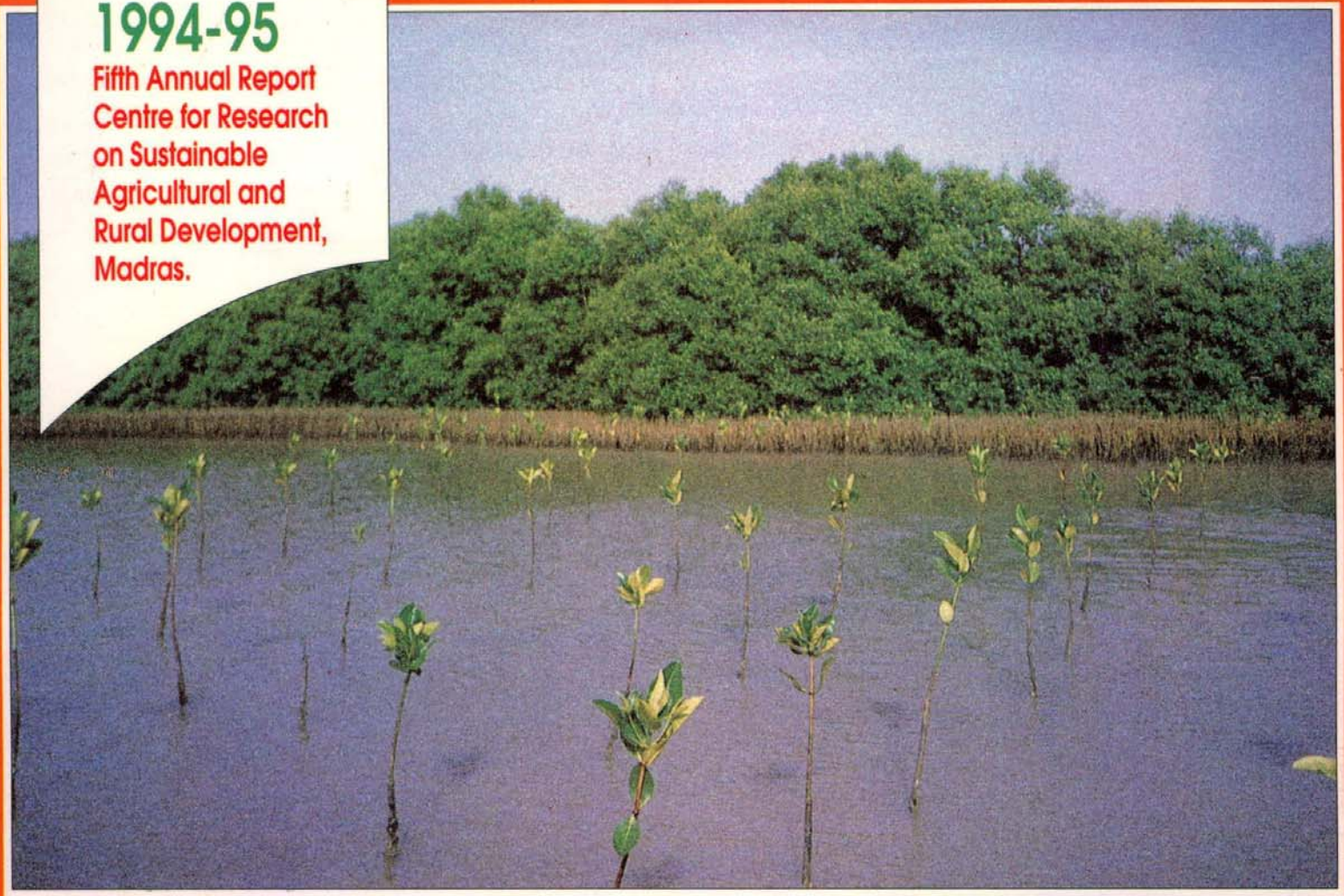
M. S. SWAMINATHAN RESEARCH FOUNDATION

1994-95

Fifth Annual Report
Centre for Research on Sustainable Agricultural and Rural Development, Madras.



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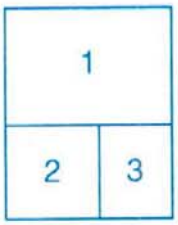

1. Individuals of *Rhizophora mucronata* reintroduced into Muthupet mangrove ecosystem.
2. Woman participant in the community aquaculture pond in Kizhur village (bio-village programme).
3. *Ceropegia jaini* : a small herbaceous plant endemic to the Western Ghats. This species listed as endangered in the Red Data Book is now micropropagated in large numbers at the MSSRF and is ready for field trails.

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Centre for Research on Sustainable Agricultural and Rural Development

Fifth Annual Report
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Introduction

For five years, the M.S. Swaminathan Research Foundation (MSSRF) and its Centre for Research on Sustainable Agricultural and Rural Development (CRSARD) have been conducting research and training programmes in integrating environmental and equity dimensions in rural and agricultural development programmes. During these years, the emphasis has been on the promotion of a job-led economic growth strategy in villages, rooted in the principles of ecology and gender equity. The increasing paucity of jobs in the organised sector stresses the need to look at employment in rural areas, not in the traditional manner of creating jobs, but more in terms of generating multiple livelihood opportunities. This approach, tested in the biovillage project in Pondicherry, has shown that the livelihood and nutrition security of resource poor families can be strengthened through new skills and income-earning opportunities. In view of the increasing feminisation of poverty, priority was given to skill and information empowerment of women belonging to landless labour households.

The work done during 1990-95 under the different programme areas was reviewed early in 1995 and the summary of a talk on an agenda for the next 5 years delivered on that occasion, is given in the Annexure. The principal highlights of the work done during 1994-95 are briefly summarised at the beginning of each programme area. Therefore, they will not be repeated in this section. Instead, attention will be drawn to a few significant results and their wider implications.

The first programme initiated by MSSRF in 1990 was the development of a methodology for Coastal Systems Research (CSR). The aim of CSR is to link the livelihood security of coastal communities and the ecological security of coastal areas in a mutually reinforcing manner. The work done so far, particularly in the area of anticipatory research for meeting the challenge of potential changes in sea levels, was welcomed by the participants at an International Conference titled *Pacem in Maribus XXII* held in December, 1994 at the Indian Institute of Technology, Madras. The participants recommended that "MSSRF should help in the organisation of an Anticipatory Research Network for Adaptation to Climate and Sea-level Changes in the Indian Ocean region. Such a Network could involve collaboration with advanced institutions in industrialised countries and private sector industry."

Such anticipatory research carried out with the financial support of the Department of Biotechnology of the Government of India resulted in the establishment of a Genetic Resources Centre for adaptation to changes in climate and sea levels at Pichavaram near Chidambaram in Tamil Nadu. This DBT-funded project, implemented during 1990-95 with the generous assistance and support

of the Tamil Nadu State Forest Department, came to an end on March 31, 1995. The Department of Biotechnology has entrusted MSSRF with the task of continuing the work on certain selected aspects such as the standardisation of propagation techniques for mangrove species and hybrids and the preparation of a chromosome atlas for mangrove species.

Another project which ended during the year under report also relates to the work on mangroves. This project, titled "Establishment of an International Network for the Conservation and Sustainable Utilisation of Mangrove Forest Genetic Resources", was funded by the Governments of Japan and Australia through the International Tropical Timber Organisation located at Yokohama in Japan. This project had the following three major components:

a. Identification of Mangrove Genetic Resources Conservation Centres and demonstration sites, three in South and Southeast Asia and Oceania and one in West and Central Africa.

b. Organisation of a Trainers' Training Programme for managers of mangrove genetic resources conservation centres, and

c. Development of a Mangrove Ecosystem Information Service.

The results of this project were reviewed by an ITTO Evaluation Team comprising Dr. Gary R. Burniske and Prof. Shigeru Kato. The Review Mission identified the following as some of the major impacts of this project:

- The development of human resources initiated through the trainers training programme resulted in a cadre of trained specialists now working in many aspects of mangrove resource management in participant countries.
- A greater awareness in participant countries of the value of mangrove forest genetic resources.
- The establishment of a comprehensive and useful Mangrove Ecosystem Information Network, and
- The initiation of activities related to mangrove forest gene conservation in the Africa region.

The Review Mission concluded that, the implementing organisation was able to achieve a great deal with a limited pool of funds.

Research in the area of biodiversity and biotechnology made good progress, resulting in the standardisation of micropropagation protocols for 15 rare and endangered species and the development of several useful bioindicators for monitoring the health of ecosystems rich in biodiversity. A detailed study was

made of genetic differentiation in the salt-tolerant wild rice, *Porteresia coarctata,* using molecular tools. Similarly, detailed analyses of molecular linkage groups were undertaken in several mangrove species using PCR, RAPD and RFLP techniques. Work on the conservation of endangered mangrove ecosystems was extended to the Bhitarkanika region of Orissa. In addition, work was initiated to assess the patterns of distribution of vertebrate diversity in the Great Nicobar Biosphere Reserve.

Another significant development in the field of biodiversity is the establishment of a Resource Centre for enabling tribal and rural families to derive economic benefit from their past and present contributions to genetic conservation and enhancement, with particular reference to agri-biodiversity. This centre is designed to give operational content to the concept of "Farmers' Rights" developed in the forum of the Food and Agriculture Organisation of the United Nations (FAO) nearly 8 years ago. The centre maintains for this purpose (a) a multimedia database on the intellectual contributions made by tribal and rural women and men in biodiversity conservation and improvement, (b) a Community Gene Bank containing seeds of folk varieties and (c) a herbarium of the economically important plants maintained and improved by tribal and rural families. In addition, young tribal women and men are being organised in the form of a "Tribal Youth corps for *in situ* conservation of agri-biodiversity."

An administratively transparent and implementable methodology for recognising and rewarding the intellectual property rights (IPR) of tribal and rural families was developed at an inter-disciplinary dialogue held in 1994. A draft *sui generis* system of plant variety protection, incorporating this methodology, was included in a publication titled "Farmers' Rights and Plant Genetic Resources" published by Macmillan India Limited. This publication was released at New Delhi in May, 1995, by Dr. Balram Jakhar, Union Minister for Agriculture and at Madras by Shri. C. Subramaniam.

At the request of UNDP, New York, a comprehensive report on methods of meeting the food security challenges of the Asia-Pacific region was prepared. This study showed that in future, public action for ending food insecurity should keep in view the following :

a. Food security should be considered at the level of the individual, rather than of the household since women tend to suffer more from poverty-induced under nutrition.

b. Non-food factors like income, environmental hygiene and primary health care are equally important, and

c. Poverty is the primary cause of under- and malnutrition.

Based on these considerations, the following definition of food security has been proposed.

> "Sustainable food security involves strengthening the livelihood security of all members within a household by ensuring both physical and economic access to balanced diet, including the needed micronutrients, safe drinking water, environmental sanitation, basic health care and primary education".

To demonstrate how the above concept of food security can be translated into field level action, work was initiated on designing a Hunger-free Area Programme (HFAP). A concept paper on HFAP was presented for peer review at meetings held in Madras and at the Planning Commission, New Delhi. Field work has been initiated in Dharmapuri District, Tamil Nadu.

Another important study related to the chronicling of farmers' experiences in the field of integrated intensive farming systems (IIFS). This study sponsored by FAO, covered 6 countries and a workshop was held at MSSRF in February, 1995, to consider the case studies from all the participating countries. It is now clear that while further agricultural intensification will be *environmentally disastrous* in industrialised countries, failure to achieve agricultural intensification and diversification will be *socially disastrous* in our country. This is because of the preponderance of small and marginal holdings and the consequent need to increase the marketable surplus available to the families operating such holdings, in order to increase their income. But such intensive, integrated farming systems should be environmentally sound, if they are to yield sustained benefits.

Many farmers in India are practising intensive, integrated farming systems. Therefore, the starting point of the IIFS study was learning from the field experience and ecological prudence of farm families. A multi-media database on IIFS farmers was therefore initiated. It is proposed to develop this database further under the title "The ecological farm families of India". In this manner, the foundation for a national sustainable IIFS movement can be laid, based on the real life experience of farm women and men.

