, also a part of 'Nilgiris Biosphere' reserve has its own history, mystery and social epistemologies that are least discovered even in this modern world. Historians are of the view that human settlement existed in the district at least ten centuries before Christ. Countless evidence of the New Stone Age civilization can be seen in the hills of Wayanad. The carvings of the Edakkal caves speak volumes of the bygone life and civilization. Western ghats, one of the important endemic bird areas of the country posses 16 endemic bird species and most of them are also seen in Wayanad. Having three different temperatures and rainfall zones Wayanad district is having diverse vegetation types including rain forest, deiduous forest, shrubs, rocky areas and high altitude shola and grass land ecosystems. Endemic species like Wayanad Laughing thrush, White bellied blue flycatcher, Malabar Grey hornbill, Small sunbird, Nilgiri Pipit but also other birds that are now commonly seen in Wayanad.

Study area and Methods

The study was conducted for a period of eight years from 1992 to 2002 by the author on various habitats of the district. The study areas we selected so as to look at status of birds population in different habitats. It was classified as 12 different habitats based on the preference of ecological niche of certain bird species. The habitats includes Tea plantations, Coffee plantations, Mixed cropping areas, degraded lands, Waterbodies, river basin, Paddy fields, Banana cultivation fields, Arecanut plantations, Homestead lands, back yards and Forested areas. The specific mono-cropping areas were selected to know how many birds are surviving in such landscapes.

Each of these 12 areas was studied for a period eight years. The surveys were conducted using line transect method in the morning and evening hours in three different seasons, summer, monsoon and winter so that the status of migratory birds also could be recorded studied. Apart from the direct field count/ observations, key stakeholders (elder farmers, tribal community members, scientists, birdwatchers) interviews were conducted from the target areas. Any unusual sittings and rare observations were photographed for records. The number of birds seen in each locality were recorded and counted. The time of occurrence and the behaviour and feeding habits were also recorded. The number species of birds seen in each of these habits were observed for the whole period. Average populations of birds seen during the year were record to get the variations in population and diversity. The changes in the pattern of agriculture and land use were recorded in each of these areas.

Results and discussion

Population decline of Wetland Birds: The habitat wise study shows that the wetlands birds, especially that feed from the paddy fields and surrounding are the most affected and there is a strong trend of decline in population and local level extinction of many species is also taking place. The "heronries" which were common in the swampy areas of Wayanad has now reduced to a few small isolated sites. The Lesser Whistling Teals (*Dendrocygna javanica)* one of the resident ducks, were abundant ten years ago in paddy fields of Wayanad. Today it is seen only in the inland lakes of sanctuaries and two other sites that are near to the reservoirs. The thousands of Pond Herons *(Ardeola grayii),* the true indicator of unpolluted paddy fields, have reduced to alarming low levels during the last ten years. The Ruddy Crake *(Porzana fusca)*, once common along the grass-thickets, streamlines and swamps have heavily marginalized. The White-breasted Water-Hen, *(Amaurornis phoenicurus)* the remaining one of the same family is still struggling for survival.

One of the major reasons for the decline of population is the indiscriminate use of pesticides in the rice and banana cultivation. Continous application of pesticides that contains heavy elements like cadmium and mercury in the paddy fields leads to the accumulation of this dreadful elements in the

body of the birds through the intake of affected feeds like small fishes, crabs, slugs etc. When it come to birds of higher levels in the food chain, like raptors, owls and also egrets, it develops into different abnormalities like, laying of shell less eggs, some times, thinner eggshells. The eggs having thinner eggshell cannot be incubated by the birds. This inturn affects the survival of the species. The application of *Thimet*, a pesticide used in the paddy fields has resulted in weakening the flying ability of Catlle Egrettes (*Bubulcus ibis)* in Kaniyambetta Panchayath in 1997. The birds that fed in the fields that were applied with this particular pesticide have observed unable to raise their wings and faced "slow death" with in a period of three days.

Disappearing Owls

The study points to a very dismal picture for most of the land birds. Among the land birds the most critically affected are the owls. Owls perhaps the most beneficial birds for mankind especially for farmers, has now seen only in protected areas of the district. The large Brown Fish owl *(Ketupa Zeylonensis*) once common among the homesteads lands near the paddy fields have almost disappeared from these areas. The Collard Scops Owl (*Otus bakkamoena*) also has become very rare in the homestead lands and cultivations. The terrible calls of Mottled Wood Owl (S*trix ocellata*), which was the source of many superstitious stories in the older times due to its similarity with human sounds, remains now only in the memory of the elderly peoples. Another major species that also being locally extinct due to habitat loss is the Brown Wood Owl (S*trix leptogrammica)*.

The major reason of population fall of Owls is the cutting down of trees that supported their nesting activities. Owls usually make nests in tree holes. The size of the trees and availability of foods within the limits are very crucial for different species to start breeding. Large-scale deforestation process and the ongoing aforestation process have left behind only few eucalyptus, acacias and silver oaks, which are not suitable for many of the birds to make nests and to feed. The loss of natural vegetation from the district has resulted in decline of small birds and snakes that contribute major share of Owls preys.

Table-1. Count of Pond Heron (*Ardiola Grayii*) : Population Status (Average)

Location	1986–90 (avg)	1991-96 (avg)	1997-00 (avg)	2002 (avg)
Karinkutty	260+	35	14	6
Panamaram	214	80+	56	35
Madakkimala	150+	45	28	10
Padinharathara	150+	35	30	27
Thariyode	165	50+	50	20
Muttil	100+	55	38	28
Valliyoorkave	150+	75+	54	44
Kallurvayal		65+	55	35
Kaniyambetta	120+	35	32	27

Table-2. Count of Lesser Whistling Teal (*Dendrocygna Javanica)* at various locations in Wayanad

Location	1986-90 (avg)	1991-96 (avg)	1997-00 (avg)	2002
Karinkutty	25	8	4	0
Panamaram	30	15	12	10
Madakkimala	150	90	84	80
Tholpetti		30	32	25
Thariyodu	45	25	22	15

Table- 3. Sightings of Nest of Baya Weaver (*Ploceus Philippinus*) at various locations

Location	1986-1990	1991-1996	1997-2000	2002
Madakkimala	42	8	4	0
Nadavayal	56	15	12	10
Valliyoorkave	27	14	12	8
Panamaram	38	24	18	12

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Loss of tree diversity and falling breeding success

Earlier farmers used to keep some "dried trees" in their farms as "reserve" firewoods. In fact this has enabled a good source of "feeding grounds" for many woodpeckers, Nuthatches, Barbets etc. Today this practices does nowhere exist. There is hardly any dried branches or dried trees, everything was cut down for meeting the unending greed of human beings and thus the birds perish.

Indiscriminate use of pesticides: The wide scale, intensive pesticide application for the control of viral diseases of arecanut was the major reason of disappearance of Baya weaver. The skillfully woven nest of Baya weaver birds (*Ploceus philippinus)*, locally called as *Thookanam Kuruvi* due to its peculiar nesting pattern, were a common scene under the leaves of tall arecanut palms and bamboo thickets in Wayanad, till the middle of eighties. Today it is hard to find a single nest. The Bayas are also facing food shortage due to the conversion of paddy fields into banana fields.

Pigeons and Doves suffer from removal of large, tall trees: The habitat destruction like cutting down of tall trees has also affected some of the rare species of birds like Wood Pigeons and Emerald Doves. Apart from this is the hunting by some of indigenous communities for food purpose. The worst case is that of **Nilgiri Wood Pigeon** (*Columba elphinstonii*) one of the endemic and **most endangered Birds of Western Ghats**. This pigeon, a large version of our commonly seen Spotted Dove (*Streptopelia chinensis*) was restricted to tall wooded areas and was common in the hilly areas of Wayanad till eighties. Today it is almost extinct in these locations. Other birds in this category that will become soon locally extinct is the Mountain Imperial Pigeon (*Ducula badia*) , a bird that prefers well wooded and forested areas and tall trees.

Dwindling House sparrows

One would definitely wonder that the lists also include the common **House Sparrows**. The population of house sparrows also have dwindled drastically. This may be due to the modernization process of town ships that provides little opportunities for successful nesting and secondly due to regular intake of pesticide-coated grains. The traditional tiled roofs of the shops provided ample opportunities for house sparrows to make nests. Non-availability of grains in the paddy fields and also the nesting materials have contributed negatively for breeding success.

Conclusions

The study points a very bleak prospectus for the avian life in Wayanad. The current paces of destruction of habitats will definitely lead to the extinction of nearly 30 species, not only the endemic species like Wayanad Laughing Thrush(*Garrulax delesserti*), White bellied blue flycatcher(*Cyornis pallipes*), Malabar Grey hornbill (*Ocyceros griseus*), small sunbird (*Nectarinia minima*), Nilgiri Pipit (*Anthus nighiriensis*) but also other birds that are now commonly seen in Wayanad.

Considering the ecological importance of birds in maintaining the delicate balance of rhythms and cycles nature, as seed disbursers, insect controllers, pollinators, birds have to be protected at any cost. A Myna is reported to have brought food including insects, locusts, caterpillars, grasshoppers etc. 370 times in a day. A German ornithologist reported that single pair of Tits destroys annually at least 120 million insect eggs or 150000 caterpillars and pupae. So the service of these "feathered biped could be well imagined.

Since the conventional conservation programmes are mainly focusing on large mammals, little attention is paid for the conservation and protection of threatened Birds and their habitats. Being arboreal, the conservation strategies for birds also should be different from conventional methods. Each individual or farmers even a city dweller can participate in the protection activities of habitat of birds by providing them nesting sites by planting suitable trees in the homesteads, and keeping some of the trees and shrubs untouched during the nesting season. There

should be more public awareness and should be more efforts at the government and at the level of common people to look at this issues seriously. The remaining wetlands has to be protected at any cost if we have to enjoy the sightings of these most loved and beautiful winged friends of mother Earth.

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CONSERVATION AND CHARACTERIZATION OF TRADITIONAL VARIETIES OF LEGUMES AND CUCURBITS IN WAYANAD

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Abstract

In Kerala, Wayanad district is well endowed with plant bio-diversity both in cultivated and wild form, which is intermingled with the cultural diversity of tribes living in this region. Among the tribes, Kurichias have been cultivating traditional cultivars of legumes and cucurbits. Their day-to-day life is associated with growing a traditional crop, which leads to On-farm conservation of these crops. These people would traditionally been utilize the same seeds (or) propagating materials year after year without shifting into an improved varieties. Each Kurichias home premise can be considered as a spot of agro bio-diversity where significant diversity of legumes and cucurbits are observed. Their knowledge on agricultural practices, seed selection, seed storage, plant protection and involvement of gender are appreciable. In order to enhance On-farm conservation of legumes and Cucurbits in Kurichias colonies, under National Agricultural Technology Project on Plant Bio-diversity. 39 varieties were identified as commonly grown in Kurichias belts, these seeds were collected along with their knowledge on traditional agricultural practices and organic method of plant protection measures. These seeds were redistributed into all colonies for regeneration and *in situ* conservation.

However, with the advent of modern varieties and techniques, some of the traditional varieties those are tolerant to biotic and abiotic stresses and suitable for organic farming would either be replaced or lost in future. So, for conserving these traditional varieties the exact identity of the crop plants are paramount important which requires morphological characterisation of the same. Among the 39 varieties identified, 11 varieties of legumes and 18 varieties of Cucurbits were characterised based on the descriptors of National Bureau of Plant Genetic Resources (NBPGR). The data were taken on random plants in replication. The purpose of characterisation is to identify, document, catalogue, exchange and utilize these varieties and revert it if genetic erosion occurs through adoption of improved varieties in future.

Introduction

Wayanad, one of the hotspots of Indian flora in the Western Ghats, has a very rich diversity of traditional vegetables. The main food crops cultivated in the area include paddy, yams, cassava, banana, plantains, various vegetables, coffee and pepper. The genetic resources that have resulted from millennia of evolution cannot be recreated once they are lost and we can only manipulate existing genes to improve our crops (Frankel, 1975). The great importance and value of crop genetic resources in the maintenance of diversity in agricultural production necessitates the involvement of traditional conservation/ cultivation methodologies and techniques for maintenance and sustainable utilization in addition to conservation in gene banks (Jarvis *et* al., 2000). Sustainable conservation is therefore vital to ensure that future generations are not denied this heritage for exploitation in the future. Though Wayanad has the requisite soil conditions for the growth of vegetable cultivation, many crops are very rarely/ occasionally found. The main causes of biodiversity losses are substitution of broad

spectrum with few modern cultivars, replacement of traditional crops by subsidized species, lack of interest of new generation in cultivation, climatic fluctuations, conversion of landscapes and lack of local market outlets.

Although Wayanad houses major tribes of Kerala (Singh. 1994), the Kurichias are advanced in some extent especially growing traditional crops through an organic way of cultivation. Kuruchia tribe lives in colonies and holding large area of agricultural land for cultivation of traditional crops of their selection based on the traits that are satisfying both for cultivation and consumption. Though Kurumas are also following the traditional agricultural practices, some of their methods are primitive and giving more importance to food crops. Every homestead of these tribes was hub of agro-biodiversity and houses considerable number of legumes and cucurbits consumed as vegetables (Table1&2). The diversity of these legumes and cucurbits has given valuable information on plant adaptability and harmonious coexistence with all components of ecosystem. The diversity of legumes especially cowpea group are remarkable in its seed colour, pod colour, pod length and days to maturity. In the case of cucurbits the diversity has been attributed for its fruit shape, size and colour pattern. These attributes are not only useful for the tribes to identify the varieties and also helpful for the breeders to take part in participatory conservation and selection (Arunachalam, 2000).

Conservation of varieties both at On-Farm and Gene Bank alone can't save these noble varieties from the advent of improved and introduced varieties (Prescott-Allen, 1981). Hence, a detailed study and characterisation of these varieties are required to be taken well in advance to conserve and revert these varieties, which have broad genetic base. Since these varieties provides valuable genes, which will be useful for the future breeding programme.

Materials and Methods

Collection and Conservation of Legumes and Cucurbits: A collection of seeds were carried out through exploration trips to various places of Wayanad and collected varieties of Legumes and Cucurbits which said to be traditional and grown mostly in tribal belts. Three colonies of Kurichias were selected based upon their history of conservation of various crop varieties. The collected varieties (Table1&2) were taken sowing during Jan-Feb month when the field is free of other corps. Required quantity of seeds were deposited both at Gene Bank and NBPGR. The selected varieties of Legumes and Cucurbits were sown in the rows with three replication following RBD for morphological characterisation of the same.

Method of Cultivation and Conservation: Good seeds to be sown are selected by giving preference to shape, weight and appearance. All seeds are soaked in water for 12 hours before sowing. The seeds that float on the water are discarded and the seeds that have sunk into the water are used. Before sowing the tip of the seed coat is broken in the case of cucurbits to enhance germination. In the study area, Kurichias remove the soaked seeds of bitter gourd and tie it in a porous cloth and leave it for three days. On the third day the seeds are transferred to the fields. At least 4 -5 seeds are sown on the ridges/ beds/ circles due to their scare of germination of seeds. Seeds of legumes are sown in such a way the hilum of the seed faces the surface of soil. Seeds of cucurbits are placed horizontally on the soil, slightly inserted and covered with a thin layer of soil.

The Kurichias are very careful in selecting their fertilizers. They believe that if chemical fertilizers are applied to their fields, the following paddy crop will not produce good returns and the durability of the vegetables cultivated also get reduced. Generally they store cucumber for 9-10 months by tying it to reapers of the houses or storing it in cool places. They use only organic fertilizers-cow dung (both dried and slurry), ash and excreta of fowls/goats. Once the seeds are sown they spend most of their time in the fields taking care of it, checking for pests, applying manure and fertilizers. Irrespective of age, even children (10-15years) are involved in vegetable cultivation. They make maximum use of their

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lands (around the area where bitter gourd is sown they sow Cowpea, Lady's finger) mixed cropping (Amaranthus inter cropped with cowpea, pumpkin, cucumber) and sustainable harvesting methods. Table-1 (i & ii) reveals the diversity of traditional legumes and cucurbits that are currently preserved and cultivated exclusively by the Kurichias and the Kurumas of Wayanad.

Traditional Methods of Plant protection: Ash was the only pesticide known by the Kurichias and Kurumas during the earlier periods, since during the earlier days pest infestations were very mild. Their access to radio and other media, interactions and communications with agricultural extension workers and other community members has prompted them to try other remedies like using tobacco decoction, cattle's urine, cow dung slurry, asafoetida decoction, tulasi decoction, neem kernel extract as pesticides. Spraying water on the plants at a high speed, application of slightly hot ash in the early mornings is a traditional method of plant control for getting rid of aphids/pests practiced by them. The reason observed for the application of ash in the early mornings is that the ash gets stuck to the water present on the plants thereby preventing the pests from infecting the plant. Frequent monitoring of the fields and checking the pests and killing them is the most frequently followed method of getting rid of pests. Utilization of fruit traps (mango, banana, tulasi) is an excellent method of plant protection that deserves importance in the case of bitter gourd and snake gourd (recently in use). The traps are prepared by using the juice of mango, banana or tulasi. The juice is taken in a coconut shell that is painted yellow and around 1gm (approx) of some poisonous substance is added to it. 3-4 coconut shells containing the juice are tied to the poles of the panthal. The farmers believe that the colour of the coconut shell and the smell of the fruit attract the insects/ pests thereby capturing and killing them. The traps are changed at regular intervals of 4-5 days.

