Proceedings of the University Union Seminars 1989

Directorate of Students Welfare
KERALA AGRICULTURAL UNIVERSITY
Vellanikkara, Trichur, Kerala

FOREWORD

The University Union of 1989 has made a bold attempt in disseminating the knowledge they have acquired in the laboratories, class rooms and experimental stations to farmers and farming families through well organised seminars and workshops. In doing so they have proved not only their organising capacity but also their care and concern for the welfare of farmer target group for whom they are to give leadership in scientific farming and application of technology in allied areas, after their graduation from this University.

They could develop a sense of confidence among farmers of Kerala and help them identify, select their specific problems and apply appropriate solutions by enlisting co-operation of experts in the concerned areas. It is indeed an admirable service quite befitting them as prospective agricultural scientists and responsible citizens of India.

I hope this documentation will be a useful record for reference as well as a model for emulation by future students of the University.

Vellanikkara,
18th December, 1989

Dr. E. G. SILAS
Vice-Chancellor

PREFACE

Kerala Agricultural University is taking care of, not only the youth of the University, but also the youth of our community and thousands of farmers of Kerala. We have tried to encourage the national integration by inviting students from other Universities and giving them a chance to interact with our students and people of Kerala.

We have introduced the students of our University along with other non-student youth of our community (1) to the western-ghat ecosystem and to instill an awareness in them for the preservation and conservation of the forest eco-system (2) to make an on the spot study of the flora and fauna occuring in tropical evergreen forest (3) to understand the living conditions of the tribal people in the forest so as to inculcate a spirit of understanding the problems of the weakest sections of the society (4) to understand and recognise the dignity of labour (5) to adjust to the rural life of our community (6) to develop a sense of responsibility to the community and (7) to develop the overall potential of the students and other non-student youth as future citizen and leaders.

Students of the University through their unions in the constituent colleges and University have tried to study the classical cultural heritage of Kerala and their presentations in the youth festival have exculled many of the conventional Universities in Kerala. They have also proved their leadership quality by organising seminars of high standard for educating the farmers of Kerala and other youth of the society in topics of much practical value to them.

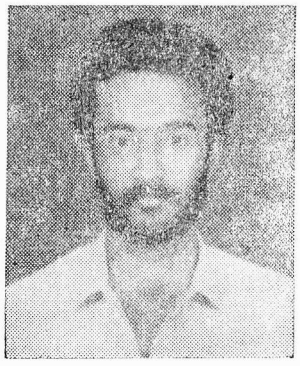
I am very happy to note that the University Union 1989 has given much attention in these line and organised several seminars in various disciplines. This is a maiden attempt of preserving the documents of experts presented in these seminars.

Vellanikkara
18-12-'89

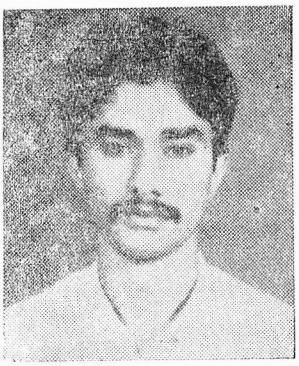
Dr. T. G. RAJAGOPALAN
Director of Student's Welfare i/c.

It is our wish that the extra academic activities should provide a venue for the active involvement of the students. Our seminars and Exhibitions gathered overwhelming response from the students. But however the heated discussions in our seminars and symposia often go unnoticed unless a permanent impression of them are made.

It is this motivation that pursue us to bring the proceedings of the seminars conducted by the Kerala Agricultural University Union in a form as this.



P. SUDHEER BABU
President,
Kerala Agrl. University Union



M. A. RAFEEK
Secretary,
Kerala Agrl. University Union

CONTENTS

SEMINAR ON
CO-OPERATION AND RURAL DEVELOPMENT

1. Poverty alleviation and Agricultural Development
—Dr. Lekshmy Narayanan Nair

2. Role of Agricultural Universities in Rural Development with special reference to Banking and Cooperation
—Dr. G. Morley Mohanlal

3. Role of Dairy Co-operatives in Rural Development in Kerala
—K. P. P. Kurup

4. Role of co-operatives in Rural Development
—P. K. M. Raja

Poverty Alleviation and Agricultural Development

N. Lekshmynarayanan Nair
Deputy Director (Agri) State Planning Board

Introduction

1. Poverty alleviation continues to be one of the major objectives of our Five Year Plans. According to the tentative projections made by the Planning Commission for the Eighth Five Year Plan, the average poverty level in the country reckoned to be around 28 to 30 per cent by the end of Seventh Five Year Plan is to be reduced to 18-20 per cent. Based on the state-wise estimates made by the Planning Commission the rural poverty ratio of Kerala has come down from a level of 63 per cent in 1973-74 to 47.4 per cent in 1977-78 and 26.1 in 1983-84 (Please see, Annexure I). Going by the past trend Kerala should aspire for a higher attainment in poverty reduction much above the all India average. Though Kerala's performance in the area of poverty alleviation is quite encouraging compared to the all India situation, the picture is not that encouraging according to the estimates made by other agencies at the instance of State Government. The Directorate of Economics and Statistics has estimated the poverty ratio of Kerala in 1983-84 as 57 per cent, while according to the Centre for Development Studies. it is in the range of 54—63 per cent. Neverthless all these data highlight the need to pursue the poverty alleviation programmes with greater vigour during the Eighth Five Year Plan.

Problems and Prospects

2. The Task Force on Minimum Needs and Effective Consumption Demand constituted by the Planning Commission (1978) defined poverty line as the per capital monthly expenditure of Rs. 49.09 in rural areas and Rs. 56.64 in urban areas, at 1973-74 prices, corresponding to the percapita daily caloric requirement of 2400 in rural areas and 2100 in urban areas, as well as expenditure on essential non-food items. The updated figures for 1983-84 are Rs. 101.8 per capita per month for rural areas and Rs.117.5 for urban areas (Please see Annexure II for Statewise detail). Assuming the average size of household as 5.3, the annual average household expenditure for fixing the poverty line works out to Rs. 6400 in rural areas. The controversy over the poverty level in Kerala arises from the premise that this has to be pegged at a much higher level, taking into consideration the inter-state variations in consumption pattern, commodity prices and expenditure on non-food items.

3. In any case substantial reduction in poverty level is possible only through creation of new opportunities for augmenting the income of households below the poverty line. Investments for poverty alleviation will be effective only if they succeed

in creation of sustainable assets for generation of income and employment for the households. In the wake of Eighth Five Year Plan it is worthwhile to examine the problems and prospects in making bigger strides in this direction.

4. Kerala is predominantly an agricultural economy with more than 34 per cent of the state income and 50 per cent of the employment opportunities originating from this sector. Out of a total work force of 67.9 lakhs available as per 1981 census 19.17 lakhs belong to the category of agricultural labourers and 8.872 lakhs cultivators. Work-force belonging to cash crops and plantation sectors as well as allied sectors like fisheries, forestry etc. which are categorised as other workers" also constitute another 6.5 lakhs. Thus the income and employment base for a vast majority of the target group to be tackled under the poverty alleviation programme lies in the agricultural sector. Integration of poverty alleviation with agricultural development, therefore, assumes great significance.

5. Integrated Rural Development Programme, Jawahar Rozgar Yojana and Small and Marginal Farmers Programme are the major schemes launched by Government of India for poverty alleviation and rural development though all these programmes, recognise agriculture as a thrust area, they often fail to get operationalised to the extent desired. In the Kerala context there is need for integrating the efforts with those farming systems which have the potential for poverty alleviation.

6. Broadly, the farming systems in Kerala could be classified into 3; namely the rice based farming system, the homestead based farming system and the plantation based farming system. The rice based farming system and the homestead based farming system with coconut, pepper etc. as the main crops, are the beset with many problems. The prosperity of the State in general and the small and marginal farmers and agricultural labourers in particular, is closely linked with the performance of rice, coconut and pepper. They together occupy more than 50 per cent of the net area under cultivation. In the spatial distribution also they cover almost all the districts extending over the coastal and midland regions throughout the state. Rice has the distinction of supporting a vast majority of the agricultural labour force particularly women.

Small and marginal farmers, by and large, depend on these crops for sustenance. A realistic appreciation of the key constraints comfronting the development of these 3 crops and a proper integration of the poverty alleviation programmes with their development would therefore helps in bringing spectacular improvements in rural economy. Some of the important areas requiring attention in this regard are explained below:

i) The area under rice has been declining steadily over the last decade (Please see annexure IV). The State lost nearly 2.5 lakh ha. under the crop during this period resulting in considerable loss of rural employment. The waning interest in rice cultivation has to be regained through systematic efforts for improving the infrastructural facilities such as minor irrigation, drainage, land development etc. for improving the productivity levels and by encouraging group farming for reducing the cost of cultivation.

ii) The productivity of Coconut in the State at the present levels of around 4500 nuts per ha. is very much below the potential, irrigation combined with better management is one of the surest means of improving the productivity levels substantially. The coconut belt offers tremendous scope for exploiting ground water for irrigating the crop. The present level of exploitation is reported to be only around 15% of the potential. A major irrigation programme not only helps in generating employment opportunity in the development of such infrastructural facility but also helps in creating and sustaining the employment potential through additional opportunities in intercropping. Thus technology and opportunity are available for securing a break through in the production of Coconut which is the back bone of our rural economy.

iii) As in the case of Coconut, productivity of Pepper is also not only low but also stagnating (Pl. see annexure V). Soil Conservation cum land development combined with a rehabilitation programme in the traditional areas of the crop could bring about significant improvements in the productivity level. The activity is both labour intensive and income generating.

iv) Coconut and Pepper offers enormous scope for value addition by way of primary processing at the farm level, as bulk of these commodities are now traded in their raw form.

v) All the 3 crops are predominantly in the small farm sector with more than 34 per cent of the area under rice, 57 per cent under coconut and 43 per cent under pepper are "less than one ha category". Size distribution of area under different classes pertaining to these crops are given in Annexure VI.

Income generated from such marginal holdings may not be adequate to support an average family in Kerala. The strategy for development of such holdings should, therefore, be based on a whole farm development approach suitably integrating some subsidiary enterprises which fit in very well with the cropping system. A number of such agro based avocations requiring relatively less land area and at the same capable of generating substantial income, are available; such as dairying, back yard poultry, duck farming, rabbit rearing, pig rearing, bee keeping, mushroom culture vegetable cultivation, sericulture etc. Economics of these activities are given in Annexure VI.

7. All the measures suggested are capital intensive and beyond the reach of the small and marginal farmers who predominate the production scenario. At the same time the activities are financially viable and this would qualify for institutional finance. Investment finance necessary for the purpose has to be largely found from institutional agencies through area based projects. The budgetary resources earmarked for poverty alleviation programmes have to be judiciously integrated with these projects so as to act as incentives for accelerating the flow of institutional finance. Beneficiaries have to be identified in an area basis and brought within the fold of Co-operatives for ensuring the required back up services. To sum up, agricultural development and poverty alleviation programmes should be planned and implemented in an integrated manner for attaining sustained growth in rural development.

Annexure—I

State-wise estimates of poverty ratios compiled by the Planning Commission

State	Rural Poverty Ratio 1977-78	1983-84	Difference in points
Kerala	47.4	26.1	21.3
Assam	48.5	23.8	24.7
Gujarat	43.1	27.6	15.5
Maharashtra	60.4	41.5	18.9
Orissa	67.9	44.8	23.1
Tripura	64.5	23.5	14.0
West Bengal	58.3	43.0	14.5
All India	51.2	40.4	10.8

Source – Report of the Task Force on Rural Development, State Planning Board

Annexure—II

State-wise poverty line expenditure level for 1977-78 and 1983-84

Sl. No.	States	Rs per capita per month at current prices			
		1977—78		1983—84	
		Rural	Urban	Rural	Urban
1	Andhra pradesh	60	70	93	108
2	Bihar	49	57	90	104
3	Gujarat	57	66	98	113
4	Jammu & Kashmir	64	74	109	126
5	Karnataka	55	63	101	117
6	Kerala	56	65	116	134
7	Madhya Pradesh	55	63	94	109
8	Maharashtra	57	66	99	115
9	Orissa	61	70	117	135
10	Rajasthan	56	65	88	101
11	Tamilnadu	62	71	118	136
12	Uttarpradesh	54	63	92	106
13	West Bengal	55	66	101	117
14	All India	56	65	99	114

Source:– Report of the Task force on Rural Development, State Planning Board.

Annexure—III

Crop-wise employment potential (per ha)

Sl. No.	Crop		Mandays
1	Paddy	Autumn	213
		Winter	180
		Summer	172
2	Coconut		87
3	Pepper		66
4	Tapioca		126
5	Banana		337
6	Arecanut		126

Source:– Report of the Task Force on Manpower & Employment, State Planning Board.

Annexure—IV

Trend of area, production and productivity of rice in Kerala

Year	Area ('000 ha)	Production ('000 T)	Productivity (kg/ha)
1960—61	778.91	1067.53	1371
1970—71	874.93	1298.01	1483
1980—81	801.70	1271.96	1586
1986—87	663.80	1133.79	1708

Source:— Directorate of Economics & Statistics.

Annexure—V

Trend of average productivity of coconut and pepper in Kerala

	Coconut (nuts/ha)	Pepper (kg/ha)
1960—61	6430	271
1970—71	5536	213
1980—81	4618	263
1986—87	4486	240

Source:— Directorate of Economics and Statistics.

Annexure—VI

Size distribution of area under different crops in Kerala

Holding size	Paddy	Coconut	Tapioca	Pepper
0.02—0.90	34.4	57.7	63.0	43.4
1.0 —1.99	29.9	19.7	19.7	23.6
2.00—3.99	22.9	15.3	11.9	19.9
4.00—0.99	10.9	6.1	5.1	11.2
10.00 & above	1.9	1.2	0.3	1.9
Total	100.00	100.0	100.0	100.0

Source:— Report on the Agricultural Census 1980-81—Department of Economics & Statistics Trivandrum.

Annexure—VII

Economics of some of the important agro-based subsidiary occupations in Kerala

Sl. No.	Name of enterprise	Unit	Average net income per year
1	Coconut unirrigated & elephant foot yam	ha.	11500
2	Coconut irrigated & Pepper & Cocoa & Pineapple	ha.	18000
3	Sericulture	0.4 ha	12900
4	Piggery	20 pigs	2500
5	Rabbit rearing	one male & 5 female	1000
6	Back yard poultry unit	18 birds	500
7	Beekeeping	20 hives	750
8	Mushroom	50 beds	2800

Note:- These are only estimates.

Role of Agricultural Universities in rural development with special reference to Banking and Co-operation

Dr. G. Morley Mohan Lal*

Associate Professor, (Rural Development), Institute of Management in Government, Trivandrum-695 033.

The Agricultural Universities have mainly concentrated on agricultural development but not on overall development of the rural communities. The agricultural Universities have now become highly specialised institutions besides having a variety of resource persons and other valuable infrastructure needed for overall development.

Our past 40 years of development efforts show that dark spots still exist in certain areas. With the introduction of the "Panchayati Raj Institutions", our efforts should be to plan and implement Rural Development programmes for "sustainable development". We have yet to organize or locate the needed organisational set up for this. It is high time that we involve the Agricultural Universities in fulfilling the "gigantic" task of achieving "sustainable development".

Multiagency approach with borrowed expetise and inefficient administrative systems and procedures have created a heavy backlog of liabilities rather than the assets created in the rural areas. Several problem areas still persists, such as soil health management, water and watershed management, maintaining and increasing crop, livestock, poultry, fish production afforestation, environmental planning, protection of ecology and environment, marketing, storage, processing, distribution of grains, food processing. health and nutrition, sanitation, family welfare programmes, rural energy, rural housing, rural water supply etc. The declining contribution of Agriculture to total GNP, the fragmentation of land holdings, problems of land-less labourer, the living conditions of women and children, the educated and illiterate rural youth, etc. require different approaches and strategies to tackle these problems.

For the past 40 years, the agricultural sector also suffers from the adverse terms of trade. The prices on an average are 10 percent lower than the prices of industrial goods since 1970-71. A loss of Rs. 63615 crores in the agricultural sector has been recorded between 1975-76 and 1982-83. The price index shows that a farmer in order to buy the same goods will have to earn an income couble that in 1970-71. The benefits of green revolution are no longer able to maximise their profits which had kept them satisfied in the past. The area under cultivation of the HYV had been stagnating. The peasant's lack of incentive is apparent in the

* Paper presented at the State Level Seminar on Co-operation and Rural Development—Problems and Prospects—on 14th November 1989, at Trichur.

declining rate of production. Production showing upward trends only in good monsoons and not with the 60 million ha. of land under assured irrigation facilities. A recorded growth rate of 3.4 per cent over 1965-70 has been reduced to 2.2 per cent in 1985-90.

Establishment of Agricultural Universities—Why?

The Education Commission (1964-66) recommend that every state should have at least one agricultural university. The commission recommend that they should be committed to the following five essential objectives.

1 Increasing dissemination and application of knowledge relating to agriculture, including basic and applied research.

2 Emphasis on teaching and research directed at solving the immediate social and economic problems of the countryside.

3 To develop and teach a wide range of applied sciences and technologies to build up the rural economy.

4 To not only teach under graduates, post graduates and research students but also to give specialised technical training to young people also are not candidates for degrees, and

5 Emphasis on adult and continuing education side by side with teaching regularly enrolled students.

To ensure a certain minimum uniformity in the structure, organisation and governance of Agricultural Universities as well as to promote a sound legal base for their development, the 'Model Act' of the Indian Council for Agricultural Research (1966) was enforced.

Thus, between 1960-65, seven states (Uttar Pradesh, Punjab, Orissa, Rajasthan, Andhra Pradesh, Madhya Pradesh and Karnataka) Agricultural Universities were established. To date there are 26 agricultural universitiss in the country with constituent colleges in Agriculture, Veterinary science, Animal Science, Dairy Science, Agricultural Engineering & Technology, Fisheries, Forestry, Horticulture, Home Science, Basic Sciences, Banking and Co-operation, with variations depending upon the local needs and requirements. Recently departments of Agricultural Meteorology, Water Technology, Seed Technology, Food Technology, Agri. Business Management which did not exist earlier have also been created in some of the Agricultural Universities. Steps are also being to taken to establish Bio-technology, Embryo Transfer Technology, Remote Sensing etc. Recently the first Veterinary and Animal Sciences University has come at Madras, the only one of its kind in the country and Asia.

Undoubtedly, the aforementioned functions of the agricultural universities have gone a long way in revolutionising agricultural production in several states. There has also been an appreciable socio-economic transformation leading to the improvement in the living standards of rural poor in several states. Accordingly, the contribution of Agricultural Universities in rural development has been a matter of legitimate national pride.

But looking to the actual state of affairs of overall development, the situation is far from satisfactory and it has often been pointed out that the innovation in agriculture have helped only the affluent and progressive farmers with higher scores on socio-economic and other personality traits. The farmers with small, marginal and medium size land holdings have yet to get the desired benefits of the innovation for optimising sustainable production on their farms. According to an estimate, 80 per cent of the unemployed are still located in rural areas. Without raising the economic and social status of these people, the development programmes conducted so far or likely to be planned in future have no substantial meaning. Not only the rural life is ridden with wide variety of problems related to health and hygiene, civic sense, communication with the outside world, acceptance of innovation for development of their farms, home and self, and the like.