Under an ICAR National Professor project, work was intensified on spreading the message and methods of Integrated Pest Management in groundnut, soyabean and cotton. A movement for producing cotton on the basis of IPM methods has been launched in the Theni area of Madurai district in collaboration with a leading textile mill. It is hoped that the small "green cotton" programme based on environment-friendly methods of cultivation initiated in Theni area will soon become a mass movement.

The work done at MSSRF on the development and dissemination of ecotechnologies received recognition through the decision of UNESCO to establish at the Foundation a Chair in Ecotechnology. An Asian Regional Workshop on Ecotechnology and Shaping the Future will be held at MSSRF in February, 1996 in collaboration with UNESCO, the Cousteau Society, the United Nations University and the Third World Academy of Sciences.

Work on various methods of reaching the unreached and voicing the voiceless made good progress. The change agents trained under the Eco-horticulture project have started having an impact in their respective villages. New social contracts are being fostered between the private sector seed industry and resource poor rural families, particularly women. Seed villages are being developed in Dharmapuri district of Tamil Nadu. Work on designing projects for taking the benefits of agri-business to resource poor rural families, sponsored by the Union Planning Commission and UNDP, is nearing completion in respect of 12 districts in the country.

With a gradual decline in per-capita availability of arable land in the country, rehabilitation and reclamation of degraded and wasted lands extending to nearly 100 million ha in area have become urgent tasks. An innovative approach in this respect was the initiation of a Wasteland Development Enterprise for the production of biopesticides in Dharmapuri district of Tamil Nadu with support from the Department of Wasteland Development of the Union Ministry of Rural Development. This project involves the planting of *Neem, Melia, Karanj* and *Mahua* with the ultimate goal of manufacture of botanical pesticides. Thus, the restoration of the health of the degraded soils and the ultimate use of such reclaimed wastelands will be symbiotically linked.

Since the present pattern of development of coastal aquaculture in the country is tending to become environmentally destructive and socially disruptive, a mission mode eco-aquaculture project sponsored by the Department of Biotechnology is being initiated in the Karaikal area of the Union Territory of Pondicherry to demonstrate how the principles of environmental sustainability, social equity and economic viability can be integrated in coastal aquaculture development.

Children and women have always been accorded priority attention in projects relating reaching the unreached and including the excluded. A significant contribution during this year is the release of 4 reports on innovative and low-cost methods of child care. These are based on detailed case studies undertaken by committed individuals and institutions. A state-wide non-governmental network for promoting better child care services for the empowerment of women was strengthened.

In the field of training, the wide range of training methods adopted in the previous years was maintained. The grant of Rs.5 lakhs made by the Tamil Nadu Government on the occasion of the dedication of the building of the Foundation on April 14, 1993, was converted into an endowment. The interest from this fund is being used for organising training programmes for farm men and women from different parts of Tamil Nadu in the field of sustainable agriculture. In 1994, training was imparted on soil health care and the use of the soil health card. In 1995, the training was in the field of integrated pest management, with particular reference to cotton.

Several seminars, workshops and Dialogues were organised during the year. The workshop on Women, Biodiversity and the Seed Industry, held jointly with the National Commission for Women, led to the designing of programmes for involving rural women actively in raising nurseries of fruit and forest tree species and in producing seeds of hybrid rice and vegetables. The annual inter-disciplinary dialogue held in January-February, 1995 was on the need for a new deal for the self-employed in the areas of technological empowerment and credit supply. The participants emphasised the need for greater attention to the public policy support needed by the self-employed in the areas of technology, training, techno-infrastructure and trade. In the field of credit, emphasis was placed on the promotion of integrated formal-cum-informal rural credit networks. Since the transaction costs of the formal credit system are high, it would be useful to promote the formation of local level credit and thrift societies. If the formal system extends the necessary support, the credit and thrift societies can help to take credit to the unreached and foster the savings habit.

Several workshops were also organised in collaboration with other organisations. Some examples are : Methods of achieving sustainable shrimp farming held in association with the Central Institute of Brackishwater Aquaculture of ICAR; Spreading the green health movement in collaboration with the Foundation for the Revitalisation of Local Health Traditions, and Banking for High Technology in association with the Indian Overseas Bank.

The printed and electronic libraries were further strengthened. Training courses were held on the use of the CD-ROM Library. The British Council made a generous donation of books for the library. Scientists and research scholars of the Foundation published a large number of papers, ranging from papers written for peer-reviewed journals for the benefit of fellow-professionals to popular articles and bulletins for farmers and the general public. The Mangrove Ecosystem Information Service was continued. As mentioned earlier, work on the development of several new databases was initiated.

The Centre continued to provide facilities to graduate students and short term scholars for their research and documentation work. The Centre was recognised by the Anna and Tamil Nadu Agricultural Universities for the purpose of students doing their Ph.D thesis work. Similar recognition had already been accorded by the Madras and Osmania Universities.

The Department of Scientific and Industrial Research of the Ministry of Science and Technology of the Government of India has recognised MSSRF as a scientific institution. The Director General of Income Tax Exemptions has accorded Income Tax Exemption under Section 35(i)(ii) of the Income Tax Act until March 31, 1998.

The Hon'ble Chief Minister of Tamil Nadu had announced on the occasion of the dedication of the building of the Foundation on April 14, 1993, that the Tamil Nadu Government will make available additional land for the work of the Centre. The Tamil Nadu Government kindly passed orders during this year, allotting another 2.05 acres of land adjoining the centre. The details of the lease agreement are being worked out. This land will be used for demonstrating the opportunities available for water harvesting and management and for the construction of a Regional Technical Resources Centre of CAPART and a Farmers' Home.

The work described in this report would not have been possible but for the generous support, advice and encouragement of numerous institutions and individuals. First, our sincere gratitude goes to all the national and international agencies listed in the section "About the Foundation" for their financial support and technical advice. Second, we cannot thank adequately the various individual and corporate donors for their generous financial help and for their trust in our capacity to carry out research and training, characterised by scientific excellence and social relevance. Different UN agencies and Ministries and Departments of both the Central and State Governments have always been very supportive. Our thanks are due to all of them. Since most of our work is done jointly with rural and farming families, we are deeply indebted to rural and tribal women and men for their active support, participation and above all for sharing their wisdom born out of day to day experience.

Promoting team work and achieving cost-effectiveness in project implementation are important goals of the Foundation. In this connection, the following comment made by UNDP on the implementation of the Small Farmers' Agri-business Consortium (SFAC) project may be worth quoting: "We are sure that the Government of India will appreciate, as we do, the highly cost-effective way in which you have implemented this project".

The most important management goal of the Foundation is to enable young scientists and scholars to grow professionally and achieve a high degree of scientific excellence and social commitment. For this purpose, the scientists and scholars were encouraged to travel in tribal and rural areas, stay in villages, attend seminars and symposia and present papers at national and international workshops and conferences. Several scientists were sent abroad for training as well as for undertaking collaborative research work. Also several scientists of the Foundation were invited by UNEP, UNESCO, IFAD, FAO and other organisations to serve on Advisory Committees and Survey Teams. The Foundation will continue to strive to provide unfettered opportunities for creative young minds to carry out research and training activities characterised by scientific depth and social relevance.

Our thanks are due to Shri. N. Ram and *Frontline* for the design of the cover. Dr. Nandhini Iyengar and Dr. V. Balaji have undertaken the task of editing the report. Much of the preparation of this report was done in-house. Messers Reliance Printers did the final printing.

Finally, sustainable research will be possible only with sustained financial support. The maintenance of the research infrastructure such as the Community Gene Bank and micropropagation facilities is extremely expensive. We are indebted to Dr. A.C. Muthiah for launching the Corpus Fund of the Foundation on August 7, 1994 with an initial donation of Rs.10 lakhs. We seek the support of all interested in promoting a job-led economic growth strategy in our villages based on a pro-nature, pro-poor and pro-woman orientation to technology development and dissemination, in strengthening our financial foundation.

Programme Area 100

Coastal Systems Research

The UN Convention on the Law of the Sea came into force on November 16, 1994. This convention provides coastal states with an Exclusive Economic Zone (EEZ) of 200 nautical miles from the shoreline. The sea surface available to India for sustainable utilization will be nearly two thirds of the land surface of the country. The integrated development of coastal areas has thus become an urgent necessity. PA 100, initiated in 1990 has as its principal aim the linking of the ecological security of coastal areas and the livelihood security of coastal communities in a mutually reinforcing manner. The eco-restoration work already initiated in the Pichavaram Mangrove area of Tamil Nadu was extended during the year to the Bhitarkanika region of Orissa. The model agro-forestry system of coastal land management developed in Vettaikaran Iruppu area of Tamil Nadu has shown how livelihood opportunities can be improved in coastal areas in an environmentally and socially sustainable manner. Since coastal aquaculture affords opportunities for women belonging to fisher and landless labour families to improve their income through the acquisition of new skills, an eco-aquaculture project is being initiated in the Karaikal region of the Union territory of Pondicherry. The results are summarised below.

Sub-Programme Area 101
Integrating Conservation with Development in Mangrove Ecosystems

The mangrove ecosystem, an important coastal wetland, provides protective, productive and economic benefits to the coastal communities. However, due to various human-induced stresses ranging from changes in land use pattern in and around mangroves to over-exploitation, it is being rapidly degraded and depleted. An integrated approach, involving conservation of the remaining mangroves, restoration of the degraded areas and development of innovative techniques for sustainable utilisation of mangrove resources will ensure that the benefits of this multiple-use coastal wetland will be available for posterity. In addition, developing

and popularising methods to grow more fodder and fuelwood in areas around mangroves to minimise the impact of grazing and felling, promoting developmental activities for overall improvement in the livelihood of the mangrove dependent population and arousing public awareness of these issues are the other important components of the integrated mangrove conservation and development programme. In the previous report, measures taken towards restoring the Ennore and Adyar mangroves were given in detail. This report describes the steps taken to restore Pichavaram and Muthupet mangroves of Tamil Nadu and the results of the preliminary studies on the utilisation of resources at Bhitarkanika mangroves.

I. Restoration of Pichavaram and Muthupet mangroves

Pichavaram mangroves

The Pichavaram mangrove was declared as a Reserved Forest in 1897 and during that time the total area of the mangrove forest was about 700 ha. But according to remotely sensed data the area in 1993 was only 149 ha (Krishnamoorthy *et al*, 1995, preliminary estimate) indicating that nearly 80% of the forest cover of Pichavaram mangrove has been degraded over a period of 100 years. It is therefore necessary to take immediate steps to arrest further degradation and restore the degraded areas. To launch successful restoration strategies the following information is required :

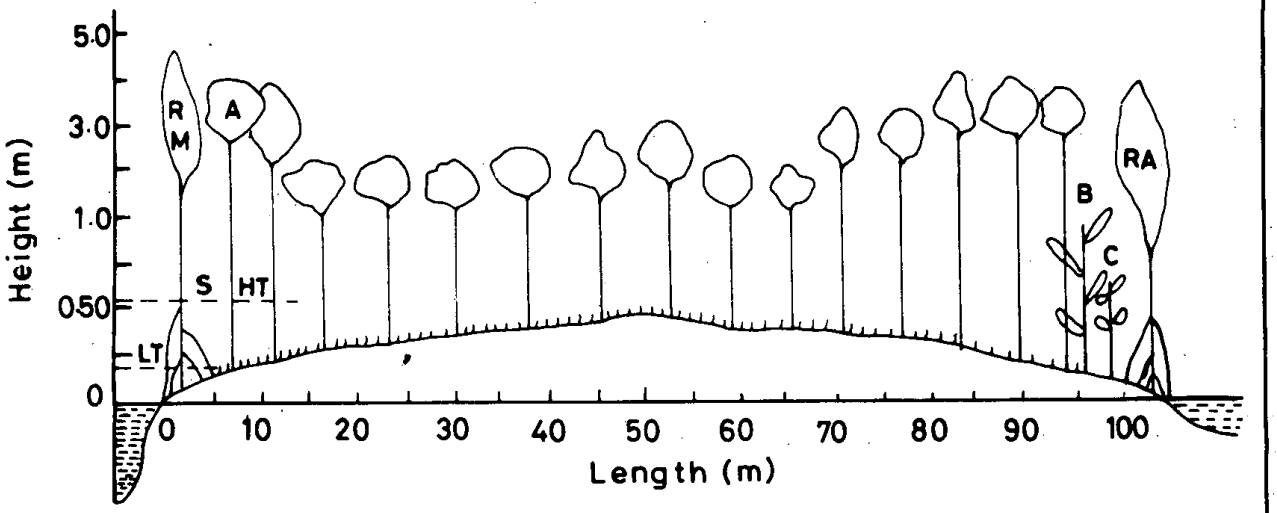
- distribution pattern and vegetation profile in relation to environmental factors that determine establishment, survival and regeneration of mangrove species
- frequency, intensity and synergistic effects of all the human-induced stresses that cause degradation
- ways and means to avoid or mitigate the impact of the stresses.