Cucurbits (Cucumber, Pumpkin) are covered with sheath of areca leaves to prevent damage caused by hailstorms. Once the Cucumber, Pumpkin plants starts creeping on the soil/ land, twigs are placed below the plants to enhance creeping. Tender fruits of bitter gourd and snake gourds are wrapped with paper/ plastic bags to get rid of pest/ aphid infections because as they observed pest attack is more severe in tender stage.

Traditional Methods of Storing Seeds/Fruits: It was observed that Kurichias make maximum use of their own lands cultivating a variety of vegetables, very rarely purchasing it from the market. However they exchange seeds within the residents of the colony and with members of the same community. Matured, good and healthy fruits/ seeds are preserved or stored for seeds. Seeds collected from matured fruits are preserved for the next season in either of the following methods.

Legumes: The seeds are removed form the pods mixed with ash and cow dung and stored either in airtight containers, cloth bags, basket, bottle gourd shells, plastic covers and kept near the fireplaces. They feel that ash obtained by burning old mats made of Pandanus provide good results. The seeds are also stored in mud pots that washed with cow's urine. They believe that by doing this pest infection can be controlled.

Cucurbits: The matured fruits are harvested and tied to poles at safe places and left to remain as such. The seeds are removed from the fruit at the time of sowing. The seeds are removed from the fruit, mixed with ash and cow dung and stored either in airtight containers, cloth bags, basket, bottle gourd shells, plastic covers and kept near the fireplaces. The seeds are also stored in mud pots that washed with cow's urine. And also the seeds are removed from the matured fruit mixed with cow dung, dried and stored in the form of cakes. Like that seeds are removed from the fresh fruit and pasted on walls near fireplaces or on walls where sufficient sunlight is available.

Morphological Characterisation of legumes and Cucurbits: This is the basic description work and is considered to be the direct responsibility of the curator. It includes basic

morphological description of accessions (characterization), which may enable any subsequent contamination, or mix-up of accessions to be identified. The extent of this description depends very much on the species in question. A preliminary evaluation work is carried out in the course of rejuvenation of an accession. A well-maintained accession can always be evaluated in another growing season.

When a population is classified into distinct, phenotype classes for a given character, it is discontinuous variation and called as qualitative variation. Such characters are under the control of one or few genes. Such variations can be analyzed by count and ratios like presence and absence of a character etc. When a character shows continuous variation from one end to another, it is called quantitative variation. Many genes with each gene contributing to the total phenotypic variation control such characters. Under qualitative characters, i) plant data, namely plant growth habit, stem shape, leaf lamina shape, ii) inflorescence and fruit data, namely, sex type, flower colour, fruit shape, fruit ridges per fruit, flesh texture etc. and in iii) seed data, such as seediness, seed cavity (small/ medium/ large) are scored using number of checks to determine variation within and among the traits. Quantitative characters, such as plant height, days to 50% flowering, number of fruiting nodes per plant, number of pods per cluster, number of fruits, days to 80% maturity are influenced by environment. These characters are responsible for yield.

The approach to scoring characters for characterization and preliminary evaluation work is a fundamental matter. The developing of descriptor lists has been done much to standardize practices to record data with consequent improvements by the breeders/ curators. There are four types of measurement data, which cover the range of quantitative to qualitative characters. Both interval and ratio scales depend upon real units (e.g., grams, meters) or are derived from them. Ordinal data generally require the construction of a standard scale, frequently on a 0-9 bases, and definition in words and/or diagrams of what each of the scores mean. Here for most of the descriptors only five character states have been described, and for most practical purposes this is probably sufficient. However, wherever justified, the intermediate values were also used. For nominal scales, the scores have no meaning as a number is either absolute or relative terms, but it may be the most convenient way to represent the data.

Results and Discussion:

On-Farm conservation of Legumes and Cucurbits: The following are the varieties depicted in the tables were conserved and characterised. In legumes both seed and pod diversity have been observed along with the differences in seed and pod yield per plant

Table-1. Traditional varieties of Legumes conserved Onfarm and at Gene Bank

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GENDERED KNOWLEDGE AND CHANGING TRENDS IN UTILIZATION OF WILD EDIBLE *GREENS*- A STUDY FROM WESTERN GHATS, INDIA

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Abstract

Often ethnobotanical studies lack evidence about how women and men differ in their relation to plant diversity. This paper describes these differences and trends in the use and management of 'wild' edible greens within and between households pertaining to three ethnic and one migrant community in Wayanad District, an agro-biodiversity hot spot in southern Western Ghats. A total of 362 people were interviewed and 20 key informants were selected from each community to examine multiple uses, preferences, marketing and local availability of edible 'wild' greens, where 102 species were recorded. The paper discusses how gender, ethnicity, age and socio-economic status affect wild green management and household nutritional security. Women are more skillful in managing the surrounding landscape and are main knowledge holders and conservationists. The implications of land use changes, agrochemicals, restrictions on forest access, development impacts and alien species invasion on the availability of wild greens are highlighted. Three conclusions are reached: first, women are taking effective steps to sustainably manage landscapes and species that provide edible greens, but changing trends in gender relations inhibit their efforts. Second, alien species invasion and modern agri-practices lead to local extinction of many greens. Third, the decline of traditional knowledge especially among youth affects the sustainable use of many 'wild' greens.

I. Introduction

The role of gender in enhancing food security has been a major topic of discussion in recent years (Patricia, 2003; Swaminathan, 1998; Leimer, 1993). Many authors have attempted to understand the roles, responsibilities and relations of women and men in collection, processing, cooking, consumption and management of various food species available to them in the wilderness (Kanvinde, 1999). Gender research shows a majority of plant species and varieties used for food and medicine are conserved and managed at household level by women (Patricia, 2003; Balakrishnan, 2003; Gurung, 1997). Women of most tribal communities feed their families with food from the forest or the nearby wilderness in many parts of the tropical world. Through their different activities and resource management practices, men and women have developed different expertise and knowledge regarding the local environment, plant and animal species and their products and uses. These gender-differentiated local knowledge systems play a decisive role in the *in-situ* (in their natural habitat/ecosystem) conservation, management and improvement of genetic resources for food and agriculture. The decision of what to conserve depends on the know-how and perception of what is most useful to the household and local community. The consumption of wild plants seems more common and widespread in food insecure areas, where a diverse kind of species is consumed.

This paper gives information of the management of leafy greens by four different socio-cultural groups- three tribal communities and a heterogeneous non- tribal group from Wayanad district- an agrobiodiversity hot spot in Western Ghats in India. The significant

contributions of rural and tribal families, particularly women, to the conservation, selection and enhancement of biodiversity have by and large remained unrecognized and unsung in this part of India. Also these wild food species are hitherto under-researched. The knowledge and skills of both men and women of these communities in managing various wild edible greens is discussed in this paper. Information on the location and landscapes where such species are seen also is provided. The paper discusses in particular how the gender relations and role differences among these communities affect the management of such diversity and nutritional security at the household level.

II. Study site

Wayanad is a hilly terrain in southern Western Ghats and lies at an altitude of 750 m above sea level. This district (ca.2136 sq. km in size.) contributes significantly to the foreign exchange earnings of the state of Kerala through its cash crops like pepper, cardamom, coffee, tea and other condiments like ginger and turmeric. The name Wayanad is said to be derived from 'Vayal nadu' meaning land (nadu) of paddy fields (vayal). Forest types of tropical wet evergreen, semi-evergreen, dry evergreen, moist deciduous and dry deciduous are seen in this district. The biological diversity of this place is very diverse at all levels-habitat, species and genetic- and with an impressive rate of endemism in flowering plants group. Flowering plants include several Red Data Book Species like *Ipsea malabarica, Hedyotis wayanadensis, Cynometra bourdilloni etc.* The rich diversity in plants has produced large number of plants of immense economic value. Among them are medicinal plants, spices, food plants and ornamental plants. Over 600 species of plants are used in the indigenous system of medicine is known from the district (Kumar, *et.al.,* 2001). A number of cultivated food plants have their wild relatives like *Vigna vexillata, Artocarpus heterophyllus, Dioscorea oppositifolia* and so on in the district. Among spices, black pepper, cardamom, cinnamon and curcuma have their wild relatives largely in wet forests. The district supports a high faunal diversity due to its wide-ranging variations in geographical features and ecosystems. The extensive forested areas and different vegetation types enable the existence of terrestrial, aquatic, and avian fauna. With the clearing of forests, the diverse animal life, characteristic of the forests of Western Ghats, is slowly get vanished from Wayanad.

In a broad sweep classification limited to the purpose of the study, Wayanad district has been broadly divided into two ecological zones - Wet & Dry - based on rainfall, climate and vegetation. The district has a wide variation of climate and season and receives abundant rainfall (ca.3000 mm). The soil resources vary by region and consequently the crops, forest types and natural vegetation. These variations bestow the land with a rich natural endowment of biodiversity. High velocity winds are common during the south-west monsoon while dry winds blow in March-April. High altitude regions are comparatively cooler climate while the mean maximum temperature is 290 C and minimum 180 C.

III. Methodology

The study began in June 2001 and was completed in three phases: The first phase, lasting about two months focused on evolving a methodology for the study. The wild food types, communities, and locations that were to be brought under the ambit of the study were finalised through discussions. Subsequently a work plan, including methods to be followed for data collection and literature survey was arrived at and a field level testing of the methodology followed it. The second phase of the study involved extensive field survey and data collection lasting through all the seasons of one calendar year from August 2001 to July 2002 that has resulted in the information about all wild edible species and materials of Wayanad district. The final phase of approximately two months was spent in analysing the information and validating and exchanging the study findings with key 'knowledge holders' from the communities.

A total of 366 knowledge holders (men, women

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and children) of different age groups were directly interviewed during the study. The data collection attempted to enumerate and categorise the species of the area used as food, the gender dimensions of its management and the level of knowledge difference in terms of age, social status and income. 15 hamlets from 5 sites were selected and the researchers along with the field assistant visited each location, meeting at least 25 families from each socio-cultural group at timings that were convenient to the community, often camping in certain remote locations for a few days. Of the five study sites chosen 4 were selected from the wet zone and one from the dry zone. Preference had been given to wet area because of the greater concentration of tribal communities in this part and its richness in terms of biological resources compared to the other region. From these five sites fifteen locations (hamlets) were selected and in which eleven fell in the wet climatic area and four in the dry part.

The interviews / discussions were carried out either in gender specific groups or in mixed gender groups. The discussions were held in the local language – Malayalam. People who seemed comparatively more knowledgeable from among the group were contacted individually and in-depth interviews were held with them. Separate transect walks were undertaken with men and women of three different age groups viz., above 40, 15 to 40, and below 15, in order to identify the species of food value, management measures, changes in gender relations and its impact on food collection and the management practices. To assess the seasonal availability of different species of wild food the same exercise was repeated in all the four seasons. During these exercises the details of various species of wild food including name, parts used, mode of utilisation, nutritive features, seasonality as well as abundance and rarity according to locations and seasons were recorded. This exercise helped in validating much of the field information on the species used and threw light on the wealth of knowledge and skills the communities had in identifying various taxa, even those that closely resembled each other. For collection of the plant samples, a series of transects were used at random covering various landscapes with in an average radius of 3-5 Km of the habitations in all the 15 locations. Specimens were collected for both herbarium and *ex-situ* germplasm preservation. Detailed information about the availability of different wild greens, people's preferences of one species over another and the gender difference in its collection and processing was gathered over 6 to 8 visits to each site and through in-depth interviews with 20 to 25 key knowledge holders from each socio-cultural group. The relevant information about all the Key knowledge holders was recorded in acknowledgement of their contribution to the study and in recognition of their rights as holders of Traditional Knowledge.

IV. The user socio-cultural groups

The study sought to focus its attention on the wild greens management practices of three prominent tribal communities of Wayand, namely the *Paniyar, Kattunaikkar* and *Kurumar.* The Paniyar are predominantly a landless group working as wage labourers and living close to agricultural landscapes, particularly the paddy fields. Kattunaikkar are traditionally a food-gathering tribe and live close to the forests. The Kurumar are a settled community, living together in joint families and engaged in agriculture. Parallely, a comparative study has also been made of the non-tribal Hindu, Christian and Muslim communities to observe the differences in their approach to and pattern of wild food resources conservation and utilization. Among the non-tribal groups special attention has been given to the Wayanadan Chetty community who live close to forests and follow traditional paddy cultivation.

The study sites at each of these locations were selected at random using a grided map of the district. The relatively greater dependency of the Paniyar community on wild food was reflected in the selection of five Paniyar settlements in the target group. One Kattunaikkar colony from the dry zone and two from the wet zone were included. As lifestyle

and wild resource dependency is uniform among Kurumar, one colony each from the dry and wet zones was selected. Five locations were surveyed in parallel to cover the non-tribal communities selected for this study.

V. Results & discussion

This paper discussed only about the wild edible greens and its management options by the different communities. Wild leaves are among the most widely consumed wild foods of the district. Most of the leafy wild food plants are locally referred to and classified as 'weeds', sprouting and flourishing after rains. Women use them in soups, stews and relishes that add flavor to staples. While some leaves are high in fats, others are high in protein and most are good source of vitamins and minerals. Among the four socio-cultural groups studied, wild and weedy greens form the most regularly used food supplement in the three tribal groups and are of great dietary importance among the Paniya families. The study identified 102 wild edible leaves, but only a few species are widely used. For instance, the Paniya women and children regularly collect only about eight species, the Kuruma and the Kattunaikka tribes zero in on just four such species regularly and others often make do with just three types of wild edible leaves. The household survey revealed that the Paniya families consume about 88 species of leafy greens followed by the Kattunaikka who consume 43 species, the Kuruma about 21 types and the settlers restrict themselves to between 3 and 6 types of leafy greens Most of these species are herbs (90%), and very few are trees (Annexure 1).

V (a). Distribution and consumption

It was found that women play a key role in the collection and processing of wild edible greens. As food providers for the family, they alone, by and large, continue to posses the knowledge related to its usage. An analysis of dependency on various landscapes for collecting these plants shows that wayside and open areas provide the maximum species (28) followed by thickets and forest (20 species), paddy fields and associated ecosystems (18), river and riversides (13) and finally the marshy areas (9). There is a great deal of variation in the wild greens preferred by different communities. This difference was sought to be ascertained by recording the frequency of usage of different wild greens by the different communities. 5 families each from the Paniya, Kattunaikka, Kuruma, Wayanadan Chetty and Muslim communities were selected and the plants used during every week of a particular month quantified. Since most of the leafy greens are specific to the user communities, a monthly calendar was prepared according to the "use pattern". The documentation among the 5 communities was repeated in 3 different seasons: summer, winter and monsoon to get the seasonal variations in the consumption of greens. Analysis of the monthly calendars from different communities shows that some plants are regularly used in all seasons (Paniya 8 species, Kuruma and Kattunaikka 4 species as vegetables). In some hamlets of Paniya, plants like Churuli, Vayalthalu and Ponnamkanni are used almost every day of the week. Species like Mudungachappu, Vellachappu and Mullancheera are used on an average 3 times a week. Based on the frequency of consumption by different socio-cultural groups, these edibles can be broadly classified into three groups' viz. frequently eaten greens, less frequently eaten greens and rarely eaten greens.

Among the frequently eaten greens (4 to 5 times a week) are species like Ponnamkkanni (*Alternanthera sessilis*), Mullencheera (*Amaranthus spinosus*), Kuppacheera (*Amaranthus viridis*) and Mudungachappu (*Solanum nigrum*). The tribal communities studied consume them frequently. Expectedly, these species are available conveniently throughout the season near their habitations and are readily accessible to women and children. One wild species regularly eaten, which is strictly restricted to forest or evergreen bushes is Maracheera *(Embelia tsjeriam–cottam*), but it is consumed only by the Kattunaikka community.