The Agricultural Universities were intended to promote the *"overall welfare of the rural poor covering all the facets of rural life"*. But so far, the agricultural Universities concentrated mainly on agricultural development only. If on the other hand, important facets of rural life were also simultaneously taken care of and developed by the agricultural universities by formulating relevant objectives, the rural development process would have definitely taken a different turn. Several of the problems like rural unemployment, under employment, migration of rural people to urban areas, rural poverty, education, literacy, environmental and ecological protection, nutrition and health problems etc. might not have been there at such an alarming rate. Unless these problems are solved at the grass-roots itself, "sustainable development" will only remain in dreams, Transfer of technology to the farming and allied sectors are vital aspects for achieving sustainable development.

In the new set up, a multi-pronged and dynamic role of the agricultural universities are called in for. The agricultural universities which have now become highly specialised institutions besides having a variety of resource persons and other valuable infrastructure needed for overall development, shall have to serve as a brain trust and information bank for actively involving themselves in planning, implementation and evaluation of rural development programmes. The concepts of participative management, participative research, and participative training are of utmost importance in the present context. This calls for effecting institutional, structural and attitudinal changes with the optimum utilisation of both human as well as national resources with application of science and technology. These are absolutely essential for the efficient and effective functioning of the "New Panchayati Raj" Institutions. The target oriented and expenditure oriented programmes will not bring 'sustainable development. The developmental efforts are converted into a more or less trade transactions. For eg, a poor farmer or beneficiary is identified by one agency and he gets a cow or a buffalo. But to obtain the desired or expected production from the asset, as on today, no one knows as to where he/she has to knock for after care or services. Several doors are there to knock. Each knock drains a bit of capital and that is the end of the asset. But all are happy because, a poor has been identified, subsidy released, loan sanctioned asset procured and given, both physical and financial targets achieved, the financial year is over, reports furnished but the loan liability

remains with the 'beneficiary'. What is the alternative? How to maintain the asset? The asset becomes a liability. The family is in difficulties he or she has no other option, but to dispose of the asset or obtain another loan for the same asset (mutual adjustments). Some amount of loan is adjusted as repaid. Again all are happy—How long this 'miracle' procedure and programme will continue? The only way to stop or control this "musical chair" is to bring some sort of descipline. This will be brought through the "New Panchayati Raj" Institutions. Definitely this will be resisted; because the miracles will stop and the beneficiary will really be lifted above the poverty line for ever.

Agriculture-linked Nutrition, Health, Education and Employment Programmes

Disease risk, food prices and farm output and work (and hence child care) are often highly seasonal and therefore is undernutrition. Awareness of this is especially important in designing agricultural research for good nutritional impact—a basic minimum diet.

Agriculture involves transforming

(1) inputs—soils (land) sun, rain, irrigation water, labour, draught-power, agrochemicals—via (2) technologies and (3) structurers of work and ownership into (4) foods and other outputs. All four components of this process affect the nutritional requirements, food availability and health of farmers, farm labourers and their families. Also all four components—especially the amount, volume and type of food outputs produced-may affect the health and nutrition of non-farm population, especially the consumers.

In India, these four components of the agricultural process are the main variables affecting human health. Typically most working time is spent in agriculture and most income on food; for poor and vulnerable groups, the proportions are usually over two-thirds.

As workers are landless or near-landless rather than small family farmers. *Hence, higher and more stable real income for persons dependent on unskilled agricultural labour is the most important contribution that, agricultural policies could make to human health in developing countries.* Yet most discussion of agricultural policies and projects from the view point of health and nutrition completely neglect this issue.

The very poor have interests different from the increasingly vocal and dominating groups in the villages. Social and economic processes at the grass roots level make the better-off the main beneficiaries of programmes developed for the poor. For the very poor, food, employment, clothing, and shelter are the main worries. Often there is little immediate interest in the health or education programmes actively demanded by the middle groups. As 'Patients' the vulnerable groups are a transient category, at least in their own perception, and are hence not likely to organise themselves spontaneously for different committees.

Higher and more stable real income for persons depend on unskilled agricultural labour is the most important contribution that agricultural policies could make to human health in developing countries. The focus should also be towards the

impact of the amount of stability of access to food and health—care on farm labourers landless poor, women and children. Very high, rising population/land ratios push real wage-rates very low. Attempts to raise them artificially (eg. minimum wage laws) reduce the demand for labour and increase unemployment in developing countries.

Similarly, artificial depression of food prices, while temporarily raising the value of wages in terms of food, soon harms the poor by discouraging both the production of food and the employment of labour to grow it. Until prosperity, diversification, and industrialisation are acheived, a low income country like ours (GNP 300 US $, 1987) can solve the main health problem of the very poor by only two effective agricultural strategies.

a) Finding ways, including new technologies, crop-mixes and crop-livestock-fisheries mixes to increase the demand by farmers for more unskilled labour, especially migrant and other marginal workers.

b) Redistributing the rights to income from agricultural assets, especially land and drought-power is possible towards the poorest labourers, otherwise to small farmers whose employment/hectare ratio is relatively high.

The farm strategy should be to increase the income generating capacity of poor families throughout the year and not bogged down to the main agricultural seasons. It is in the slack agricultural season that the poorest households, who are most reliant on income from casual female labour, go hungry because demand for labour is usually much below average; the supply of labour also falls slightly as workers are discouraged from job searching, especially in the rainy, 'unhealthy' season coincides with this time. Thus, household food stores are depleted and food prices high at times when infections are prevalent. Thus the Agricultural strategy should be linked to food, nutrition, health, education and employment programmes.

The introduction of local participation in information gathering and analysis demands a drastic change of perspective. Local people always know much about their environment than outsiders, even though their knowledge is often incomplete and not scientifically systematised. For example; they have lived through a lifetime of seasonal variation, they know much more about the local effects of the season on labour demand, hunger, food reserve, and disease than any outsider can ever hope to deduce from generalised findings.

The 'participatory (action) research' * tradition attempts to promote the idea that people at the grass-roots level be brought into data gathering analysis (and even to some extent into problem definition). If such participation is successful, people are more likely to confront policies and decisions, made in a far-away capital, with local realities, and to *generate pressure to ensure that the findings are acted* upon. The people stand simultaneously on the last step of the downward, 'technical' ladder of planning, implementing and monitoring and on the first step of the upward 'political' ladder of promoting change.

* Swantz M. L.—1984—Research for Human Development. Research with people in a perspective of another culture. EADI Working paper No. 7, Tilburg, EADI, 1984.

The addition of more underemployed labour each year, in the country, results in a situation where in, very little savings are possible with these vast labour flocks so that capital-intensive innovations are not possible with those sub marginal farmers or labourers. The farm labour also require high energy requirements. It is high time we study to find out the level of energy intake by farm/other workers especially women and their productivity. Especially at peak seasons, those households that are the most hungry and in poor health must sell much farm labour and can buy little. They may thus be in an 'energy trap', which impedes their efficient conversion of work into the food (and hence health) that their families need. The importance of nutrition of ensuring that a mother's work is compatible with child care in hungry times.

Is more work for women good or bad for their nutriton that of their children? The extra female income is offset reduced attention to child care, or that it is more likely to spent on extra food for children than is extra male income. Further studies are required in different region.

The international Commission on peace and food, an independent non-governmental organisation, consisting of 23 eminent scientists and professionals from 17 countries held its inaugural meeting on October 19 and 20 at Trieste (Italy) to launch a new initiative to double world food production, stimulate economic development of the world's poorest one billion people. Dr. M S. Swaminathan *, Chairman of the organisation in his inaugural speech mentioned that the ''key environmental. issues such as the destruction of precious forests, overfishing, soil erosion, depletion of ground water resources and the dangerous accumulation of toxic chemical in soil, water and food are alarming. He urged the human community to pool the resources and redeploy scientific, technical and financial resources from the armaments race into programmes to provide peace and political security for all the world's hungry and safer and healthier environment in the whole planet. Unless we act now to create a better common future for the lowest income billions of the human family, there can be no better common future for humanity''. The world head quarters is going to be in India? Why-the reason is simple. At the present rate of our development, India will harbour 50 per cent of the World's poor and illiterates by 2000 A. D.* *

Thus, we have no other way but to strengthen and revitalise the 'Panchayati Raj Institution' to undertake the developmental challenges the country is facing today, especially in 'Rural India'.

The new approach to Agri. Development based on Agro-Climatic Zones is a welcome change. But how can it be effective? How for the Agricultural Universities can help? What is the organisational set up.

---

* Dr. M. S. Swaminathan—Initiative to double food production. The Hindu, dated 25.10.1989.

** Morly Mohan Lal, G.; Poverty Alleviation The Indian Experience,The Himalaya Publishing House, Bombay, 1988.

Role of dairy Co-operatives In rural Development in Kerala

K. P. P. Kurup

Dairying in the co-operative sector in Kerala had its beginning in 1939 when the Calicut Milk Supply Union was registered. However, the activities of dairy Co-operatives remained at a low level till the modern techniques of processing and marketing were incorporated. When the first dairy plant in Kerala was established in Trivandrum in 1961, the authorities started thinking of registering more dairy co-operatives. There were 150 primary dairy co-operatives and 9 District Milk Supply Unions in the State in 1960. The number was increased to 356 in 1970. There was limited scope for development of these co-operatives as they had no direct link with the urban market. Milk procurement also was limited by the Dairies then managed by the Government which was not helpful to the Societies or milk producers to enhance their production and procurement of milk. In 1975, the Kerala Livestock Development and Milk Marketing Board was established in the public sector with a view to bring the milk production, procurement and marketing under one Organisation. Thus integrated milk marketing in Kerala was made only in 1976 when all the Dairies, Milk Chilling Plants and milk production enhancement infrastructure were brought under the control of KLD & MM Board. By 1980, the number of dairy co-operatives was increased to 1050; however, these Societies were not united or integrated, and majority of them were working independently procuring and selling milk according to the local market available to them.

The integrated approach of dairying as envisaged under 'Operation Flood programme was adopted by the State when the Kerala Co-operative Milk Marketing Federation was registered on February 21, 1980. The Federation destined to implement the Operation Flood Programme in the State took over the management of all milk processing Units in southern districts and the Cattle Feed Factory on 1st April, 1983. On November 1, 1981, the first Anand Pattern Dairy Co-operative started milk collection at Kachani in Trivandrum District.

ANAND PATTERN

The concept of 'Anand Pattern' originated in the rural villages of Gujarat which has proved that the co-operatives can become financially viable institutions, achieve efficiency and provide services responsive to farmers' needs. The basic philosophy of Anand Pattern is to combine India's greatest asset, the power of its people, with professional management in a vertically integrated co-operative structure that establishes a direct linkage between those who produce milk and those who consume milk and milk products, eliminating all middle men. This structure transfers to the rural milk producer the largest share of the consumers rupee, creating the

incentive to enhance milk production. It supports production by exposing farmers to modernity, by placing the farmer in command as the owner of his co-operative. It involves him in the process of rural development.

The Anand Pattern Dairy Co-operatives differ from the traditional milk societies in several respects.

(i) The Anand Pattern Societies are owned, controlled and managed by milk producers whereas anyone can become a member of a traditional society.

(ii) The operational area of APCOS is limited to 2 or 3 wards of a Panchayat enabling producers' participation in the management and business of the society.

(iii) Pricing of milk is based on scientific principles reckoning the quality of milk, in contrast to arbitrary pricing in traditional societies. Milk Price is paid regularly at weekly fntervals.

(iv) Technical inputs for milk production enhancement, viz. balanced cattle feed, veterinary services, fodder seeds etc. are made available at the farmers' door-steps.

(v) Profit distribution—channelising the lion's share of the net profit of the co-operative to the farmer members as producer bonus.

(vi) The provisions of bye-laws and the style of functioning eliminates middlemen and vested interests catering to the needs of milk producers.

PRESENT POSITION

There are 1054 registered Anand Pattern Co-operative Societies (APCOS) in Kerala federated to 3 Regional Co-operative Milk Producers' Unions—Trivandrum, Ernakulam and Calicut, the apex body being the Kerala Co-operative Milk Marketing Federation Ltd. As on September 30, 1989, there are 509 registered APCOS in Trivandrum Region, 373 in Ernakulam and 172 in Calicut. When the programme was initiated in 1980, there were apprehensions at different quarters regarding the long-term sustenance of these Institutoins. These doubts were proved to be baseless as evidenced by the growth of APCOS (see Table).

PERFORMANCE OF APCOS DURING THE PERIOD 1983-1989

Particulars	As on 31.3.83	1983 -84	1984 -85	1985 -86	1986 -87	1987 -88	1988 -89	As on Sept. 30 1989
1 No. of functional APCOS	179	282	404	459	588	705	883	946
2 No. of farmer members in APCOS	32958	49156	67641	88443	108874	137103	182682	186457
3 Average milk procurement per day by APCOS (Ltrs)	28330	49974	81803	84765	113638	157596	202267	221014

ECONOMIC IMPACT

The Anand Pattern Milk Societies in Kerala have a many sided impact on the economic and social life of the State. The impact of 'White Revolution' can be seen in the village in the form of generation of funds, creation of self-employment opportunities, direct employment in societies, ensuring distributive justice and removing economic and social disparities. For instance, the average daily milk procurement by the Federation in Kerala increased from 68972 litres in 1983-84 to 2,29,264 litres as on the quarter ending July—September 1989, the value of which amounts to more than Rs. 9.50 lakhs per day. This will work out to Rs. 34 crores in an year. The total milk handled by all Co-operatives in the state will come to 3 lakh litres of milk per day (LLPD) and the value of which comes to about Rs. 12 lakhs per day (44 crores per year). The major portion of the milk value was earlier appropriated by intermediaries, but now this amount is being regularly siphoned to the village milk producers, avoiding middlemen. Milk producers who were always at the losers' end before Anand Pattern was introduced now have considerable savings and own more milch animals.

Co-operative dairying has also paved the way for economic emancipation of women, scheduled castes and scheduled tribes. Another achievement is the improvement of communication and introduction of modern technology at the grass-roots level. Innovative techniques like embryo transfer will facilitate rapid multiplication of genetically superior animals.

The Co-operative sector is now handling only 8.5% of the 36 LLPD milk produced in the State. If the trend in production and procurement is maintained it is possible that the milk production will reach 60 LLPD by end of this century and the Co-operative sector should be geared up to handle 10 LLPD by this time. This will work out to 16.6% of the total production and the milk value paid to the producers by this sector alone will come to Rs. 146 crores per year at the current price. If this can be achieved milk will continue to hold the second position in terms of value of agricultural commodities produced and as the most important subsidiary income to the poor and marginal farmers in the State.

The success of 'Anand Pattern' and the four-fold increase in milk procurement through village co-operatives in the last 8 years have given us hopes of reviving our rural economy by relying more on co-operative dairying. This development will help to solve the problems of rural unemployment, poverty, malnutrition and social as well as economic injustices in rural areas to a considerable extent.

Role of Cooperatives—Rural Development

P. K. M. Raja,
Principal, Co-operative Training College, Trivandrum

Introduction

India is a country of villages and about 80% of the population live in villages numbering over 5.58 lakhs. Since independence over policy makers and planners have been emphasising to accelerate the rural development on account of political, social, agricultural and economic factors. Agricultural and allied sectors continue to be the most important segment of the economy. The rural people are the real power behind the government. This necessitates giving rural development prime importance.

During the period from 1951-52 to 1984-85, the Central Government spent Rs. 1,86,618 crores against the plan outlay of Rs. 1,74,714 crores. Out of this expenditure, power accounted 23.9%, transport and communication 17.6%, industrial and minerals 16.7%, agriculture 13.5% and irrigation and flood control 9.7%, accounting in all 81.4% of the total investment. For rural development, about 5[illegible]% of the total investment. For rural development, about 50% of the totai investment. have been made resulting in some benefits. However, the development that has taken place is limited in terms of the country's need and potentiality. Poverty is still ramphant and agriculture continue to be the main stay of 70% of the population. The size of the agricultural holdings are progressively being reduced. The cottage and small scale industries have decayed and sizable number of the rural population is suffering from unemployment and low income. Productivity in agriculture is also low. Though the population has increased more than 50% during the last 50 years, the growth of new and alternative occupations have not been adequate to absorb them. On the whole, the economic development of the past few decades did not bring much succur and rather increased inequality of income and wealth.

RURAL DEVELOPMENT PROGRAMMES & POLICIES

The major hurdles in socio-economic development of rural areas are small land holdings, poverty, unemployment and under employment, starvation, malnutrition, ill-health, illiteracy, caste and various types of exploitation by vested interests. High percentage of the population is illiterate with an average of the life span of 40 to 45 years. Their employment days is 150 to 250 on an average in a year and they spend about 90% of income on food.

Development in socio-economic sense includes economic growth, social and distributive justice, employment opportunities, social service facilities etc. to enable to enrich the quality of life.

Rural development is a strategy to improve the economic and social life of the rural poor in the overall spectrum of development. It is a multi-faced development of rural economy by optimum use of local resources in man, material, land, water etc. It is not only important to increase productivity and achieve overall economic growth but also to ensure that poor and weaker sections get the benefits of progress.

MAJOR DEVELOPMENT PROGRAMMES

In our country, we have been experimenting continously with a variety of rural development programmes. The Govt., financial institutions and voluntary agencies have all implemented a number of schemes for the development of rural India. More than 40 programmes have been formulated and implemented for this purpose. Broadly these development programmes can be classified into four categories viz. beneficiary oriented programmes such as IRDP, nutrition programmes etc., specific area oriented programmes like drought prone area programmes (DPAP), command area programmes etc., sectoral programmes like programme for education, health care, transport, establishment of fair price shops etc., and programmes for raising production and productivity such as programmes for increasing irrigation potential, dairy development, rural industries, handloom development etc.

The first major attempt in comprehensive area planning for rural development was community development programmes launched on October 2, 1952 with the primary objective of bringing an overall development in the rural areas. Some other major programmes introduced are nutrition programmes, SFDA/MFAL, DRAP, tribal development and hill development programmes etc. Amongst them latest one is IRDP, aimed at developing rural areas in a coherent and systematic manner, It is designed to develop employment ventures in activities like sericulture, animal husbandry and land based activities in the primary sector, weaving, handloom etc. in the secondary sector, and service and business in tertiary sectors. More recently Jawahar Rozgar Yojana (JRY) was launched in April, 1989 as a major action to end rural poverty. In October, 1989 this was extended to cover urban areas. The aim of JRY is to help the country's youth to secure employment and reduce their unending visits to employment exchanges and other places for jobs.

WEAKNESS & CONSTRAINTS:

At the beginning of the 7th Plan, it is estimated that over 22 crores of people in rural area and over 5 crores in urban area were below poverty line. In terms of recent survey, this was 39.9% in rural area and 27.7% in urban areas. The 7th plan aimed at bringing down this level to 36.9% and 25.8%. However, the poverty eradication programme suffered a set back due to the drought conditions and fall in agricultural production and other distortions which has taken place in the last three years of 7th plan.