Studies on the distribution pattern of the 12 exclusive mangrove species present in the Pichavaram mangroves shows that their spatial distribution is restricted to three zones namely, *Rhizophora* Zone, *Avicennia* Zone and *Suaeda* Zone. *Rhizophora* Zone occurs as a narrow strip along the boarder of the tidal channels and creeks; the breadth of this zone varies from 4 to 10 m, the average breadth being 6m. *Rhizophora mucronata* and *R.apiculata* are the dominant species of this zone. The important point is that distribution of 8 out of 12 species present in the Pichavaram mangroves is restricted to this narrow zone and any changes in the habitat condition of this zone will lead to local extinction of these 8 species. *Rhizophora* Zone is immediately followed by *Avicennia* Zone and its breadth varies from 4 to 20 m depending upon the size of the islands. *Avicennia marina*

is the dominant species of this zone. *Suaeda* Zone is located next to *Avicennia* Zone and is dominated by *Suaeda maritima*.

Studies on the vegetation profile in relation to topography, extent and frequency of tidal inundation and soil salinity along 9 randomly selected transects show that wherever the contour is smooth and flat and below the level of high tide, it is flushed completely and regularly by tidal waters; the soil salinity of these places is low, varying from 18 to 29 g/l which is favourable for most of the mangrove plant species. The number of species present in these places are high and the growth is also normal (Fig 1.1).

Figure 1.1 : Smooth and flat topography

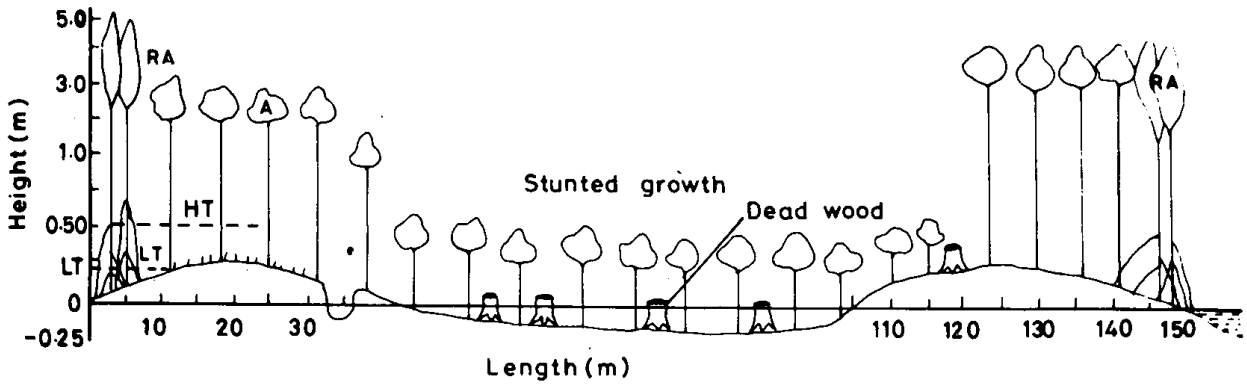


RA - Rhizophora apiculata
RM - R . mucronata
B - Bruguiera sp.
C - Ceriops sp.
A - Avicennia marina

On the other hand, in areas where the topography is trough or cup shaped, the tidal water which enters into the trough shaped portion during the spring tide becomes stagnant because of the elevated sides and the stagnant tidal water evaporates till the next spring tide which occurs after 15 days. This leads to increase in soil salinity which is lethal to any mangrove species. Soil salinity in the trough shaped portions is as high as 110 g/l whereas the optimum salinity for

most of the mangrove species is only around 20 g/l. Hence, the individuals present in the trough shaped middle portions of the Pichavaram mangroves are either poorly grown or dead (Fig. 1.2). The reason for the formation of such troughs is the reduction in fresh water flow into Pichavaram mangroves, which in turn is due to reduced influx of fresh water in the Cauvery riverine system.

Figure 1.2 : Trough shaped topography



RA - Rhizophora apiculata

A - Avicennia marina

Thus, the real cause for the degradation of Pichavaram mangrove has been identified and based on these observations a hypothesis has been formulated to restore the degraded areas. According to this hypothesis, the areas degraded by the formation of troughs can be restored if facilities for proper tidal flushing are provided. To test this hypothesis a 5 ha degraded plot was selected and the contour map of this area was prepared with the help of a local engineering consultant (Fig.1.3).

Based on the contour map a canal system was designed and laid in the selected area for proper and regular tidal flushing. This canal system comprises a feeder canal of 3 x 1.8 x 1m dimension and 4 distributory canals of 1.5 x 0.8 x 0.8m dimension (Fig 1.4).

Figure 1.3 : Contour map of the degraded area

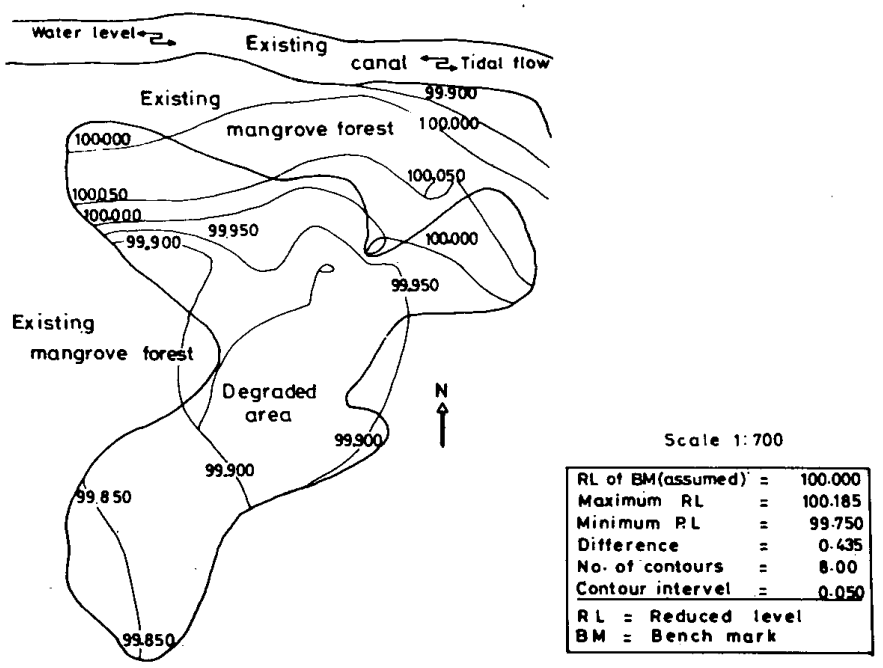
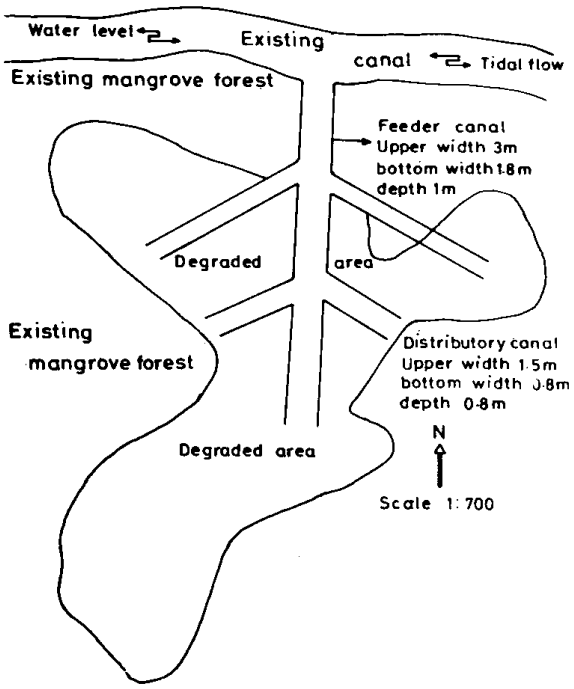


Figure 1.4 : Canals laid in the degraded area for proper tidal flushing



They were laid in the degraded area in October 1994, i.e. just prior to the onset of the Northeast monsoon season to facilitate rapid decrease in soil salinity during the monsoon rains. Later, the distributory canals were connected by small interconnecting canals and 3000 individuals of *Rhizophora mucronata* were planted along the banks of these canals in January 1995. The survival rate is 72% and growth is normal. Morphometric data are being collected regularly and will be given in the next report.

Muthupet mangroves

Muthupet mangrove ecosystem is characterised at present by the presence of only 4 species of mangroves but the palynological studies carried out by the French Institute, Pondichery, show that species belonging to genus *Rhizophora*, *Bruguiera* and *Ceriops* were present in this mangrove until recently. Our analysis shows that the unscientific management policies followed by various management authorities from 1830 to 1970 were responsible for the disappearance of these species. The analysis also indicates the possibility of reintroducing the above mentioned species, provided the habitat conditions of these species are not altered drastically. To test this hypothesis, 500 individuals of *Rhizophora mucronata* collected from Goa were reintroduced and after a period of 10 months the survival rate was seen to be about 60%.The morphometric data of the reintroduced individuals are given in Table 1.1.

Table 1.1 : Morphometric data of *Rhizophora mucronata* reintroduced into Muthupet mangroves

Growth parameter	Average	Range
Net growth (cm)	37.13	22.2 to 56
No. of internodes	6	5 to 7
No. of leaves	7	6 to 10
Leaf area (cm^2)	48.2	10.8 to 80.6

The results clearly indicate that Muthupet mangrove is still capable of supporting species like *Rhizophora mucronata* which was one of its original inhabitants. Similar experimental plantations will be undertaken to determine the possibility of reintroducing other species like *R. apiculata, Bruguiera* sp. and *Ceriops* sp. in the region.

II. Resources of Bhitarkanika mangroves, Orissa and their utilisation by the coastal communities

This study is being carried out in Bhitarkanika Sanctuary, a mangrove rich area of India located in the state of Orissa. This area contains the largest diversity of species of mangroves in India, and shows nearly all the types of mangrove formations in the forested area of 141 sq.km. The forested area is not contiguous but is in three blocks and two islands and forms a part of the deltaic region of Bhrahmani and Bhitarani rivers. The rivers are perennial in nature and have abundant water. A point of interest is the formation of mudbanks and new islands that are being colonised first by grasses and then by mangrove species.

Nearly 3,00,000 people residing in the 200 villages within the delta are dependent on these areas for their livelihood. Villages bordering the mangrove forest cause degradation of mangroves by converting the forest land for paddy cultivation. There are two distinct groups of inhabitants in the sanctuary, viz, original Oriya settlers and Bengali families.

A preliminary survey of the socio-economic status of 7 villages, namely, Gupti, Okilapada, Bagapatia, Eashwarpur, Righaghar, Ajgarpatia and Raveneshwar, located near the Bhitarkanika mangrove was conducted. Agriculture is rainfed and paddy is the main crop in all the villages studied. The area is close to the Bay of Bengal and is subject to tidal action. In summer, when river inflow is less, the paddy fields become saline; hence the land remains fallow from January to June. Communication facilities are negligible and transport is heavily dependent on private boat operators and government managed ferry services. Potable water is available in village ponds and the tube wells that were established in the last 5 years through a development programme funded by DANIDA. All the 7 villages surveyed are dependent on the mangrove forest for fuel and small timber.