Greens that fall in the category of less

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frequently eaten are used 2-3 times a month based on their abundance, availability and accessible supply. Aliyanchappu, (*Zehenaria mysorensis*), Kattuthakkali (*Passiflora calcarata*), Kallurukki (*Scoparia dulcis*), Maracheera (*Waltheria indica*), Muthil (*Centella asiatica*),. Aalanchappu (*Bidens pilosa),* Kuriyankaya *(Diplocyclos palmatus*) and Kozhuppacheera (*Trianthema portulaccastrum*) fall under this category. Many of these species, except *Bidens pilosa*, *Scoparia dulcis* and *Centella asiatica* do not grow in abundance near the habitations and are mostly found in the hills, often as weeds in the coffee plantations. All the three tribal communities gather these and consume them in combination with other wild food species. For example, Paniya women prefer to cook Muthil (*Centella asiatica*) mixed with Kozhuppacheera (*Trianthema portulaccastrum*) and Kattuthakkali (*Passiflora calcarata*) with crabs or fish. The greens, according to them, tastes better this way than when cooked separately. It is however becoming increasingly difficult to fetch different varieties in a single visit and the practice is now often given a go by. Moreover, some of these greens eg. Kuriyankaya (*Diplocyclos palmatus*) need to be rather laboriously processed to remove the bitter taste and make it palatable, which itself is a deterrent to its frequent consumption.

Greens like Koombichappu (*Adenia hondala*), Kayalkkalli (*Bambusa arundina*cea), Nakkuneety (*Ophioglossum reticulatum)* Kattukaipa (*Momordica dioica* and *Momordica subangulata*) Kozhivalan (*Alternanthera bidentata*) and Vattachappu (*Marselia* sp.) are greatly preferred but their consumption does not match the revealed preference. These species are seen to be not always readily available, not easily accessible and are seasonal. Species like Kattumudunga (*Lycianthes laevis*), Kozhivalan (*Alternanthera bidentata*), Koombichappu (*Adenia hondala)* and Panachithalu (*Cryptocoryne retrospiralis*) are rare in distribution and found only in the hills. The Koombichappu and Kattumudunga are pure forest species and seen only in interior hillocks. Though the dishes made of these are well relished by all the members of Paniya families, their collection is now restricted to the rare forays they make in to the interior forests in search of firewood or honey. But several of the edible leafy species, in fact a large majority of those identified, are seldom consumed, despite their abundance, availability and accessibility. Some of these are Cherukadaladi (*Cyathula prostrata*), Mukkapeera (*Mukia maderaspatana*), Chorakam (*Polygonum glabrum),* Naikkaduku (*Cleome viscosa)* and Brahmichappu (*Bacopa monnieri)*. Each community is aware of these species, but gather them only during emergency conditions. The Paniya families, for instance, know over 60 such species but use them only during times like severe monsoon when there is acute food scarcity.

Some species are gathered specifically for pregnant or lactating mothers for their medicinal properties. All the communities of the study area, however, talked about such species and seemed to know their characteristics, palatability and nutritional benefits. But the values of mainstream society have seeped in enough in to the tribal community and even the famed wild leaf eaters like the Paniyas today consider it below their dignity to be seen gathering these species from the open areas. The women of Paniya community have learnt to use even some of the invasive species like *Bidens pilosa* as greens. This plant is referred to by the non-tribals as “Kandonekkuthy” for its numerous prickly small fruits. However, the Paniya women have named it Alanchappu in deference to it rejuvenating properties. Alanchappu literally means leaves that rejuvenate. It is remarkable that the Paniya women have identified the rejuvenating properties of an invasive plant that the common populace considers but a troublesome weed and are using it as a delicious food supplement.

Compared to the Paniya, the Kattunaikka community use less leafy greens (49 species) and this can partly be attributed to their lower dependency on agricultural and associated landscapes. However, they regularly include several greens in their diet. Marakkeera,

(Embelia tsjeriam-cottam) Maradusoppu (*Capparis* sp.)*,* Kannisoppu, *(Commelina bengalensis)*and Hattakheerai (*Justicia nilgherrensis*) are among the greens regularly consumed by the community. Among the 102 wild greens the study identified, Kattunaikka community exclusively consumed 16 species. Most of these are pure forest species, which are not generally accessed by the Paniya or Kuruma women. Many of these species are highly seasonal and depend heavily on soil moisture for their growth. During summer the Marakkeera and Maradusoppu are available, where as many of the other species sprout only during rainy season. Maradusoppu and Marakkeera are available throughout the year not merely because they are evergreen shrub species but also because their use as leafy green is restricted to these communities, thus ensuring that there is no over exploitation.

Among the three tribal communities studied, the Kuruma women are the least dependent on wild leafy greens for their food requirements. The reasons cited for this reduced dependency range from low preference of the men and children in the family to wild leafy greens in the diet, availability/accessibility/time constraints to perceptions that accessing wild greens for food reduces social prestige. Invariably, in all the Kuruma households, there are home gardens, which are maintained well by women and this may be another reason for their lower dependency on wild greens. The use pattern among the resource poor settled communities like Wayanadan Chetty, mixed communities from the Hindu, Christian and Muslim shows the frequency of use of wild greens is very little compared to the tribal communities. The knowledge about edible wild greens among the settler communities is also much less. The study revealed that while the Wayanadan Chetty, a predominantly an agricultural community knows 14 such greens, the Muslim and Christian communities knew about 12 wild edible greens and the Hindu community knew about 8 of them. Their minimal dependency on wild greens has to do with the fact that they possess fairly well maintained home gardens and their relatively better economic status provides them better market access. A concomitant reason, of course is that it is considered below their social standing to eat wild greens, a habit only associated with the tribal communities! The species diversity in the home gardens maintained by the settler communities, it must be noted, does have a direct bearing on their wild plant dependency. The leaves of many of home garden species are used as greens, the most common being Mathanchappu *(Cucurbita maxima),* Muringayila *(Moringa oleifera),* Kumbalachappu *(Benincasa hispida)* and Payarucahppu *(Vigna anguiculata).* Interestingly, it is found that once in an year, in the heavy monsoon month of Karkidakam, some women of the settler communities do collect some wild greens like Mudungachappu (*Solanum nigrum*), Vankadalady (*Achyranthes aspera*), Thavara (*Cassia tora*), Thalu (*Colocasia esculenta*) etc. for preparing the medicinal gruel '*Karkkidagakanchi*' and '*Noyambukanchi*. This ritualistic/part rejuvenating regimen is now fast dying out, but for some efforts in recent years by the advocates of traditional medicine to revive it. These wild greens are cooked in combination with the home garden species during this month.

V (b). Gender roles in collection, usage and management

Gender roles and responsibilities assigned by the society give women the predominant role in collection and processing of wild greens for consumption. As in the case of other socially signed female roles, this requires patience and is time consuming. Women consider it as their responsibility, and this role does not vary on account of religion, ethnicity or class. For instance, the women of Muslim, Christian, Tribals (hunter- gatherers or settled agriculturists) -all undertake this responsibility. Women perform cent percent of all labour inputs required, from collection to processing and serving. They have knowledge about each and every plant, such as its location, availability, factors influencing palatability, nutritional value and so on. For collection of the greens, women of Paniya community walk considerably long

distance compared to other category of women mentioned in the present study. The Paniya women of Mutharikkunnu colony walk about 2-4 km everyday in search of greens, tubers and firewood. The traditional dressing style of Paniya women is attuned to storing and carrying comfortably the collected foodstuffs from field. Interestingly, it is noticed that young girls of the community, who otherwise have taken to the dress styles of the mainstream communities, drape the traditional dress, often over their modern clothes, when they accompany the older women for wild food collection. At times they are seen using bamboo baskets or areca palm sheath to carry the collected materials.

Compared to the other women, Paniya and Kattunaikka women are more experienced and knowledgeable regarding collection and storage. Moreover, they do not consider it demeaning or lowering their prestige to go for wild collection even in open places like waysides and fallow grounds. Whereas men, especially the Paniya and Kuruma youth and certainly the men-folk of settled communities, look upon wild green collection as beneath their dignity. Exceptions are there - when the tribal men or youth spot a rare but delicious leaf like Nakkuneetti or Koombichappu as they wander through the wild, their hands would reach out. Spotting and bringing home such rare herbs is considered an achievement. Since they travel to more distant places compared to women, their chances of spotting such herbs are more than women, who in general are confined to the domestic domain, particularly in the case of the Kuruma community. Generally though, it is considered that the man's role is to get the staple food like rice or tubers and it is the women's duty to add diversity and flavor by getting the leaves. Since many of the leaves are seasonal, they ensure year round supply of edibles to supplement their diet by zeroing in on commonly available greens endemic to the season - like 'thalu' during Mazhakkalam (rainy season), 'churuli' during Manjukalam (winter) and 'ponnamkkanni' during Venalkalam (summer).

It was noted that some of the wild greens are exploited not only for their leaves but also for other parts like flowers in the case of Koombichappu (*Adenia hondala*), fruits in the case of Katttuthakkali (*Passiflora calcarata*) and petiole, corms and fruits in the case of Karimthalu (*Colocasia esculenta*). Women thus use the resource in a variety of beneficial ways, not restricting themselves to just the commonly used leaves. They adopt various processing methods to make the edibles consumable and palatable. For example, Kattunaikka women use different species of Kattuchena (*Amorphophallus paeonifolius var. paeonifolius*) for the corms, but only after it is washed thoroughly several times in fresh water and then boiled in tamarind water. This takes the 'bite' - an irritating itching sensation in the throat when eaten otherwise - off. Likewise Vayalthalu's *(Colocasia esculenta),* tender petioles are harvested before the leaves unfold and then peeled, boiled in tamarind water and again kept smeared with turmeric powder/paste for a while to remove its irritable raphides. Women patiently do such time consuming chores to make several varieties of wild food edible and tasty. Similarly the pods of Kattupayar *(Mucuna monosperma)*, with its prickly and irritable bristles have to be peeled off and boiled in tamarind water to make it edible.

According to the usefulness of each species, the women adopt various management mechanisms for its conservation and sustainable usage. Paniya women, while collecting the leaves, irrespective of the species, harvest only the required quantity, that too from a larger number of available plants of the species. In case of Vayalthalu and Kollithalu they always pluck the leaves in a manner that a sizable portion of the petiole is left to avoid the corm of the plant from decaying. This is despite the fact that the petiole is itself an important food supplement for them; but it is never harvested in a way that would cause damage to the underground corm. To ensure the long-term availability of some leafy greens like Karimudunga (*Solanum nigrum),* Kuruma

women collect its mature fruits separately and throw them in the near by fields and home gardens, hoping for germination and long term availability. They desist from the use of inorganic fertilizers or chemicals in their agricultural field and do not disturb the fields where wild leafy vegetables grow, in order to ensure the long-term availability of the greens.

V (c). Gendered knowledge on the other uses of wild edible greens

As noted tribal and non-tribal men and women of the study sites use many of the wild food species, especially leafy greens, not just as edibles, but for their therapeutic properties and for rituals. The related knowledge is more confined to the women of the community (Table 6). Among the 30 documented multiple uses of wild food species, uses known to women alone are 14 and to men alone are 3, while knowledge about 13 uses are common to both men and women. The medicinal uses of wild food pertaining to women related problems like white-discharge; abdominal pain during menstrual periods, post delivery related abdominal diseases, skin diseases of newly born babies, etc. are known only to women. Only women possess knowledge related to reproductive health therapy with the aid of wild food and such knowledge is transferred among female members of the family only. Many of the multiple uses known to both men and women are for common diseases like rheumatism, jaundice, breathing problems etc.

Socio-cultural groups like Hindu, Muslim, and Kuruma in the study area use some plants like Thalu (*Colocasia esculenta*), Thakara (*Cassia tora*) as vegetables only during special occasions/periods due to its medicinal property (Paniya use these plants regularly). According to Hindu beliefs, Karkkidakam (July-August) is considered as 'Jeshta masam', which in general is considered a starvation month. People suffer from various diseases and ill health due to heavy rain and winds during this season. Women of these groups take special care to include various wild plants in their diet to increase immunity. There is less dependence on plants from their home gardens during this month since, due to heavy rain and absence of sufficient sunlight, home garden plants tend to get infested with various pests, some of which are highly toxic. During this period some special medicinal dishes like Karkidagakanji are prepared using wild edible plants, many of which have got medicinal properties. 'Muthiyamma' from Puthoorvayal Kuruma colony confided: "during Karkkidakam, plants like thalu (*Colocasia esculenta*) and thakara (*Cassia tora*) are imbued with medicinal properties and regular use of these plants then strengthens the bones and increases disease resistance power of the body". During 'Karkkidakam' these plants are used almost every day. Normally Thavara tastes bitter, but the heavy rains and the attendant vigorous vegetative growth during Karkkidagam seem to reduce the bitterness. Some of the Muslim families of this area still prepare some special medicinal dishes like 'Noyambukanchi' in which they use thalu and thavara along with seeds of jackfruit.

VI. Implications of 'development' on the availability of greens and women

VI (a) Conversion of paddy fields

The paddy fields of Waynad had been a veritable treasure trove of a variety of leafy greens and a host of other wild food, regularly accessed by the tribal communities, especially the Paniya and Kuruma communities. Paddy fields, as they existed nearly two decades ago in Wayanad, provided food, employment and ecological security to the tribals. Apart from greens, a number of other species of high food and health value such as fish, crustaceans like crab and snails, and medicinal plants are associated with this agro-eco system. The tribal communities like Kurichya and Kuruma completely rely on paddy cultivation and this ecosystem for their food security. The Paniya community depends on paddy fields for employment. Women of this community are among the most adept at all tasks related to paddy cultivation and they depend on the wage earnings from it as their principal source of

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income. Paniya women know and use 19 plant species from the paddy fields and its mud bunds. Besides this, a number of rituals and traditions of the Paniya, Kuruma and Kurichya communities are strongly intertwined with this ecosystem. From an ecological view point, the paddy fields situated in the low lying areas of the undulating Wayanad terrain acts as a trough collecting and retaining a large quantity of water that is used by a number of plants and animals (most of them, of direct use to the dependent communities). Conversion of this land for cultivation of perennial crops (or, as is the recent common practice, for banana cultivation) limits the storage capacity of this "sponge" leading to water shortages in nearby wells during dry seasons, and floods during rainy seasons.

The shift in land use from paddy cultivation to the banana crop, with its attendant reduction in the water content of the soil and the high infusion of chemical fertilizers and insecticides, have taken a heavy toll. Many Paniya and Kuruma men and women have complained that these chemicals are directly polluting their drinking water sources. Another very important social and economic repercussion is the loss of employment opportunities of Paniya women, which has forced them to go in search of jobs even to remote places like Coorg, where they often get exploited by contractors. There is a clear need for a more rational and sustainable management of remaining paddy fields in the district, not merely because the production of the staple food of populace is affected, but also because its preservation is inextricably linked to the food supply chain. The availability of greens, fish and crabs and a host of other locally important products and benefits depend on the paddy fields remaining intact.

VI (b) Over application of chemicals

People observed that the unscientific application of chemical pesticides weedicides/ fertilizers etc. in the coffee, tea, cardamom and banana plantations have considerably reduced the population of common edible greens and mushrooms. Paniya women of Mutharikkunnu cited a recent incident where five members of a family had to be hospitalised after consuming greens collected from a banana plantation sprayed with toxic pesticides. The feeling that wild greens may not be safe any more has also reduced its consumption according to these women.

VI (c) Invasion of alien species

All open clearings like waysides, grazing lands, new plantations and the fallow paddy fields are the usual sites for green leaves collection. A variety of alien species that have appeared suddenly and are getting naturalized rapidly now throng these locations. The climate of the district is highly suitable for the fast growth of many of these exotic species. Some of these have replaced the edible greens; for example species such as *Cassia tora*, *Alternanthera sessilis*, *Amaranthus viridis, Amaranthus spinosus, Colocasia esculenta* (Karathalu) etc. are edged out by exotics like *Lantana camera, Parthenium hysterophorus* or *Drymaria cordata* etc. Sizeable areas of Muthanga sanctuary are now infested with *Lantana camera* and *Chromolaena odoratum*- two noxious exotics. They now thrive in the area, which has been clear felled of Eucalyptus plantations. Interestingly, the eucalyptus plantation itself came in to being after pristine natural forests were cleared to plant them as part of the social forestry scheme! *Mikania cordata* is another troublesome weed now found in almost all the forest fringes in the district. People describe the unusual way this species choke and destroy the other plants as "Drudharastralinganam", the vicious embrace of the epic character that crushes the unsuspecting opponents to death. *Mucuna pruriense*, *Parthenium hysterophorus, Bidens pilosa*, several species of *Blumea* are some of the quick growing alien

species, which have proliferated in different habitats in the study area.

Interestingly, some of these alien species, as mentioned earlier, are now included in their collection of greens by the Paniya women. *Bidense pilosa*- ("Alanchappu" as the Paniyas have named it) has turned out to be a delicious

supplement in their food. This species, found as a weed in plantations, is now sought to be controlled by the planters using strong weedicides! The *Bidens pilosa* now flourishes in all the open landscapes, particularly in the human managed ones like the coffee plantations. Among the communities studied only the Paniya women go for this species, but it underscores the fact that the ingenuity of the tribal women is capable of discovering new edible plants to replenish their food basket. It is also an assertion that "traditional knowledge" is dynamic, evolving and ever changing, with both additions and deletions over time.