It has been also alleged by different quarters that large and medium farmers have been syphoning the benefits from the development programmes. A large

number of small and marginal farmers, landless labourers continue to be below the poverty line and this has resulted in a good deal of social tension and clashes in villages.

Other weaknesses observed in the implementation of the rural development programmes are:

- Though land reforms are introduced in the States, distribution of land to the tillers and landless in different parts of the country has not taken place.
- Advantage of the improvements in agriculture are taken predominantly by substantial farmers.
- Organisational set up for bringing rural change are dominated by upper sections of the people.
- Initial enthusiasm shown by the people in the projects are declining.

PUBLIC COOPERATION – BASIC NEED FOR RURAL DEVELOPMENT

As mentioned above, the benefits of implementation of several rural development programmes have not reached the poor. This point has been raised and discussed in various seminars, conferences, workshops etc. The programmes, though of diverse nature, are sometimes contradictory and overlapping, highly bureaucratised lacking public cooperation and people's participation in the rural development programmes. Because of the past experience, there is a general distrust over bureaucratic apparatus and suspicion about the genuineness of the programmes. People will cooperate and participate only if they are convinced that the programmes are responsive to their needs and aspirations. The feed back informations are to be responded speedily and positively to motivate the people to participate willingly. Peoples' choice, view etc. are to be ascertained at all stages of the programme, for ensuring peoples' participation.

Other points to be looked into for successful implementation of the rural development programmes are the following:

- In the existing rural structure, disseminaiton of technology with special emphasis on small and marginal farmers is essential to modernise agriculture
- Implementation of land reforms in letter and spirit should be made.
- Efforts should be made to upgrade skills and provide economic benefits through programmes of self-employment and development of cottage and small scale industries etc.
- The existing organisations providing credit and other facilities should be oriented towards target group.
- The social services should be biased in favour of poor sections of the people,

ROLE OF COOPERATIVES:

According to ICA, establishment and growth of cooperatives should be regarded as one of the important instruments for economic, social and cultural development as well as human advancement in developing countries. The three objectives

of cooperative development are fostering economic development; promotion of social justice and strengthening political democracy. Planning Commission has stated that cooperatives are indispensible instruments of planned economic action in a democracy.

Cooperative movement was introduced in our country to provide lasting solution to the problems of rural economy. This abounding faith in the efficacy of the movement to solve the ills of the rural economy in general was emphasised time and again and has resulted in the policies persued under the Five Year Plans. Cooperative movement has considerably expanded and diversified into various sectors of the economy.

In the words of Pandit Jawaharlal Nehru—"the idea of cooperation is something much more than merely an efficient and economic way of doing things. It is economic, it is fair; it equalises and prevents disparities from growing. But it is sometimes even deeper than that. It is really a way of life and a way for life which is not 100 per cent socialist way though it is much nearer to socialism than capitalism".

PROGRESS

The cooperative movement has been in existence in our country for more than eight decades and has become a mammoth organisation. The activities of the cooperatives now cover different segments of economy particularly agricultural credit, marketing, processing, storage, distribution of agricultural inputs, distribution of consumer articles etc. There are 3.42 lakhs different types of cooperatives with about 14.65 crores membership and working capital of about Rs. 47,552 crores. The cooperative movement is unique in its diversification and there is hardly any segment of the economy uncovered by the cooperative movement. On one side we have small village level cooperatives and on the other most advanced and successful capital intensive institutions like IFFCO, KRIBCO, PETROFILS, Heavy Engineering cooperatives, sugar factories, spinning mills etc.

The cooperative as peoples' institutions, organisation of rural class, artisans and economically weaker and down trodden have tremendous potential to work as a nucleus of rural development.

Cooperatives have bearing on the smooth functioning of the services like credit, supply of inputs, distribution of consumer articles and help in devising ways and means for increasing agricultural production and promotion of small scale industries, etc.

STRUCTURE

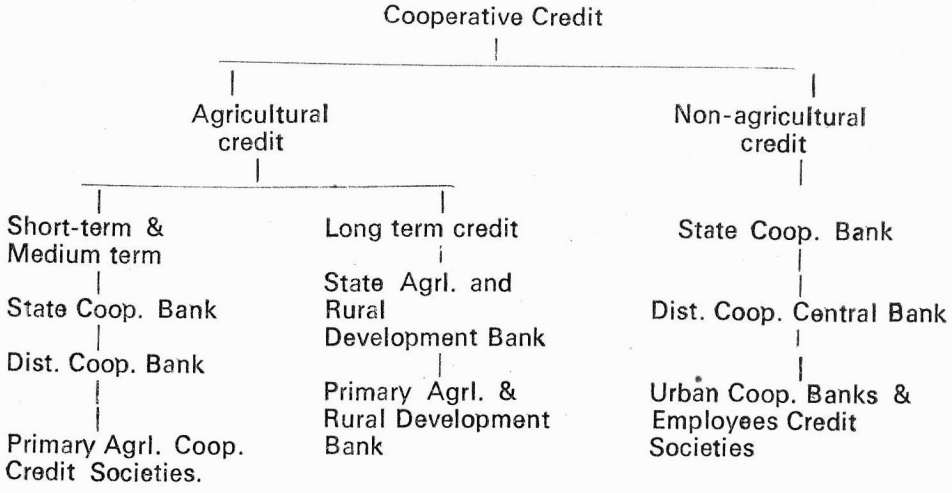
Structurally, the principles of federalism, characteristic of cooperatives has been extended to the National level for various sectors of the movement. There are more than 20 national level cooperative organisations registered under the multi unit cooperative societies act which could impart necessary dynamism and leadership in their respective fields of activity.

To broadly classify cooperatives, there are agricultural cooperatives which are organised to help in the professional capacity of agricultural producer and non-agricultural cooperatives set up for providing goods and services to people.

COOPERATIVE CREDIT

In fact cooperative movement in India was primarily introduced for the purpose of eradicating rural indebtedness and agricultural credit cooperatives which were first to be organised still hold a prominent place in cooperative system of the country.

Cooperative credit structure in the country is as below:



During 1987-88, the total volume of agricultural credit distributed by co-operatives for agricultural and rural development would be around Rs. 4.225 crores which work out to be about 47% of institutional credit. Other institutional agencies providing credit for rural development are commercial banks and regienal rural banks.

Short and medium cooperative credit structure consists of a three tier pattern consisting of state cooperative banks (apex banks), Dist. cooperative banks at district level and primary agricultural credit societies at village level. In respect of long term credit, a 2 tier structure with state agriculture and rural development banks at state level and primary banks at base level are functioning.

MULTI-AGENCY APPROACH

With a view to cope up with the needs of new agricultural strategy and fill in credit gaps, a multi-agency approach in rural financing has been accepted in the country since 1968. New commercial banks and regional rural banks are also in the field of agricultural finance as a complementary to cooperative credit organisations. Under the scheme known as 'Lead Bank Scheme' districts are allotted to State Bank of India and its subsidiaries as well as to nationalised commercial banks to work as a Lead Bank to meet all the credit needs of that area.

With a view to implement the multi-agency approach to credit in rural areas, regional rural banks (RRBs) came into existence. They have been set up in areas where the coverage by cooperatives and commercial banks are relatively poor. Apart from providing the banking facilities in rural areas, they provide loans and advances to small and marginal farmers, agricultural labourers, cooperatives, rural artisans etc. within its area of operation.

NABARD

With a view to promote integrated rural development and secure the prosperity of rural class, the Govt, of India through an act of Parliament set up national bank for agriculture and rural development (NABARD) and it started functioning from 1.7.1982. NABARD is the national level apex institution concerned with policy, planning and operations in the field of credit for agriculture and other economic activities in rural areas. NABARD provide finance to the State Cooperative Banks, State Coop. Agricultural and Rural Development Banks, Commercial Banks and Regional Rural Banks for promoting agriculture and allied occupations, small scale industries, handicraft and other rural crafts and other allied economic activities in rural areas.

COOPERATIVE MARKETING & PROCESSING

Cooperative marketing societies are organised to rationalise the whole marketing system with the objective of strengthening the bargaining capacity of cultivators, to enable him to secure better price, eliminate superfluous middlemen, to provide the needed finance, to pursuade to grow better quality of produce and to stabilise price. Coop. marketing is beneficial to the producer, consumers and the whole society at large. The super structure of cooperative marketing consists of National agricultural cooperative marketing Federation of India Ltd., State Marketing Federations at state level and primary marketing cooperatives at taluk level. These cooperatives apart from arranging marketing to the producers advantage also provide them the necessary inputs for raising the crops as well as service such as storage, grading, transport etc. at minimum cost. During 1987-88, cooperatives are expected to market agricultural produce worth Rs. 3,900 crores.

Processing of agricultural commodities organised on cooperative basis helps economic development in general and cooperative development in particular. It helps rural industrialisation and can be an effective instrument of socio-economic change in areas when they are located. Also in areas where cooperative processing units have been successfully established they have proved invaluable as instruments of development in allied fields. The cases of large sized processing cooperatives like cooperative sugar factories, cooperative spinning mills, solvent extraction plants, oil complexes etc. can be sited as examples of their contribution in rural development.

DISTRIBUTION OF CONSUMER ARTICLES BY COOPERATIVES:

The cooperative distribution of consumer articles in the villages to strengthen the public distribution system has been given great emphasis in recent years. The

two tier system involves a lead society like marketing co-operatives, urban co-operative store or branch of state consumer federation and group of primary agricultural credit societies and over 60% of village societies have been brought under rural consumer programme. About 74000 fair price shops constituting about 28% of retail outlets including PDS in rural areas are run by co-operative. Co-operatives distributed consumer articles worth Rs. 1,875 crores in rural areas during 1986-87.

CO-OPERATIVES FOR WEAKER SECTIONS

Development of co-operative benefitting the weaker section particularly in areas such as handloom, sericulture, coir, fishery and dairy etc. have been given special attention in our country. Handloom, a vital sector of the economy is the biggest cottage industry and employs over 100 lakh people making it next to agriculture in terms of economic impact and rural employment. By the end of 1985 about 60% of the weavers are expected to be brought under the co-operative umbrella. The handloom sector produce annually around 370 crores meters of cloth, sericulture, an important agro-based labour, another intensive cottage industry, provides employment to over 50 lakh people belonging to weaker sections and development of co-operatives in sericulture sector is an integral part of strategy of co-operative development. In respect of coir industry which is a source for part time or full time employment to a number of people, the co-operatives share of coir industry is estimated to be around 13%.

Fisheries co-operatives both in coastal and inland areas, have been organised to render economic assistance to the dispersed and disorganised fishermen whose dependance on merchants and middleman is even greater than that of those following agricultural persuits. Also other types of coops. such as poultry, transport, labour contract and forest labour societies, co-operative farming societies etc. have been organised in our country to provide release to the exploited people.

ACHIEVEMENTS

The phenomenal growth of co-operatives in the country has brought prosperity to the villages as well as the urban areas. Some of the economic benefits provided by them are cheap production credit, popularisation of modern methods of cultivation, better prices for farmer producers rural industrialisation, distribution of essential commodities, protection to the weaker sections of the community, encouragement of thrift and banking, etc. The social benefits are teaching the people to live harmoniously on a community basis in unity, brotherhood and co-operate feeling. Through education and training, co-operatives have given valuable knowledge in democratic planning, business methods etc. to the people.

However, as has been rightly pointed out "co-operative success depends upon a well co-ordinated group of employees knowing that they are answerable to the manager, a manager conscious of his answerability to board of directors, a board realising that they are agents of their members, a membership which understands that they are responsible for their patronage and control for a business which not

only serves them but which is a part of great national community of mutual interests and obligations". Without these chain of responsibilities and efficiencies co-operation cannot succeed in fulfilment of their objectives.

In conclusion, it can be said that the co-operative movement has great potentialities to provide a real solution to a number of economic and social evils in the developing countries and with their reliance on self-help and mutual assistance the co-operatives, are the most suitable agencies to work as model agency for rural development n our country.

□

SEMINAR ON AGRICULTURAL DEVELOPMENT AND ENVIRONMENTAL CONSERVATION

1. പരിസ്ഥിതി സംരക്ഷണം—പ്രകൃതിസ്നേഹത്തിലൂടെ

—ശ്രീമതി സുഗതകുമാരി

2. നീണ്ടുനിൽപ്പിന്റെ ഗവേഷണം തുടങ്ങാൻ സമയമായി

—ഡോ. പത്തിയൂർ ഗോപിനാഥ്

3. Pesticide residues in food and human environment— a retrospect

—*A. Visalakshi*

പരിസ്ഥിതി സംരക്ഷണം — പ്രകൃതിസ്നേഹത്തിലൂടെ

ശ്രീമതി സുഗതകുമാരി

കേരളത്തിൽ നമുക്ക് നമ്മുടേതായ കാർഷിക രീതികളും കാർഷിക സംസ്ക്കാരവും ഉണ്ടായിരുന്നു. ബ്രിട്ടീഷുകാരുടെ അധിനിവേശം അവിടത്തെ കൃഷിരീതികളും ഇന്ത്യയിൽ പ്രചരിക്കുവാൻ കാരണമായി. നമ്മളും നമ്മുടേതായ കൃഷിരീതികളും വ്യവസ്ഥകളും കയ്യൊഴിഞ്ഞ് വെളുത്തവർ ചൂണ്ടിക്കാണിച്ചത് അന്ധമായി അനുകരിച്ചതിലൂടെ പരിസ്ഥിതിയെ സംരക്ഷിച്ചുകൊണ്ട് യുഗങ്ങളായി ഇവിടെ നടന്നിരുന്ന കൃഷിരീതിയുടെ താളക്രമം തെറ്റിപ്പോയി.

കാലിഫോർണിയൻ മണ്ണിൽ പോഷകമൂല്യങ്ങളും ശോഷിച്ചുവരികയാണ്. കൂടുതൽ രാസവളങ്ങളുടെയും കീടനാശിനികളുടെയും ഉപഭോഗംമൂലം കാലിഫോർണിയായിലെ കൃഷിയിടങ്ങളിൽ മണ്ണ് മൃതപ്രായമായിക്കൊണ്ടിരിക്കുന്നു. തുടർച്ചയായി നടത്തിക്കൊണ്ടിരിക്കുന്ന കടുംകൃഷി മണ്ണിന്റെ ചൈതന്യത്തെ മുഴുവൻ ഊറ്റിയെടുത്തിരിക്കുന്നു.

അക്കാരണത്താൽ ജലസേചനത്തിന് കൂടുതൽ വെള്ളം ആവശ്യമായി വരുന്നു. അമിതമായ ജലത്തിന്റെ ഉപഭോഗം ഭാവിയിൽ ഏറ്റവും വലിയ പരിസ്ഥിതി പ്രശ്നമായിത്തീരും. മണ്ണിലെ ഉപ്പിന്റെ അളവ് ക്രമാതീതമായി വർദ്ധിക്കുന്നതുമൂലം മണ്ണ് ഉപയോഗരഹിതമായിക്കൊണ്ടിരിക്കുകയാണ്. സാക്രമന്റോ താഴ്വരയിലെ മണ്ണ് സെലീനിയം തുടങ്ങിയ വിഷവസ്തുക്കളുടെ കൂമ്പാരമായി മാറിയിരിക്കുകയാണ്.

കാലിഫോർണിയയിലെ കൃഷിയിടങ്ങളും നമ്മുടെ സങ്കൽപങ്ങൾക്ക് അതീതമാണ്. അതിവിശാലവും ബൃഹത്തുമായ പാടശേഖരങ്ങൾ? അവിടങ്ങളിൽ ജലസേചനം നിർവ്വഹിക്കുന്നത് അതിസൂക്ഷ്മതയുള്ള കമ്പ്യൂട്ടർ ശൃംഖലയാണ്. അമിതമായ സമ്പന്നതയും സന്തോഷവും കളിയാടുന്ന കാർഷിക മേഖല. അതിഭയങ്കരമായ ഒരു വെള്ളക്ഷാമം നാളത്തെ ഏറ്റവും വലിയ പരിസ്ഥിതി പ്രശ്നമാകും.

ഇപ്പോൾ അമേരിക്കയിൽ ഇക്കോളജിക്കൽ കൃഷിയിടങ്ങൾ ആരംഭിച്ചിട്ടുണ്ട്. മണ്ണിനെ ഫലപുഷ്ടിപ്പെടുത്തുവാൻ കമ്പോസ്റ്റ് മാത്രമേ ഉപയോഗിക്കാറുള്ളൂ. കീടങ്ങൾ ഈ കൃഷിയിടങ്ങളിൽ വന്നെത്തിയപ്പോൾത്തന്നെ അതിനോടൊപ്പം ഉപകാരികളായ ഷഡ്പദങ്ങളും പക്ഷികളും വന്നെത്തി കീടങ്ങളെ നശിപ്പിക്കുവാൻ തുടങ്ങി. ഇവിടെ കീടനാശിനികൾ ഉപയോഗിക്കാറില്ല. എപ്പോഴാണ് സംഹാരം നിർത്തേണ്ടതെന്ന് കീടനാശിനിക്കറിയില്ല. അവ മണ്ണിന്റെ സർഗ്ഗാത്മകമായ ചൈതന്യത്തെ നശിപ്പിക്കുന്നതോടൊപ്പം മണ്ണിൽ ജീവിക്കുന്ന ഉപകാരികളായ ജീവികളെയും നശിപ്പിക്കുന്നു.

കേരളത്തിൽ രണ്ട് ശുദ്ധജല തടാകങ്ങളാണുള്ളത്. അതിൽ ശാസ്താംകോട്ട കായൽ നശിച്ചുകൊണ്ടിരിക്കുകയാണ്. വെള്ളായണി കായലിന്റെ ശുദ്ധീകരണവും സംരക്ഷണവും ഇവിടത്തെ പരിസ്ഥിതി സംരക്ഷണത്തിന് തന്നിവാര്യമാണ്. ഈ ശുദ്ധജലതടാകത്തിന് ശാപമോക്ഷം നൽകി സംരക്ഷിച്ച് വരും, തലമുറക്ക് പ്രദാനം ചെയ്യേണ്ടത് ഓരോ പ്രകൃതി സ്നേഹിയുടെയും കർത്തവ്യമാണ്. വെള്ളായണി കായലിന്റെ ശുദ്ധീകരണത്തെക്കുറിച്ചും സംരക്ഷണത്തെക്കുറിച്ചും കൂടുതൽ പഠനങ്ങളും ഗവേഷണങ്ങളും നടത്തുവാനും അങ്ങനെ വരും തലമുറക്കായി നിസ്വാർത്ഥമായ സേവനം ചെയ്യുവാനുമുള്ള ധൈര്യം കേരള കാർഷിക സർവ്വകലാശാലക്കുണ്ടാകേണ്ടതാണ്.