Raveneswar village

From the preliminary survey it was found that the income of most of the inhabitants of Ravaneswar village is entirely dependent on the mangrove resources. Their primary source of income is through basket making and mat weaving, using a grass called *Naalia* (*Myriostachya wightiana*) which is an associate species of mangroves. The village does not have electricity, educational or medical facilities and has just one tube well that feeds the needs of 25 households. All the residents are landless Oriya families who cultivate paddy on share cultivation.

Seven households were interviewed to understand their occupation and social and economic status. All respondents had a monthly income of less than Rs.1500,

and were not able to have any savings. This income was by basket and mat weaving and paddy cultivation. Local varieties of paddy used are *Raspanchuri*, *Laddu*, and *Pattene*. Their assets, besides a thatched house, are fishing nets, milch animals and poultry.

The inhabitants of this village are engaged from July to January in both basket weaving and agriculture. During the lean season nearly all male members are employed as casual labourers in Paradip or in Cuttack and some go even as far as West Bengal, Haryana, Gujarat and Delhi in search of temporary employment. *Naalia* grows in abundance on an island called Bagulidian which is approximately 10 km away from Raveneswar and can be reached by hiring a private boat. Permits to extract this resource are issued by the sanctuary authority and are valid for one month. As a result, a group of people hire a boat and camp in the boat or at the island for 10-15 days at a stretch. The cost of the boat was estimated by the villagers to be Rs.10 per day per person. The grass and stolon are pulled out by hand, tied together and brought back to the village. Each person collected more than 50 kg of the grass. The quantity per family increased when two members of the family were involved in the collection.

The grass is utilized to weave mats. The stolons are used in making baskets which have a ready market. The *naalia* baskets and mats are priced at Rs. 5 - 40. The baskets and mats are also bartered for rice or paddy or other products.

It was observed that the income generated by the families was not sufficient and every family was involved in share cultivation and engaged in agriculture labour in adjoining villages. Most of them acknowledged that the presence of mangroves saved the agricultural land from becoming saline. A few mentioned that regular harvesting of the grass was essential since the grass is prone to pest attacks if not harvested and also that there is better growth after harvesting. The regular monsoon and total absence of drought in the area was also attributed to the presence of the forest. All respondents felt that the resource base was increasing over time.

III. Application of remote sensing in studies related to mangrove ecosystem

The presence of a large number of small, interconnected creeks and channels and the marshy nature of forest floor prevent accurate survey of the extent of mangrove forest and associated land forms by conventional methods. But with the advent of remote sensing technology it is possible to assess the mangrove forest cover and to identify and delineate the associated geomorphological units.

Changes in mangrove forests can also be effectively monitored. Data regarding Pichavaram and Muthupet mangroves, Tamil Nadu and Bhitarkanika mangroves, Orissa are being analysed using the data products given in Table 1.2.

The analysis of dia-positive of Bhitarkanika region shows that the extent of the mangrove forest cover was about 16712.5 ha in 1994 and during the same year the area of the degraded mangroves was about 1563.25 ha. The visual analysis of remote sensing imageries indicated that the area of mangrove in Pichavaram and Muthupet in 1994 was about 260 ha and 1720 ha respectively. The above data need to be confirmed after ground truth collection.

The digital data products are also being analysed for these areas and results are to be compared with visual analysis. The data for the year 1986 will be analysed to find the changes in the mangrove area during 1986 to 1996.

Table 1.2 : Remote sensing satellite data products being used in mangrove studies

Muthupet	Pichavaram	Bhitarkanika
IRS 1B LII Geocoded FCC dated 21.04.94	IRS 1B LII B2 Geocoded FCC Dated 04.06.94	IRS 1B LII B 19/53 Filmpositive of 1:500000 scale dated 09.01.94
IRS 1B LII Digital data dated 18.07.94	IRS 1B LII Digital data dated 21.04.94	
Landsat 5 TM Geocoded FCC dated 23.05.86	Landsat5 TM Digital data dated 23.05.86	
Landsat 5 TM Digital data dated 23.05.86		

Sub-Programme Area 102
Eco-aquaculture

Coastal aquaculture, regarded as a 'sun rise' enterprise from the point of view of economic returns and export potential, is unfortunately acquiring the reputation of being ecologically destructive and socially disruptive. The aim of this project is to demonstrate how ecological aquaculture can be promoted in such a manner that brackish water aquaculture becomes a sustainable 'sun rise

industry' not only for the rich but also for women and men belonging to fisherman and landless labour families.

The Department of Biotechnology, Government of India, sponsored a "mission-mode project on semi-intensive shrimp culture farm and hatchery" at Karaikal which will serve as a training centre for creating a cadre of fisheries entrepreneurs who can integrate the principles of ecology and social equity in coastal aquaculture projects. These training courses will help the women and men from fisherman and landless labour families to take up sustainable shrimp farming. The complex nature of the potential environmental impacts necessitates integrated planning, combining considerations of ecological, social and economic aspects to resolve the major conflicts.

The Govt. of Pondicherry has generously allotted 12 ha of land at Keelavanjoor village, and 2 ha of land at Akkaraivatam village, Karaikal for the establishment of grow-out ponds and hatchery. Technical guidance is being provided by the Central Institute of Brackishwater Aquaculture (CIBA) of the Indian Council of Agricultural Research in Madras.

A micro level survey to find the parameters such as tidal amplitude, land elevation, water quality and quantity, pollution status, flood level survey, soil quality, epidemiological study and meteorological data was conducted. An engineering survey was also conducted to prepare a contour map and design the farm layout. The layout of the model farm is designed to provide a reservoir, buffer zone, settlement tank and bio-ponds to carry out coastal aquaculture in a sustainable eco-friendly manner.

A bench mark survey to study the condition of the soil, irrigation and drainage channels, status of agriculture, animal husbandry and fisheries was taken up.

Soil sampling

Soil sampling was carried out at the proposed farm site, Keelavanjoor. The soil is clayey-sand and saline. Agricultural activities are not productive and the land has been fallow for the past 6 years. Samples were taken at six places of 20 cm interval and are being analysed by the Agricultural Department of Karaikal.

Status of agriculture activities

Production data were collected through a household census survey of Keelavanjoor village. Agriculture is the primary occupation of the villagers. The farmers cultivate 3 crops of paddy in the kuruvai, samba and thalady season. *Vigna mungo*, *Vigna auriculata* and *Arachis hypogea* are also grown in small

pockets. The agricultural economy of Karaikal region is dependent on the Northeast monsoon and water supply from the Mettur dam. The uncertainty of water release from the Mettur dam is a serious concern, since without assured water supply the farmers cannot take up cultivation in all the three seasons.The land use pattern is shown in Table 1.3.

The grow out pond site at Keelavanjoor village belongs to the fallow land category, the soil is saline and agriculture has been abandoned. Agricultural activities are carried out in the neighbouring village on the western side. To minimize salinity problems due to seepage, a buffer zone will be created on the western boundary of the farm.

Table 1.3 : Land use pattern in Keelavanjoor

Category	Area (ha)
Total area of the Keelavanjoor village	436
Agricultural land	175
Cultivable land	175
Fallow land	15
Current fallow land	72
Area sown once	102
Area sown twice	11
Area irrigated	102
Permanent pasture	16

Source: District Information Centre, Karaikal

Current status of the fisheries activities

Ten species of fin fish and 6 species of shell fish (including wild shrimp seeds) of commercial interest are found at Vettar, the primary water source. Fin fishes and shell fishes are commercially exploited by the local fishermen and wild shrimp seeds are collected by the people of Keelavanjoor seasonally to supply to the nearby grow-out farms. The *Penaeus indicus* seed fetches about Rs. 0.15 and *Penaeus monodon* about Rs. 0.60 each. These wild seeds are collected by using scoop nets and by hand picking. The fin fishes can be used as high protein live shrimp feed. The crab species, *Scylla serrata* can also be cultured under controlled conditions since the wild seeds are available seasonally.

A case study was conducted on the existing eight farms to analyse their current status, age and history, the technology adopted, the socio-economic problems, the environmental issues, the role of women and other problems faced by the fishermen community and others. The social and environmental problems raised by the people in the coastal districts have been taken into account. Preventive measures were studied and discussed with experts so that the occurrence of these problems can be avoided in our mission mode demonstration and training farm.

Sub-Programme Area 103
Establishment of a Model Integrated Coastal Ecosystem

Activities under this programme are designed to strengthen the livelihood security of the coastal families on an ecologically sustainable basis. The work initiated in the coastal village of Vettaikaran Iruppu continued to make good progress especially in coastal agroforestry, coastal forestry and animal husbandry activities. This programme is funded by the International Development Research Centre, Canada. The aim of the programme, as mentioned in the previous Annual Report, is to establish a model pilot coastal ecosystem which could serve as a base for technology transfer besides demonstrating sustainable management of natural resources.

Climate and rainfall

In the year 1994 the rainfall was poor but uniformly distributed during the month of November. This helped the crop to a great extent. However, absence of rain for a long spell in December 94 and early January 95 created problems and the timely rains in the middle of January helped to tide over the crisis as may be seen from Table 1.4.

Table 1.4 : Rainfall pattern (in mm)

Rainfall	October	November	December	Total
Normal	287.0	477.0	327.0	1091.0
1992	159.0	280.0	169.0	608.0
1993	244.4	647.5	446.7	1338.6
1994	101.6	468.8	117.4	687.8

Technological Interventions

Details of the various technological interventions undertaken in the area and their results are described below.

Agroforestry

During the current year a drip irrigation model was introduced for the groundnut crop (*Arachis hypogaea*) and it is hoped that the Casuarina trees (*Casuarina litorea* = *C.equisitifolia*) will also be benefited by it. An area of 0.0225ha was covered. The performance of the crops was satisfactory and most of the villagers visited the plot. This experiment will be continued. The performance of both groundnut and blackgram (*Vigna mungo* = *Phaseolus mungo*) was good during the year 94-95 (Table 1.5).

Table 1.5 : Yield details of crops (94-95)

Name of the crop	Area cultivated (ha)	Yield of grain/pods (kg)	Yield of biomass (kg)
Holding A			
Groundnut (Total area)	0.20	460.5	440.0
Under drip irrigation pure	0.0225	66.5	76.5
Under drip irrigation mixed with Casuarina	0.0225	36.5	45.0
Non drip irrigation pure	0.0421	116.0	95.0
Non drip irrigation mixed	0.0761	170.5	154.0
Control	0.0368	71.0	69.5
Holding B			
ADT3 blackgram	0.20	65.3	104.10

It was found that mulching the Casuarina plants, which was initiated last year, gave better results of survival i.e., 1.1% over the control in one plot and 8.3% survival over the control in another plot. There was an increase of 28.39% in height and 53.92% in girth over control during the 2nd year and 10.79% in height and 2.40% in girth over control in the 3rd year. This may be due to the frequent irrigation and nutrients given to the agricultural crops which also benefited the main crop of Casuarina (Table 1.6).

Table 1.6 : Performance of Casuarina

Measurement Dates	Experimental Plot		Control Plot	
Holding A	Height of the plant (cm)	Girth of the plant (cm)	Height of the plant (cm)	Girth of the plant (cm)
8.11.92	31	1.50	31.0	1.50
8.11.93	169.02	4.71	131.64	3.06
20.11.94	277.63	7.25	250.60	7.08

Sylvi-horticulture

The experiments of 1992-93 were repeated during 1993-94 when there was water stagnation in both the plots and also during 1994-95. The performance during 1994-95 was satisfactory as may be seen from Table 1.7. The stand of the fruit plants is good.