VII. Conclusion

The study shows though many of the edible greens have multiple uses and medicinal value there is a sharp decline of interest among the present day generation because of various reasons. Women however, still play a major role in the sustainable management of the most commonly used greens, as the household nutritional security becomes their responsibility. They skillfully manage various landscapes and habitats that provide the food and medicinal plants and also they use a leafy green in many ways. Shift to cash economy favouring men, leaving women confined more to household and non-cash tasks. This along with several other socio-economic factors led women's position adversely affected at home and community level. The declining availability of the wild greens leading to declining use of such foods and related drop of women's knowledge. Aggressive alien invasive species and land use changes lead to the displacement or loss of a large number of wild greens. Though some of these invasive species have been controlled to some extent by utilization purpose by women, their rapid spread creates problem for the survival of many native greens. The knowledge gained by women to use and manage in a sustainable manner even such invasive species is a dramatic illustration of the constant evolution of TK.

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Annexure 1. List of wild plants used as greens

Sl.No	Local Name	Botanical Name	User Groups
1	Alanchappu	*Bidens biternata (Lour.) Merr.*	P, Ku, K ,O
2	Aliyanchappu	*Zehneria maysorensis* (Wt.& Arn.) Am.	P, Ku, K
3	Ambal	*Nymphaea nouchali* Burm.f.	P, Ku, K
4	Attanga	*Cucumis porphetarum* L.	P, Ku, K
5	Ayanichakka	*Artocarpus hirsutus* Lamk.	P, Ku, K,O
6	Brahmichappu	*Bacopa monnieri* (L.) Pennell	P, Ku, K
7	Chakka	*Artocarpus heterophyllus* Lamk.	P, Ku, K,O
8	Cheenaparangi	*Capsicum anuam* L.	P, Ku, K,O
9	Cheriyakadaaldi	*Cyathula prostrata* (L.) Bl.	P, Ku, K,O
10	Cherucheera	*Alternanthera bettzickiana.*Br.	P, Ku, K,O
11	Cherukadaladi	*Cyathula prostrata L.*	P, Ku, K,O
12	Chooral	*Dendrocalamus strictus* (Roxb.) Nees	P, Ku, K
13	Choracheera	*Alternanthera dentate* Br.	P, K,O
14	Chorakam	*Polygonum chinense* L.	P, Ku, K
15	Choriyanam	*Laportea interrupta* (L.) Chew.	P, Ku, K,O
16	Chorkam	*Polygonum glabrum L.*	P, Ku, K
17	Churuli	*Diplazium esculentum* (Retz.) Sw.	P, Ku, K,O
18	Eenthukumpu	*Cycas circinalis* L.	P, Ku, K,O
19	Hattakkeerai	*Justicia nilgherrensis (*Nees) T.Anders.	P, Ku, K
20	Hinnisan kaya	*Tamilnadia uliginosa* (Retz.) Tirveng.	P, Ku, K
21	Kadambu	*Barringtonia racemosa* Bl.	P, Ku, K
22	Kadukucheera	*Blumea barbata* DC.	P, Ku, K,O
23	Kaida	*Pandanus fascicularis* Lamk.	P, Ku, K
24	Kalicheera	*Amaranthus viridis var.*	P, Ku, O
25	Kannisoppu	*Commeliina bengalensis L.*	P, Ku, K
26	Kara	*Catunaregam spinosa (*Thunb.) Tir.	P, Ku, K
27	Karimthalu	*Colocasia esculenta* (L.) Schott	P, Ku, K,O
28	Karinkoovalam	*Monochoria vaginalis* Presl.	P, Ku, K
29	Kattucheera	*Amaranthus caudatus.*L.	P, Ku, K,O
30	Kattueenthu	*Phoenix sylvestris* Roxb.	P, Ku, K
31	Kattukaipaka	*Momordica dioica* Roxb.	P, Ku, K,O
32	Kattumandaram	*Bauhinia purpurea* L.	P, Ku, K
33	Kattumudunga	*Lycianthes laevis* (Dunal) Bitter	P, Ku, K

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34	Kattupaval	*Momordica subangulata* Bl.	P, Ku, K
35	Kattupayar	*Canavalia cathartica Thours.*	P, Ku, K
36	Kattupayar	*Mucuna monosperma* DC.	P, Ku, K
37	Kattuthakkali	*Passiflora calcarata* Mast.	P, Ku, K,O
38	Kattuvenda	*Abelmoschus angulosus* Wall.	P, Ku, K,O
39	Kayalkkalli	Bambusa arundinacea Willd.	P, Ku, K,O
40	Kayamachapu	-	P, Ku, K,O
41	Keezharnelli	*Phyllanthus niruri* L.	P, Ku, K,O
42	Kollithalu	*Colocasia esculenta* (L.) Schott	P, Ku, K,O
43	Komaransoppu	-	P, Ku, K
44	Koombichapu	*Adenia hondala* (Gaertn.) de Wilde.	P, Ku, K
45	Koovilisoppu	*Crotalaria laevigata* Lam.	P, Ku, K
46	Kozhimullan	*Hygrophila schulli* Ham.	P, Ku, K,O
47	Kozhivalan	*Achyranthes bidentata* Bl.	P, Ku, K
48	Kozhuppacheera	*Portulaca oleracea* L.	P, Ku, K
49	Kumbil	*Gmelina arborea* Roxb.	P, Ku, K
50	Kundimaruma	*Sonerila rheedei* Wt.	P, Ku, K
51	Kuniyanchappu	*Diplocyclos palmatus* (L.) Jeffrey	P, Ku, K
52	Kunni	*Abrus precatorius* L.	P, Ku, K
53	Kuppacheera	*Amaranthus viridis* L.	P, Ku, K,O
54	Malampuli	*Begonia malabarica* Lamk.	P, Ku, K,O
55	Malampuli	*Begonia integrifolia* Dalz.	P, Ku, K
56	Malampunna	*Dillenia indica* L.	P, Ku, K
57	Malanchuruli	*Dryopteris coculata*	P, Ku, K
58	Malankkeerai	-	P, Ku, K
59	Mancheera	-	P, Ku, K
60	Maracheera	*Waltheria indica L.*	P, Ku, K
61	Marachembu	*Remusatia vivipara* Schott.	P, Ku, K
62	Maradasoppu	*Capparis sp.*	P, Ku, K
63	Marakkeera	*Embelia tsjeriam-cottam* A.DC.	P, Ku, K
64	Minnamkkanni	*Alternanthera pungens* Kunth	P, Ku, K
65	Minugalasoppu	-	P, Ku, K
66	Motampuli	*Physalis minima* L.	P, Ku, K
67	Mudungachappu	*Solanum nigrum* L.	P, Ku, K,O
68	Mukkapeera	*Mukia maderaspatana* (L.) M. Roem.	P, Ku, K
69	Mullancheera	*Amaranthus spinosus* L.	P, Ku, K,O

70	Mullancheera Chuvappu	*Amaranthus spinosus* L.	P, Ku, K,O
71	Murikkinchappu	*Erythrina stricta* Roxb.	P, Ku, K,O
72	Muthilila	*Centella asiatica* (L.) Urban	P, Ku, K,O
73	Muyalcheviyan	*Emilia sonchifolia* (L.) DC.	P, Ku, K
74	Naikkadugu	*Cleome viscosa* L.	P, Ku, K
75	Nakkuneeti	*Ophioglossum reticulatum* L.	P, Ku, K
76	Njetipanakumpu	*Arenga wightii* Griff.	P, Ku, K
77	Noolithali	*Antidesma acidum* Retz.	P, Ku, K
78	Palancheera	*Ceropegia stocksii* Hook.	P, Ku, K,O
79	Palankeera	*Ceropegia metziana* Miq.	P, Ku, K
80	Palcheera	*Euphorbia hirta* L.	P, Ku, K
81	Panamchapu	*Caryota urens* L.	P, Ku, K
82	Panchithalu	*Cryptocoryne spiralis* Fisch.	P, Ku, K
83	Panichisoppu	-	P, Ku, K
84	Parachava	*Dryopteris coculata* J.Sm.	P, Ku, K
85	Parippukkeera	*Chenopodium album L.*	P, Ku, K
86	Paruthiyila	*Hibiscus hispidissimus* Griff.	P, Ku, K,O
87	Poninthavara	*Cassia occidentalis* L.	P, Ku, K
88	Ponnamkkanni	*Alternanthera sessilis* R. Br.	P, Ku, K,O
89	Poola	*Bombax ceiba L.*	P, Ku, K,O
90	Poovarasu	*Thespesia populnea* Soland.	P, Ku, K
91	Puliyarila	*Oxalis corniculata* L.	P, Ku, K,O
92	Sambarcheera	*Talinum cuneifolium* Willd.	P, Ku, K,O
93	Thaivasoppu	*Pteridium aquilinum*	P, Ku, K
94	Thavara	*Cassia tora* L.	P, Ku, K,O
95	Thazhuthama	*Boerhaavia diffusa* L.	P, Ku, K,O
96	Thonachisoppu	-	P, Ku, K
97	Unnithandu	*Costus speciosus* (Koen.) Smith	P, Ku, K
98	Valiyakadaladi	*Achyranthes aspera L.*	P, Ku, K,O
99	Vallimaruma	*Cissus discolor* Bl.	P, Ku, K
100	Vasalachapu	*Basala alba* L.	P, Ku, K,O
101	Vattachappu	***Marselia***	P, Ku, K
102	Vayalthalu	*Colocasia esculenta* (L.) Schott.	P, Ku, K,O

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CROP DIVERSITY ENHANCEMENT AND TRIBAL EMPOWERMENT

CROP DIVERSITY ENHANCEMENT AND TRIBAL EMPOWERMENT

(**Policy Makers' Workshop**, Nov. 6, Parallel Session 1, Chair : Dr. S. Balaravi, M.S. Swaminathan Research Foundation))

Session Chair	: Dr. S. Balaravi
Keynote Speakers	: Dr. Suman Sahai
	Dr. K.K.N. Kurup
Presentations	: Sri. P. Balan
	Sri. G. Girigan
Panel Discussants	: Dr. Indira Balachandran
	Dr. Koshy John
	Dr. P.K. Muraleedharan
	Sri. P. Kesavan
	Sri. Palliyara Raman
	Sri. P.M. Nanda Kumar
Rapporteur	: Dr. Arivudai Nambi

Crop Diversity Conservation, Enhancement and Tribal Empowerment in Kerala

Within the broad area of biodiversity, the emphasis now is on plants, animals and micro-organisms of current and potential economic value. This segment of biodiversity is conveniently called as *Agrobiodiversity*. *Agrobiodiversity* provides humanity all of its food and many medicines, industrial products and a wide range of goods and services, plus genetic materials for agriculture, medicine, and industry. *Agrobiodiversity*, particularly the crop diversity plays a major role in the sustainability of agricultural production and livelihood security of the poor. The tribal men and women have not only conserved such genetic wealth, but have added value to them through selection and information.

Wayanad - an agrobiodiversity rich site is designated as a "hottest biodiversity spot" of hotspot- Western Ghats. The pace of erosion is alarmingly high in all spheres of biodiversity, especially the agricultural- both genetic and landscape diversity -in the district. The shift in cropping pattern from subsistence to mono cropping has led the fast erosion of crop diversity. The plant genetic resource has undergone a rapid declining with the introduction of modern varieties. The change in land use pattern is one of the major reasons that led the erosion of agrobiodiversity. A Study by MSSRF (2002) shows the Paniya tribal women and men in Wayanad know about 265 different species of wild food and many of such foods have been collected from a diverse kind of habitats of which paddy fields and associated ecosystems like marshy areas, waysides and plantations gains much significance. Paddy cultivation replacement by banana and ginger crops has posed serious threats to the typical wetland eco system of the district. It has irretrievably altered the habitat of many species. The waterfowl, water snake, apple snail etc. is a lost sight now. All which were the indispensable part of the paddy ecosystem, which kept checking and balancing the system of paddy pests and diseases to a greater extent. In addition, paddy fields harboured innumerous number of medicinal plants, which were being used mainly by women for home remedies. Paddy fields act as small reservoirs and help the percolation and aquifer recharge. It helps to maintain the water table of the wells of its influencing area un-sinking even during summer. The invasion of cash crops in place of paddy cultivation accompanied with the liberal use of chemical inputs annihilated the soil micro flora and

fauna. The neck deep marshy lands, once or twice cultivated with paddy now become a tractor ploughable field. Such swift surface water depletion and draining is taking place, when banana or Areca nut palm cultivation is made. The continuously five year cultivated banana field become unproductive, uncultivable land and becoming irrecoverably lost, which pose threats to food security as well as the ecosystem security of the poor ecosystem dependant communities. For instance, Wayanad once harboured 100 and odd local paddy varieties have now been confined to 10-15 varieties.

A participatory and integrated approach is needed for a better way of addressing the issues of tribal empowerment. One of the areas of approach should be the protection and enhancement of crop and breed diversity of the tribal and rural communities.

-Dr. S. Balaravi

On the backdrop of these issues, the subject of crop diversity and tribal empowerment has been discussed in this session with an objective of deriving some "doable action plans" at local and state levels.

DISCUSSION

Dr. Suman Sahai

The public domain knowledge and materials were used effectively for the present day agricultural and biological development. This knowledge and materials, particularly that related to the agrobiodiversity (the economically known and otherwise useful biodiversity) are contributed by the tribal and rural communities. We owe to them for the development of many of the high yielding varieties of crops, breeds, many modern medicines and food. First priority therefore, should be given to restore the prestige of such traditional knowledge. Legislation of the protection of the rights of knowledge holders like farmers and healers is also to be initiated. For avoiding the "Biopiracy", State and National Governments along with international community should act as protectors of indigenous knowledge related to biodiversity. Now it is mandatory for the member countries who have signed the agreements like CBD and GAAT to protect their biological resources and plant varieties through patent or through independent *sui-generies* system or combination of there of. Subsequently, Govt. Of India enacted a legislation called *Plant variety Protection & Farmers Rights Act 2001* to recognize farmers' contributions. The Indian Parliament is also passed *Biological Diversity Bill 2002* to protect and use country's various biological resources in a sustainable manner. There is an urgent need to protect the traditional knowledge and it needs national and international level efforts. The tribal and rural communities will have to "Claim their Rights to get their Rights – Be proactive – to be aggressive"

Dr. K. K. N. Kurup

Most of the tribal communities belonged to the category of landless agriculture labourers whose empowerment was marginalized or abrogated in the context of new economic policies. The recent incident of Muthanga is the symbol of their frustration and keen desire for possession of land. The tribals of Wayanad, who were the descendants of Neolithic settlers, earned their livelihoods as hunters and later as food gatherers. From these stages of human civilization, they were gradually exposed to the process of peasantisation. Each community had its own natural settlements in the forests. The arrival of Britishers, introduction of cash crops like coffee and tea, migration etc paved the way for alienation from their original habitats. Revising the economic policies, providing land, capital and technology for cultivation and increase in the efficiency of government departments connected with tribal development are the crucial issues. Immediate steps are needed to educate them to bring them

into the main stream and also to create new employment opportunities.

Sri. P. Balan

Following are the key issues in tribal development from the perspective of an *Adivasi.*

1. Malnutrition and health problems
2. Declining employment opportunities
3. Land alienation
4. Food insecurity and reduced food basket
5. Lease farming
6. Exploitation from middlemen
7. Erosion of traditional knowledge

Hence, any policy framework should be made in the context of these concerns. Our current needs and requests are:

- Provide basic amenities in tribal hamlets
- Skill training in livelihood improvement
- Permit to collect the NTFP from forests
- Awareness generation on sustainable collection and processing
- Renovate traditional crafts and industries
- SHG formation in tribal hamlets
- Increase the credit access
- Cultivable land distribution and infrastructure development
- Adopt Community led Participatory Forest Management
- Ensure Premium price for products produced by Tribes under traditional methods
- Chronicle TK for scientific validation and for sustainable utilisation with our proper invlvement – protect the rights of tribes through recognition and rewarding

Sri. G. Girigan

One of the major thrust areas of MSSRF is conservation and enhancement of biodiversity, particularly the agrobiodiversity, which have been developed and conserved by the farm communities. This agrobiodiversity is now viewed as the intellectual contribution of farmers, and protecting the rights of those farmers is considered necessary for allowing them to continue their essential role in conserving and enhancing genetic resources.