"നീണ്ടുനിൽപിന്റെ ഗവേഷണം തുടങ്ങാൻ സമയമായി"

ഡോ. പത്തിയൂർ ഗോപിനാഥ്

കേരള ശാസ്ത്ര സാഹിത്യ പരിഷത്ത്

നീണ്ടുനിൽപിന് നിദാനമാണ് കൃഷി. ആദിമമനുഷ്യൻ ആധുനിക മനുഷ്യനായ് പരിണമിച്ചത് കൃഷി വളർന്നപ്പോഴാണ്. ഇന്നുള്ളവർക്കും ഇനിയുള്ളവർക്കും നിലനിൽക്കാൻ കൃഷിവേണം. അതുകൊണ്ട് കാർഷിക ഗവേഷണം നിലനിൽപിന്റെ ഗവേഷണമാകണം. പ്രകൃതി പ്രതിഭാസങ്ങളെ അറിയുകയും അറിവ് പ്രയോഗിക്കുകയുമാണ് സാങ്കേതിക വിദ്യ. ഭൗതികോൽപാദനത്തിന്റെ ഘടകവുമാണ് സാങ്കേതിക വിദ്യ. ഉൽപാദനം കൂടണമെങ്കിൽ പ്രകൃതിയിലുള്ള ഇടപെടലുകളും വർദ്ധിക്കുക അനിവാര്യമാണ്.

ലോകജനസംഖ്യ ഇന്ന് 500 കോടി കവിഞ്ഞിരിക്കുന്നു. അടുത്ത 50 വർഷങ്ങൾക്കുള്ളിൽ 1000 കോടി ആകും. കാടുവെട്ടി കൃഷിയിടം കൂട്ടാൻ കഴിയാതെ വന്നപ്പോൾ വലിയൊരു ജനതതിയെ തീറ്റിപ്പോറ്റാൻ ഉള്ളമണ്ണിൽ ധാരാളം വിളയിക്കുകയേ നിവൃത്തിയുള്ളൂ വെന്നുവന്നു.

നിർമ്മിതവളം, കീടനാശിനി, കളനാശിനി, സങ്കരവിത്ത്, കടുംകൃഷി..... സാങ്കേതികവിദ്യ വളരുകയായിരുന്നു. സാങ്കേതിക വിദ്യയുടെ ഈ വളർച്ചക്ക് കറുത്ത മറ്റൊരു വശം കൂടിയുണ്ടായിരുന്നു—രൂക്ഷമായ മണ്ണൊലിപ്പ്, ജൈവസമ്പത്തിന്റെ നാശം, അമിത പോഷണത്തിന്റെ ആപത്ത്, കീടനാശിനികളും കൃഷിനാശിനികളും ആയിത്തീർന്നത്, ഭൂമിയുടെ അടിയിൽ കാലിയായിവരുന്ന ഊർജ്ജക്കലവറ അങ്ങനെ ഒട്ടേറെ തിരിച്ചടികളും.

എഴുപതുകളുടെ തുടക്കത്തിൽ മറ്റു മേഖലകളിലെന്നപോലെ കൃഷിയിലും രണ്ടു പക്ഷക്കാരുണ്ടായിരുന്നു, ഒന്ന് കാൽപനികത്വത്തിന്റെ അതിപ്രസരമുള്ള തിരിച്ചുപോകൽ സിദ്ധാന്തം. ഇന്നുള്ള മുഴുവൻ കോട്ടങ്ങൾക്കും കാരണം സാങ്കേതികവിദ്യയാണെന്നു വിശ്വസിക്കുന്ന ഈ സിദ്ധാന്തത്തിന്റെ പ്രധാന വക്താക്കൾ ഷൂമാക്കർ, ഇവാനിലിച്ച്, ഫുക്കുവോക്ക തുടങ്ങിയവരായിരുന്നു. സാങ്കേതിക വിദ്യക്ക് പരിഹരിക്കുവാൻ കഴിയാത്തതായി ഒന്നുമില്ലെന്നു വിശ്വസിക്കുന്ന ബൂർഷ്വാ യാന്ത്രിക വാദമായിരുന്നു രണ്ടാമത്തേത്. മനുഷ്യന്റെ ഭൗതിക സാഹചര്യങ്ങൾ വർദ്ധിപ്പിക്കുന്നതിന് സാങ്കേതിക വിദ്യ കൈകാര്യം ചെയ്യേണ്ടവർ എന്ന നിലയിൽ രണ്ടാം വാദത്തിന്റെ സൃഷ്ടാക്കളായി, വക്താക്കളായി ഇക്കൂട്ടരെ ചിത്രീകരിക്കാനാണ് മറ്റുള്ളവർ ശ്രമിച്ചത്. എഴുപതുകളുടെ തുടക്കത്തിൽ ആരംഭിച്ച ഈ രണ്ടു വാദങ്ങളെക്കുറിച്ചും പത്തുവർഷത്തോളമുണ്ടായ വാഗ്വാദത്തിനുശേഷം ഇന്ന് പൊതുവെ അംഗീകരിക്കപ്പെട്ടിരിക്കുന്ന ചില വസ്തുതകളുണ്ട്. ആവസ്തുതകൾ അറിയാൻ നാം ശ്രമിക്കുകയും ആ ബോദ്ധ്യപ്പെടുത്തലിന്റെ വെളിച്ചത്തിൽ നീണ്ടുനിൽപ്പിന്റെ പ്രധാന ഘടകമായ കൃഷിയുടെ മേഖലയിൽ കൈകാര്യം ചെയ്യുന്ന നമുക്ക് എന്തു ചെയ്യാനാകും എന്നാണ് ചിന്തിക്കേണ്ടത്. ഈ വസ്തുതകൾ ശരിയായി ഉൾക്കൊള്ളാൻ കഴിയാതെ വരുന്ന സാഹചര്യത്തിലാണ് കൃഷിയും വികസനവും തമ്മിൽ പൊരുത്തപ്പെടില്ല എന്ന വാദമുദിക്കുന്നത്. സ

മതുശനത്തിന്റെ വശമാണ് നിലനിൽപ്. പ്രകൃതിയിലെ ബന്ധങ്ങൾക്കും അവയുടെ പൊരുത്തപ്പെടലിനും നിലനിൽപിനും സമതുലനം അത്യന്താപേക്ഷിതമാണ്. ഇനിയുള്ള ഇനിയുണ്ടാകേണ്ട കൃഷിയുടെ അടിസ്ഥാനശിലകം അന്തർലീനമായിരിക്കുന്നത് ഈ സമതുലധത്തിലാണ്. മുൻകാലങ്ങളിലുള്ള അറിവുകളുടെ അടിസ്ഥാനത്തിൽ നാം വികസിപ്പിച്ചെടുത്ത സാങ്കേതികവിദ്യക്ക് തിരുത്തലുകം നൽകി തിരുത്തി തിളക്കി എടുക്കലാണ് നവീന സാങ്കേതിക വിദ്യ. ഈ നവീന സാങ്കേതിക വിദ്യ സ്വീകരിക്കുന്നതിലാണ് ശാസ്ത്രീയ സമീപനത്തിന്റെ, പരിസരവും വികസനവും തമ്മിൽ സമന്വയിപ്പിക്കെണ്ടതിന്റെ, സമതുലിതവാദത്തിന്റെ താത്വികവശം കിടക്കുന്നത്.

തിന്നാനുണ്ടാക്കലാണ് കൃഷി. ജീവിക്കുവാൻ തിന്നണം അതുകൊണ്ട് ജീവിതമാണ് കൃഷി എന്ന ചിന്താഗതി വരണമെങ്കിൽ കൃഷി നീണ്ടുനിൽക്കണം. അതിന് ഇന്നുള്ള ഗവേഷണ വികസന പ്രവർത്തനങ്ങം പോര എന്ന് നമുക്ക് ബോദ്ധ്യപ്പെടണം. കഴിഞ്ഞ നാൽപതു വർഷത്തെ കാർഷിക ഗവേഷണം കേരളത്തെ എവിടെയെത്തിച്ചു എന്നു ചിന്തിക്കണം. ശുപാർശാ പുസ്തകത്തിലെ വിവരങ്ങം കൊണ്ട് എല്ലാം നേടാം എന്നും ഇനി പുതിയ ഗവേഷണം ആവശ്യമില്ല എന്നുമാണ് കാർഷിക ഗവേഷകരുടെ നിലപാടെങ്കിൽ കൃഷിയും വികസനവും പരിസ്ഥിതിയും ഇനി പൊരുത്തപ്പെട്ടുപോവില്ല.

മണ്ണും ചെടിയും മണ്ണിന്റെ തനതു പുഷ്ടിയും അതാതു പ്രദേശത്തെ കാലാവസ്ഥാഘടകങ്ങളുമായി യോജിപ്പിച്ചുകൊണ്ടുള്ള ഒരു മുറയല്ല നാം കർഷകർക്കായി വികസിപ്പിച്ചെടുത്തിരിക്കുന്നത്. മണ്ണിന്റെ തനതു പുഷ്ടി വളർത്താനുള്ള ഗവേഷണങ്ങം ഒന്നും ഇവിടെ നടക്കുന്നില്ല. മറിച്ച് ഇവിടത്തെ ഗവേഷണങ്ങം കീടനാശിനികളുടെയും രാസവളങ്ങളുടെയും അളവ് നിശ്ചയിക്കലും അവ ഉപയോഗിക്കുവാനുള്ള രീതി നിശ്ചയിക്കലും മാത്രമായിത്തീരുന്നു. കേരളത്തിൽ ആറേഴുതരം മണ്ണും പതിനാലു തരം കാർഷിക കാലാവസ്ഥാമേഖലകളും ഉണ്ട്. ഇവയൊന്നും പരിഗണിക്കാതെയും മണ്ണു പരിശോധന നടത്താതെയുമുള്ള പൊതുവള ശുപാർശയുടെ യുക്തി എത്രയുണ്ട് എന്ന് ചിന്തിക്കുവാൻ സമയമായിരിക്കുന്നു.

കേരളത്തിലെ പ്രത്യേക സാമ്പത്തിക, സാമൂഹിക ചുറ്റുപാടുകളിൽ ശുപാർശാപുസ്തകത്തിലെ മിക്ക നിർദ്ദേശങ്ങളും ഒരു ശരാശരി കർഷകന് താങ്ങാനാവാത്തതാണ്. ഇത് മനസ്സിലാക്കിക്കൊണ്ട് ജൈവസംതുലനം നിലനിർത്താൻ മറ്റു പരിഹാരമാർഗ്ഗങ്ങം ആലോചിക്കുന്നതിനു മിനക്കെടാതെ മുൻ ശുപാർശകൊണ്ട് തങ്ങളുടെ കൃത്യനിർവ്വഹണം നടന്നു കഴിഞ്ഞു എന്ന മൗഢ്യവിശ്വാസത്തിലാണ് നമ്മുടെ ഗവേഷകർ. വർഷത്തിലെ മുഴുവൻ സീസണിലും ഭക്ഷ്യവിളകം നടുന്ന രീതി ഉപേക്ഷിച്ചുകൊണ്ട് ഒരു സീസണിൽ വിളകം ഉപയോഗിച്ച് ജൈവചംക്രമണം ഫലപ്രദമായി നടത്തി മണ്ണിന്റെ തനതു പുഷ്ടി എത്രത്തോളം വർദ്ധിപ്പിക്കുവാൻ കഴിയും, തദ്വാരാ നിർമ്മിത വളങ്ങളുടെ ഉപയോഗം എത്രകണ്ട് കുറക്കുവാൻ കഴിയുമെന്നുള്ള ഗവേഷണം നടത്താൻ ഇതുവരെ ഗവേഷണ പദ്ധതികം തുടങ്ങിയിട്ടില്ല. നീണ്ടുനിൽപിന്റെ അനിവാര്യതക്കായി ഗവേഷണം തുടങ്ങാൻ സമയം വൈകിയിരിക്കുന്നു.

Pesticide residues in food and human environment—a retrospect

A. Visalakshi
College of Agriculture, KAU, Vellayani

Major use of pesticides is in agriculture combating the pests and disease problems and in public health combating the vectors of the dreaded diseases like malaria. While discussing on the pesticides in relation to human welfare, the emotional expressions about the charges against the pesticide use and the pesticide industry, the importance of pesticide scientists and the pesticides was lost somewhere.

The history of pesticide use in India from 1948, and the future projections will reveal the position of these chemicals in India's economy and human welfare of the country. In 2000 AD, India's population would be around 1000 million which would require at least 225 million tonnes of cereals. At present, the production of cereals is around 155 million tonnes. To bridge this gap and to increase the production the crucial role played by the pesticides to avoid crop losses and to control vector born disease affecting human health can't be over ruled.

About 50% of the potential food produced is lost due to pests, diseases, rodents, birds, nematodes and this loss was combated by the use of pesticides. Area under pesticide coverage has been rising steadily over the years; in 1950 it was 0.6 million ha, in 1970 it was 40 million ha and in 1985 it was 90 million hectares.

The use of pesticides in India since 1948 could be divided into 3 phases, first phase 1948 to 1965, second phase from 1966-1975 and the third phase 1976 onwards.

In the first phase, the "era of optimism", the indiscriminate use of pesticides in public health and agriculture continued after the discovery of DDT and HCH in 1948—49 followed by the cyclodienes, organophosphates and carbamate group of insecticides.

A radical change was rooted during this period by the publication of the book "silent spring" by Rachael Carson in 1962 which made the scientists, politicians and the public to think about the irrational use of pesticide in the environment which paved the way for a changed approach in pest control.

Second phase: This era could be rightly referred to as "era of doubt". After the introduction of high yielding varieties in 1964, there was increased agricultural inputs like irrigation, fertilizers and high yielding varieties. Following this there was resurgence of pest population through out the country. High yielding varieties and monocultural practices led to a change in the pest complex.

At the end of this period, the pesticide use in agriculture accounted for nearly two third of the total pesticides used in the country. As the production was increasing on one hand, the crop losses due to pests and diseases were also increasing to the tune of 30-40 million tonnes of food grains per year. To combat this there was a simultaneous increase in the use of pesticides in the field of agriculture.

During this period the draw backs of excessive use of pesticide as schedule applications was felt and there was a drastic change in the pattern in the pesticide use. The persistent pesticides were replaced by biodegradable, less persistent and selective pesticides. The idea of judicious use of pesticides in the Integrated pest Management giving importance to host plant resistance, biological control, cultural control etc was propagated.

Third phase: The bad effects of excessive and irrational use of pesticides like, widespread resistance problems, residue problems in the consumabale products and pollution problems of environment were analysed and the idea ot Integrated Pest Management mooted in earlier years was put to practice in some of the crops like paddy and cotton.

The I P M concept aims at use of pesticides only at pest population levels of economy injury, proper timing and methods of applications, the use of low and ultra low volume concentrates use of granular insecticides, use of pesticides least toxic to natural enemy complexes and integrating the use of these chemicals with other methods of control such as cultural and biological methods with least disruption of the ecological balance of the environment.

The role played by the extension personnels of the country to manipulate the proper usage of these pesticides in the environment cannot be over ruled. The misuse, and overuse of these chemicals, which lead to contamination of the environment leading to health hazards can very well be reduced by proper teaching and training of the illiterate farmers and other people involved in agriculture and public health. With the concerted effort of the public the scientists and the extension personnels, a clean agricultural practice could be envisaged leading to increased production achieving the goal of self sufficiency in our country.

Widespread use of pesticdes to control insect pests of crops, animals and public health has resulted in the accumulation of some of the persistant chemicals in the human system and its environment. The different components of the human environment where these accumulations have taken place are the food commodities and the human systems.

Monitoring of pesticide residues in foods has shown their distribution in grains, pulses and vegetables which constitute the normal diet of an average Indian.

Cereals and pulses: The pesticide residues were monitored in wheat grains, rice wheat flour and pulses during 1965 to 1971 in Punjab, Uttar Pradesh, Andhra Pradesh, and Karnataka and it was found that out of 924 samples monitored 518 contained residues of DDT, HCH and malathion (Bindra and Kalra, 1973). A multicentric

study during 1981-83 showed that out of 1000 samples analysed 2.5% of the samples only were free from residues (Kalra, 1986). Later studies revealed that out of 1975 samples of different food commodities monitored 15 to 58.7% of the samples contained DDT and 6.7 to 49.5% contained HCH residues. (Anon, 1986)

Vegetables: The monitoring for pesticide residues on different vegetables has been reviewed by Lalitha and Prasad (1978). The reports on residue levels of insecticides in the market samples from Delhi and Hydrabad from 1975 to 1978 revealed that 972 samples out of 1736 were contaminated with either DDT or HCH (Lakshminarayana, 1975 and Krishnamurthy and Reddy 1978)

Aquatic system: Aquatic ecosystem also accumulate pesticide residues in water, fish, sediment etc. DDT was found in the fish tissues and reverine sediments and biota in the different parts of the country. (Pillai and Agarwal, 1979; Joshi, 1986). The monitoring report from Madhya Pradesh showed the presence of DDT and HCH residues in 44.8 and 37.9% of the samples respectively (Kalra, 1978).

Bovina milk: In India bovina milk has been reported to be heavily contaminated with DDT and HCH residues above the maximum permissible limits in many of the samples analysed in different states of the country. DDT residues ranged from ND to 216 ppm and HCH residues traces to 13 ppm (Agnihotri *et al* 1974; Lakshminarayana and Menon. 1975; Dhaliwal and Kalra, 1977; Kalra and Chowla, 1983; Mercy, 1985; Anon, 1987 and 1988, and Visalakshi *et al* 1989).

Butter: Monitoring report of DDT and HCH residues in butter from different parts of the country showed that DDT level was from traces to 17.7 ppm and HCH level ND to 20.9 ppm. (Agnihotri et at 1974; Dhaliwal and Kalra, 1977; Kalra and Chowla 1983 and Anon, 1988)

Human systems: The residue levels of organochlorine pesticides in human tissues can provide a reasonable index of their exposure to contaminated food and environment. The biopsy human fat samples and blood and human milk were analysed to assess the level of contamination.

Human fat: Indians were reported to carry the highest level of DDT residues (13.3 to 28.0 ppm) in body fat (Dale *et al.* 1975 and Ramachandran *et al.* 1974). But later studies on the residues in fat samples from different regions of the country showed that DDT levels were far below the high values reported earlier. (Kalra and Chowla, 1981).

Blood: Studies conducted from Delhi on the blood of people revealed that 174 out of 182 samples contained DDT residues (Agarwal and Pillai, 1975) the mean values being 0.284 ppm in men and 0.276 ppm in women:

Human milk: Very little information is available on the contaminations of human milk with insecticide residues in India. Kalra and Chowla (1982) reported that DDT and HCH residues were found in all the 75 samples collected from different parts of

Punjab. Of the 100 samples of treast milk examined from Coimbatore 62—64% contained HCH residues varying from 0.03 to 1.29 ppm and 7% contained DDT (0.02 to 0.1 ppm) (Mercy 1985).

Thus it is evident and is highly necessary that monitoring for DDT and HCH residues should be taken up all over the country, since these two insecticides form about 60% of the insecticides consumption in India, to know about the extent of contamination of the human environment with insecticides.

References

Agarwal, H. C., M. Pillai, K, K. Yadav, D. V. K, B. Menon and R. K. Gupta, *Bull. Wld. Hith Org.* **54**: 345-351 (1975).

Agnihotri, N. P., Dewan, R. S. Jain, H. K. and Pandey, S. Y. Residues of insecticides in food commodities from Delhi-II, high fat content food material. *Indian J- Ent.* **36**: 202-208 (1974).