Table 1.7 : Performance of agricultural crops in sylvi-horticulture programme

Name of the crop	1993-94			1994-95		
	Area cultivated (ha)	Yield of grain (kg)	Yield of biomass (kg)	Area cultivated (ha)	Yield of grain (kg)	Yield of biomass (kg)
Soyabean (Co1)	0.10	62.00	96.00	0.04	11.0	32.0
Redgram (ICPH8)	0.10	7.50	112.00	—*	—	—
Blackgram (ADT3)	0.10	141.50	105.60	0.07	39.5	61.5
Sunflower (MSFH8)	0.02	9.25	28.25	0.03	20.5	51.5
Groundnut (VRI 3)	0.28	277.00	326.00	0.11	280.0	184.0

*not cultivated

The performance of redgram and soyabean (*Glycine max*) was not satisfactory. The crops were irrigated by oil engine and pump. Due to non-availability of drumstick (*Moringa pterygosperma*) the large scale distribution could not be done during 1993-94. However this year (1994-95), 1081 plants were distributed and almost every other house in this village has a plant of this variety (*PKM1* drumstick). The performance of blackgram (ADT3) was consistent in both the years. The hybrid sunflower (*Helianthus annus*) which was a new introduction performed very well.

Ground water irrigation

As planned and indicated in the earlier Annual report two crops sequence was followed in the two holdings during 1993-94. In holding A, VRI 2 groundnut was sown followed by TMV4 gingelly (*Sesamum indicum*). In holding B, Co7 ragi (*Eleusine coracana*) was planted even when there was water stagnation which was followed by VRI 3 groundnut. The yield details are in Table 1.8.

Table 1.8 : Performance of crops in groundwater programme

Name of the crop	Area sown (ha)	Date of sowing	Date of harvest	Yield pods (kg)	Biomass (kg)
Holding A (Oil Engine)					
VRI 2 groundnut	0.100	2.12.93	17.03.94	142.50	169.00
TMV4 Gingelly	0.015	11.05.94	30.07.94	10.25	35.00
Holding B (Pot Watered)					
Co7 ragi	0.050	21.01.94	18.03.94	28.80	67.20
VRI 3 Groundnut	0.080	27.03.94	25.06.94	67.50	102.50

It is seen that crops that are irrigated by oil engine and pump perform better than pot watered crop.

As indicated in the earlier report, paddy nursery (*Oryza sativa*) was raised as an experimental measure on June 10, 94 as soon as it was announced that Mettur dam will be opened for irrigation on 12.6.94. The seedlings were supplied to three delta farmers in Tiruvarur area and transplanted on 07.07.94. These farmers gained valuable time of one month by avoiding the "nursery raising". The short-term *kuruvai* paddy was planted one month in advance and harvested one month in advance in early October, thus escaping the Northeast monsoon rains which affect the yield of grain and straw. The farmers gained about Rs. 6000/ha. The successful working of this project has shown that delta farmers can have tie-up arrangements with coastal farmers to produce paddy seedlings.

The seedlings raised in coastal soils are seen to thrive well in the main field due to the good root system developed in the sandy soils of the coast.

The TMV3 gingelly was found to perform well and it gave an yield of 683.33 kg per ha. During the year 1994-95 one crop of groundnut was raised in one holding but no crop could be raised in the other holding for want of water.

Reclamation of problem soils

This programme was continued this year. With regard to paddy the yield details are furnished in Table 1.9. The plot applied with Casuarina needles gave an increased yield over the rest. In the case of ragi, in another holding, the plot

applied with mahua (*Madhuca longifolia*) and mango leaves gave increased yield. The pH of the soils in each holding is under analysis.

Table 1.9 : Treatment details of reclamation (Paddy)

Treatment details	Date of planting	Area covered (sq.m)	Date of harvest	Yield of grain (kg)	Yield of biomass (kg)
Casuarina needles + Farm yard manure (FYM)	18.11.94	270	22.2.95	83.00	164.50
Mahua needles + FYM		270		70.18	144.00
Control + FYM		270		79.00	142.50

Kitchen garden

Organic farming was practised in one holding using goat pellets and farm yard manure. Biopesticides like Repelin RD-9, a neem based product, was tried in pest control with success. Cole crops like (knol-khol) *Brassica oleracea var. gongylodes* and (cauliflower) *Brassica oleracea var. botrytis* were tried in some areas based on the previous year's experience. The crops performed well. Nearly 15 farmers raised the cole crops in their kitchen garden.

Mushroom was raised using Casuarina needles instead of the conventional paddy straw. It was found that Oyster mushroom can be grown using Casuarina needles also as a base.

High density forestry

This is the only programme that suffered due to prolonged stagnation of water. Subabul (*Leucaena latisiliqua = L. leucocephala*) suffered the most. Out of the two holdings where the experiment was laid, one was abandoned and the plot handed over to the owner. Subabul failed to revive. The details of poles harvested are furnished in Table 1.10.

Table 1.10 : Yield details of forestry experiments (in kg)

	Casuarina		Subabul	
Year	Poles	Fodder	Poles	Fodder
Holding A				
1993-94	27.50	292.50	12.50	214.25
1994-95	95.50	104.00	88.00	12.50
Holding B				
1993-94	330.50	257.50	338.50	166.50

Subabul has become popular and is advocated for planting in upland areas where there is no water stagnation. 437 seedlings were supplied to 18 farmers.

Soil and water conservation

The VRI 2 groundnut grown during 93-94 was affected by excessive moisture during the early stages and gave an yield of 127.75 kg from 0.186 ha. Sunflower and Co7 ragi were also planted. Sunflower gave an yield 3.5 kg from 40 sq.m and ragi gave an yield of 34.5 kg from 140 sq.m. The experiment was repeated during 1994-95 and the crops performed well as detailed in Table 1.11.

Table 1.11 : Yield details of crops

Name of the Crop	Area (ha)	Yield of grain (kg)	Yield of biomass (kg)
Holding A			
Groundnut VRI 2	0.186	274.00	323.00
Ragi Co7	0.010	12.00	22.00
Sunflower MSFH8	0.008	26.50	49.40
Blackgram (Pure Crop) ADT3	0.015	5.20	—
Bund Crop		4.00	—
Holding B			
Redgram	0.050	Not harvested	
Blackgram	0.050	40.50	89.00
Sunflower	0.015	15.25	62.00

The moisture level in the holdings which were bunded at an interval of 15 m to conserve moisture was periodically monitored and it was found that the bunding did not make any significant contribution in conserving moisture, and paving the way for a second crop. However the performance of the single crop raised is found to be good.

Goat rearing under stall fed conditions

As indicated in the previous report, 34% to 38% of the feed given, was collected as fuel. Two goats were compared for their growth and it was found that Jamnapari goats grow fast as shown in Table 1.12. Monitoring the growth of the goats will continue.

Table 1.12 : Growth of the goats

Details of the goats	Date of birth	Weight (kg)		Body length (cm)		Height (cm)	
		26.3.95	28.4.95	26.3.95	28.4.95	26.3.95	28.4.95
Jamnapari	20.1.95	5.5	9.50	39.0	56.0	43.0	58.5
Local	22.1.95	4.0	7.75	35.0	45.0	39.0	51.0

The Jamnapari goats supplied by us have done 219 servicings and almost every house in this village has a kid born to the Jamnapari buck.

Restoring the fertility of the saline soil in the coastal areas

Various research activities as indicated in the previous annual reports were carried out. It was found that in the first year trials, application of *Pyrites* @ 10 tons per ha gave the highest yield of 3.89 tons of paddy/ha followed by Casuarina needles @ 5 tons/ha which gave 3.76 tons of paddy/ha. In the second year, a second crop of paddy was raised to evaluate the residual effect of the various treatments studied in the 1st year. It was found that the plot applied with coir pith gave an yield of 5.21 tons of paddy per ha followed by Casuarina needle which gave an yield of 5.05 tons/ha. The pH variations in the various treatments are under scrutiny.

The details of the 8 interventions are summarised in Table 1.13.

Training programmes

A demonstration on mushroom cultivation using Casuarina needles was organised on 28.5.94 which was well attended by ladies. A field trip was also organised on the same day. On 21.9.94, a training was conducted on "Rainfed Paddy Cultivation" by the officials of the state agricultural department (Nagapattinam). 38 male & 5 female participants attended the training. A meeting was convened among participant farmers to discuss future plans on 24.12.94. A field trip was conducted for explaining about various interventions on 29.1.95.

Table 1.13 : Details of interventions

Intervention	Results
Agroforestry *Cajanus cajan* (redgram) and *Arachis hypogaea* (groundnut) were grown as mixed crop with Casuarina as in previous years. *Vigna mungo* (blackgram) was sown as mixed crop.	• Coconut husk treatment reduces mortality of plants by 1.10 to 8.3% during summer. • Casuarina under agroforestry system showed increase in height and grith over control where intercropping was not done. • Drip irrigation has given more yield in the pure crop area.
Hortiforestry Ziziphus, *Punica granatum* (pomegranate) *Mangifera indica* (mango), *Leucaena latisiliqua* (subabul) were grown in the main field. *Moringa pterygosperma* (drumstick) was planted along the borders. Groundnut, redgram, *Glycine max* (soyabean), *Helianthus annus* (sunflower), blackgram were grown as intercrops.	• The growth of fruit plants is good. • Sunflower was introduced for the first time and has given good yield. • The performance of soyabean is not satisfactory. • VRI 3 groundnut was grown by 5 farmers. This performs well in coastal sandy soil. • ADT3 blackgram has been successfully replicated by 6 farmers. This crop performs well. • A total number of 1081 drumstick seedlings were supplied to 176 farmers.
Ground Water Irrigation With available water, *Eleusine coracana* (ragi), *Oryza sativa* (paddy) nurseries and crops like groundnut, *Sesamum indicum* (gingelly), and vegetables were grown.	• The concept of raising paddy nursery under casuarina wood lots was followed successfully. • Gingelly TMV4 variety yielded 10.25 kg from 150 sq.m (683.33 kg/ha) which was a good yield. • Two crops could be grown in a year, by growing short duration varieties like Co7 ragi and groundnut VRI3 under favourable conditions.
Reclamation of problem soils Gypsum was applied. Apart from farm yard manure (FYM), casuarina needles, (Mahua leaves) *Madhuca longifolia* were also applied. Ragi, Co7 and paddy ADT-39 variety were grown.	• In the case of paddy, the plot applied with casuarina needles gave an increase in yield over control plot. • Paddy ADT39 variety yields consistently and 4 farmers have cultivated this variety.

Table 1.13 (contd.) : Details of interventions

Intervention	Results
Kitchen gardens	
Improved varieties of vegetables were grown. Cole crops like cauliflower, knol khol, (cabbage) *Brassica oleracea* var. *capitata*, (carrot) *Daucus carota* and (beetroot) *Beta vulgaris* were also grown.	• 15 farmers of the village raised knol khol with success. Organic farming was practised in one holding.
High density forestry	
The growth of (Subabul) *Leucaena latisiliqua* and Casuarina was monitored.	• In one holding, subabul was harvested completely. First thinning was done for casuarina. • Subabul is becoming popular as a fodder. 437 seedlings from our nursery were distributed to 18 farmers.
Soil and water conservation	
Groundnut, ragi, sunflower, blackgram and redgram were grown in the plots.	• It is seen that by adopting early sowing in November-December in uplands where there is no problem of water stagnation, the crops could be harvested with minimum number of irrigation or no irrigation at all. VRI2 groundnut and MSFH8 sunflower perform well.
Goat rearing under stall fed conditions	
Growth was monitored.	• Jamnapari breed is becoming popular. A total number of 219 servicings have been done. • Studies are being conducted on growth rate of Jamnapari kids compared to local kids.

Programme Area 200

Biodiversity

This programme encompasses the habitat, species and sub specific categories of biodiversity monitoring and conservation. Studies were carried out in six major national parks / protected areas to ascertain the reasons for their becoming threatened habitats. Work on saving plants listed in the Red Data Books of the Botanical Survey of India and on Coastal Mangrove Ecosystems was continued. Action research and biodiversity surveys were extended to the Bhitarkanika region of Orissa and the Great Nicobar Biosphere Reserve. The Community Biodiversity Conservation Alliance was strengthened and a multimedia database on the intellectual contributions of tribal and rural families in the area of plant genetic resources conservation was started. Steps were initiated to develop a resource centre for the protection of the IPR rights of tribal and rural families with reference to their unique contributions to genetic conservation and enhancement. The IPR Resource Centre consists of a) a Community Gene Bank, b) Herbarium and c) multimedia database. Genetic diversity in Mangroves and endangered plant species was assessed using molecular techniques. Research on micro-propagation of threatened plant species and on bioindicators to monitor the health of ecosystems rich in biodiversity made further progress. The results of these studies are described in this section.