The Community Agrobiodiversity Centre (CAbC) of MSSRF is supporting farm communities by providing training and assistance in the conservation, enhancement and sustainable use of traditional crop varieties. Centre took interest in promoting traditional paddy cultivation through diversification of rice varieties which are economically profitable in order to protect the paddy ecosystem and supporting the farmers in seed production and distribution of specialty rice varieties like *Navara, Veliyan, Gandhakasala, Kalladiyaran* and *Chennellu*. It also undertakes capacity building programmes for women in income generation activities by cultivating native vegetable crops as well as utilizing locally available natural resources in a sustainable manner, and student, youth and NGOs for widening their knowledge base and skills in biodiversity conservation. However, the challenging problems for our intervention are:

- Erosion of crop and breed diversity and TK
- Unemployment in tribal and rural sector
- Decline in natural resource base
- Health related problems in tribal areas
- Degradation of Agriculture land

With an aim of increasing the livelihood security of the farm -women and men, two programmes have been launched in the district by CAbC – one is on promoting traditional primary health care practices, and the other is

on experimenting LEISA (Low External Input Sustainable Agriculture) activities meant for more income from less land. The activities of the health care programme called, "Green Health Campaign", which meant for using both medicinal plants and the knowledge of communities, particularly the traditional healers and women associated with it, to improve both their health as well as the economic status. This programme includes awareness campaigns, trainings, plant exhibitions, ethno-botanical surveys, establishment of community -level herbal gardens, and community-level marketing of the herbal products. Hither to about 200 families have been brought under this programme. This has evoked a wide interest among the people.

Dr. Indira Balachandran

There are several indigenous plant species that have high commercial demand which are still collected from the wild and are becoming very rare, but not successfully introduced in cultivation. The National Medicinal Plant Board has recommended 32 species of medicinal plants for large- scale cultivation, out of which 20 species can be cultivated in South Indian habitats. The cultivation of medicinal plants should be encouraged among tribes. There must be some mechanisms to transfer of modern technology and skill up gradation among the rural and tribal farmers.

The herbal market in the State today is unorganized due to various reasons. The nature and dynamics of this domestic trade, is far from simple. It involves central and regional markets through a number of private dealers and agencies, government controlled cooperatives. All having upstream linkages with numerous local and "road-head" markets, which in turn have myriad middlemen, petty shopkeepers and agents feeding them with primary supplies. Proper marketing strategies have to be worked out for marketing the medicines and herbs in appropriate values.

We have to give more emphasis on TK based development of medicines. Patenting the innovations of tribal communities especially those connected with respect to traditional health care practices. Developing databases on the threatened plants conserved by the tribal communities of Wayanad district is also very important.

Dr. Koshy John

Original habitats of tribal communities have to be protected and empower them to cultivate the crops that they like and restrict the encroachment to their lands. Also what needed now is synergy of traditional knowledge with modern technologies. We must encourage ethnic foods of tribes with a proper brand name. In India, Kerala has high potential to produce diverse organic products, including textiles, furniture, cosmetics, wines (e.g. palm toddy), vegetables, fruits, pet food, baby food and even organic water at community level, but with proper skill training and quality education. Therefore, we must encourage organic cultivation by taking into consideration of TK and traditional skills of our tribal and rural elders.

Dr. P. K. Muraleedharan

A study by KFRI shows that only seven percentage of total consumption of raw drugs in Kerala is met by the cultivation, while 93 percent is still through collection from the wild. The situation thus, warrants the supply of good quality raw drugs cultivated and marketed by ensuring relevant quality control measures. Several species have got high demand, for example, Kacholam has an annual demand of 748956 kg, in Malabar region alone. Likewise, Chengazhi (17487 kg), Kasthuri Manjal (13271kg) and Vayambu (89875 kg) are used heavily in Kerala. Intermediary play a significant role in the trade, but unfortunately it is largely secretive in nature as there is no declared market for raw drugs or fresh picks from herbal gardens. Therefore, we should explore proper

marketing strategy for NWFPs as well as cultivation of traditional crops like rice is an important step towards this direction. Tribals should get permission for the collection of NWFPs which is a major source of income for them. We must ensure they get fair price for the produces collected. Joint Forest Management programmes should by all means be a joint venture wherein tribal communities and forest department play equal roles.

Sri. P. Kesavan

Tribal communities are the part and parcel of forest ecosystems. They have never gone beyond the interest and existence of forest ecosystems. This approach must be the crux of the forest mangement effort. They also hold knowledge, which have a positive bearing in the protection of forest and conservation of biodiversity and live in close harmony with forests. Their right to live in the forest should not be denied. The local community, if empowered, they will be able to even directly manage the forests with their traditional wisdom and by the guidance of Forest Department and other experts.

Sri. Mohan Kumar

The non-tribal people should change their attitude towards tribal communities and we should address the development of tribal communities from their perspective. Land problem is a major issue and society should act for materializing the dreams of tribes those who were once the owners of the Wayanad. Forest department must keen to engage tribes as forest protectors and jobs associated with forest. We should see that people tribal development programmes are chanelised through them only.

OPEN DISCUSSION

Sri. Mukundan

The historical status of tribal communities of Wayanad could be recognised in the folk songs. (A song orated by him explained the historical journey, the pathways of changes that occurred in the course of time from the king to the slave). The tribes should have the right for a decent life in their soil.

Sri. Kalhan

The tribes of Wayanad were once treated as slaves. The government banned the slave trade however, they are yet to rehabilitate the tribes in a proper manner. What needed are: proper education, revitalization of traditional crafts and industry and new employment opportunities. They also should get land entitlement.

Sri. K.C. Vellan

There is an urgent need for documentation of food habits and traditions of each tribal community. Efforts should take to link the ethnic food of tribal communities with market. Government should ban the application of chemicals and pesticides in and around the tribal lands. The indiscriminate use of chemical fertilisers and pesticides poses a number of problems at present. The chemical inputs used in the uplands reach the low lying area through run off water and leaching in and contaminate the streams and rivulets in valleys. Policy makers should consult the tribes before making policies and implementing of projects in their areas.

Sri. Arimula Raghavan

There is a need for a detailed multi disciplinary study about the the culture, traditions and status of tribal communities. There should have attempt to address the newly emerging problems. The money allotted for the development of tribal communities must spend properly in a transparent manner and by consulting with the tribal leaders and social workers.

Smt. Santha

The tribal healers are facing lots of problems like – poor market price for their products; less availability of medicinal plants, little encouragement from the part of Government

and so on. The invaluable treasure of indigenous knowledge passed on to successive generations mainly through word of mouth is getting eroded beyond the limit of setting the pace. Therefore, activities should be promoted for regaining the lost and fading traditions by inculcating habit to foster a sense of kinship with nature.

Smt. Rugmini Bhaskaran

The access to agriculture land and right over it by women is the most crucial issue among the tribes. The illicit liquor making and its effect on tribal communities is another big problem. Stringent actions must be taken against those who have involved in atrocities against tribal women. Educated youths of tribal communities should get employment in government services. There should not be any discrimination against tribal children. Education/awareness programme involving of tribal representatives is very important to reach the tribal men and women.

Sri. P. K. Kelu

The nexus of politicians and beurocrats is the issue in alienating the tribes. The fund allotted for the development of tribes should spend only for them and a unity among tribes is required to fight for the rights of tribes.

Sri. Unni Naikkan

The basic amenities like drinking water, sanitation facilities etc should be given to tribal communities. Government should keep their promise of distributing the alinated land.

Sri. N.K. Babu

The educational programme among the tribal communities must be strengthened with the right participation of government. Basic facilities must be provided to tribal hamlets and colonies. PDS programme should reach to them effectively. Organise meetings in village levels to understand the tribal problems and possible solutions from their own perspectives.

Sri. Palliyara Raman

Organise trainings and capacity building programmes, campaigns in the tribal hamlets to increase the confidence and help them to enter in new employment opportunities. Representatives of tribal farmers, women and conservers, and scientists should come close together and form a powerful body to finalize the research, extension and action programmes needed for substainable development of Wayanad district in particular, and the State in general. The actions evolve by this way should be in tune with the needs of the poor farm communities.

Sri. P. M. Nandakumar

Capacity building of local institutions – the Community Based Organisations, NGOs, Line Departments and tribal and rural families in the area of Eco-Agriculture – an integrated field of Agriculture and Conservation through training and education should be our focus. The central objective of any programme on sustainable agriculture and associated NRM systems must embrace and enhance productivity, livelihoods, ecosystem services and biodiversity. In Wayanad district (a high land agro-biodiversity hot spot in Kerala) the pace of erosion of biodiversity is alarmingly high in all spheres of the agro-ecosystems. The shift in cropping pattern from subsistence to mono cropping has led to rapid loss of crop diversity at both species and genetic levels. A holistic approach is needed to address tribal empowerment. Co-ordination of government, NGOs and social workers is the need of the hour to reach the goals set in tribal empowerment.

OBSERVATIONS & RECOMMENDATIONS

1. Recognise and reward the contributions of tribal communities

- Tribal communities (men, women & communities) have a rich traditional ecological knowledge base (agrobiodiversity, healing systems, ethnic foods, folk

taxonomy, landscape and ecosystem management, arts and crafts…)

- They have been the primary conservers of the agro-biodiversity .They have a right to better living standards (water and sanitation, higher education, health security, food and nutrition security)
- They also need a space in this developmental paradigm (access to technical education, technology, skill empowerment and economic empowerment) and

We need to recognize and reward them (local, national and international level) for their invaluable past and present contributions to biodiversity and ecosystem management and enhancement.

This can be achieved by a participatory approach (with the tribal people) in terms of drawing up targeted programmes, implementations and monitoring with adequate policy support.

2. Develop a Proactive State Policy

- The State must continue to play their role in public investment (Infrastructure support to education, health and environmental sanitation, skill and economic empowerment, liberalized credit support for agricultural operations and entrepreneurial activities) in protecting and enhancing the lives and livelihoods of those, particularly poor and land less tribal and agricultural labour communities.

3. Encourage Sustainable Land Use

- Encourage research on the valuation of ecological services of different ecosystems including forests, agricultural lands etc..
- Impose restrictions in the form of cess to discourage unsustainable practices. The money generated could be channelized to tribal farmers practicing sustainable agriculture/ utilization of natural resources as incentives.
- Attention to be paid to ecological foundations – soil health care, efficient use of biodiversity, agrobiodiversity, ethnic food diversity and water.
- Prevention of conversion of paddy fields - There is an Act (Kerala Land Utilization Act –1956) that imposed restrictions in converting ecologically important landscapes like paddy fields, which needs to enforce strictly.
- Regulate the introduction of 'Alien' and 'Exotic' species to the agricultural and forest landscapes to help in conserving native biodiversity.
- Consider the management of tribal dominated areas in the way of "Man and Biosphere" approach.
- Kerala is an ideal leader for Organic Farming and therefore, should promote organic farming to occupy a unique niche in the agrimarket.

4. Set Conditions for Creating Sustainable Livelihood Options

- Provide education, skill training, access to information and technologies.
- Encourage bio-resource based micro-enterprises through easy credit- linked policies.
- Establish market linkages and support such activities through timely provision of infrastructure (drudgery reduction, value addition, appropriate technologies) and information (sourcing of material and markets).
- Re-organise Tribal co-operative societies as centres for herbal raw drug medicine units based on local resources.
- Quality literacy programmes for producers and gatherers to enhance quality and competitiveness in the market by enhancing backward and forward linkages.
- This can be achieved by setting up village level Knowledge Centres (which will

provide access to information, development of entitlement data-bases, etc.)

5. Revitalise appropriate Local Traditions

- The state must take efforts to revitalize folk and herbal medicine practices, ecological foods as well as the practice of conservation of sacred groves, sacred trees and ponds.
- Enlarge the food basket by revitalization of the use of traditional food crops like millets and tubers.
- An expert committee to study the possibilities of revitalizing appropriate local traditions (arts, crafts and skills and conservation of sacred groves) may be constituted.

6. Protect and Enhance Crop Diversity and Co-ordinate the efforts in Documentation of Local Resources and TK

- The State should take necessary steps to generate awareness about PPV&FR and Biological Diversity Acts and provisions related to the registration of traditional varieties under PPV&FR Act.
- Local Panchayats should be encouraged to organize Biodiversity Management Committees and prepare Biodiversity Registers – within a time frame (with a gender sensitive approach)
- Promote Genetic and Computer literacy among students particularly of rural and tribal areas through Genome clubs.
- Build the capacity of farmers through local Panchayats in registering traditional varieties for materialising the provisions of rewarding and recognizing the contributions of tribal and rural communities in conservation.
- Farmers have to be mobilized to register their varieties (Farmers' varieties), locally used medicinal plants, wild foods and other important bioresources through the preparation of Peoples, Biodiversity Registers.
- Promote seed exchange systems between farmers and communities through conducting Seed Fairs and Fruits/flowers exhibitions.
- Establish seed village and encourage farmers' participatory breeding and technology development programmes.
- Conduct education and awareness programmes on Biodiversity, Farmers' Rights, Intellectual Property Rights etc for panchayath authorities farmers, NGOs and Youth on a regular basis.
- Establish a local level Gene Fund to give incentives to farmers and conservers by pooling donations from individuals and institutions. Contributions to such fund should be exempted from the income tax.
- Develop computerized database on a common format about the Farmers' varieties, locally used medicinal plants, wild foods and other important bio-resources and may encourage local and regional networks after considering the IP issues.

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AGROBIODIVERSITY CONSERVATION AND ENHANCEMENT: GENDER ROLES AND TRIBAL EMPOWERMENT

AGROBIODIVERSITY CONSERVATION AND ENHANCEMENT: GENDER ROLES AND TRIBAL EMPOWERMENT

(**Panel Discussion**, Nov. 7, Parallel session I, Chair: Dr. Krishna Sreenath, Central Institute of Fisheries Tchnology, Cochin)

Session Chair : Dr. Krishna Sreenath
Co Chair : Dr. Sudha Nair

Presentations :

Sri. K.K. Annan
Dr. P. S. Geethakkutty
Sri. M.K. Ratheesh Narayanan
Sri. G. Girigan

Panel Discussants :

Smt. Ajitha
Smt. T. Omana
Dr. T. Ravisankar
Sri. Louis B. Figaredo
Dr. Celine Sunny
Prof. Sarada Rajeev
Smt. Elyamma Vijayan
Dr. Meera Devi

Gender Roles in Agrobiodiversity Conservation: the Kerala Context

Study conducted by FAO on rural women recognizes that the rural women in Asia play a key role in biodiversity conservation as seed selectors, managers of home gardens and as holders of traditional knowledge associated with food crops, medicinal plants, wild foods, forest products and about various landscapes and natural resources. It is the women who conserves, preserves the valuable plant genetic resources and series of genes conferring valuable traits– such as disease resistant, salt tolerance, resistance to drought or water logging etc. for commercial and domestic use. The intricate knowledge involved in performing this task used to be transmitted from women to women. Most women in rural societies worldwide are often primarily responsible for ensuring household food security, health and family continuity.

Traditionally men controls the resources, take decisions regarding land use and neglect the opinion of women. They are the policy makers and since women are not the decision-makers in many social and political forums or not in position to influence decisions, their concerns and constraints does not get reflected. Their voices and opinions have to be heard and included in the agenda of the Biodiversity Conservation strategies and the support needed for women in conserving biodiversity has to be worked out. The "Gender blindness" and the consequent "invisibility" of women's role in biodiversity and food security will disappear if their contributions in these areas are well documented.

MSSRF's studies (Girigan & Anil Kumar 2002; Ratheesh & Anil Kumar 2003) in Wayanad show that changes in cropping patterns (rice to banana; rice to areca) have affected the employment prosperity of women and deprived their social and economic status. And the tribal women are responsible for the collection, conservation and utilisation of wild food species in and around their vicinity and fighting against starvation by playing multiple roles as gatherers of food, wage labourers and managers of the home gardens. It shows that they play a crucial role by providing their labour (unpaid family labour), conserving seeds of traditional varieties of food crops, gathering and processing wild food, preserving and storing the food for meeting future contingencies etc. Balakrishnan *et.al* (2001) described the role of Kattunaikka women as folk taxonomists in identifying wild tubers in a study conducted among them. These studies in general emphasize the contributions of women in the conservation and sustainable

utilisation of agrobiodiversity. But, unfortunately, the pivotal role of women in conserving biodiversity is not yet been received the attention of policy makers because of lack of gender sensitive approach and the consequent "invisibility" of women's role in agrobiodiversity conservation.

The session has to discuss these issues and make a wider audience to understand the perception of women in conservation of biodiversity and catalyze to frame a policy strategy sensitive to women.

-Dr. Krishna Sreenath

This has been discussed at length and derived few conclusions and recommendations. We hope the conclusions and recommendations emerged out of this workshop will enable the concerned to prepare a policy framework for gender sensitive development strategies in conservation and management of bio-resources.

PRESENTATIONS & PANEL DISCUSSION

Sri. K. K. Annan

Tribal communities have many problems in terms of their livelihood security ranging from health related problems in general to problems pertained to poverty. The increasing cost of formal health care systems and declining popularity of traditional health care practices affect the rural and tribal women. There is increase in health problems among women and it is aggravated by the lack of traditional health care remedies which in turn due to extinction of medicinal plants from their common surroundings. Changes in agricultural practices have its own effect in the health status of women. It is high time to popularize the traditional health care practices among poor and the needy people.