Anonymous Proceedings of the 2nd Annual Workshop of AICRP on pesticide residues held at TNAU, Coimbatore (1986).

Anonymous Annual Report of AICRP on pesticide residues for 1986-87 (1987).

Anonymous Annual Report of AICRP on pesticide residues for 1987-88 (1988).

Bindra, O. S. and Kalra R. L. A review of work done in India on pesticide residues. In progress and problems in the Pesticide Residue Analysis. Ed. Bindra, O. S. and Kalra, R. L. pp. 4-14 (1973).

Dale, W. E., Copland M. F. and W. J. Hayes. Jr. Chlorinated insecticides In the body fat of people in India. *Bull. World Heath organisation* **33**: 471-77 (1965).

Dhaliwal, O. S. and Kalra, R. L. DDT residues in milk samples from Ludhiana and surrounding areas. *Indian J. Ecol.* **4**: 13-22 (1977).

Joshi, H. C. DDT residues in fish in the river Hooghly. *Proc. Sym. Pest. Resid. & Env. Pollu.* pp. 93-96 (1986).

Kalra, R. L. Proc. Sym. Nuclear techniques in the studies of metabolism, degradation and effects of pesticides. Bombay pp. 9-30 (1978).

Kalra, R. L. and Chawla, R. P. Pesticide Industry in India: Facts and figures. Ed. B. V. David, Viswas Pub. pp. 251-285 (1981).

Kalra. R. L. and Chawla, R. D. Occurrence of DDT and HCH residues in human milk in India. *Experientia* **37**: 404-451 (1982).

Kalra, R. L. and Chawla, R. P. Studies on pesticide residues and pesticide pollution. Final technical report of PL 480. Project P. A. U. Ludhiana pp. 230 (1983).

Krishnamurthy, M. and Reddy, C. P. V. Residues of chlorinated hydrocarbons in market vegetables at Hyderabad. *Pesticide Residues in the environment in India.* Ed. Edwards C. A. Veeresh, G. K. and Kruger, M. R. pp. 146-149 (1978).

Lalitha, P. and Prasad, V. G A review of work done in India on insecticide residues on/in vegetables. *Pesticide Residues in the Environment in India.* Ed. Edwards, C. A., Veeresh, G. K. and Krungar H. R. pp. 120-146 (1978)

Mercy, J. N. Residues of chlorinated hydrocarbon insecticides in milk from Coimbatore M. Sc (Ag.) Thesis TNAU (1985).

Ramachandran, M., M. Sharma, I. D. Sharma, S. C. Mathur, P. S. Aravindakshan, A. and G. J. Edward. DDT and its metabolites in the body fat of Indians *J. Comm. Dis.*, **6**: 259-259 (1974).

Visalakshi, A., Thomas Biju Mathews and Naseema Beevi, S. HCH residues in milk samples from Trivandrum region. XI Regional Workshop of NARP at College of Agri. Trivandrum Abstract pp (1989).

Agritech—'89

FRONTIERS OF AGRICULTURAL ENGINEERING —THE KERALA SCENARIO

1. Modern equipments for minimisation of post harvest losses
   —*Dr. V. V. Sreenarayanan*

2. Role of agricultural engineers in soil conservation
   —*Prof. K. John Thomas*

3. Introduction of Transplanters, Stationery Threshers and Baby Combines in Kerala
   —*M. K. Vasudevan Pillai*

4. Soil and water conservation programmes in slopping lands
   —*N. Abdul Azeez*

5. Role of renewable energy resources in Agriculture
   —*Dr. R. V. G. Menon*

Modern Equipment for Minimisation of post-harvest Losses*

Dr. V. V. Sreenarayanan**

1.0 Introduction

There has been substantial increase in agricultural production in the state during the past three decades due to the introduction of improved agricultural technology. However, this has produced about a host of problems commonly referred as "Second Generation" problems. For example, the crops harvested during wet season, place a heavy demand on drying and storage facilities. The combination of more intensive cropping schedule, shorter growing seasons, and more intensive production-inputs increase the demand for labour at critical times. Increased productivity also led to the failure in the e isting infrastructure to cope up with the large marketable surpluses: heavy post harvest losses ranging from 10 to 15% depending upon the commodities such as durables semiperishables and perishables; inability of the farmers to retain these surpluses; glut in the market etc.

The post harvest problems with perishable crops are worse, as compared to durable commodities. The horticultural crops differ from other food crops like cereals with respect to certain natural characteristics like moisture content (70 to 95 percent, as against 10-20 percent in case of cereals), texture (soft as against hard texture in case of cereals) unit size (5g to 5kg, as against less than 1g in case of cereals) etc which make them highly perishable resulting in huge post harvest losses.

The post harvest technology of the various crops has not been given adequate attention so far, eventhough it has the capacity to provide more food, feed and fibre through scientific conservation, eliminating avoidable losses and making available more nutritive food and value-added products from low grade raw materials by processing fortification, packaging, transport and marketing. It also enable the creation of agro-based processing industries to produce the value-added products assuring greater financial returns and generating employment opportunities, thus reviving rural economy. Thus the farmer whoes role is reduced to producer only can be transformed into producer-cum-processor by evolving appropriate agro-based rural industries.

---

* Paper presented during the State Level Seminar–Cum Workshop on "Frontiers of Agri–cultural Engineering–"The Kerala Senario" held at College of Agricultural Engineering, Tavanur, on 2-4 September' 89

** Professor and Head, Department of Agricultural Processing, Tamil Nadu Agricultural University, Coimbatore-641 003.

Further, the planned growth of agro-processing industries would at the one hand restrict the flow of people from village to industrial cities and on the other hand integrate rural and urban economics by eliminating regional imbalances.

By improving the various harvest and post-harvest operations and losses can be minimised drastically and the benefits of high productivity already achieved will percolate to the farmers who took the maximum risk in raising the crops.

Many improved post harvest technologies/processes have been developed during the past years as summarised below and their popularisation and adoption will go a long way in increasing the food production of Tamil Nadu by 2000 A. D.

2.0 Harvesting and Threshing

Improper harvesting and threshing result in losses upto 5% in the case of paddy, therefore, better production techniques alone are not sufficient to solve the food problem. The predominant methods practised in the state consist of manually harvesting the crop and then threshing by manual, animal or mechanical means. However, of late, interest in mechanising the harvesting-threshing operation is high due to the increasing cost and seasonal shortage of labour and the timing problems involved in multiple cropping. The recently introduced dwarf varieties of cereals are also better suited for mechanised harvest and threshing. The use of improved equipment and systems can reduce this large labour demand by increasing labour productivity. It is important, however to remember that the main objective of mechanisation is not simply to replace human labour but to increase profitability by increasing product quality and reducing production cost. There are, however a number of constraints that have hindered the mechanisation of harvesting-threshing operations:

i. Social constraints—displacement of the traditional role of the people in harvesting and threshing.
ii. Farm constraints—small farm holdings and lack of access road to the fields.
iii. Farmers constraints—reluctance to change from the traditional methods to the new because of poor mechanical aptitude or low income.
iv. Crop constraints—excessive moisture content at optimum harvest time, uneven ripening, high shattering tendency of new varieties.
v. Equipment constraints—lack of functionally and economically suitable equipment for the local conditions.

2.1 Moisture content at Harvest

The time at which harvesting occurs has an important effect on the post-harvest losses. Most of the farmers judge the maturity of cereal crops either by visual observations of golden-yellow colour of the grains on the panicle of plants in the field or through abiting test or both. At this stage, the moisture content of grain (paddy) is approximately 15-18 percent (w.b). This conventional practice of harvesting crop at lower moisture content results in significant losses (5 to 10 percent) in yield caused by shattering birds, insects, rodents etc.

Research works carried out in many institutions have revealed that early harvest after maturity minimise the post-harvest losses of food grains. The optimum harvest moisture content for paddy found to lie between 20 to 23 per cent (w.b). The results also clearly indicated that the paddy harvested at optimum moisture level has better milling quality (total yield and head yield), than paddy harvested at lower moisture levels.

Similar studies for other crops like sorghum, groundnut, soybean, wheat etc have been reported advocating the practice of 'Early Harvest' after maturity to reduce the losses, besides getting superior quality of food grains.

In addition to this, early harvest of crop from the field saves valuable time for the farmers for field preparation and subsequent sowing preparations for the next crop, thus increasing effective utilisation of a land. This is an important factor in view of the multiple cropping practices.

2.2. Harvesting Methods

The hand sickle is the most common paddy harvesting tool used in the state, whose efficiency depends on the various cultural practices, the density and variety of the plant, the degree of lodging, the soil conditions and the skill of the reaper.

Design and development of bullock drawn reapers, engine mounted reapers, and power tiller mounted reapers for cereals and diggers for root crops have been completed in the past few years. These are suitable for small farms and are not likely to create labour problems, unlike combine harvesters, which are in large scale use in highly developed Western Countries. In our condition, where labour is not very costly, a system between completely manual and completely mechanised harvesting operations will be more desirable. For example, considering a cereal harvesting machine owned by the farmers, a high capacity reaper windrower where the tying of bundles is done manually will be more suitable to our situation than a reaper binder, the operational cost of which is higher, because of the cost of twine required for automatic binding of the crop.

2.3. Threshing Methods

Threshing is one of the most important operations after harvesting in the crop production technology of cereals. The threshing is performed through various methods viz (i) hand beating (iii) hand feet rubbing (ii) bullock treading (iv) tractor treading and (v) mechanical threshing.

Nowadays threshing by hand beating and rubbing is done at very limited scale, as it is costly and laborious, the threshing by bullock treading is practised at large scale in the state, but it is also time consuming and involves drudgery. The threshing by tractor threshing is also done at limited scale, but this is again inefficient method of power utilisation. Mechanical threshing is becoming most popular due to the inherent advantage of method, and multicrop threshers which can be adjusted/ converted easily for threshing of different crops are gaining importance in the state.

3.0. Drying

Drying or dehydration is a process where moisture is removed from a food product to enhance its storability, transportability, flavour or texture. By reduction of moisture content of product to very low levels, the opportunity for microbial deterioration is eliminated and the rates of other deterioration reactions are reduced signif c-antly. In addition to preservation, drying reduces product weight and volume by considerable amount and improves the efficiency of product transportation and storage.

Special care has to be taken in selecting the method of drying, since the materials is a hygroscopic and respiring biological products. It should be noted that no single set of operating instructions apply to any particular type of dryer Establishing a drying procedure is a situational proposition; many factors such as ambient air conditions, type and quantity of produce which has to be dried, expected use of the product, economics of drying etc must all be considered. Methods of crops drying include natural or sun drying and artificial drying.

3.1. Sun drying

Sun drying is the traditional method of drying which was practiced by the farmers from the very beginning of the farming history. A major quantity of the crops grown in the state is dried by this method.

3.1.1 Features of sun drying

a) The incontrolled, non-unform and slow drying induce severe temperature and moisture gradients within the grain kernels which result in "Sun Checks" or cracks in kernels. When sun dried paddy grains milled give large quantity of brokens due to these cracks.

b) The process is dependent on availability of the sun energy, which is normally not available during monsoon season. The advent of multiple cropping with the new varieties and better water management practices may often shift the harvesting time and thus thue drying to be carried out, in rainy season. Sun drying then becomes very difficult.

c) Considerable quantity of grain (1 to 2 percent) is lost by the birds, insects and rodents during the process.

d) Requires very large area, hence not suitable for the rice mills located in cities where there is scarcity of land.

e) Lowest initral investment, maintenance cost, requires no fuel or mechanical energy and hence cost of drying is lowest.

3.2. Mechanical Drying

Many types of mechanical dryers have been developed including the batch and continuous types, dryers, fitted with agricultural waste-fuelled furnace, solar f at plate collector etc.

There are many methods of artificial drying and there are sound engineering and economic reasons why each method is better suited for certain kinds of drying than the others. No one type of dryer is best suited for all drying needs. The user must choose the best one for his specific needs.

All the draw backs associated with sun drying are absent in the case of artificial drying. However the use of artificial dryers is limited, mainly because of the requirement of higher initial investment operating cost and and skilled labour.

3.3. Dehydration of Fruits, Vegetables and their products

The preservation of fruits, and vegetables by dehydration offers a unique challenge. Owing to the structural configuration of these products, the removal of moisture must be accompanied in a manner that will be least detrimental to the product quality. Prolonged heat treatments result in the loss of delicate flavour, decrease in nutritional quality and acceptability of the products. A constant search is being made to develop new processes and designs, and build equipment that would retain the original food value while removing the water, as a result of which a variety of process are at the disposal of the food technologists. The techniques and equipment developed recently, for the removal of water from fruits and vegetables and their products at lower temperatures include, Osmatic dehydration foam mat drying, explosion puffing, micro wave drying, infra red drying etc.

In addition to efficient use of energy, emphasis in recent years has been on the improvement of the product and lowering the cost of production.

4. Cleaning and grading

Most of the agricultural crops after harvesting and threshing have to undergo cleaning and grading, both for consumption as well as for seed purposes. Many efficient and cost-effective equipment have been developed during the past years, including winnowers (hand, pedal and power operated), seed cleaner-cum-grader (Crippen and petkus models) groundnut grader, diverging roller grader etc,

5. Shelling and Decortications:

Manual practice of removal of husk and shell from various agricultural produce is time consuming and inefficient, besides involving a high degree of drudgery. Therefore many improved equipments have been developed for shelling and decortication. They include groundnut decorticator (hand operated and power operated), caster sheller, maize sheller, arecanut dehusker, sun flower seed sheller, seed extractors for chillies, tomato etc.

6. Parboiling of Paddy

Parboiling is a premilling conditioning of grain with husk intact. Paddy is soaked first followed by steaming and drying. It is estimated that about 50% of the paddy grain produced in the state is parboiled.

6.1 Features of Parboiling

a) Shelling of parboiled paddy is easier because the husk is split during parboiling.

b) The extra strength acquired by the rice kernal during parboiling helps to reduce the breakages.

c) Parboiled rice retains more proteins, vitamins, and minerals than raw milled/ rice of the same paddy.

d) Parboiled rice, because it is harder, is more resistant to insect infestation during storage compared to raw rice.

e) Loss of solids into the gruel during cooking is less in parboiled rice besides withstanding over cooking as compared to raw rice.

f) The bran from parboiled rice contains about 25 to 30% oil where as, raw rice bran contains about 15-20% oil

g) Parboiled rice takes more time to cook to the same degree of softness than raw rice.

h) Parboiled paddy must be dried from 45% to 14% moisture for proper milling and storing.

i) The parboiling process needs an extra investments of capital

The higher outturn of total rotal rice (about 1 to 2%) as well as head rice brings an additional profit to the miller and at the same time ensures a lower price to the consumers.

6.2. Parboiling Methods

Parboiling has been traditionally carried out at homes by extremely simple methods, and these are still practised in villages. For example, paddy may be briefly boiled with water in small containers and then drained and dried; or after the initial heating, the moisture may be left to cool slowly for several hours after which most of the water is drained out and the vessel heated again for steaming. In these methods, since the hydration and heating are not separated the process cannot be adequately controlled. So the paddy is usually over cooked or under-cooked.

Single boiling and double boiling are the traditional methods adopted for the large scale commercial parboiling of paddy. In these processes the rice acquires disagreeable odour arising from microbial fermentation during the long soaking.

CFTRI method is the improved method practised in almost all modern rice mills in the state. Though this is a batch process it can be made semi-continuous by having a number of tanks and staggering their operation to feed a dryer one after other.

Recently some novel developments have been made in the Paddy Processing Research Centre, Tanjore. One relates to cold soaking in presence of Chromate which eliminates fermentation. Another is that a hot brine wash of the soaked paddy just before staming helps draw out water and reduces drying cost. In the third process paddy is washed with water and then subjected to direct pressure steaming

which parboils it with a low moisture content; hence processing time and drying cost are both greatly reduced.

7. Milling of Paddy

Paddy milling is one of the largest industries in the state, in terms of the value and volume of raw material handled. The processing of paddy is carried out in a variety of mills like, huller mills, huller cum sheller mills, and modern (Rubber roller sheller and centrifuge shellers) mills.

It is a proven fact that the modern mills give the highest yield of rice with least brokens and better quality of by products. The average percentage of additional out-turn of total and head rice obtained in modern rice mills over the conventional rice mills is shown in the table below.

Type of rice mill	Additional out-turn of total rice (%)	Additional out-turn of head rice (%)
For Raw Paddy		
Over sheller	2.5	6.1
Over Huller	6.6	15.1
For Parboiled Paddy		
Over Sheller	0.8	1.3
Over Huller	1.6	4.1

Considering quantity of paddy produced in the state, the additional recovery of total rice and head rice is quite enormous in using the modarn rice milling machineries.

During the 60s, there were very few rice mill manufacturers in the country manufacturing modern rice mills and processing equipments. With the introduction of modernisation programmes, the number of firms manufacturing these machineries have gone up considerably.

Initially, the problem of poor quality of rubber roll for the sheller posed some problems in the modernisation programme. As a result, the rolls were imported for an initial period of 2 to 3 years. Thereafter, the rubber roll manufacturing industry has been able to produce quality rubber rolls matching the international standards and thereby restoring the confidence of the millers in the rubber roll sheller technology. Although the cost of the present rubber roll appears to be higher efforts are in progress to further improve the quality of rubber roll as well as to reduce its manufacturing cost to render it attractive for the mills. The development of rolls using polyurethane which is considered to be having more resistance to wear and can also dehusk a larger tonnage of paddy is in progress.

8.0. Storage of Agricultural commodities

Most of the produce in the state is produced by small farmers. Of the total food grain production, 60-70% remain in the rural sector over a period of 8-10

months which they use for consumption, as seed or feed or to get better price in the off-season. Majority of the farmers store their produce in traditional structures. The marketable surplus of 30-40% is handled by the organised sector which includes Government agencies, traders and food industries, where storage is for a period of 3-6 months generally or in case of buffer stocks, more than a year.

8.1. Factors responsible for Commodity Deterioration in Storage

Scientific and socio-economic factors determine the extent of deterioration of produce during storage. The former includes, physical, biological. chemical, and engineering aspects; while the latter includes finance, farming methods, storage and marketing.

8.2. Existing storage structure facilities and practices in rural sector

In a majority of places, food grains are stored mainly in the traditional structures and containers made locally, and from material locally available in their respective surrounding. The structures differ in size and shape, capacity and type. The shelf life of the produce depends on the materials and methods of construction and the amount of commodity stored. Materials of construction used include bamboo, timber, bricks, mud, paddy, straw etc and the produce may be stored in bulk or in bags.

Most of the existing rural storage structures have Inherent deficiencies and do not give adequate protection against insect rodents, moisture and micro organism. They are neither fire proof nor amenable to carry out fumigation. However they are inexpensive as the material of construction is available locally and the artisans are to fabricate. The structures have gained confidence of farmers over long periods. Hence any change in the present system requires well organised approach. Progress made with regard to storage structures and relate to improvement of existing storage structures and introduction of metal and non-metal structures.

Role of Agricultural Engineers in soil conservation

Soil and water conservation engineering is the application of engineering principles to the solution of soil and water management problems. The conservation of these vital resources implies utilization without waste so as to make possible a high level of production which can be continued indefinitely.