N. I. Vavilov Centre for Research and Training in Sustainable Management of Biological Diversity (SPA 201 - 203)

Sub-Programme Area 201
Protecting the Endangered Protected Areas

The work of investigation and study of six critical areas, chosen on the basis of their biological wealth uniqueness and threats to biodiversity, was completed this year. Studies on three of these areas Bhitarkanika Wild Life Sanctuary (Orissa), Gulf of Mannar Marine National Park (Tamil Nadu) and Nilgiri Biosphere Reserve

were done by scientists from MSSRF in collaboration with the concerned Forest Departments.

Bhitarkanika Wild Life Sanctuary (Orissa)	Dr. Hemal Kanvinde
Gulf of Mannar Marine National Park (Tamil Nadu)	Dr. Sanjay Deshmukh & Mr. G. Venkataramani
Nilgiri Biosphere Reserve	Dr. Ranjit Daniels & Dr. V.S. Vijayan (Director, SACON)

The study of three other critical areas namely Manas World Heritage site (Assam), Gulf of Kutch Marine National Park (Gujarat) and Dudhwa Tiger Reserve (U.P) were entrusted to specialists and organisations who have experience and knowledge about these areas.

Manas World Heritage site (Assam)	Shri. Deb Roy Former Additional Inspector General of Forests (Wildlife)
Gulf of Kutch Marine National Park (Gujarat)	Ms. Prithi Nambiar Co-ordinator Centre for Environmental Education, Ahmedabad
	Dr. G.M. Oza International Society of Naturalists, Baroda
Dudhwa Tiger Reserve (U.P)	Mr. Raman Mehta WWF India, New Delhi
	Mr.Valmiki Thapar Ranthambore Foundation, New Delhi

The Rajiv Gandhi Foundation extended financial support to these studies.

The Convenors / Specialists entrusted with the assignments organized site specific alliances with interested individuals/Institutions, who could contribute to the study and could complete the tasks by August - September '94. Dr.V.S.Vijayan arranged a workshop (31st August) of interested parties and Institutions at Kallampalyam, Coimbatore in which both Government and non-Governmental agencies participated and their views were incorporated in the draft on Nilgiri Biosphere Reserve.

The six reports were presented for further consideration and comments at a largely attended special seminar arranged as a part of the Silver Jubilee celebration of WWF India, held in November '94 at New Delhi. Based on all the inputs received, the six reports were finally revised and edited and given to the Rajiv Gandhi Foundation for publication.

Island ecosystems : Patterns of distribution of vertebrate diversity on the great nicobar biosphere reserve

Island ecosystems all over the world are threatened by a variety of anthropogenic factors. Islands in the tropical seas are especially under such human pressures as tourism and development. Currently it is found that some of the low oceanic islands are likely to be submerged due to sea level rise. Since the island species and humans have evolved under unique biotic and abiotic circumstances, *in situ* conservation of the flora, fauna and human communities is a real challenge. The Great Nicobar Island has hence been declared as Biosphere Reserve under the Man and Biosphere Programme.

The M.S. Swaminathan Research Foundation has undertaken a study of islands with regard to the *in situ* conservation of biodiversity. The first project has been launched in the Great Nicobar Island, sponsored by the Department of Environment and Forests, Govt. of India. Preliminary studies are underway on the island. The main objectives of the study are :

- Preparing bench-mark inventories of the vertebrate communities
- Identifying habitats of high species diversity and conservation value with special emphasis on endemics, habitat specialists and endangered species
- Monitoring habitat degradation brought about by humans
- Identifying habitats of lower vertebrates such as amphibians, reptiles and freshwater fish
- Identifying habitat requirements and communities of sea snakes.

Sacred grove conservation programme

Sacred groves, tracts of intact forests varying in size from a few trees to dense stands extending to a few hectares, are the vestiges of an ancient practice in India. Sacred groves represent a tradition of nature conservation by the people much prior to the modern concept of "Wildlife Reserves". These forest patches are generally conserved on religious grounds and taboos vary from place to place, largely based on local beliefs.

Today, most of the groves have disappeared and those that exist are vulnerable to pressures of development. In order to have a meaningful intervention in protecting these sacred enclosures a community oriented approach has been initiated. Rehabilitation effort was started with the help of WWF at St.Thomas Mount, a historical site of Madras, and at Soundaraja Perumal Temple at Thadikombu village of Dindigul Anna District in collaboration with Krishi Vigyan Kendra and the Rotary Club of Dindigul West. About six hundred saplings, varying in vegetative composition, were planted in an area of five acres around the temple. A series of meetings was conducted to sensitise the local people to understand the needs and importance of conservation practices. These meetings proved to be very useful and have created a great deal of interest among the local community to reestablish the sacred precinct.

A detailed database has been designed to make a record of the existing sacred groves of Tamil Nadu. So far, fifteen sacred groves have been identified and field data recorded. This database is designed in such a way that it incorporates the multimedia features, covering finer details pertaining to the subject. It has three main components : the geographical location and other general details; the religious, cultural and human values and history of the grove and finally scientific details like vegetative composition of the grove, the rationale behind the choice of species, and the presence of the rare and endangered species within the boundaries of the sacred grove. This database will be updated from time to time both in terms of the volume of information and structure.

Two other places in Madurai district have been identified to continue the rehabilitation work with the help of the local NGOs for the coming year. It is also intended to select a few more sacred groves which are on the verge of destruction and rehabilitate them with the help of the local NGOs, communities and school children in the coming year.

Sub-Programme Area 202
Tribal Area Biodiversity Conservation Programme

Biological diversity is essential for sustaining human life as food requirements vary from place to place and community to community. In order to have security for the sustenance of all life forms which have one to one relationship, it is essential that biological diversity be conserved. Conservation of biodiversity should be complemented with the conservation of cultural diversity as it is the basis of knowledge on sustainable utilisation of biological resources. The knowledge now available with the ethnic groups all over the globe is the result of their close association with nature over the ages, passed down through generations. The

reason that the knowledge has been conserved by them is largely due to their realisation that the edible, medicinal and crop plants are vital life sustaining resources. This knowledge base of tribal people can open doors to find alternative food and drug resources.

The present ethnobotanical studies conducted on four tribal communities in twelve tribal hamlets (of these nine are being studied for the first time) have given information on seventy four plant species used in nutrition, medicine, fish poisoning and material culture. A few examples are given in the enumeration.

The present work includes one more ethnic group, namely, Muthuvans and four more tribal hamlets, in addition to those studied since the beginning of the programme.

Tribes and their habitat

Tribal communities, namely Kadars, Malasars, Malayalis, Muthuvans, and Pulayars living in Coimbatore, Dharmapuri, North Arcot-Ambedkar and Salem districts in Tamil Nadu have been taken up for the study (Fig. 2.1). Tribal areas surrounded by natural vegetative cover were selected.

Intellectual property rights data base

The documentation of indigenous knowledge with passport details is being done to create a data base for protecting the intellectual property rights (IPRs) of indigenous people for their contributions and informal innovations. The data base consists of

- details of the utilisation value of plant genetic resources
- tribal communities conserving this knowledge by practice, and
- habitat of the tribe using the plant.

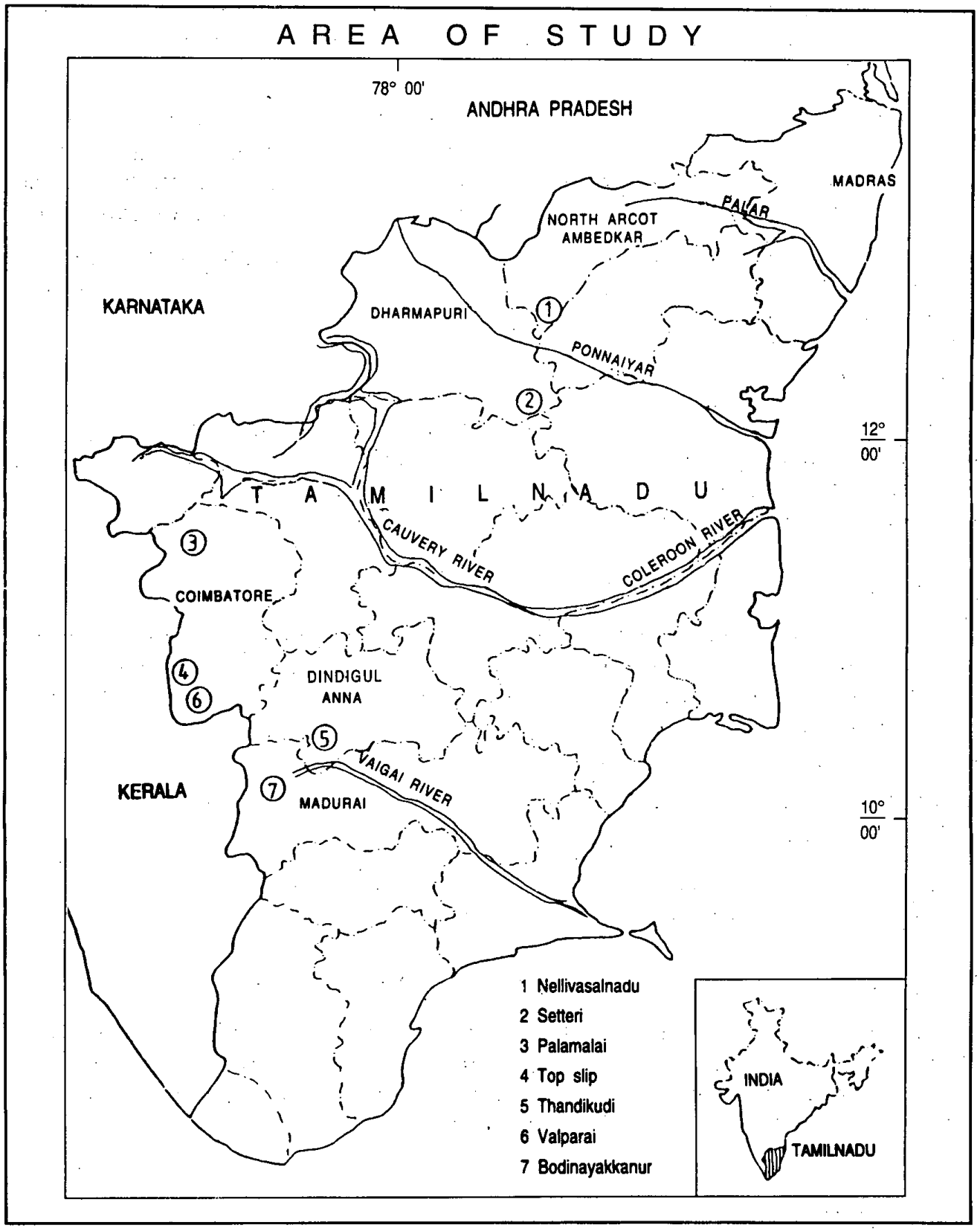
These details will help to recognise and reward the knowledge of the tribal people accumulated over centuries.

Enumeration : Plant species used by the tribes under study

Information on the plant species used as food, medicinal applications, fish stupefaction agents, leech repellant and in material culture is given in enumeration*. The plant names are arranged alphabetically, followed by the family name and local name. Uses of the plants are also given.