Sri. M. K. Ratheesh Narayanan

The gender roles in the management of wild foods and issues related to the conservation and sustainable utilization of wild food species is an issue while dealing with the forest resource management. Women play a crucial role in the food security of tribal communities, for instance, Paniya play a major role in protecting many of wild edible greens. Habitat destruction, landscape conversion, indiscriminate use of chemicals and pesticides are some of the present threats to women and food security of the poorest of the poor communities who are quite often the ethnic groups like *Paniya*, *Adiya* and *Kattunaikka* in place like Wayanad.

Sri. G. Girigan

The impact of conversion of paddy fields on gender roles and relations among different communities of Wayanad is an issue that to be understood at policy level and address on an emergency basis. The lack of access to agriculture land, lack of decision making capacity, lack of property rights and lack of economic freedom among women are some of the reasons that pave the way for conversion of paddy fields. The results are: gender displacement, poverty, malnutrition and men focused power relation changes in the family.

Smt. Ajitha

Tribal communities in general and women in particular conserve the biodiversity. However, they are facing lots of problems and alienated away from their original habitats and environments and thereby endangering the existence of tribal communities. Land entitlement issues to be addresses first. The irrational developmental activities in agriculture and allied sectors that paved the way for the current problems like crop diversity erosion and tribal/women disempowerment. The export oriented cash crop production in agriculture is one of the major threats to employment security. The fluctuations in the international market affect the agrarian economy of Wayanad. Lack of enough employment opportunities in traditional sectors compel women to depend on low paid and high risk jobs (risk in terms of sexual exploitation). Consumerism is also a threat to

women empowerment. The products of women SHGs face lack of market due to the influence of MNCs through media. The possible effect of tourism is a matter of serious concern. A movement against globalization for protecting the rights of common people especially tribal and rural women is the need of the hour.

Smt. Omana

Women especially tribal women are the worst sufferers of ecosystem destruction, mono-cropping, de-forestation and such negative actions. The destruction is the outcome of changes in lifestyle and human culture. trend to imitate cinema, liquor are also seriously affecting the lifestyle of tribal communities. We must provide basic necessities to tribal women and at the same time their natural environment and habitats should be entitled to them.

Dr. T. Ravisankar

Biodiversity and cultural diversity are the two interlinking aspects when we speak about management of biodiversity. Biodiversity is either getting degraded or getting more species specific by way of evolution and also through invasion of aliens. Cultural diversity is the knowledge associated with the biodiversity. Both are interlinked, if you don't have the BD you will lose the cultural diversity on the biodiversity. The cultural diversity (about edible plants, traditional crops and so on) is available with both men and women. But the knowledge possessed by the men only is being recognized whereas of women by and large is poorly recognized. The non-recognition is the cause of destruction. If we don't recognize this, we will lose the biodiversity even before understanding the value of biodiversity.

Women play a crucial role in conservation of valuable plant genetic resources by possessing unique knowledge associated with the seed selection, cultivation, processing and utilization, storage etc. This knowledge is then passing over to the next generation women and thereby playing an important role as the conservers of biodiversity. Apart from all the agricultural operations they perform like their male counterparts, they also have to spend more time on reproductive household activities, which affect the health security of women. Study in a fishermen village shows that women spend approximately 18 hours a day an household relative activities. The importance of gender sensitive approach is thus very important. Therefore, there should be interventions to reduce the time spend by women so as to get them time for developmental activities otherwise their burden may get increased and pave the way for much gender inequality.

Gender mainstreaming is very important, otherwise it will affect the health security of women and then to children and so on. There need gender mainstreaming at class level, caste level and age level. The strategies followed in India may attract the South-Asian attention so we must come up with gender mainstreaming strategies and policies for a larger section of people in the world.

Another aspect that need attention is translation of guidelines of JFM, Legal measures for the conservation of biodiversity and gender roles and relations in local language. This is to be done and circulated widely on a high priority basis.

Sri. Louis B. Figaredo

A major tool for empowerment is knowledge. There are lots of research works about gender aspects going on. however, the results of research restrict to very limited people. As far as Kerala is concerned, the traditional society belongs to heterogeneous groups-in hunting/ gathering society, their major concern is food and women play a crucial role in the collection and processing of food and that is why women get a respectable position and economic dominance among those communities. When we consider an agriculture society – there are two types of communities – horticulture

oriented society and intensive agriarian society. In horticulture society, they use simple tools for agricultural operations. In agricultural society they perform intensive cultivation with the help of mechanical/ animal power. When we consider the position of women in both classes we can see the dominance of women in agricultural operations and they are getting respect among them. In agriculture society, the contribution of women is comparatively less. Declining biodiversity is the major reason for the subordinate status of women in the society. This variation can be viewed when we move from hunting/gathering society to intensive agriculture society.

Recognizing the value (use value or economic value) of biodiversity is one of the ways to conserve biodiversity. There also need proper mechanisms for benefit sharing. The documentation of gendered knowledge in biodiversity will help us to recognize their contributions more explicitly.

We also should look into protection of common properties like streams and canals with the help of local organizations and women groups.

Dr. Celine Sunny

We are working for the application of technology for the socio-economic development of tribal women and men at Rajagiri Institute of Research in Gender and Development in Kalamassery. The programme started with a socio-economic survey to analyse the intensity of economic difficulty and their survival strategies, farming periods etc. Strategies were developed according to their needs and skills they possess. In lean periods (about three to four months) they spend their time idle and they do not go for the collection of forest produces because of many reasons including the shortage of MFPs. The survey also found that both the men and women possess skill in handicrafts. During the participatory planning it was decided to revitalize the traditional arts and crafts with the help of modern technology. They are producing wonderful handicrafts out of bamboo and other species. In the initial stage it was women who participated in the training and later on men also took part in the training and handicraft production. Additional income from the handicrafts helped women to increase their self confidence and it also increased the esteem of both men and women

However, these people have problems like market access, access to raw materials etc. Marketing of products produced by women groups/ co-operatives/ federations is a big problem to be addressed properly. There need support from the part of government and other agencies working in the area of marketing.

For further intervention, we began to document the knowledge of both men and women in bio-resource utilization in the form of Community Biodiversity Registers. I feel, preparation and gendered documentation of Community Biodiversity Knowledge may help women to get recognition in the society.

Prof. Sarada Rajeevan

Folk songs, often indicate the disappearance of diversity – diversity of paddy fields, diversity of human culture, biodiversity etc. What needed is mental empowerment (self confidence) among women to get ready to take part in developmental process. The people including both women and men of each locality should decide the kind of development required for their area. The projects and developmental interventions for the socio-economic development should have adaptability to the local conditions, sensitive to gender and ethnic diversity. Bio resource and local knowledge based developmental projects are suitable for Wayanad (eg. Fodder grass and livestock rearing). The role of both men and women should be clearly defined in the projects.

Gender sensitive human resource development strategies have to be developed. Women friendly, eco friendly, home friendly and location specific technologies have to be developed with the participation of women. Awareness, and Action of has to be the focus of our intervention.

Smt. Eliyamma Vijayan

The question of why we should conserve biodiversity depends upon the perception on development. As per the present development strategy, biodiversity is just a raw material for development. Should we approach biodiversity conservation in this perspective or whether we should change our approach and consider biodiversity as an alternative development model for enhancing life supporting and livelihood options of the society, is the basic challenge of humanity? The existing development models are basically export oriented and oriented towards profit motive. We also look conservation of biodiversity in the background of genetic engineering, Patents and IPR regimes in which MNCs are exploiting biodiversity rich third world countries as a source of raw materials. In this context, biodiversity conservation is a serious matter of concern.

It is high time to change the perception of development and approach towards biodiversity conservation. In the past, biodiversity was conserved by the community in total by sharing knowledge, skills and resources for ensuring the well being of the society and by protecting the resource base. We also should develop a lifestyle that respects the diversity of thoughts, culture, beliefs etc.

Women are the worst sufferers of the destruction of biodiversity and that is because of the modern developmental strategies we followed. Changes from agriculture to agri-business led to the alienation of tribal communities, unsustainable land uses, undoing of land reforms, production insecurity, consumption insecurity etc. When the issue of biodiversity conservation emerges it becomes the sole responsibility of women and ethnic people. The male dominated policy makers argue that women have an inborn affinity towards nature and biodiversity. By glorifying these qualities of women, the responsibility of biodiversity conservation is passing on to the shoulders of women. There is no inborn affinity towards nature among women, but they are very close to the nature during the course of their life and that is why they nurture and care biodiversity and natural resources and the existing gender roles shapes the women as the conservers of biodiversity. Accordingly, both men and women are equally responsible for the conservation of natural resources. There also need the revitalization of community management practices of bio-resources with the active participation of both men and women. We need a movement that supports the conservation of native diversity and protecting the interest of women and weaker sections.

I also refer in this context, that a Manual for Panchayath representatives about development (Guidelines for development) that do not disturb the native biodiversity and landscape complexities is needed. The Manuel can be circulated among Panchayth members that will help them to understand consequences of the destruction of biodiversity. Initiating Community Seed Banks and genetic literacy campaign in all Districts of Kerala is also an immediate need.

Dr. Meera Devi

Wayanad is blessed with biodiversity and traditional knowledge; however, both men and women could not convert it into livelihood options in a sustainable manner. The panelists to look into how the Public Distribution System is functioning among tribal women and men to strengthen the food security.

The rural people in Wayanad possess rich knowledge, rich biodiversity, and skill in converting them into various products. But they lack marketing skills and inputs for marketing. When they go for large scale production they have to compete with local producers and MNCs. There is a big gap between MNCs and local herbal knowledge and marketing skills. So the policy must be framed to promote the

local industries and de-promote the MNCs. This is a big challenge that has to be addressed at policy level. For starting a micro level herbal processing centre, there need license and lots of investment that SHGs/ tribal women can not do. So the issue is how to de-promote the mono-culturing factors. These kind of issues need policy level attention and intervention.

Women have to come forward to raise their voice against the developmental demerits to convert it into gender sensitive sustainable development. All forums – Gramasabhas/ Panchayath – have to be used for influencing the policy makes from locally to nationally and internationally.

OPEN DISCUSSION

(Local women and men SHG leaders)

Smt. Annakkutty Paul

After the indiscriminate use of chemicals and pesticides in banana fields, there witnessed a sharp increase in health problems among tribal women in Wayanad. Malnutrition coupled with the impact of pesticides make the scene worst in most of the tribal colonies. The lack of access to hospitals, due to many reasons, compels tribal women to continue to suffer and gradually it paves the way for serious problems and reduces their longevity. The problems like poverty, malnutrition, sanitation, health care etc are to be addressed with prime concern. Revitalization of their own health care traditions, provision of quality seedlings of food crops, provision of skill training and education, generation of employment opportunities are the possible solutions.

Smt. Mahitha Moorthy

The women labourers in plantation sector suffer a lot. The serious issue is the employment fluctuation and uncertainties faced by women in the plantation sector. A detailed study on the occupational hazards among plantation workers is needed and so is the need for awareness generation among women about their rights, gender issues etc. The priority must be given to rehabilitate the unemployed plantation workers and women by forming their SHGs and also by providing vocational training.

Smt. Bharathiyamma

The pesticide application and unsustainable land uses are the primary issues related to women. The present development strategies, not only destructed the biodiversity but also the social harmony. We also should be concerned about the declining sex ratio, rehabilitation of aged people, health problems of women, an also growing atrocities against tribal women. Creative support from the concerned Organisations for the development of women of the weaker sections should be extended.

Smt. Visalakshi Prabhakaran

The approach of the society on gender issues is to be changed. Women should get power in economic resources like land and other properties. The most important intervention is awareness to indicate the mismatch between social roles and responsibilities entitled to both men and women.

Sri. Arimula Raghavan

The SHG movement is really worthy, as observed in some of the tribal colonies, women could interact freely with non-tribal women and it indicates the self- confidence among tribal women. We may promote Kudumabasree and SHG movements to cover all the tribal groups in a phased manner. Reservation in Govt.phased services for tribal women is also implemented.

Dr. Sudha Nair

Dr. Sudha Nair summed up the on-going debate on gender issues and briefed the modalities and requested the participants to suggest specific recommendations looking in to a holistic dimension.

OBSERVATIONS & RECOMMENDATIONS

1. Recognise the Gender roles in conservation

- Women of the tribal and rural communities play a predominant role and they possess enormous knowledge in conservation, management and use of bio-resources, which needs to be documented, recognized, and properly evaluated.
- Gender differentiated contribution exists in the agrobiodiversity conservation and traditional knowledge systems and practices.
- Women and Men have the right to better living standards, water and sanitation, technical and higher education, health security, food and nutritional security and that to be heard and participate in developmental programmes.
- There is a pressing need for revitalization of the traditional systems related to the reproductive health care practices, homestead gardens, medicinal herbs, food crops which they use in there everyday life.

2. Develop a *pro*-active State Policy

The State must play a pro-active role in bringing the tribal and rural women into the mainstream of development through appropriate policy support and enabling mechanisms (access to higher and technical education, health and nutritional security, skill empowerment, credit, employment and economic empowerment). There should be targeted specific action plans drawn up to address these above mentioned points and pave the way for their effective participation.

3. Extend Institutional Support

- Existing national/state level institutions like Women Commissions, Commissions for Backward classes, Minorities, Scheduled Communities should address the gender related issues in natural resource management, biodiversity conservation and development.
- Local level institutions like women SHGs/ Co-operatives/ Gramasabhas / Panchayats etc must be strengthened in order to address the issues related to gender sensitive development approaches in biodiversity conservation and utilization.
- The role of women in the management of common property resources like PFM, Water Users Group, Conservation programmes etc need to be strengthened and their capacities need to be built to enable an effective participation, revival of communal rights, inclusive of women, living within the forest ecosystems and hot spots.

4. Provide Better Living Standards

- Health clinics and health camps for women and children need to be conducted in regular intervals at panchayat levels in tribal concentrated areas. Health insurance schemes for tribal men and women are a must as they are highly vulnerable to diseases. De-addiction centres for men need to be set up to get rid of their alcoholism and counseling centres for women to enhance their self confidence to face developmental challenges.
- Research should look into the needs of women in conservation, management and developing appropriate and local specific technology to reduce drudgery in performing the respective roles - as gatherers, cultivators and seed conservers, homestead managers, healers etc.
- Ensure the extension of the PDS system to food insecure tribal groups in remote areas.

5. Improve Sustainable Livelihood Options

- There is a need to revitalize local artisans, skills, local food culture by supporting women SHGs involved in eco-enterprises through capacity building in terms of value addition, marketing skills, institutional support for production and market outlets.

Special government employment schemes are required for women in off season related to their skills and available resources (e.g. bamboo based handicrafts).

- Promotion of indigenous knowledge system and practices through various media to recognize and understand the gender differentiated contribution to the BD conservation and enhance their status and promote their basic human rights.
- Special efforts need to be undertaken by the State to mobilize tribal women and create awareness on their legal rights and their role in conservation and value of agrobiodiveristy and facilitate networking and linkage among different tribal and non tribal women's federations. They also should be encouraged to be part of local tribal movements and federations.
- The Community Biodiversity Registers acknowledge the gender differentiated knowledge systems derived out of their gender roles and should include the documentation of women's knowledge and their contribution in conservation, management and sustainable usage to enable them to acquire rewards and equal sharing in benefits. Guidelines for development with gender sensitive approach for panchayaths- inclusive of community seed/food banks, legal and genetic literacy, CBR etc are to be provided.
- Extension of the Kudhambsree, IT enabled development like Akshaya programme etc, should be extended effectively to tribal women.

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HERBAL WEALTH AND MEDICINAL RICES IN TRIBAL AND RURAL LIVELIHOOD SECURITY

HERBAL WEALTH AND MEDICINAL RICES IN TRIBAL AND RURAL LIVELIHOOD SECURITY

(**Panel Discussion**, Nov. 7, Technical session III, Chair : Prof. M. S. Swaminathan, M.S. Swaminathan Research Foundation)

Session Chair	: Prof. M. S. Swaminathan
Key note Speaker	: Dr. N. Anil Kumar
Presentations	: Sri. V. Saji Kumar
	Sri. N.K. Mahadevan
	Sri. K.B. Ramesh Kumar
	Ms. Sunitha Bhaskaran
Panel discussants	: Dr. Leena Kumari
	Dr. C.R. Elsy
	Dr. Abdul Nizar
	Sri. Radha Krishnan
	Sri. Abdul Kareem
	Sri. K.V. Divakaran
Rapporteur	: Dr. A.B. Ramashree

Kerala - A Herbal Bio-Valley

According to 2003 Human Development Report, Kerala has health indicators similar to those of USA - despite a per capita income 99 percent lower and an annual expenditure on health of just $28. How is it achieved, even with its high density of population? Three reasons could be attributed - the strategic geographic position of the State, which helped it to possess rich biodiversity and a salubrious climate; its longest and more or less unbroken herbal based health care traditions, especially in terms of household remedies and the Ayurvedic system of medicine; and the collective reforms that took place in societal and individual life of *Malayalees* through their cultural, spiritual and political strengths.