The engineering problems involved in soil and water conservation may be divided into five phases: erosion control, drainage, irrigation, flood control and land clearing. Although soil erosion takes place even under virgin conditions, the problems to be considered are caused principally by man's removal of the protective cover of natural vegetation. Flood control consists of the prevention of overflow of low land and the reduction of flow in streams during and after heavy storms. Land clearing includes the removal of trees, stumps, brush, or stones from otherwise tillable land. The two principal ways of increasing crop production are to develop new land not now in production and to improve the productivity of present cropland. The development of new land is brought about primarily by drainage, irrigation, and land clearing. However all five phases are applicable to the improvement of land already in production.

Sound soil and water conservation is based upon the full integration of engineering, plant, and soil sciences. The agricultural engineer because of his training in soils, plants, and other basic agricultural subjects, in addition to his engineering background, is well suited to carrying out the integration of these three sciences. To carry out this plan the engineer must have a knowledge of the soil including its physical and chemical characteristics as well as a sound over-all viewpoint. All professional groups should have an appreciation of each other's problems and should co-operate to the fullest extent since few problems can be solved within the limits of any one profession.

To be fully effective in applying technical training, the agricultural engineer must also acquaint himself with the social and economic backgrounds that relate to soil and water conservation. He must have a full understanding of the various governmental structures and mechanisms that have been developed to implement sound soil and water conservation programmes. A number of references will provide this background material. The agricultural engineer should also become familiar with the principles of mapping and classifying land for its use in accordance with its capabilities.

Kerala has very undulating topography with hills, hillocks and valleys. The valleys are mostly paddy fields. In rainy season surface and sub-surface run off from the surrounding hills drain into the paddy fields making these fields waterlogged. During this season drainage is the main problem in the paddy fields while soil erosion is the most serious problem on the hills which have very steep slopes.

Cultivation on slopes over 50% is not uncommon in Kerala, eventhough all the conventional text books on Soil conservation recommend that lands having more than 40% slope should be put permanently under afforestation and natural vegetation should not be disturbed. The pressure of population on land is so much that this recommendation cannot be followed. The recommended practice is to construct California or Pueto Rico type terraces and pitch the downhill side with stones for stability. This method is effective but cost of pitching is becoming prohibitive. Now it has become necessary to find out alternative cheaper but effective methods of construction of bunds. Taking advantage of the high infiltration rate of most of the hill soils of Kerala, it may be possible to develop a combination of mechanical and agronomic methods for checking soil erosion.

It is estimated that in Kerala out of about 21.8 lakh hectares of cultivated and major portion needs intensive soil conservation measures. Nearly 4 crores tonnes of soil is lost annually due to erosion. If it is not checked now, within 20 years, major portion of Kerala will have only rock formation, according to Russian experts.

'Urual pottal' is another problem facing Kerala. A huge quantity of water with overburden of topsoil and uprooted vegetation in high velocity, explode and rush downward valley or river causing major casualitfes are familiar to the peoole of Kerala especially in Wynad and Idukki districts and is termed as 'Urual pottal.,

Land slides and land slips are occurring annually during south west and north east monsoon periods. Among a number of factors climatic and biotic factors are the main reasons which cause land slides and land slips. With good vegetative cover the soil-water-plant are in equilibrium and generally inspite of heavy rainfall the system is able to dispose of rainfall by interception, infiltration, storage in soil profile, deep percolation, evaporation and transpiration. However once the vegetative cover is removed the entire soil-water-plant system is disturbed. There will not be any interception, the run off will increase, the soil of steep slopes when fully saturated become subject to slipping and sliding. The other major course is construction of defective bench terraces on very steep slopes.

Clearance of new hilly areas for cultivation, industry, hydro-electric projects, town ships, roads, bridges, coffee and tea plantations and absence of proper planning as regards to the proper disposal of rain water results in severe erosion and finally results in land slides and land slips. Bad managements of agricultural lands, plantation crops, forests, grass lands, over grazing, bad roads, burning of grass lands, blasting, high intensity rainfall etc. cause splash sheet, rill, gully and stream bank erosion.

When the rainy season starts people in high ranges are subjected to gross fear for their lives. Every life will be interrupted due to fear of land slips and slides. P.W.D. have the programme of repairing the roads after the slips and slides occurred on roads. No other attempt had so far initiated to wipe off the land slide fear from the minds of the people.

Now there is public awareness on the need for agricultural engineering expertise in the State. These needs are in a small way met by the different Government Departments. The Department of Agriculture has an Agricultural Engineering wing and soil conservation wing. Small irrigation and drainage projects are now undertaken by the Minor irrigation wing of the P. W. D. The staff recruited in these Departments are mostly either agricultural graduates or engineering graduates trained in the conventional disciplines of Civil or Mechanical engineering. It needs hardly to be emphasised that they are not fully competent to meet the requirements of their work. A major handicap in the work of these departments appears to be lack of personnel specially trained in agricultural engineering. A major step to be undertaken, for better co-ordination of work is to merge these wings of the two departments to form a Department of Agricultural Engineering under the Minister of Agriculture for overall agricultural development. Realising the importance of agricultural engineering in the developmental activities, many states in India have already done this including our neighouring state, Tamilnadu.

Suggestions for formulating integrated soil conservation schemes

While formulating Integrated Soil Conservation Schemes it should be ensured that all natural recources available are planned to be exploited to the optimum. For development of land to a state of maximum fertility, especially when it responds favourably to the application of inputs, various development activities would be involved. After having identified the various activities, priorities, keeping in view of the practical limitations, have to be determined. Care should be taken to see that proper phasing of the development is planned so that the cost of development is minimum. Expert opinion especially from the Head of Department of technical specialists in the concerned field may be obtained in working out a plan of action as and when found necessary. Planning and preparation of soil conservation integrated projects, should be based on detailed studies of the local factors, gravity of erosion hazards, land capability, cropping pattern etc., so as to enable to have maximum benefit to the beneficiary and community as a whole.

The need for soil conservation measures, particularly in hilly and highly undulating areas where Agricultural measures are adopted should be assessed giving comparative merit in terms of erosion hazards, land use etc. The cost of soil conservation measures will be different from areas to areas depending on the terrain, soil structure, slopes, availability of materials for construction, the cost of labour etc. While formulating integrated soil conservation projects on watershed basis, it should be ensured that estimates for stone pitched puertorriccan type terrace walls, graded contour trenches with Agronomic/Agrostologic work, staggered contour trenches with Agro/Agrostological work along the berms of earthern bunds, waste weirs, gully control and other water management structures like check-dams, gully plugging, drop pits, retaining walls, catch water drains, silt detention dams etc., Agronomic measures like strip cropping, contour cultivation etc., Agrostological measures and forestry measures etc., may have to be incorporated. The scheme formulated should be able

to serve the purpose of conservation of soil and water and earn a reasonable return on the investments, so that the beneficiary would be in a position to repay the loan after meeting the operational expenses.

Integrated soil conservation schemes are to be taken up only on water-shed/ catchment basis. Selection of water-shed should be made taking into account mainly the drainage pattern. It is also preferable to have well defined boundaries like streams, roads, rivers etc. Catchments identified for undertaking soil conservation programme, if found to be large, can be sub-divided into smaller sub-catchments/ water-sheds taking into account the drainage details with natural boundaries. The technical and administrative feasibility may also have to be assessed before the commencement of field investigations for better efficiency.

Introduction of Transplanters, Stationery Threshers and baby combines in Kerala

M. K. Vasudevan Pillai,
State Agricultural Engineer

1. Introduction

Modernisation of Agriculture will remain infant without adequate level of Farm Mechanisation by the use of appropriate improved agricultural implements and Machinery. Mechanisation in our country and in Kerala in particular has not registered any appreciable level and due to the same reason Indian Agriculture is still infant in modernisation as could be seen from the fact that production and productivity are at stand still for most of the crops and dipping in the case of other few crops. In spite of hectic activities undertaken in the fields of inputs like improved seeds, fertilisers, pesticides and loans and subsidies during the last decade, we could not register any increase in production at all. Eventhough there is a fall in net area under crop, this alone cannot be considered a sufficient cause for production fall. There is substantial reasons to believe that the stagnation in production and productivity can be attributed to inadequate use or non-use of appropriate improved agricultural implements and machinery. This aspect is stressed in this paper with reference to paddy cultivation as paddy is the major crop of Kerala state.

2. Mechanisation and Development

The apprehension that Farm mechanisation will create rural unemployment is rather ill conceived. Eventhough Farm mechanisation has a bearing on production and productivity, it is generally followed by urban industrialisation and general development. It may be noted that a developed country has, not more than 10% of population fully dependent on Agriculture and another, say 10% partly dependent on Agriculture. Thus in most of the developed countries like Japan, USA, USSR etc. less than 20% of population only are dependent on Agriculture. In all these countries, durlng early stages of development, more than 60% or so, were dependent on agriculture. Industrialisation absorbed more farm labour and the vacuum created in the farm labour front was filled up by farm machinery. In India, even now more than 70% of population are dependent on Agriculture. We have thus a long way to go ahead to create the labour vacuum in the Farm labour front to attract more farm machines. Introduction of farm machines shall synchronise with industrialisation eventhough it may not be possible to avoid slight overlaps and labour unrest in the process of Farm Mechanisation. Anyway in the present context of very slow industrialisation and surplus rural labour, introduction of large scale farm machinery (for total farm mechanisation) will not be advisable, eventhough, this has a bearing on production and productivity.

Keeping all these aspects in mind, we can introduce the following machinery without much labour unrest.

(A) Paddy Transplanters.
(B) Stationery Power Threshers
(C) Baby Combines.

A Paddy Transplanters

The field of transplanting of paddy seedling is most neglected, evennow. We are still following the broadcasting and manual transplanting methods. For assured uniform plant growth, a thoroughly prepared land is absolutely necessary. However, land preparation and land levelling alone will not assure uniform plant growth and ultimately uniform maturity. Plants should be uniformly and correctly spaced. Depth of planting should also be uniform and to the correct depth, depending upon soil type, soil conditions and seedling size. Number of seedlings in a spot shall also be uniform and correct. None of these factors are achieved in broadcasting or manual transplanting. In manual transplanting, the number of seedlings in each spot varies from person to person and so in depth and space of planting. All these will contribute to irregular plant growth, protracted flowering and irregular maturity resulting in a heavy crop loss of 5 to 10%. The only remedy is to adopt Transplanters which will solve these problems. A paddy transplanter will assure uniform and correct depth and spacing as well as number of seedlings in one spot. A well prepared and levelled land with seedling transplanted by a paddy transplanter will easily give an assured increase of production of 5 to 10%.

B Stationery Power Threshers

1 Why power Thresher?

The relevance of Power Threshers can be clearly understood by taking a case study of harvesting done in 1 Hectare of paddy field in Moncompu in Kuttanadu. These days generally 40 to 50 people will be engaged for harvesting (They are not engaged: they will enter the field as they desire for which the cultivator has no appreciable control). Cutting, bundling "Kattas" and head loading to 'Kalam' (threshing yard) will be over by 2'0 clock depending up on the distance of Kalam. 'Kattas' are stalked separately by each person or group who harvested the crop. After stalking the 'Kattas' the labourers go home as they will be too tired to thresh their 'Kattas' by their own labour. In Kuttanadu, kattas are threshed by foot pressing. These people will not turn up for threshing the next day or even the day after since they will be going for harvesting other fields to have maximum 'koythu'. In fact they will continue harvesting during the season in their possible accessibility. Ultimately the 'Kattas' they harvested will be in the kalam unthreshed for weeks and weeks. Some time it will take even a month to clear the kalam. The cultivator will have to idle in the kalam through out this period wasting a lot of money and opportunities This waste can be avoided by engaging a stationery power operated or diesel engine operated Thresher. A 7.5 HP power thresher can thresh the entire harvest of one hectare in 10 hrs. After harvesting is over, which will generally be over by 3'0 clock, the

machine can be engaged for threshing. Since the labourers who harvested (who will be generally tired) need not do any manual work, they will stay there to collect their due 'Patham'. If threshing is not completed the same day, it can be completed the next day afternoon since the labourers will be away for harvesting new fields in the forenoon.

2. Additional expense of engaging threshers

1 The labourers may be given the same 'Patham' in force in the locality (1/8 patham & 1/32 Theropu) so that there will be no labour unrest. In fact they will only be happy since they need not thresh with their feet. Moreover they will get their 'Patham' immediately after harvest since otherwise they complete threshing manually only after 20 days or even a month.

2. The cultivator who invest money for thresher also need not loose any thing by giving full Patham' due to the main reason that he can clear his 'Kalam' after threshing within 3 or 4 days time against the usual disgusting watch & ward of 20 to 30 days in the kalam.

3. Individual Owners of Threshers may hire out to needy small farmers so tha he can make the investment profitable also. For example a 7.5 HP Thresher with trolly and all required accessories will cost Rs. 25.000/- This machine can be hired for say Rs. 150/- per day without running expenses (power or fuel) & operation charge (Say Rs. 50 per day) within a span of 3 to 4 years one can get back his investment.

4 The farmer who hire the Thresher will also be benefitted. For example a Farmer having 1 Hectare will have to hire a Thresher for 2 days for which he will have to spend Rs. 500/- including operation charges transporting charges and hire of the Thresher. Even though he has to disburse the full 'Patham', the Rs. 500/- he spent is not a loss since he is saving 20 to 25 days watch and ward in the 'Kalam' as is happening now.

5. As stated earlier, a 7.5 HP Power thresher with motor will cost Rs. 25,000/-. Those who own Kubota Power Tillers need not purchase motor. They need purchase Thresher without motor costing Rs. 20,000/- and operate with a belt drive from the Kubota Engine.

6. Additional Employment

Each machine will provide employment for 2 men. One for bringing 'Kattas' and other for the operation of the thresher.

7. Winnowing

Since thresher is attached with a Winnover, there is no need for much winnowing after drying the paddy. This way the farmer is saving much money for traditional winnowing or even engaging a winnower. In fact power operated winnowers are quite common in Kuttanadu areas these days.

8 Subsidy

As an insentive a 25% subsidy can be sanctioned to popularise Power Threshers.

Introduction of Power threshers will be the dawn of the second phase of Farm Mechanisation in Kerala. It is featured by the most peculiar aspect that it will not create any *unemployment loss*. It is a bonus to the 'Koythal' since they get full 'Patham' without their laborious manual threshing. Power Threshers will create additional employment as well as profit for the owner of the thresher. The additional employment created in the factories which manufacture threshers will be really fantastic since we need thousands of Threshers in Kerala alone.

So it is high time that we introduced stationery Power Threshers in Kerala State.

C. Baby Combines

After paddy transplantor and stationery Threshers, the next farm equipment that has a remarkable and positive bearing on production is the Baby Combines, suitable for even the smallest possible plots of Kerala conditions. At present harvesting and threshing are being done manually incurring heavy shedding losses at various stages of harvesting and threshing. During harvesting seasons, labourers at times rush to the field and there is heavy competition for harvesting. Paddy is rashly cut without making bundles. After harvesting is over, bundling is done and then transported to threshing yard. It lies at the yardf waiting for the persons who harvested and it take weeks and weeks to got it threshed. There are instances of even germination of the paddy. It has been assessed that there is a shedding loss of 10 to 15% at various stages of manual operations, in case of high yielding variety. Shedding at the paddy field alone is assessed at 250 to 300 kgs per hectare, which will come to nearly 10% of the propuction per hectare. Shedding loss on transporting and loss at threshing yard is over and above the above losses. At any rate a minimum of 10% loss cen be avoided by the introduction of Baby Combines. A Baby Combine cuts, conveys, threshes, winnowes and collect the paddy in the gunny bags attached to the combine. There is absolutely no loss at all. A single machine which can avoid a loss of 10% of the production—the Baby Combine—is not yet in use on the Indian Farmers. The present shedding loss is nothing but a criminal waste especially in a poor country like ours where death due to starvation is still not very uncommon.

Concluding Remarks

In the light of the discussions held so far, it can be seen that there is much scope for further Mechanisation in Agriculture. Without Farm Mechanisation any hectic activity to modernise Agriculture will not impart rural economy, suff cient momentum for take off from the present squalor. Birth of new and innovative farm equipment will be followed by pain in the labour rooms. However, it will be least painful as compared to mechanisation in any other fields of modernisation. And there is no way to stop modernisation. Improved Agricultural Implements and Machines will have then a major roll to play in the modernisation of Agriculture and food production at lesser costs. Hence it is high time that we introduced Paddy Transplantors, Stationery Power Threshers and even Baby Combines in the Kerala Farms.

Soil and water conservation programmes in slopping lands

N. Abdul Azeez

Additional Director (Soil Conservation)

Introduction

Land and water are two important natural endowments which are crucial life supporting elements and need to be properly utilised for increasing the productivity and improving the economic condition of the rural people. About 80% of the population in India are dependent on these two elements for their livelihood. Soil and its fortility also helps us in growing fuel fodder, timber and ether forest products through large scale afforestation and grass land development which in turn maintains the ecological balance. Available estimates including these reported by National Commission on Agriculture show that about 175 million ha. ie. 53% of the total geographical are of the country suffers from soil erosion and land degradation. The evidence of degradation show that expensive multipurpose reservoirs are getting silted up at alarming rates, gullies and ravines are steadily encroaching into productive lands of many of our major command area and considerable number of flora and fauna are being endangered for total extinction due to unscientific management of land and water.

According to National Land Use and Conservation Board an estimated 5334 to 6000 million tonnes of soils are annually eroded in India. About 30% of this is washed into sea, about 9% gets deposited into reservoirs and the rest gets lodged on land.

The problem of soil erosion and consequent depletion of soil fertility is severe in Kerala due to the high intensity of rainfall and undulating topography of cultivated land. Unscientific cultivation practices indiscriminate denudation of forests and injudicious water management on the hill slopes have resulted in deterioration of the land. Kerala suffers from the hazards of flood during monsoon seasons. Most of the rain water runs down the hillocks in to the major 44 rivers and ultimately to the sea. Even though Kerala comes under the high rain fall area, the last few years have witnessed a series of droughts. Out of the total geographical area of 38-86 lakhs ha. in Kerala nearly 19 lakhs ha. suffer from severe erosion. Out of this, it has been roughly estimated that ten lakhs ha. of land suffers from severe hazards of erosion. All the reservoirs of irrigation and hydro electric project of the state are being silted up fastly due to soil erosion in the catchment areas.

Approach

The National Commission on Agriculture has recommended that the land use policy should ensure intensive utilisation of land prevent its deterioration, create widespread productive employment and reduce regional and sectoral disparities. Soil being the most important medium of plant growth, its management and improvement must permeate, the policy of land use, soil conservation (including land reclamation and development) being looked at an integral part of programme for maximising land use. Consistent to this concept, with available resources and large human labour force in the country, the soil and water conservation and land reclamation programmes have to be taken up in sympathetic relationship—one supporting the other, for raising aggregate production of food, fodder and fire wood while ensuring greater and fuller employment and more balanced and risk cushioned ecology.