*results for the year 1994

Figure 2.1 : Areas of study of tribal families



Edible (Wild)

Bridelia retusa (L.) Spreng. (EUPHORBIACEAE) - Asiva maram (Pul)	Fruits eaten by Pulayars of Pannikuzhi.
Buchanania lanzan Spreng. (ANACARDIACEAE) Morali (Muthuvans)	Fruits eaten by Muthuvans of Karumutty.
Canavalia gladiata (Jacq.) DC. (FABACEAE) - Thammatam; Parangavara (Pul)	Seeds cooked with tamarind and consumed by Pulayars.
Canthium dicoccum (Gaertn.) Teijsm & Binn. (RUBIACEAE) Negini (Mal)	Fruits eaten by Malayalis.
Caryota urens L. (ARECACEAE) - Koondhal pana (Kad)	Apical meristem powdered, processed and eaten.
Cullenia exarillata Robins. (BOMBACACEAE) - Kurangu pala (Kad)	Petals eaten, seeds fried and eaten by Kadars of Udumanparai.
Garcinia gummi-gutta (L.) Robs. (CLUSIACEAE) - Puli yotta	Fruits used as substitute for tamarind by Kadars of Udumanparai.
Hemidesmus indicus (L.) R. Br. (PERIPLOCACEAE) Nannari (Mal)	Root decoction consumed for improving health.
Ziziphus rugosa Lam. (RHAMNACEAE) - Kotta palam (Kad & Pul)	Fruits eaten by Kadars of Udumanparai and Pulayars of Pannikuzhi.

For medicinal applications

Anaphyllum wightii Schott. (ARACEAE)	Rhizome paste applied for cuts and wounds by Kadars. Note : Only a portion is used so as to allow regeneration.
Asparagus racemosus Willd. (LILIACEAE) Paapa kilanagu (Pul) & Sadavalli & Kundalali sappu (Kad) & Thanneer vittan (Mal)	Root paste mixed in breast milk and orally administered by Pulayars of Keelpoonachi for dysentery in children - one to two spoonfuls daily in the morning and evening till cure. Same mixed in goats' milk and given orally two to three spoonfuls thrice a day for three days for piles by Pulayars of Keelpoonachi. Leaf paste applied on head and during bath for body swellings - morning and evening for three days. Roots of one plant ground, mixed with 50 ml. of honey and orally administered for Piles by Malayalis- daily in the morning for three days.
Bridelia retusa (L.) Spreng (EUPHORBIACEAE) Asiva maram (Pul)	Stem bark paste used as leech repellent by Pulayars of Pannimedu.
Centella asiatica (L.) Urban (UMBELLIFERAE) Kaamala	Leaf paste applied on body during bath in the morning for three days. and leaf juice orally administered for jaundice - thrice a day for three days by Kadars.
Curcuma neilgherensis Wight (ZINGIBERACEAE) - Vadham (Kad): Kathiri manjal	Rhizome paste applied for skin irritation and for pimples by Kadars of Udumanparai.

Dodonaea viscosa (L.) Jacq. (SAPINDACEAE) - Villari (Mal)	Leaves boiled in water, filtered and the juice orally given for jaundice by Malayalis - 100 ml. daily in the morning for three days. Diet : tamarind is avoided.
Erythropalum populifolium (Arn.) Mast. (ERYTHROPALACEAE) Kanayaan soor valli kodi (Kad)	Root extract applied for ear infection, two to three drops till cure by Kadars of Udumanparai.
Lepisanthes umbellata (L.) Rafin. (PIPERACEAE) Peetha thala	Leaf paste applied on head during bath, and leaf extract mixed in honey and orally administered for cold twice a day for 3 days.
Macaranga peltata (Roxb.) Muell.-Arg. (EUPHORBIACEAE)	Stem bark with that of Canarium strictum and "Paali maram" boiled in water and fumes inhaled for toothache.
Phyllanthus rheedii Wight (EUPHORBIACEAE) Keezha nelli (Kad)	Leaf paste mixed with goats' milk, and orally administered by Kadars for jaundice - two to three spoonfuls twice a day for two to three days.
Rauvolfia serpentina (L.) Benth. ex Kurz. (APOCYNACEAE) Eayakundan	Roots chewed for stomach ache by Pulayars.
Sida acuta Burm. f. (MALVACEAE) (Valukka pooda)	Leaf paste orally administered for ulcer by pulayars. (25 gm of leaf paste mixed in 1 tumbler of water and given daily in the morning for four days).
Sida cordifolia L. (MALVACEAE) Palam paachi thala	Leaves eaten or leaf paste orally administered with buttermilk for white discharge - 100 ml. of buttermilk and one spoonful of leaf paste daily in the morning for three days.
Terminalia chebula Retz. (COMBRETACEAE) Kadukkai	Fruits are mixed in water and orally administered for stomachache by Pulayars of Pannikuzhi. Fruits ground and applied for leech bite by Muthuvans of Karumutty.
Wrightia tinctoria (Roxb.) R. Br. (APOCYNACEAE) Veppala (Mal)	Stem bark pounded, boiled in water and orally administered for peptic ulcers by Malayalis - 100 ml. in the morning for one day.

As stupefaction agents

Tephrosia candida DC. (FABACEAE) Kolinja thala (Kad)	Leaves crushed and used as fish poison by Kadars.

In material culture

Entada pursaetha DC. (MIMOSACEAE) Thelli Kaayi	Stem bark used as hair wash and detergent by Pulayars of Pannikuzhi
Grewia tiliaefolia Vahl (TILIACEAE) Thadisam (Kad & Pul)	Stem bark used as fibre and fibre ash as hairwash. Leaves used for thatching house by Pulayars of Pannikuzhi and Malasar of Kozhikamuthi
Ochlandra travancorica Benth. ex Gamble (POACEAE) Oda (Kad)	Culms used for house construction, making baskets and mats. Leaves used for thatching houses and for making meal plates by Kadars of Udumanparai.
Sida rhombifolia L. (MALVACEAE) Valukka poodu; Poodan	Whole plant ground and applied on head during bath for cooling effect by Kadars.
Trema orientalis (L.) Blume (ULMACEAE)	Stem bark used for fibre by Pulayars of Pannimedu.

The above practices clearly reveal that the knowledge of tribal communities has much relevance in the conservation of plant genetic resources. As the tribals are fast losing their traditional knowledge, similar studies are being undertaken simultaneoulsy in tribal areas of adjoining states so as to document the knowledge before it is lost forever.

In situ conservation of crop genetic resources

In situ conservation of native and traditional food crops is essential as it serves to maintain and promote crop genetic diversity. The native and traditional strains, often undergoing hybridisation with local wild and weedy relatives, are major sources of intra-specific genetic diversity. They play a significant role in enriching the local biodiversity. Conservation of genetic diversity of such food crops in *in situ* condition is critical to future food security. It is unfortunate that in the traditional peasant/tribal agricultural systems, the crop genetic diversity is decreasing at an alarming rate. This is mainly due to the introduction of new high yielding varieties and modernisation of agriculture.

Considering the value of indigenous and traditional crops, field studies were carried out in some of the tribal areas of Tamil Nadu to document the existence and prevalence of land races and to collect seeds of the same to be stored in the community Gene Bank for future use. While it was encouraging to find the existence of traditional crop varieties in *in situ* conditions during our field visits (1993-94) to the tribal pockets of Nellivasal Nadu in N.A.-Ambedkar district (inhabited by the Malayali tribe) and Palamalai in Coimbatore district (inhabited by Irula tribe), the findings of the studies carried out thereafter (1994-95) in some other tribal pockets of Tamil Nadu, namely Kolli Hills in Salem district, Valparai and Siruvani in Coimbatore district were disturbing and discouraging.

Introduction of cash crops and high yielding varieties have modified the traditional/tribal agricultural system in Kolli hills. In most of the tribal areas, subsistence farming, which was generally the characteristic feature until a few years ago, has been to a great extent affected by the advent of tapioca. Large areas which were once used for cultivating traditional food crops like *ragi (Eleusine coracana), samai (Panicum* sp.*), thinai (Setaria* sp.*), varagu (Paspalam* sp.*), gothumai (Triticum aestivum), cholam (Zea mays)* have been replaced by tapioca and turmeric. New HYV paddy (*Oryza sativa*) varieties have taken over much of the cultivated areas hitherto occupied by the traditional paddy varieties like *samba nellu*. One consoling factor is that, though tapioca dominates the agricultural scene, the Malayalis still cultivate their traditional crop varieties, though on a smaller scale than before. The tribal people, including the younger generation, realise the value of these traditional varieties. But due to monetary benefits they

have had to turn to tapioca and HYV paddy like J13, IR64, IR50, etc. whose yield is more than that of the traditional paddy variety.

Similarly among the Kadars of Udumanparai in Valparai, there is a change in the traditional cultivation practices. Cardamom is given higher priority compared to the traditional food crops like paddy, *ragi, thinai, varagu* and *cholam*. It is stated that the higher prices offered for cardamom is responsible for their neglect of traditional crops.

The Muduva tribes of Karumutti hamlet in Valparai regretted that they could not cultivate their traditional crops during the last two years. These people generally clear the bushes and burn them before they prepare their agricultural lands. It is understood that in recent years, the forest officials have not allowed them to practise their traditional mode of cultivation. The practice of slash and burn cultivation could have prompted the forest department to restrict the tribals from cultivating their land in the traditional manner.

The Irula and Muduga tribes in Siruvani region could meet their subsistence needs until a few years ago by cultivating traditional crops like *samai, ragi, thinai, varagu* and pulses like *avarai* (*Dolichos lablab*), *thuvarai* (*Cajanus cajan*) and *kollu* (*Macrotyloma uniflora*). However, now they have become daily wage labourers in order to survive. They have not been able to cultivate due to elephant menace. The concerned authorities have not taken effective measures to tackle this problem. The tribals are only too aware that this problem is caused by habitat destruction leading to food insufficiency which has driven the elephants out of their natural habitat in search of alternative sources of food.

Interestingly, in all the areas studied, at least three or four varieties of each traditional food crop (each differing in their agronomic character) have been observed.

Considering the possible erosion of crop genetic diversity, it is intended to encourage and strengthen the cultivation of native and traditional crop varieties in tribal and rural areas by developing crop genetic conservation strategies and meaningful interventions adapted to the local habitat and people. It is also proposed to integrate farmers' knowledge and experiences while developing strategies for crop genetic conservation.

Sub-Programme Area 203
Community gene bank

Conservation of plant genetic resource material, especially through the Gene Bank, is widely accepted, in view of the increasing habitat destruction and depletion of natural resources. The main objective of the Gene Bank is to provide modern techniques for the preservation and use of landraces, indigenous varieties and other plant genetic material.

As per an agreement with the International Plant Genetic Resources Institute, M.S.Swaminathan Research Foundation designed, constructed and commissioned a Gene Bank to support the Community Biodiversity Network. The Gene Bank was formally commissioned on January 27, 1994. It has a capacity to store 1.5 million gm of seed for a period of seven years. A full time manager is responsible for seed processing, documentation and maintenance of the Gene Bank. All the necessary accessory equipments for seed processing were installed.

A team of scientists working in the Biodiversity Conservation Network Programme at MSSRF is exploring the tribal areas of South India. The number of accessions has increased to 140 against 80 in the last year. The collection includes cereals, millets, pulses, vegetables, spices and economically important grass seed materials. A passport data sheet has been developed to enumerate the characters of the seed material collected in the field. The material thus collected will also be distributed to tribal and rural farmers, breeders and scientists on their request. Sample herbarium specimens of rare and endangered plants are also being maintained. The collected materials will be evaluated and characterised at the Centre's research plot at Kattupakkam, Chengalpet district, Tamil Nadu. The passport information which is being collected is documented by using Gene Bank Management Software, developed by International Plant Genetic Resources Institute, Rome.

The Gene Bank manager attended a training programme on "Documentation on Gene Bank" at MARDI, Kualalumpur, Malaysia and on "Exchange and Quarantine of PGR" at NBPGR, New Delhi.

Network with NGOs and local groups

Realising the need to collect more data and samples of the 'folk' seeds, an NGO network has been created through interactions with the local NGOs, and information on the varieties available with different rural communities and their usage patterns is obtained. They are also requested to send those plant varieties to the Community Gene Bank. MSSRF is also engaged in communicating to the

rural people the importance of collecting and preserving valuable plant genetic resource material.