It is high time to take advantage of these achievements of the State to develop the health care system to lead the way for its economic prosperity. The comparative advantage of Kerala in the global scenario of herbal medicine is not only the existence of a wide variety of Medicinal Plants and traditional health care systems like Ayurveda, but also its diverse ethnic - herbal knowledge. Kerala can capture this opportunity as it is endowed with a rich genetic wealth- a capital wealth for its economic prosperity and play a major role, if its political machinery finds innovative partnerships in R & D for sustainable use of the herbal wealth of the State.

Six major steps are needed for the sustainable use of medicinal resources of the state. These are: (1) *Genetic Resources Conservation* & *Sustainable Use*, (2) *maintaining the Purity* and *Authenticity of Ayurveda*, (3) *establishing Growers Associations for medicinal plants*, (4) *establishing Herbal Sanctuaries*; (5) *establishing Herbal bio-valley* and (6) *educating the public about the Protection of Plant Varieties and Farmers' Rights* and *Biodiversity Acts*. It would be desirable to develop the region extending from the Silent Valley Biosphere Reserve up to Wayanad as a Herbal Bio-Valley, on the model of the Silicon Valley of USA for Computer Software. The herbal bio-valley should provide the biological software essential for a dynamic medicinal plant industry. Development of a dynamic medicinal plant industry requires an integrated approach in addressing all these six components.

Prof. M. S. Swaminathan

Keeping this rationale in mind, the session has reviewed papers presented and discussed the immediate actions needed in this sector. We hope these recommendations will be of help to the concerned authorities and policy makers to take a strong decision for sustainable utilization of the herbal wealth of the State.

OBSERVATIONS & RECOMMENDATIONS

1. Conserve Medicinal Plants and Medicinal Rices

(Key note address: Dr. N. Anil Kumar; Panel discussants: Dr. Leena Kumari, Dr. C.R. Elsy and Dr. Abdul Nizar)

1(a). *Conserve Rare Groups of Medicinal Plants*

The Genetic Resources of the State are becoming rare and threatened. For instance, the medicinal orchids like *Cymbidium aloifolium, Dendrobium ovatum, Eulophia nuda, Flickingeria nodosa, Luisia zeylanica, Malaxis acuminata, M. rheedi, Satyrium nepalense* and *Vanda testacea* that are employed for a variety of therapeutic uses are now become highly endangered. The National Medicinal Plants Board listed all the medicinally important orchids as very rare or endangered and disqualified such collections from the wild for exporting. Another such banned species for export is *Cycas circinalis*, which is a gymnosperm plant with varied uses as medicine, food and decoration for its seeds, pith and leaves. Such critically endangered species that are listed in various Red Lists should be multiplied in mass numbers using tissue culture and other rapid seed multiplication techniques.

1(b). *Develop Medicinal Rices and Herbal Foods*

Among the rice varieties known, some are with the qualities of a drug and are used internally in ailments like diarrhea; diseases of the urinary organs and occasionally in catarrh; also externally as an application to muscle wasting, burns and scalds. *Navara, Chennellu, Erumakkari, Kazhungum puthada, Karutha chembavu,* and *Kunji Nellu* are few of the rice cultivated entirely for the medicinal purpose in Kerala. But except Navara and Chennellu others are not now known in cultivation.

At least half- a -dozen rice varieties with medicinal value are known to be in use in Kerala, but cultivated largely at household level for some special purposes. Wider cultivation of such rice varieties can be promoted after establishing the 'specialties' of such varieties. To cite an individual case as noted

in this context is *Navara* - a rice variety, which is widely used in Ayurveda for curing various ailments. Navara is a very early maturing type of rice, which is harvested within a span of 60 to 90 days. Two clearly distinguishable forms exist in this variety - one with black glumes and other with golden - yellow glumes. Within the strain there are two more different forms - one with awn and other without awn. Thus, the variety is existing in four morphologically distinguishable strains, but adapted to same kind of agro-ecological conditions.

Amongst the two strains, the black coloured strain without awn is claimed to be the genuine variety and considered to be medicinally more useful according to the farmers and healers of Malabar region. Whereas for the farmers of Thrissur and Palghat region, the black glumed spike with awns are the real Navara. In south and central Kerala, but farmers do not even know there is a strain of Navara with black glumes. Theirs is the slender, golden- glumed beautiful grain without awn. Still farther, towards south, the farmers and healers cultivate and use the golden - glumed - awned type. Yet all these are being used in local health care systems as well as in Ayurveda for many of the ailments. Navara was never been in use as a food grain for regular consumption by the farmers of this region, and because of this reason there were no large- scale cultivation. It is however, recommended to feed the newborn babies in the form of a dish- 'angri' made of navara flour and dried powder made of a banana variety called 'kunnan" much before their first feeding ritual. This rice is said to be very nutritious, balanced and safe food for

babies. It is recommended for consumption for the people of all ages to increase the vitality, and as a natural energiser. The rice is better when used in raw. Therefore, the immediate actions to be taken are:

- Initiate studies involving scientists from different disciplines –biochemists, ethnobotanists, medico botanists, and medical doctors- to reveal scientifically the qualities of Navara for making it to enter the herbal and food market.
- Take steps for the validation of local use of *Navara* rice using conventional and modern techniques.
- Conduct product development research by giving priority to medicinal rice like *Navara* and *Chennellu* for producing nutritious food like Baby Food and other such Value added products.
- Since 2004 is UN International Year for Rice, take immediate efforts to begin a holistic approach to Navara rice-Project by integrating different studies from agronomy to molecular biology.
- Encourage Students to start Agri-business and Farming to produce commodity and products with the guidance of NABARD and/or such set- ups for agricultural and rural development..
- Give priority to Red Data Book species and Endangered plants for *in-vitro* and Seed propagation. Mass propagation, and establishing nursery centres of medicinal plants need urgent attention.
- Promote both In-situ and Ex-situ conservation of economically important but threatened or rare medicinal plants·

2. Initiate Organised Cultivation of Medicinal Plants

(Panel discussants: K. Radha Krishnan, Abdul Kareem and K.V. Divakaran)

Medicinal Plant cultivation is becoming popular among the farmers, especially in Ghat regions, which are rich in natural resources and biodiversity. However, a careful analysis reveals that a majority of cultivated medicinal plants are exotic, which otherwise are not available in wild to meet the demand of the industry. For example, now famous medicinal or aromatic plants among the farmers of Kerala and Karnataka like Annato (*Bixa orellana*), Stevia and Peppermint (*Mentha piperita*) are not indigenous to India. At the same time there are several indigenous plant species that have high commercial demand which are still collected from the wild and are becoming very rare, but did not successfully introduced for cultivation. The National Medicinal Plant Board has recommended 32 species of medicinal plants for large- scale cultivation, out of which 20 species can be cultivated in South Indian habitats. These species and medicinal rice varieties like *Navara, Chennellu* and spices like wild pepper and orchids like Nervilia are a few among the plants with potential for large - scale cultivation . Therefore following steps are to be undertaken immediately.

- Address the problem of Planting material scarcity by setting-up village level Seed Production Centres (nurseries) of commercially viable plant species. Educated youth can start this as an enterprise as a part of the Agri-Clinic.
- Set up the infrastructure needed for large-scale medicinal plant cultivation. For example, Tissue Culture Lab; Drying Yards, Raw Drug Processing Unit etc. at district level in the places identified for this purpose.
- Formation of Medicinal Plant Cultivators Groups -(Self Help Groups of Women and Farmers) in the model of Sanjeevani (AVS, Kottakkal) and link them with the pharmaceutical enterprises.
- Organize the National Medicinal Plant Board's efforts more farmer -friendly. The State unit of Board may have to strengthen their out reach to farmers with less hazles in medicinal plant cultivation.·

- Promote Organic cultivation through Group Farming. Production Centres for organic inputs are to be established at Panchayath level by piling inputs raised at *in-situ* level.
- Offer institutional back up to farmers, for the production of quality seedlings of selected plants and provide useful information about plant species, their cultivation, storage, and marketing methods.
- Introduce certification process for proving the authenticity of the medicinal plant produced and the method of cultivation followed for its production.
- Carry out an economic analysis of cultivation of the species of high commercial demand.

3. Conduct Periodical Studies of Raw Drugs Market Dynamics

(Panel discussants: K. Radhakrishnan, Abdul Kareem and A.B. Rama Shree)

The herbal market of the State today is unorganized due to various reasons. The nature and dynamics of this domestic trade, is far from simple. It involves central and regional markets through a number of private dealers and agencies, government controlled cooperatives all having upstream linkages with numerous local and "road-head" markets, which in turn have myriad middlemen, petty shopkeepers and agents feeding them with primary supplies. There are also contract farmers who regularly supply bulk quantities of raw drugs to established Institutions like AVS. About 450 raw drugs are used in the manufacture of 500 Ayurvedic medicines on a commercial basis in Kerala with an annual trade in Ayurvedic medicines about Rs. 200 crores. A study by KFRI shows that only seven percentage of total consumption of raw drugs in Kerala is met by the cultivation, while 93 percent is still through collection from the wild. The situation thus warrants the supply of good quality raw drugs cultivated and marketed by ensuring relevant quality control measures. Several species have got high demand, for example, Kacholam has an annual demand of 748956 kg, in Malabar region alone. Likewise, Chengazhi (17487 kg), Kasthuri Manjal (13271kg) and Vayambu (89875 kg) are used heavily in Kerala. Intermediary play a significant role in the trade, but unfortunately it is largely secretive in nature as there is no declared market for raw drugs or fresh picks from herbal gardens. Therefore, the Recommendations are :

- Study the genuineness of Raw drugs through morphological, taxonomical and molecular methods.
- Conduct a thorough market study ranging from the harvest to market and consumers' table and publish the prices of plants traded directly by the user companies.
- Small- scale Raw Drug Collection Centres at Panchayath level may be promoted, and collections from such centres could be pooled at few semi- processing units equipped with good storage facilities in some selected localities depending upon the degree and level of cultivation of medicinal plants. A central processing unit cum export facility also may be started at the district or zonal level with all modern facilities. This Central unit can function as a supply unit for exporters/ domestic markets and the manufacturing industry.

4. Coordinate attempts in Documentation of Traditional Knowledge

(Panel discussants: Dr. C.R. Elsy, Dr. Anil Kumar and K.B. Ramesh Kumar)

One of the primary aims of any research on the genetic wealth is to give effect to the provisions of the recent legislations of India viz. Protection of Plant Varieties & Farmers Rights Act 2001 & Biological Diversity Act 2002. Setting examples for benefit sharing arrangements with the knowledge providing communities is imperative for conserving their dying traditional wisdom as well as the plants valued for their uses. This critically depends on the ability to link such knowledge with the innovations in the biotechnological discoveries based on prior

knowledge of its uses. The steps such as mobilising communities/ individuals to register Claims of Knowledge, documentation of such knowledge on Ethno-medicine and building databases, and employing relevant methods for its validation are to be taken, if the tribal men and women could be benefited by the provisions of the two Indian Acts. Very diverse folk medicinal plants are found in many remote areas in Kerala. However, their documentation is becoming a confusing exercise as a given species may bear different vernacular names in different places. We should not shy away from utilizing such kind of knowledge in a wider way, but of course with the consent of the knowledge holders of such genetic wealth. The steps needed in this direction are:

- Establish Medicinal Plant Knowledge Centres at district or zonal level for dealing with Farmers' Rights and to give all the details from seed collection to value addition and marketing to the farmers.
- Prepare Panchayath level Medicinal Plant Registers by involving local traditional healers, elderly men and women, herbal collectors, raw-drug dealers and ayurvedic doctors.

5. Some Objectives of concern in Medicinal Plant Sector (Open discussion)

1. *Genetic Gardens for Medicinal Plants*

Although farmers are interested in the cultivation of medicinal plants, there is no ready supply source for planting materials for the species in demand as of today. There is a dearth of availability of good quality planting materials. Therefore, the farmers and women SHGs will have to be encouraged by providing good quality mother seeds/planting materials and the infrastructure needed for rapid multiplication through competent technical institutions in the district. This would help in the timely availability of planting and seed materials. In this context, plant nursery units at centralized and village levels be initiated. Setting up of tissue culture labs at district level attached with KVK or such kind of organisations will certainly help to solve the problem of large-scale supply of planting materials.

2. *Research Initiatives for establishing Geographic properties of Medicinal Plants*

The geographical advantages of highlands reflected in the properties of several medicinal plants cultivated in hilly areas, are to be investigated in a scientific manner. Products like honey, amla, wild pepper, both the cultivated and wild turmeric and ginger collected from the forests of Wayanad are characteristically different in properties from such products obtained from other geographic locations. Studies should taken up to understand the genetic variability of the different species of medicinal plants and the result of such studies are to be correlated with the knowledge associated with such materials in the realm of ethnic medicine, ayurveda and modern sciences.

3. *Initiatives to Promote Herbal Tourism*

Herbal or Ayurvedic Tourism has high potential in the state, thanks to its salubrious climate and rich herbal wealth. The landscape diversity that varies from forests, bushes, thickets, rocky grasslands, fallow fields, springs, streams, canals and wetlands- a fine example of a heterogeneous ecosystem as well as the rich ethnic diversity with unique health care knowledge and practices, provide an ideal situation for Herbal tourism. This potential could be utilised in a scientific and more efficient manner.

4. *Herbal Parks for Herbal Production*

A sizable percentage of income of rural house holders is spent towards health care needs, thus along with the education and awareness programmes, the production of herbal products at community level by ensuring all quality parameters could be encouraged. Good quality production and storage measures have to be ensured in case of these products in a cost-effective manner at community level. The women SHGs

are to be trained by skillful and qualified herbal practitioners in such ventures to enable them to produce simple primary health care nutraceuticals and diverse kinds of cosmaceuticals.

5. *Networking of Partner Institutions and Linkages with PRIs*

The responsibility of conservation and enhancement of the Herbal wealth of Kerala is shared by several institutions, notably, TBGRI-Palode, AVS- Kottakkal, KFRI- Thrissur and a number of new pharmaceutical firms in private and public sector. Networking of such R&D institutions and their linkages with the Panchayath Raj Institutions after identifying the area of collaboration is an effective strategy for achieving the goals set in this sector. For instance, the Community Agrobiodiversity Centre of MSSRF is working for the revitalization of primary health care traditions for a long period of time through a networking approach with NGOs, University/Govt. Extension services, Forest Departments and PRIs. The Centre has taken up the current subjects - legislations in Biodiversity and Plant varieties' conservation as their focal theme for education and training in the sustainable use of the herbal resources.

Table-1. Medicinal Plants with domestic and export potential suitable for cultivation in Kerala & South Indian region.

Local Name	Botanical Name	Local Name	Botanical Name
Ashokam	*Saraca asoca*	Kacholam	*Kaempferia galanga*
Pathimugham	*Caesalpinia sappan*	Brahmi	*Bacopa monnieri*
Koovalam	*Aegle marmelos*	Pachila, Pachauli	*Pogostemon pachouli*
Palakappayyani	*Oroxylum indicum*	Koova	*Curcuma zeodaria*
Kumizhu	*Gmelina arborea*		
Kanikkonna	*Cassia fistula*	Shathavari	*Asparagus racemosus*
Nellikka	*Emblica officinalis*	Chittaratha	*Alpinia galanga*
Neelayamari	*Indigofera tinctoria*	Paal Muthakku	*Ipomaea digitata*
Thippali	*Piper longum*	Kurangu Manjal	*Bixa orellana*
Iruveli	*Coleus zeylanicus*	Safed Musali	*Chlorophytum borivilanum*
Adapathiyan	*Holostemma ada-kodien*	Vellakunni	*Abrus precatorius*
Kattupadavalam	*Trichosanthes cucumerina*	Nagadandi	*Baliospermum montanum*
Amukkuram	*Withania somnifera*	Trikolpakonna	*Operculina turpethum*
Ramacham	*Vettiveria zizanioides*	Chittadaladokam	*Adhatoda beddomei*
Nannari	*Hemidesmus indicus*	Kattaar vaazha	*Aloe vera*
Naykkuruna	*Mucuna pruriens*	Vayampu	*Acorus calamus*
Koduveli	*Plumbago indica*	Thulasi	*Ocimum sanctum*
Savam naari	*Catharanthus roseus*	Sathavari	*Asparagus racemosus*

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POULTRY FARMING IN RURAL AND TRIBAL LIVELIHOOD SECURITY

POULTRY FARMING IN RURAL AND TRIBAL LIVELIHOOD SECURITY

(**Panel discussion**, Nov. 6, Parallel session II, Chair: Dr. Jalaludeen, Kerala Agricultural University, Thrissur)

Session Chair : Dr. Jalaludeen, KAU

Keynote Speaker : Dr. L. R. Gopinath

Panel Discussants : Dr. Radhamma Pillai, RARS, Ambalavayal

Mr. Manjunath, Venketasa Hatcheries

Rapporteur : Smt. Elsy Mathew

Prospects of Poultry Farming in livelihood security

Both Agriculture and Animal husbandry are important when agricultural development of any state is concerned. Poultry figures one of the major activities in Animal husbandry in India. Our state's average growth rate in poultry is 5.8% for the last few years. Though average growth rate in poultry is reasonable, the cost of production of egg as well as processed chicken is very high and only way to bring down the cost of production is enhancing the production efficiency. Major share of the expense in poultry production goes to poultry feed. In our state it is estimated that on average 70 – 75% is spending for poultry feed.