Watershed as a Planning Unit

In most part of the country, including Kerala, water is the Chief agent causing erosion, catchment degradation, including loss of protective cover and also transporting the eroded materials to far away places such as reservoirs. However in considerable areas, particularly in the Western and Southern arid and semi arid regions besides wind, water which is continuously in short supply but on occasions also comes in torrential rains followed by flash floods. Again loss of proper cover and productivity of land surface are due to inability in optimising the use of available rain water through conservation and re-use particularly to tied over the dry spells. Therefore it would be seen that in the ultimate analysis in most part it is the management of rainfall and resultant runoff both for control measures as well as productive land management systems. The action of rainfall on flowing water is best understood with the attributes of physiography and management practises in vogue in a particular area. The factors which influence run off, erosion and resultant flood and sedimentation range from climate to physiography. Similarly production potential, for optimum use of available resources of water and soil, is also affected by such factors. The interaction of these factors, in the context of degradation and production potential is best understood when examined on the basis of a natural unit. Watershed happens to be such a natural hydrologic or physiographic unit and therefore, offers a very good unit for planning and implementing the soil conservation programmes. Watershed also satisfies the area concept which is considered a rational base for economic development of available resources.

Kerala state with its 44 rivers can be delineated into 44 macrowatersheds, 151 sub watersheds and 960 micro watersheds. Delineation of watersheds and the prioritisation can be done with the help of topographical maps and with the data available with the soil survey organisation and the state land use board.

Treatment

Considering the available level of technology and research support package of practices have baen broadly identified for combailing these problems in different

soil conservation regions. In the beginning the programmes started with simple measures like bunding, terracing, afforestation etc. Over the past few years the conservation planning got diversified and improved due to valuable research support and feed back from the field. Presently besides traditional measures mentioned above, a large number of moisture conservation measures, check dams, trenches and other structures including ponds, have come into use for multiple uses such as control of erosion, prevention of encroachment of gullies, into productive land, harvesting and scoring water for improvement of water regime, re-use of harvested water in mini commands, restoration of degraded lands for agriculture rehabilitation of degraded land, through utility plantation such as cashew. This diversification has helped in increasing production of crops, fodder and firewood while creating casual and regular employment opportunities at extensive locations which are subject to chromic underemployment.

The following identified technologies of soil and water conservation can be effectively applied under Kerala conditions. The nature and type of work can be selected on the basis of slope % crops grown, soil characteristics, socio-economic conditions etc.

I. **Agronomic practices**

1 Contour cultivation
2 Strip cropping
3 Crop rotation
4 Cover cropping
5 Inter cropping
6 Mulching
7 Zero tillage.
8 Suitable cropping pattern.
9 Contour furrows, pitting and planting.

II. **Agrostological measures**

1 Contour embankments with suitable grass species planted on it at regular interval. Agave and Pineapple can also be tried on embankments.
2 Vetiver hedges on contour.
3 Alternate grassed hedges with contour trenches/bunds.
4 Use of soil stabilising grasses on water ways and channels.
5 Turfing the sides and tops of bunds.
6 Using vegetative structure for stream bank protection and land slide stabilisation.

III. **Mechanical structures**

(Soil Conservation Engineering Measures).

1 Contour bunding—earthern bunds and Rubble pitched contour bunds.
2 Contour trenches and embankments.
3 Bench terracing.
4 Slaggered trenching.
5 Crescent bunding

6 Water harvesting structures
7 Check Dams and Gully plugging structures
8 Diversion channels and water ways
9 Retaining walls and groynes along stream banks
10 Waste weirs

IV. Soil Conservation Forestry Measures

1 Planting suitable trees on contour along with grass hedges
2 Shelter belts and wind breaks
3 Afforestation on steep slopes and denuded hillocks
4 Promotion of Agroforestry practices
5 Combination of crescent bunds and tree planting on contour

The selection of appropriate technology suited to the particular watershed depends on runoff, erodibility –index and future programmes of land use.

Broad features of the State making it ideal for effective watershed planning are furnished below

1 Location

8° 18′—12° 48′ N Lat
74° 52′—77° 22′ E Long

2 Boundaries

Karnataka	—	North
Tamil Nadu	—	East & South
Lekshadweep sea (Arabian sea)	—	West

207712

Appendix

RUBBLE PITCHED CONTOUR BUNDING

(Puertorican type of Terracing)

Specifications

Top width	—	45-50 cms
Thickness of pitching	—	15-22 ,,
Side slope uphill side	—	½:1
,, Downhill side	—	1:5 to 1:3
Foundation	—	15=20 cms

$$L = \frac{100\ S}{VI}$$

L — Length of terrace wall per Ha.
S — Slope %
VI — Vertical Interval
Vertical Interval is fixed as per the Ramser's formula:

$$VI = 0.3 \left(\frac{S}{3} + 2 \right)$$

Where VI = Vertical Interval
S = Slope %

HEIGHT OF BUND

Upto 5% Slope	—	50 cms
6% to 10%	—	70 ''
11% to 30%	—	1 M
36% & above	—	1.50

This is a general specification. Alterations may be necessary according to field conditions.

3	Area	38863 sq. km.
4	Population	25453680 (1981) Density-654/sq.Kms
5	Districts.14	Taluks-61-Panchayats-999 Villages-1362, Community-Development Blocks-151.
6	Length of Sea coast	560 kms.
7	Width of sea	15 km-120 km.
8	Mountain	Plantian remnants of 2 or 3 attitudinal ranges. Peak-Anamudi-2696 mets.

9	Depressium in Mountain ranges.	30 kms. called Palghat gap
10	Kayala (lagoons Estuaries)	34 Nos. Vembanadu-205 sq. kms.
11	Nos. of rivers and drainage pattern.	44 Rivers (3 east flowing) Dendritic-Sub parallel-radiat.

Geology: 4 Major rock formations

i. Quarternary sediments
ii. Laterite developed on Crystalline and sedimentary rocks
iii. Sedimentary rocks (Ecno zoic)
iv. Crystalline rocks (Pre cambrian)

Minerals:

Ilmenite
Monozite
Rutile
Zircon
China clay
Fire clay
Ball clay
Glass sand
Lime stone
Crupirites
Iron ore (Magnatite quartizite)
Placer gold panning
Gem (chrysoberyl)
Bauxite
Lignite
Peat
Talc
Plogopite
Mica

13. Hydrogeology

1 90% of total geographical area is occupied by Precambrian Crystalline rocks
2 Fracture zones are good ground water reserves
3 Chrystalline and charnokites in the midland region yield 10-15 lits of water/minutes
4 Weathered horizons in Khondalite terrains is deeper and sustain yield up to 120 kt/Min.
5 Water table in Zenozorc sediments in Quilon and Trivandrum goes down to 30-50 mts.
6 Water table in quarternary sediments is 10 mts.
7 In suit and midole coastat plain 510 – 2580 lit/man.
8 Water from zenizeic aquiters are potable and capable of transmitting 1,68,000 cubic metres/day where as draft from this is just over 50000 c mets.

14. Climate

Rainfall	Most of the areas are under tropical dry and wet conditions with high maritime influence certain areas in the eastern parts experience sub-tropical type of climate.
Place of Annual Precipitation	<100 cm. Chinnar Marayoor >500 cm. Neriyamangalam Variability—20—40% during S. W. C. >50 in dry season
Temperature	March to May > 32°C— gradually comes down. Again increase in October—November <27° C during December & January Seasonal and variation 5°—7°C

Wind

Places dominated by wind from North-West-Cannanore & Calicut from East and West-Palghat from West and North west-Cochin from North West-Trivandrum. Generally wind from North-East and east prevails in the morning while in other times from west and north-west, No.of calms is more in the morning varying from 2% in Alleppey-80% in Punalur. In the evening number of calms is more in Palghat being nearly 27%, while it is minimum in Alleppey-1%.

Maximum speed	>20 km/hr in Alleppey, Cochin & Trivandrum.
Minimum speed	< 5 kms/hr. in Palghat and Punalur.

15	Soils	10 Broad group 13 great groups.
16	Human resources	Rural population-81% (National 76%) Rural population 0.55 million in Wynad. 2.44 million in Quilon.
	Density	1·25 person/sq. km.—Alleppey. 186 ,, —Idukki
	Urban population (urban area – 1788 sq. kms.)	4.77 million (10 towns)
	Decadel growth	38%
	Population	0.5 million—Cochin. 0.48 ,, —Trivandrum 0.40 ,, —Calicut
	Maximum density	3190 person/sq.km.—Cochin.
	S. C. population	2.55 million ie. 10%
	S. T. ,,	0.26 ,, ie. 1%
	Population growth	SC. 27% ST. 35%
	No. of Sch. Castes	68
	,, Tribes	35
	Literacy	69% (National 36%)
	Male	74% (,, 47%)
	Female	64% (,, 25%)

Occupational structures

Cultivation	18%	of total main workers.
Agricultural Labour.	28%	-do-
House hold Industries	4%	-do-
Other works	55%	-do-

17 Infrastructure

Irrigation

The state has harnessed only 20% of irrigation potential to irrigation 30% of total irrigable land.

Paror

Only 6% of total hydroelectric potential has been utilised.
Total consumption in 1981-82-3883 MKWH
Percapita consumption—115 KWh (National 121)
Industrial consumption—43%
Agricultural —10%

Communication

Surface road	—	90,340 Kms.
National Highway	—	836 Kms.
State High way	—	2022 Kms.
P.W. Roads	—	14129 Kms.
Railway	—	886 Kms.
Waterway	—	1900 Kms.

Post & Telegraph

Post Office	—	4576
Telegraph office	—	1913

Financial institution

Direct financing	—	2680 lakhs.
Distribution of Co-operation	—	

Oriented to promote integrated rural development by strengthening the links among financial credit supply of Agriculture inputs, marketting, processing and distribution of essential commedities.

Educational Institutions

High schools	—	2075

Forest utilisation

Annual production	—	150 million cubic metre

Contributed to 2% of state income (1976-77)

Requirement of Industrial establishments	—	800 million cubic metre
Fuel wood	—	83 million cubic metres/year
Match wood	—	2.8 million cubic metres
Pulp wood	—	3 -do-

18. Land use

Arable lands. Coast to the inland upto 100 mts. MSL—further east along river valleys.

Forest land. 300 mts. MSL and above.

High altitude plantation in Periyar and Wynad — Tea, Coffee, Cardamon, Rubber

Grass lands — Isolated patches

Waste lands — Hard crust, laterite etc.

19. Classification

a)	Total geographical area	—	3885497 Hects.
b)	Forest land	—	1081509 ,,
c)	Land put to non-Agri. uses	—	263017 ,,
d)	Barren and uncultivable land	—	82343 ,,
e)	Permanent pastures and grazing lands	—	3711 ,,
f)	Land under miscellaneous tree crops	—	46614 ,,
g)	Cultivable waste	—	129582 ,,
h)	Fallow other than current fallow	—	27727 ,,
i)	Current fallow	—	42258 ,,
j)	Net area sown	—	2206736 ,,
k)	Area sown more than once	—	663578 ,,
l)	Total cropped area	—	2870314 ,,

20. Area operated by major size classes 1980-81

Marginal (Below-1ha)	—	750400 Hects.
Small (between 1&2)	—	398200 ,,
Semi medium (between 2 & 4)	—	331400 ,,
Medium (between 4&10)	—	195300 ,,
Large (10ha. & above)	—	130000 ,,
Total	—	1805300 ,,

21. Area under different crops:

Sl. No.	Crops	Area in percentage to total cropped area (Hects.)
1	Rice	29.11
2	Coconut	23.91
3	Tapioca	10.44
4	Rubber	6.93
5	Cashew	3.75
6	Pepper	3.46
7	Betlenut	2.63
8	Coffee	1.39
9	Other plantation	1.33
10	Pulses	1.28
11	Tea	1.25
12	Sesamum	0.50
13	Banana	0.34
14	Sugar	0.26

Agriculture—Rice and Tapioca:

1. Of the total cropped area of 2.97 lakh hects. 0.87 million hects. come under rice.

Average	—	9% Idukki
	—	54% Palghat
	—	48% Trichur
	—	40% Ernakulam
	—	39% Alleppey

2. Palghat ranks first in yield—1935/kg./ha.
3. *Coconut*

Kozhikode	—	35% of the total area
Trivandrum	—	32%
Alleppey	—	31%
Palghat	—	6%

4. Yield-6142 Units/Hects. in Trichur | Rest will be a recent
   3375 Units/Hects. in Palghat | Development

Tapioca	—	Trivandrum	—	20%
		Quilon	—	26%
		Kottayam	—	14%
		Palghat	—	3%
Yield		Idukki	—	20,577 kg./ha. The lowest 12,433 kg./ha.

Cashew

4% of the total cropped area. This crop has earned Rs. 1061 million of foreign exchange for the country and engaged 0.13 million workers in 261 factories in the year 1979-80. Yield rate is maximum in Kozhikode and minimum in Malappuram.

Tea

Area under tea—37283 ha. ie (10% of the area in India).
Production —46718 tonnes of tea/year (11% of the country).
Idukki and Kozhikode, Palghat, Trichur.
Highest yield — 2650 kg./ha. in Palghat.
2000 kg./ha, in Trichur.

Coffee

41,337 hect. (kzd—24434 hects.)
22% of the total coffee production
Yield 580 kg./ha. in Palghat.
120 kg./ha. in Ernakulam.

Pepper and Betelnut

Pepper Kerala contributes—96% of total production.
Area—101045 ie. over 3%.
Yielding 20146 M. tonns—Idukki, Kottayam, Kozhikode, Cannanore.
Maximum yield—327 kg./ha. in Kozhikode.
101 kg./ha. in Kottayam.

Betelnut

78179 hects.
12094 million nuts (50% area in Trichur, Malappuram and Cannanore).
Maximum 197000 nuts/hect. Kozhikode.
97000 nuts/hects. Kottayam.

Sesamum

Production accounts only 10% of domestic demand.
Area — 14774 hects. ie less than 1% of the cropped area.
Greyish — Konattukara.
Yield — 430 kg./ha. — Trichur.
220 kg./ha. — Palghat.

Pulses Area — 38040 — Production 15087 tonns. which meets only 8% of total requirements.
Yield — 650 kg./ha. in Idukki.
623 kg./ha. in Cannanore.
379 kg./ha. State average

Other plantain and sugar

Plantain occupies 39,441 hects. ie. over 1% of T. C. A.
low lying in shaped areas are suitable.
Yield 9326 kg./ha. in Kottayam.
8154 kg./ha.

Sugar crop

Area — 7,727 hects.
Yield — 3,461 kg./ha. in Cannanore
6990 kg./ha. in Palghat

Banana

Less than 1 per cent of total cropped area.
7770 kg./ha. in Trivandrum.
9060 kg./ha. Trichur.

Rubber

93% of the total production. Annual average production accounts for 128,719 Tonnes from an area of 205, 900 ha. nearly 7% of the total cropped area.
Yield — 760 kg./ha.
510 kg./ha.

Cropping pattern

Earthern border is support tea, coffee and cardamum and other plantation crops. Below this an lower hills and slopes of high land region rubber; pepper and other tree crops are grown. Further west in the midland annual and seasonal crops. Coastal zone is mainly under coconut rice etc.

PLANNING AND EXECUTION OF WATERSHED MANAGEMENT PROGRAMME

1 Delineation of watersheds may be done with the help of topographical map and the data available with soil survey organisation and Land Use Board.

2 Prioritisation of watersheds may be done with the help of soil survey data and field verification.

3 Watershed inventry may be collected from the field in the prescribed proforma.

4 Detailed contour survey may be conducted.

5 Based on the data generated, detailed plan should be formulated following the undermantioned steps.

a) Prescribe treatment for cash class of land under various components.

b) Cost according to itemwar requirements with brief note may be worked out.

c) Total cost of the project.

d) Cost benefit ratio.

e) Financing agency.

f) Implementing agency.

g) Phasing.

h) Evaluation and Monitoring.

Data sheets and specification for different recommended items of work are appended.

Soil and Water conservation programmes on watershed basis should be taken on priority basis to achieve optimum and sustained crop production, for the protection of the reservoirs of River Valley Projects from siltation, for the generation of rural employment and to achieve the top most priority of maintaining the ecological balance.

Role of Renewable energy resources in Agriculture

Dr. R. V. G. Menon
Director, ANERT.

ABSTRACT

Man the everhater of equilibrant systems found means and modes to harness his own mascular energy, animal energy, energy from fossil fuels and has lately turned his attention to the tapping of non conventional sources of energy. Agriculture is an energy intensive field but the energy input to agriculture is very limited. As for India we are well below the optimum energy input level and even this is sustained at a great risk. Man has depleted the very vast natural sources of energy within a few years due to his unimaginative and short sighted policies. This has led to catastrophic consequences and has forced us to look into decentralised alternative energy sources. Agriculture should also look into this alternative system. The decentralised sources are the sun, wind, tides, waves etc. Information intensive methods can replace energy intensive techniques. The progress in agriculture will depend on its interaction with nature.

SEMINAR ON CONSERVATION AND UTILIZATION OF NATURAL RESOURCES

1. Conservation and utilization of Natural resources—Key note address

   Prof. Mathew Thamarakad

2. Some thoughts on problems and perspectives of forest policies of Kerala State

   Prof. K. Unnikrishnan

3. Wildlife resources and Development

   Dr. C. Pythal

4. Forests—their propagation and utilization

   V. R. K. Nair

Conservation and utilization of natural resources

Key Note Address: Prof. Mathew Thamarakkad.
Head, Dept. of Botany, St. Joseph's College, Devagiri.

BIOSPHERE is that part of the earth in which life exists. It receives ample supply of energy from extraneous source namely sun. Man plays a vital role in biophere. He is a component of the biosphere and his activities are not confined merely to this planetary level, but they have been extended to the space too. For his existance man must utilize the resources of nature both physical and biological. But in doing so he disturbs the delicate balance of nature's structures and functions. These disturbances in the form of depletion of natural resources and environmental pollution have caused great concern to man.

When we glance through the history of man, we will find that the early man, evolving, some one million years ago was not different from any of his ancestor's or fellow animals. Descending from the trees to the ground he remaind a food gatherer and subjected to predations by carnivoues. Man differed from all other animals only in a single trait, the ability to learn from experience. and to acpuire knowledge from preceeding generations. For a long time man remained as a part of the natural ecosystem, namely a hunter and food gatherer. With the gradual development of tools, he exerted greater influence over others like. But the physical environment remained unaffected. The advent of fire was the first break through and invasion on nature. The fire was not only used to cook food and keep himself warm, but also to clear large areas of land and to keep predators away. This gradually resulted in settlement's and beginning of agriculture. This happened only ten thousand years ago. A shifting cultivation was practised and nomadic life continued. From the 11th centuary onwards, the wind and water power had been in use on a wide scale. In the 18th century the industrial revolution took place. The discovery of new sources of fuel along with rapid advancements in science and technology made a rapid onslaught on nature.

Today the activities of man are unrestricted. Not only the earth is in his control, but also the outer space. The natural resources are consumed at his own sweet will. The weather is modified to suit his needs. Flora and fauna are controlled. Theusands of chemicals unknown to nature before are poured into the soil, air, and water. With the nature in his control, the population has increased, so rapidly, that the availability of resources has become limited. The physical environment in many places is no more habitable. All these created a fear of dooms day for man. Though the situation is getting worse, it is still possible that the application of an understanding of the functioning of nature and its limitation may rescue man.

Resources are all those requirements of an organism, population or an ecosystem which help in accumulation of energy by their increased availability (Watt 1973). In this contest time and space are also important resources. The resources are of two kinds They are (1) The biological resources. These are renewable resources as they can grow in quantity through reproduction and utilization of simple substance. (2) The physical resources. These are non-renewable resources as they are available in limited amount and which cannot be increased in any manner.

The rapid decline in the quantity and quality of these resources has led to the concern for their management and conservation. This means the scientific uti iz-ation of the resources by maintaining a sustained yieldand also the quality of the resource. Conservation is not preservation or protection. Though it may be necessary for scientific reasons to preserve portions of these natural resources for prosperity.

WATER RESOURCES

Among the physical resources the most important is water. Though there is huge quantity of water present on the earth, only a fraction of it, the fresh wate', is of importance to most of the life. Water resources are in a state of rapid circulat on. Water is the best solvent and carrier of waste from man and his civilisation. This capacity is not unlimited. The excessive dumping of wastes, domestic sewages, industrial effluents and agricultural run off have resulted in water pollution. The natural balance of flora and fauna in the water has also been disturbed. Man has accelerated the evaporation loss by lifting under ground water and spreading it over large land surface for irrigation. The use of fertilizers and pesticides have also rendered water un-suitable for man. The irrigation in arid areas resulted in increaed salinity and spread of epidemics such as malaria.

SOIL

Soil is a complex dynamic system. It develops as a result of interactions of various minerals, climate and the organisms living in it. Soil supports a complex community of plants and animals. This depends upon the capacity, of the soil to hold enough water and provide nutrients for the growth of the plant. The continued supply of nutrients is achieved by the decomposition of the organic matter, by micro-organisms. The removal of natural vegetation disrupts the system as their nutrients are not returned to the soil. The soil surface is exposed to the action of wind and water and the microorganisms no more live there. The mineral particles, humus and nutrients get lost. This phenomenon is called erosion. Agriculture and grazing of cattles also destroy the soil properties. Addition of inorganic fertilizers causes salinity and acidity. The addition pesticides destroys microbial life.

Soil conservation, hence is very important. Maintenance of a vegetable cover checks erosion.

MINERAL RESOURCES

Man's scientific and technological advancement are very much based upon the use of minerals. Minerals are available in limited quantities and it is estimated that at the present rate of consumption most of the minerals would be exhausted by the turn of this century. More than that, the mining of the ores leaves large areas of land untit for agriculture or forestry. The small quantities of ores left on the surface are highly toxic to plant growth. The process of extraction results in production of numerous poisonous gases and chemical compounds that are poured into the atmosphere and thereby the atmosphere get polluted. Recycling of the waste may offset some of these problems. The cost of recycling may be uneconomic. But the cost of environmental pollution abatement may be sufficient to justify the recycling.

FOREST RESOURCES

Forests constitute the largest, complex and most important resource covering about one-third of earth's land area. The forests have been the most affected resource due to human interference. Man evolved in the tropical forests. The early man depended on forests not only for his habitat but also for food and protection. The modern man gets fuel, timber, paper pulp, and raw materials for synthetic fibres. The forests have a great influence upon all the recources of man. They regulate the earth's temperature, the water cycle, control flood and help balance the Co_2 and o_2 in the atmosphere. They check soil erosion and maintain soil fertility by returning the nutrients to the soil.

Man has cleared forests to have more access to more land for agriculture and urbanisation. Forests are destroyed for timber and fuel. Deforestation results in recurrent floods, soil erosion loss of fertility of the soil and at times a greater incidence of disease because of loss of organisms which helped in controlling the Vectors.

Man is raising plantations of monoculture for providing timber or pulp. This does not alleviate the problems but increases them. The monocultures drains the soil of specific nutrients required by the species in greater quantities. Monocultures are also susceptible to epidemics.

Scientific management of forest would require plantations of mixed forests and recycling of forest products in order to reduce the exploitation of natural resources.

AGRICULTURE

Man depends on agriculture for about 90 percent of his food supply. The agriculture which began about ten thousand years ago has become highly mechanised and complex. The agriculture production depends upon deep ploughing of the soil, irrigation, weeding and use of inorganic, ferilizers, insecticides and fungicides. These lead to soil erosion increases salinity, depletion of organic matter in the soil, increased possibilities of epidemics and pollution of soil, air and water.

To avoid these, use of organic manures may be increased, the treated sewages may be used, mixed cropping may be followed and chemical fertilizers, insecti-

cides and fungicides be used in least quantities. The soil erosion and loss of nutrients can be avoided by maintaining a vegetal cover around the year.

GRAZING RESOURCES

The pastures or grass lands are important resources for grazing of animals which provide, milk. fur, wool etc. The grasslands, help in soil conservation. Over grazing destroys the essential features of a natural ecosystem. The growth of the vegetation is affected and the selectiveness of the grazers leaves behind only undesirable plants. The soil becomes compact, depleted of nutrients with low water holding capacity. When the plant cover is very much reduced soil erosion may take place.

The management of pastures requires an understanding of the production potential and the carrying capacity of the system. Further the seeding of pastures with proper combination of different forage species, especially legumes would help in maintaining the soil fertility and would also improve their nutritive value.

FISHERIES

Fish are important source of protein for man all over the world and recently there has been greater emphasis on aquaculture. Rapid exploitation of natural fisheries led to decline in the fish population. Many species face extinction because of over exploitation. The increased imputs of sewage and pouring of heated water into streams, and also the construction of dams have been responsible for depletion of fisheries resources. The management of fishery resources, requires the application of various ecological principles and an understanding of fish biology.

WILD LIFE

Wild animals are also valuable resources for man. The decline in the number of carnivorous predators like lions and tigers would increase the number of herbivores which may eat up most of the vegetation or may help in the spread of the disease. The wild flora and fauna are a rich source of genes, which can be used in breeding new forms of plants and animals for desirable characters like d sease resistance. higher production etc. The conservation of the habitat alone can help conserve the wild life.

POLLUTION

Pollution may be defined as any undesirable change in the physico-chemical and biological properties of air, water and soil which may cause harm to man, other organisms to cultural and natural elements of man's environment. The substances that cause pollution are called pollutants.

AIR POLLUTION

Air pollution is caused by the addition of poisonous gas and particulate matter. Most gases are the products of combustion of fuels in automobile, industry and in domestic uses, These gases includes mixtures of C and N oxides and hydrocarbon. Urbanisation and industrialisation have resulted in excessive air population,

At higher levels, Co is lethal to man as well as other organisms. Ozone in small concentrations damages crops like tobacco, tomato and peas. SO_2 and H_2S damage cereal crops and apple orchards. Nitrogen oxides are harmful to plants and animals, Fluoride causes serious damages to plants. The particulate matter arising from mining, quarrying, grinding, polishing, sawing and textile industry causes numerous respiratory diseases and allergies, The particulate matter may also consist of pesticides and poisonous chemicals such as tin, aresenic, lead and cadmium. Some of these cause T. B. and carcinomas.

WATER POLLUTION

Addition of any organic and inorganic substance which may reduce water unfit for a particular use is considered water pollution. The domestic sewage, agricultural waste and the industrial effluents pollute water. The use of water as a coolant in industry has resulted in thermal pollution.

SOL POLLUTION

Soil is polluted by use of excessive fertilizer, pesticides and herbicides. Mining, construction of buildings and roads also pollute soil. Another source is dumping of solid wastes. Ionising radition is also a source for pollution.

The best way of conserving our very finite natural resources and wild life is by making the common man aware of the need.

Some thoughts on problems and perspectives of forest policies of Kerala State

K. Unnikrishnan

Professor of Botany, University of Calicut, 673 635.

"Not to see wood for trees" is perhaps the right expression in more than one sense to describe the attitude of policy makers on forestry practices of our State. They see only trees in the wood. The trees which can be converted into cash as early as possible. The diversity of plant life in a forest, variety of animal life interacting with the living plants and umpteen other non-living components—all involved in a continuous flux or energy producing and sustaining activities, ultimately contributing to the climatic rhythm, perennial water resources and human civilization—such a magnificent dynamic composite concept of forest has been conspicuous by its absence in the thinking of our forest policy makers and forest department. The long term interests are sacrificed for short term gains in such a context. I am now giving certain well known but little digested (by all concerned) ideas related to the problem.

The hard realities

The legal definition of a forest is, "an area of land proclaimed to be a forest reserved, protected or other under a forest law". An outdated ecological definition of a forest is, "a plant community predominantly of trees and other woody vegetation usually with a closed canopy". Eugene P. Odum (1983) considers a forest form the angle of ecosystem. The introductory part of this talk is based on that. The climatic climax or at least edaphic climax of vegetation, constantly interacting with the diverse animal and plant lives on one hand and on the other with the non-living components, so as to be involved in fluxof energy receiving and imparting process—that is the forest or ecosystem of forest. The very survival of human civilization depends on such a forest, as the climate, the agriculture, the industry, the art and the literature are all ultimately derived from forest-boundry. The man-created problems of pollution, food-shortage, deterioration of health and hygine, famine, erosion, land slide, depletion or erosion of genetic pool, degradation of food chain, loss of natural balance, problems of diverse nature arising out of biomagnification, etc. can be expected to be solved only by bold and imaginative forest policy. It is well accepted by all experts on land use all over the world that a country should have 1/3rd of its area as forests. We have less thar 8% of the area as forests in Kerala according to the studies conducted by remote sensing facilities provided by satellites. As per records of Forest Department we have 12360 Sq. Kms. of forest, but the Kerala Government resource survey of 1973 recorded only 9400 Sq. Kms of forests. In reality it is far less than that as recorded from outer space. Even this much of forest is rapidly vanishing.

Three basic facts

Odum (1986) draws attention to a number of basic factors that are to be remembered while dealing with the environmental problems. Of these consider the following three basic factors are worthy of special attention in this context:

Importance of levels of organization hierarchy: A forest resource viewed not as a collection of trees and animals living among them, but as a dynamic ecosystem with the levels of organization hierarchy shown in the scheme given below:-

Biotic components + Abiotic components = Biosystems

Biosystems have the following hierarchy—

Genes	Cells	Organs	Organisms	Populations	Communities
matter				Energy	
Genetic systems	Cell systems	Organ systems	Organismic systems	Population systems	Ecosystems

Eventhough ecology mainly focusses on levels from organisms to communities to from organismic systems to ecosystems the principles of hierarchy implies the anchorage on lower levels as well. In this hierarchy a damage in higher level will damage the lower levels also. But a damage in lower level may not as readily be reflected in higher levels, as alternate pathways will be found out by nature, and it will take a long time to perceive the changes in higher levels. When a forest (an ecosystem) is destroyed everything below in hierarchy is wiped out.

2 The importance of the emergent property principle

An emergent property of an ecological level or unit cannot be predicted from the study of the components of that level or unit. Non reducible properites, that is, properties of the whole not reducible to the sum of the parts, is another way to express the properties of concept. For example, the sum total of properties of Hydrogen and those of Oxygen will not be found in the emergent property of union of two Hydrogen molecules with one of Oxygen. In levels of ecological hierarchy are properties of a unit or level cannot be added to the next higher and so on to calculate the totality of the emergent property. Forest is not sum total of trees or animals.

3. The importance of law of entropy

'Entropy' is the degree of disorder in a system. The living system or evolution of life or of ecosystems are all examples of reducing entropy step by step. In other words the process of living or evolving life through generations into new species or slow natural evolution of ecosystems are all examples of gaining negative entropy. This biological view point of entropy may at first appear to be in contradiction with physical laws on entropy. The physicists may say that the whole universe is tending to increase the entropy, how can a part of the universe go against the universal

law' It is very well established now that there is no contradiction. The biological world builds up life through negative entropy, and during the process it "pumps out" disorder into the rest of universe, which ultimately will lead to the increase of entropy or disorder in the whole universe. These facts give us the additional responsibility to protect life on earth. Because we have a narrow space and time for conveniently building up stages of negative netropy. By destroying the grand results of such negative entropy, here forest ecosystems, we dig our own graves.

What shall be our priorities

1 To protect the existing forests at all costs. For this alternate methods are to be found out for production of electricity, high head-level-requiring dams,providing areas for house construction, agriculture etc.

2 Arid and semi-arid areas are to be targeted for introduction of plant species which will be occasionally growing there at the time of consideration, or can be found in identical terrain in other places. The USSR trials are for selecting species like this with a view to elevate the water table in course of time so as to introduce their greater variety of species.

3 The water shed zones, the banks of rivers, the grass lands, etc may be marked out for "adoption and aforestation" by social welfare groups in every panchayat, and proper incentives may be provided for such action groups.

4 Research and Development Wing of Forest Department may be organized to carry out and co-ordinate the advanced research in this area, with specific intention of aforestation of the different areas.

5 Panchayath-based social welfare forest groups may be organized with definite targets for aforestation in their areas; and also definite forest protection forces my be organized under their auspices who may monitor on various kinds of destruction of forests by antisocial elements.

6 Large scale medicinal plant introduction in the above areas be promoted under the auspices of social welfare forest groups. For items 5 & 6 the financial aid for unemployed youths may be canalised in addition to specific funding. Definite areas may be given in river banks or grass lands for specified aforestation by high school and college students in the area.

7 Plantation for industrial purposes may be separately done in denuded or semi-arid areas, and not in forest areas.

8 Forest Research Institutes and Universities may be co-ordinated for researches on aforestation programmes.

9 Stringent punishments are to be thought of by suitable laws and law enforcing authorities for offenders of forest wealth.

10 Forest wealth is to be redenfined and re-assessed by the authorities with the help of experts from the point of view of ecosystem analysis and not from the point of view of timber value or value of minor forest produces or conspicuous animal life.

We are made to believe that ecology and economy are adversaries. On the other hand they are natural relatives. Only those who have an eye on 'profiteering at any cost or at others cost' may be propagating the myth that ecology and economy are enemies. The sooner we realse the danger of misconception the better it will be for our next generation.

Wildlife Resources and Development

Dr. C. Pythal
Associate Professor (Wildlife Science)
College of Forestry, Vellanikkara

ABSTRACT

Wildlife may generally include free-living animals and plants but in routine, professional appropriateness exclusively imply only all non domesticated animals. In the long saga of Organic Evolution, mankind has been in intimate association with all non-human animals from the very origin onwards till the beginning of domestication of animals and the cultivation of plants, the progress of the processes of the latter and the attendant civilisation severing the bond gradually and compelling the wildlife to retreat and occupy the present position of isolation in preserves.

The domestication of animals about 12,000 years ago and the cultivation of plants gradually relieved man from his prime dependance of wild animals for his existence-necessities of food, weaponry, sheltering materials and other amenities, while intensive farming and improved technologies made man still less reliant on most majority of the species of wildlife. However, the long association has been persistingly remaining imprinted in the history of human culture and civilization.

Man's unending quest for expansion, adventure, oddifies and wealth have taken great tolls on wildlife in alarmingly increasing proportions during the recent period making conservation imperative for the continued survival of the remaining wild animals.

Conservation to be successful warrants action based not only on the spirit of tradition and the dogma of ethics but also the reality or the demagogic pressures demanding increasing needs and is best reckonable not as a blanket protection but as a managed preservation permitting realisation of the benefits of the nurtured natural wildlife resources for development.

Such an approach requires the adoption of methods and technologies including the direct ones like wildlife cropping and harvesting, farming and ranching, captive utilisation for performance and amusement, free-living usage for tourism promotion and regulated sporting plus research-and technology-potential utilisation as well as the indirect ones such as identification and application of uniqueness for developing Bionics, usage of genetic values for grading up livestock and creation of new domesticates. The wildlife resources promise enormous potentialities in all the above fields.

The existing approach of use-oriented conservation of wildlife is currently getting shifted to a Resource-Oriented one in many countries, but comprising only limited developmental prospects, the latter warrants replacement by Development Oriented conservation for ensuring the survival of wildlife as well as for assuring human progress of civilization.

The legacy of Indian wild life

Dr. E. A. A. Shukkoor
Farook College, Calicut

ABSTRACT

The species diversity combined with faunal richness is the striking feature coming to the mind when one ponder over the legacy of Indian wild life. Probably only northern South America has a richer fauna and only tropical America and some of the most isolated area like Newzealand have a higher rate of proportion of species formation and evolutionary response. This diversity and faunal richness is a contribution of the peculiar geophysical and geologic history of Indian sub continent. The peculiarity of the geologic history of India is that during the evolutionary past in the Cenozoic era the northern oriental region compassing the present Himalayas and gangetic belt was under water until well on in the recent. The northern fringes of Himalayas were under water of the great Central eurasian sea, the sea of Tethys which continued into the pliostocene times, less than 20 million years ago, gradually retreating to leave behind the Mediterranean, the Black, Caspian, and Aral sea. As the sea gradually disappeared the land rose and this gave way for the animals of the surrounding zoogeographic regions especially the Indochinese fauna to migrate over to 'neonate' India. When the mountains further grew the hill stream fishes migrated even up to the southern tip of Ceylon along the water streams of the hill ranges of Himalayas-Vindhya-Satpura-Western ghat highways (Sunder lal Hora 1950). This highway enabled through time the higher chordates also to nop-stop and jump to India and to settle here. When the land further rose to the real awe awakening form of Himalayas she recapitulated in her attitude all the climatic varieties that the world has in its latitudes. Various factors like (1) limitation (2) zonation (3) geographical radiation (4) differentiation of faunas (5) concentration in the largest in the most favourable areas further acted in combination with conditions warranted by Bergman's principle and Gloger's theory for the adaptation and evolution of flora and fauna. Now the descication with its geographic nucleus at Sahara is marching towards Indian interior along the western front. This is a feature of the mordern times, ie, of the last 8000 years. This trend is actually destroying the future of the rich wild life legacy that we inherited. Our forests, if is a function of the geologic events, the fauna is a produot of this flora. As a corollary the destruction of the fluna is a result of floral destruction. The present state of deforestation, desertification, and endangering of animals have landed us in a precarius condition of not only the sage of wild life coming to an end rendering us unable to pass it over to posterity but the very existance of man being put into question. People ask why preserve all these plants, animals and beasts, when man starve to death. It is enough to say here just like Henry Millario said that we preserve since they are there not because there aren't several other reasons to be advocated for the preservation of animals which are [to examine qualify and balance of environment we live famous verse of Valmiki Mani shada hold more meaningful in present juncture.

Forests – Their propagation and utilization

V. R. K. Nair I. F. S. (Retd)
Special Officer, College of Forestry

1. Forests: Importance
   Forests of Kerala.
2. Propagation
   A. *Evergreen forests*
      -Natural Regeneration
      -Artificial Regeneration
   B. -Man made forest
3. Utilization
   a. *Major Forest Products*
   1, Various uses of wood.
   2. Requirement for various industries.
   3. Utility of important woods of Kerala.
   4. Firewood products and requirement.
   b. *Minor Forest Products*
   1. Vegetable products.
      -Different Products.
      (Bamboo, Fibre, Oils, reseins, Acid, Oleoresines, Tar, Drugs, Spices etc.)