Composition of poultry feed is different for production of egg and dressed chicken. The energy supplying portion and protienaceous portion are the two important compositions to be considered when feed formulations are consulted. Maize, jowar, rice bran are the major energy suppliers whereas oil cakes like ground nut oilcake, gingelly oil cake, soybean meal, dry fish are the protein source. Energy supplying portion consists of 64–89% for general feed, feed for 9–19 months old chicks respectively–s mainly used are maize or jowar, consists about 50% of the feed. A model broiler starter feed has 50% of its composition is maize where as in feed composition for finisher broiler feed it will be 55% and small chicks the maize (broken) content will be 45%.

Per capita consumption of poultry products in Kerala is comparable to developed countries in Europe and so there is a big scope for its further development. But climatic condition, population density of the state, average land holdings, availability of raw materials for the production of poultry feed are the major hurdles for the breakthrough in this direction. To make headway in poultry production as in the neighboring states, the R&D has to find out alternate source for energy supplying materials. Tropical tuber crops, mainly cassava or perhaps yams can be considered as a candidate. Moreover, peoples participatory approach / joint farm can be exploited in enhancing the production of poultry feed.

This session that consists of veterinary scientists, farmers and entrepreneurs and women SHG members may discuss the subject in detail.

-Dr. Jalaludeen

Keeping this rationale in mind the panel has discussed the problems and prospects in poultry farming in Kerala. The panel has unanimously agreed that the poultry farming is an important area for improving the livelihood options of tribal and rural communities. Following are the recommendations to set up an economically, socially and environmentally viable poultry industry for the state of Kerala.

OBSERVATIONS & RECOMMENDATIONS

1. As there are no exact data available on the egg and poultry meat in the State, a detailed survey on the volume of poultry activities should be taken up urgently. Panchayath level recording of such data on yearly basis is necessary.
2. Efforts should be made for the intensification of Rural Poultry Production Programmes in every panchayaths of the state with the help of Kudumbasree women groups.
3. Conservation of Desi Found breeds/ germplasm in Kerala has to be initiated and strengthened. Tribal areas of the State has to be given priority in such interventions.
4. Considering the role of poultry in poverty alleviation, nutritional security and providing employment, industrial poultry production need to be strengthened in the State.
5. As Kuttanad ducks are potential egg producers of very large size compared to all other native ducks in India, measures to enhance its productivity and its popularization may be taken up-urgently.
6. Small –scale poultry Dressing Plants/Meat-Processing Plants may be set up in Panchayath/ Taluk levels for clean meat production.
7. As farmers are not getting remunerative prices for their products, steps should be taken for better marketing efforts and effective distribution systems (for eggs and chicken in urban –rural area.)
8. Empowerment of rural women through small–scale programme at urban level should be explored. Efforts should be made for the popularisation of other species of poultry, viz. chicken, guiniie, turkey etc.
9. A Poultry Development Board may be set-up at National Level with region wise-representation.
10. Emphasis may be given for the production of poultry feed grains by assuring remunerative prices through Government as well as NGOs.
11. Financial support may be given for NGOs and co-operative societies for establishing small feed-mixing plants (custom feed mixing).
12. Efforts may be taken for the commercial production of local breed poultry eggs.

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XIII SWADESHI SCIENCE CONGRESS

PROGRAMME

6-8 NOVEMBER 2003

Community Agrobiodiversity Centre,
M.S. Swaminathan Research Foundation Kalpetta, Wayanad

Inauguration by Dr. M.A. Kuttappan, Hon. Minister for Welfare of Backward and Scheduled Communities, Govt. of Kerala

Inauguration of Biodiversity Exhibition by K. Gopalan, Dist.Collector, Wayanad

DAY 1: NOVEMBER 6th, 2003 (THURSDAY)

09.00 – 10.30	REGISTRATION	**Venue- CAbC Entrance**
10.30 – 11.30	INAUGURAL SESSION	**Venue- KURINJI HALL**
	Invocation	**Kumari Ishrath**
	Welcome	**Dr. M. Velayutham,** Executive Director, MSSRF
	About SSM and Congress	**Dr. K. I. Vasu,** President, Vigyan Bharthi
	Presidential Address	**Sri. K. K. Ramachandran Master** MLA
	Lighting of Lamp and Inaugural Address	**Dr. M. A. Kuttappan,** Hon. Minister for Welfare of Backward and Scheduled Communities, Govt. of Kerala
	Inauguration of Biodiversity Exhibition	**Sri. K. Gopalan IAS,** District Collector
	Felicitation	**Sri. K. K. Ahmed Haji,** District Panchayath President
	Vote of Thanks	**Dr. N. Anil Kumar,** Programme Director, CAbC, MSSRF
11.30- 11.45	Tea Break	

Forenoon 11.45- 13.00,
Plenary Session
Venue: KURINIJI HALL

Chairman		**Dr. K. V. Peter,** Vice Chancellor, KAU, Thrissur
Key Note Addresses		
11.45- 12.00	Agricultural sciences	**Dr. Prabhakaran Nair,** Consultant, FAO
12.00- 12.15	"Farmers' Rights" and Farmer Empowerment	**Dr. S. Balaravi,** Advisor Biodiversity, MSSRF
12.15- 12.30	WTO implications on plantation industry	**Sri. N. Dharmaraj,** Vice President, Harrisons Malayalam Ltd.
12.30- 12.55	Discussion	
12.55- 13.00	Vote of Thanks	**Sri. A. Jayakumar,** Organizing Secretary, SSM

Afternoon Session- 14.00- 18.00

Technical Session I- AGRICULTURAL SCIENCES
Venue: KURINJI HALL

Session Co-ordinators		**Dr. V. P. Potty,** SSM, **Dr. K. Madhusudhanan**, CAbC, MSSRF **Dr. Jayaprakash,** SSM
Rapporteur:		**Smt. Deepa Varma,** MSSRF
16.00 - 16.30	Tea Break	

Technical Session I- a view of Agriculture session

Policy makers workshop: Dr.S.Balaravi, Dr.Suman Sahai, DR. K.K.N.Kurup (from left)

DAY 1: NOVEMBER 6th, 2003 (THURSDAY) Afternoon Session,
PARALLEL SESSION I- POLICY MAKERS' WORKSHOP
Theme: Crop Diversity and Tribal Empowerment

14.00- 18.00	**Venue: PALAI HALL**
Session Coordinators	**Dr. Sudha Nair,** Director, Biodiversity, MSSRF
	Dr. Arivudai Nambi, Principal Scientist, MSSRF
	Sri. G. Girigan, Scientist, CAbC, MSSRF
Chairman	**Dr. S. Balaravi,** Advisor, Biodiversity, MSSRF
Rapporteur:	**Sri. T. Raveendran,** CAbC, MSSRF
Keynote Speakers	**Dr. Suman Sahai,** Gene Campaign, New Delhi
	Dr. K. K. N. Kurup, Ex. Vice Chancellor, Calicut University
Paper Presentation	**Sri. Narayanan**, Tribal Leader, Wayanad
	Sri. G. Girigan, Scientist, CAbC, MSSRF
Panel Discussion	**Dr. Indira Balachandran,** Centre for Medicinal Plant Studies/ AVS, Kottakkal
	Sri. Mohan Kumar, Senior Scientist, KIRTADS
	Sri. P. S. Muraleedharan, Senior Scientist,KFRI
	Sri. K. Gopalan, IAS, Dt.Collector, Wayanad
	Sri. Nanda Kumar, RASTA, Kalpetta
	Sri. V. Kesavan, Chairman, SC/ST Federation
	Sri. Palliyara Raman, Tribal Leader, Wayanad
	Sri. R. Venugopal, Secretary, Rural Wholesale Market, Bathery
	Sri. K. V. Divakaran President, OFCO, Wayanad
	Louis B. Figaredo, VOICE, Bathery
Summing up	**Dr. S. Balaravi,** Advisor, Biodiversity, MSSRF
Vote of thanks	**Dr. Sudha Nair,** Director, Biodiversity, MSSRF

Lead Talk by Sri.Manjunath, Manager, Venketeswara, Hatacheries, Karnataka in Parellel Session II Poultry Farm for livelihood Security

Day 1: NOVEMBER 6th, 2003 (THURSDAY) Afternoon Session
Parellel Session II Theme: Poultry Farm for livelihood Security

14.00- 18.00	**Venue: NEITHAL HALL**
Session Coordinators	**Sri. Alphonse**, MSSRF
	Sri. Oliver Israel King, MSSRF
Chairman	**Dr. Jalaludeen,** KAU, Thrissur
Co-chair	**Sri. Manjunath**, Manager, Venketeswara, Hatacheries, Karnataka
Rapporteur	**Smt. Elsy Mathew,** CAbC, MSSRF
Keynote Speaker	**Dr. L. R. Gopinath,** Senior Scientist, MSSRF
Panel Discussion	**Dr. Radhamma Pillai,** RARS, Ambalavayal
Summing up	**Dr. Jalaludeen,** KAU, Thrissur
Vote of thanks	**Dr. Sajeev**, SSM
16.00- 16.30	Tea

DAY 1: NOVEMBER 6th, 2003 (THURSDAY)
POST TEA SESSION Technical Session III

Venue- SAHYADRI **Exhibition/Poster Session**

A view of exhibition /poster session

Linking Science and People: Special lecture : Prof. M. S. Swaminathan, Chairman, MSSRF

Special Lecture, Swadeshi Science, Science Through Ages : Prof. K. I. Vasu, President, Vigyan Bharathi

DAY 2: NOVEMBER 7th, 2003 (FRIDAY)

	Plenary Session	**Venue: KURINJI HALL**
9.00- 11.00	Welcome	**Dr. Suresh Kumar,** State Secretary, SSM
9.00- 9.30	Chairman's Address (Linking Science and People)	**Prof. M. S. Swaminathan,** Chairman, MSSRF
9.30- 10.00	Special Lecture (Science through Ages)	**Dr. Balagangadharan,** VSSC, Trivandrum
10.00 – 10.30	Special Lecture (Swadeshi Science)	**Prof. K. I. Vasu,** President, Vigyan Bharathi
10.30- 11.00	Open Forum, 11.00- 11.30	Tea Break

DAY 2: NOVEMBER 7th, 2003 (FRIDAY)
SIR C. V. RAMAN MEMORIAL LECTURE

11.30-12.30	Delivered by	**Dr. P. Pushpangadan,** Director, NBRI
12.30- 12.55	Open Discussion	
12.55- 13.00	Vote of Thanks	**Dr. T. Ravishankar,** Associate Director, MSSRF
13.00- 14.00	Lunch	

SIR C. V. RAMAN MEMORIAL LECTURE **:** Dr. P. Pushpangadan, Director, NBRI:

A view from technical session II: Environment Science and Physical Science/ Chemical Sceince & Agricultural Science

DAY 2: NOVEMBER 7th, 2003 (FRIDAY)
TECHNICAL SESSION II: ENVIRONMENT SCIENCE AND PHYSICAL/ CHEMICAL SCIENCE & ARICULTURAL SCIENCES

14.00 –18.00	**Venue: NEITHAL HALL**
Session Coordinaors:	**Dr. V. P. Potty,** SSM
	Dr. K. Madhusudhanan, Scientist, MSSRF
Chairman	**Dr. Arivudai Nambi,** Principal Scientist, MSSRF
Rapporteur	**Sri. Manoj. R,** CUSAT, Cochin
Keynote	**Dr. R. Satheesh,** Reader, School of Environmental Science, Gandhi University

This session included Papers and Presentations carried over from the Agricultural Session

Prof. M. S. Swaminathan Addressing the Session: Health Sceinces

Key note paper : Dr. N. Anil Kumar, MSSRF

DAY 2: NOVEMBER 7th, 2003 (FRIDAY)
TECHNICAL SESSION III: HEALTH SCIENCES
(MEDICINAL PLANTS/MEDICINAL RICES & HEALTH FOODS)

Sesssion Coordinator:	**Dr. Radhakrishnan,** SSM
Chairman	**Prof. M. S. Swaminathan,** Chairman, MSSRF
Co-Chairman	**Prof. M. N. Sreedharan Nair,** Rtd. Profssor, M.G. College TVM
Rapporteur	**Dr. Rema Devi,** AVS, Kottakkal
Key note address	**Dr. N. Anil Kumar,** Director,CAbC, MSSRF
Panel Discussion	**Dr. Z. Abraham,** NBPGR, Thrissur
	Dr. Leena Kumari, KAU, Thrissur
	Dr. Elsy, KAU, Thrissur
	Sri. Radhakrishnan Nair, AVS, Kottakkal
	Sri. Abdul Kareem, AVS, Kottakkal
	Sri. K.V. Divakaran, Pozhuthana
	Dr. Gracy Mathew, Asst. Professor, AMPRS, Odakkali
Summing Up	**Prof. M. S. Swaminathan,** Chairman, MSSRF

Parallel Session III: Gender and Agrobio diversity

Smt. Ajitha, ' Anewshi' particpating in the panel discussion

DAY 2: NOVEMBER 7th, 2003 (FRIDAY)

Parallel Session III, Gender and Agrobio diversity

	Session Coordinator:	**Dr. Meera Devi,** Coordinator, Gender and Dev., MSSRF
	Chairman	**Dr. Krishna Sreenath, CIFT, Cochin**
	Co-chair	**Dr. Sudha Nair,** Director, Biodiversity, MSSRF
	Presentations	**Sri. K. K. Annan,** Ex. MLA & Tribal Leader
		Dr. P. S . Geethakkutty, KAU, Thrissur
		Sri. M. K. Ratheesh Narayanan, Scientist, MSSRF
		Sri. G. Girigan, Scientist, MSSRF
16.00-16.30	Tea Break	
	Panel Discussion	**Smt. Ajitha, Anewshi, Calicut**
		Smt. Omana, RASTA
		Dr. T. Ravishankar, Assoc. Director, MSSRF
		Sri. Louis B. Figaredo, VOICE, Bathery
		Dr. Celine Sunny, Director, Rajagiri College of Social Sciences
		Prof. Sarada Rajeev, School of Management Studies, CUSAT
		Smt. Aliyamma Vijayan, Director, Sakhi, TVM.
	Summing up	**Dr. Krishna Sreenath,** CIFT, Cochin
	16.30- 17.30	**Slide Show: Ecology of Western Ghats**
		Sri. Sethumadhvan, Kalpetta

Day 2: NOVEMBER 8th, 2003 (SATURDAY) TECHNICAL SESSION IV
CONTEST FOR YOUNG SCIENTIST AWARD

9.00- 13.00	**Venue: KURINJI HALL**	
	Session Coordinator:	**Dr. K. Madhusudhanan,** Scientist, MSSRF
	Chairperson	**Dr. Sudha Nair,** Director, Biodiversity, MSSRF
	Rapporteur:	**Dr. Jayaprakash**, SSM
	Paper Presentation- This session included 16 Paper presentations	
11.00- 11.30	Tea Break	
11.30 – 13.00	Contest for Young Scientist Award: Paper presentations continues.	
13.00- 14.00	Lunch Break	

Young Scientist Award to
Sri. R. Manoj, CUSAT,

Swadeshi Science Movement
Award to Prof. K.S. Manilal

Day 3: NOVEMBER 8th, 2003 (SATURDAY)
VALIDICTORY FUNCTION

Venue: KURINJI HALL

Welcome	**Dr. K. Ravindran,** President, SSm
Presidential Address	**Prof. M. S. Swaminathan,** Chairman, MSSRF
Chief Guest	**Dr. G. M. Nair,** Director TBGRI
Award Presentations	**Dr. G. M. Nair,** Director TBGRI **Dr. K. Ravindran,** President, SSM **Sri. A. Ratnam,** Chairman MAC, CAbC
Summing up of the Proceedings	**Dr. N. Anil Kumar,** Programme Director, CAbC, MSSRF
Vote of thanks	**Dr. K. Madhusudhanan,** Secretary, 13th SSC
National Anthem	

Vote of thanks: Dr. K. Madhusudhanan,
Secretary, 13th SSC

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Smt. Annakkutty Paul, Convenor
Smt. M. P. Swapna

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Sri. Dhaneshkumar
Smt. Lissy Paul
Sri. K.V. Divakaran
Sri. P.T. Varghese
Sri. M. K. Ratheesh Naryanan

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Sri. V. P. Sajeev, Convenor

Award

Sri. P. A. Muhammed, Chairman
Sri. P. M. Nanadkumar, Convenor
Sri. T. Raveendran

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