Future dimension

Local biodiversity conservation cannot succeed unless tribal and rural communities receive their fair share of benefits. There is such debate around the globe in the recent past to work out means to establish the intellectual property regimes for the knowledge and efforts related to conservation of genetic resources of the tribal and rural communities. The community Gene Bank established in MSSRF plays a significant role in identifying the indigenous community/people responsible for such conservation efforts over the years.

Biotechnology and Biodiversity (SPA 204-208)

Sub-Programme Area 204
Farmer Centred Agriculture Resource Management (FARM)

FARM, an Asia-Pacific collaborative project involving 9 countries, is sponsored by the FAO. The main objective of this study is to demonstrate the compatibility of sustainable agriculture and on-farm conservation of biodiversity. The M.S.Swaminathan Research Foundation is one of the collaborating agencies in this project. The major components of the study proposed by M.S.Swaminathan Research Foundation are :

- Characterization and use of indigenous on-farm biodiversity
- Diversification of farming systems to enhance on-farm biodiversity and
- Conservation and characterization of biocontrol agents.

As part of this project, the coastal parts of Tamil Nadu, including the South Arcot district and Tindivanam areas, have been chosen. Eight localities in the study area have been identified and were visited in February-March 1995. When these sites were visited, the standing crop was groundnut.

Samples of soil, ants and spiders have been collected. These are being studied further in the laboratory. Some of the preliminary results are given below.

Soil microorganisms

Soil microbial activity was assessed by enumerating the bacterial and fungal populations; enzyme assays with reference to dehydrogenase, invertase, amylase and cellulase were also done to access the enzyme activity at the different sites. Five soil samples were collected from each site and pooled. From this 10 gms of soil were taken and microbial populations were enumerated in triplicates using serial dilution techniques. Lowest count was recorded at site 4 (Table 2.1). In sites 5-8, there was a good microbial count. The same trend was observed for enzyme dehydrogenase and invertase for which the activities were good while cellulase and amylase activities were almost negligible. To develop molecular markers, studies were carried out on free-living and associated nitrogen fixers. *Bradyrhizobium* was isolated from the nodules of the groundnut plants from these different sites, using standard techniques on yeast mannitol agar (YEMA). *Azotobacter* was cultured on nitrogen free mannitol agar. The DNA and protein of these isolates have been extracted as detailed under genetic diversity studies.

Table 2.1 : Sitewise details of the microbial counts in the study area

Site	Total heterotrophic count (cfu x 10^4 per gm soil)	Total fungal population (cfu x 10^2 per gm soil)	Dehydrogenase mg formayan per kg soil	Invertase mg glucose released per gm soil
S1	236	665	0.80	3.00
S2	246	1405	0.82	3.08
S3	254	313	0.96	4.16
S4	154	345	0.69	1.56
S5	280	990	2.00	5.84
S6	288	1363	2.40	4.84
S7	294	720	2.36	5.12
S8	370	1906	2.44	5.88

Fungal species have been isolated using Rose-Bengal Potato Dextrose Agar medium and identified up to their generic and/or species levels (Table 2.2).

Genetic diversity in associated plants and microbes

Phyllanthus amarus a common medicinal plant associated with groundnut in the South Arcot district was collected from the 8 sites. The samples have been analysed for genetic polymorphism both at the inter- and intra-population levels

using RAPD and isozyme markers. Six random primers were used producing a total of 28 amplification products of which 6 were polymorphic.

Table 2.2 : Sitewise distribution of the fungal species in the study area

Fungal Species	S1	S2	S3	S4	S5	S6	S7	S8
Alternaria sp	+	-	-	-	-	-	-	-
Aspergillus candidus	+	-	-	-	+	+	-	+
A. flavus	-	+	+	+	+	+	-	-
A. nidulans	-	-	-	+	-	-	-	-
A. niger	+	+	+	+	+	+	+	+
A. ochraceous	+	-	-	+	+	-	-	-
A. terreus	+	+	+	-	+	+	+	+
A. wentii	-	+	-	+	+	+	+	-
Aspergillus sp 1	-	+	-	+	-	+	+	-
Aspergillus sp 2	-	+	-	-	-	-	+	+
Cladosporium sp	-	+	-	+	-	-	-	-
Curvularia lunata	-	-	-	+	-	-	-	-
Curvularia sp 1	-	-	+	-	+	-	-	-
Curvularia sp 2	-	-	-	-	-	-	-	+
Emericella nidulans	-	+	-	+	+	-	-	+
Fusarium oxysporum	-	-	-	-	+	-	-	-
F. roseum	-	+	-	-	-	-	-	-
Fusarium sp	-	-	-	-	+	-	-	-
Gliocladium sp	-	-	-	-	+	-	-	-
Penicillium citrinum	+	+	+	+	-	+	+	+
P. oxalicum	-	+	+	+	+	+	+	+
Penicillium sp	-	-	-	-	-	+	-	+
Rhizopus sp	+	-	+	-	-	-	-	-
Trichoderma viride	-	-	-	-	-	+	-	-
Unidentified sp 1	-	-	+	-	-	-	-	-
Unidentified sp 2	-	-	-	+	-	-	-	-
Unidentified sp 3	-	-	—	-	+	—	—	+
Total	7	11	8	12	13	10	7	10

+ Present ; - Absent.

Genetic diversity in the nodulating Bradyrhizobial strains in groundnut was also studied using RAPD markers. 10 random primers have already been tested. The total protein profiles of these strains have also been studied.

Ant species

Ants with their varied biological niches can serve as useful bioindicators of ecosystem health. Ants were systematically collected from the groundnut fields during the mornings and evenings in 6 of the 8 selected sites. Eleven species in 7 genera representing 2 subfamilies were collected. The details of the occurrence of the species are given in Table 2.3. This is just a preliminary sample and will involve further sampling before any conclusions can be drawn.

Table 2.3 : Ant species occurrence in the 6 sites studied

Species	S1	S2	S3	S4	S7	S8
Camponotinae						
Camponotus 1	+	+	+	-	+	+
Camponotus 2	-	-	-	-	+	+
Camponotus 3	-	-	-	+	-	+
Prenolepis	+	-	+	+	-	-
Myrmicinae						
Meranoplus	-	-	-	-	+	+
Monomorium	+	+	+	-	+	-
Pheidole 1	-	-	+	+	+	-
Pheidole 2	+	-	-	-	-	-
Pheidole 3	-	-	-	+	-	-
Crematogaster	+	-	-	-	-	-
Solenopsis	-	+	+	+	-	+
Total	5	3	5	5	5	5

+ Present ; - Absent.

Spiders

Spiders serve as biocontrol agents in crop lands. Several spiders have been collected from the same 6 localities as that of ants. These have been sent to a local expert for identification.

Sub-Programme Area 205
Protecting Endangered Species

This programme involves the collection and study of plants listed in the Red Data Book, plants of economic importance including wild relatives of crop plants and mangrove species. Efforts to conserve these plants *in situ* as well as *ex situ* are being made including techniques of micropropagation and genetic characterisation at the Foundation. These are discussed under SPA 205, 206 and 207.

Protecting endangered plant species

Conservation efforts to save endangered plant species of Western Ghats is continuing. We have conducted intensive surveys of plants in 7 different localities for this purpose. This study has resulted in the collection of 75 taxa which include 22 species listed in the Red Data Book of Indian Plants.

The approach

These 75 species were assessed and reviewed on the basis of the revised IUCN guidelines. There are several criteria involved in this, ranging from the population estimate, number of mature individuals, extent of occurrence, habitat degradation etc. These species fall into 4 categories viz., Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Conservation Dependent (CD). The *Critically Endangered* taxa are the ones which are facing very high risk of extinction in the near future: Population reduction is estimated by the severe decline (at least 80%) during the last 10 years and the estimated population size is less than 50 mature individuals and extent of occurrence is less than 100 km^2. A taxon becomes *Endangered* when there is at least 50 % decline in population during the last 10 years and the extent of occurrence of less than 5,000 km^2 and the population with less than 250 mature individuals. The *Vulnerable* taxa are the ones with an estimated population decline of at least 50% during the last 20 years and extent of occurrence is less than 20,000 km^2 or in an area of occupancy of less than 2,000 km^2 and having a population of below 1000 mature individuals. The taxa which are in the *Conservation Dependent* category are at present not threatened but need taxon specific or habitat specific conservation programmes to prevent them becoming one of the threatened categories. There are 20 Critically Endangered, 25 Endangered, 20 Vulnerable and 10 Conservation Dependent species (Table 2.4). All these species are found to occur in an area of less than 5000 km^2. The research management of all these species includes monitoring, habitat management, genetic and life-history studies (except for *Salacia malabarica* and *Strombosia ceylanica*) where the research management is limited

to monitoring and habitat management. The data quality relates to general field studies carried out in the last 10 years. Some examples are given below.

Table 2.4 : Chart showing the details of the critically endangered species

Species	AO	EST #	TRENDS	THRTS
Sageraea grandiflora	< 10 km²	20	D	G, I. L, Lp
Salacia malabarica	< 10 km²	10	D	G, I. L, Lp
Euonymus serratifolius	< 5 km²	2	S	I. L, Lp
Goniothalamus rhyncantherus	< 10 km²	10	D	I. L, Lp
Hedyotis ramarowii	< 10 km²	< 50	D	I. L, Lp
Albizia thompsonii	< 10 km²	< 50	D	I. L,
Piper barberi	< 10 km²	< 50	D	G, I. L,
Nothopegia aureo-fulva	< 5 km²	< 20	D	G, I. L
N. travancorica	< 10 km²	< 50	D	I. L
Smithia venkobarowii	< 50 km²	< 100	S	I. L, Lp
Crotalaria clarkei	< 10 km²	< 100	D	I. L, Lp
Colubrina travancorica	< 10 km²	< 20	D	G, I. L
Cordia octandra	< 10 km²	< 20	D	G, I. L
Exacum courtallense, var. laxiflorum	< 10 km²	< 20	D	I. L, Lp
Morinda reticulata	< 10 km²	< 50	D	I. L, Lp
Pogostemon travancoricum	< 10 km²	< 5 0	D	G, I. L,
Rauvolfia micrantha	< 10 km²	< 100	D	I. L
Rhynchosia acutissima	< 10 km²	< 20	D	I. L, Lp
Anisochilus verticillatus	< 10 km²	< 50	D	I. L, Lp
Strombosia ceylanica	< 50 km²	< 50	S	I. L, Lp

AO = Area of occupancy **EST #** = Estimated number; **TRENDS** : D = decreasing, S = stable; **EA** = Extent of Area AA-2 < 100 sq.km; **THRTS** = Threats, G = genetic problems, I = Human interference, L = Loss of Habitat, Lp = Loss of habitat beacuse of exotic plants

Rauvolfia micrantha : This is an allied species of the well known reserpine plant *R. serpentina.* The population reduction of this species is estimated to be 80% during the last 10 years mainly because of loss of habitat, human interference and disturbance. The extent of occupancy of this species is less than 100 km²

and mature individuals of a population in a given locality are not more than 50 in number. So this species certainly qualifies for CR category. This taxon is known to us only from Goodrical R.F., Pathanamthitta and Agastyamalai, both in Kerala.

Crotalaria barbata : This legume is reported from Nilgiris, Anamalai and Siruvani in Tamil Nadu and from Munnar in Kerala. It is estimated that there is at least 50% decline in the population of this species in the last 20 years, due to the reasons given above. Mature individuals of this species in all the localities we know are not more than 250 in number. So we conclude that this taxon is Endangered in its wild habitat.

Anaphyllum wightii : This is a rare medicinal plant belonging to the family Araceae. The roots are widely used by Kani tribes of Kerala against snake bite. This species is now threatened due to over-exploitation and habitat loss. The area of occupancy of this species is less than 2,000 km^2 and mature individuals in any locality are much less than 1000 individuals. So this species qualifies for the Vulnerable category.

Julostylis polyandra : This is a recently described taxon collected from Goodrical R.F., Pathanamthitta, Kerala. It was later reported from different parts of Kerala in many numbers. There are large numbers of populations of this species observed in Ponmudi Hills, Neyyar Dam area, and Kakki Hills. This species does not currently qualify under any of the criteria given for Critically Endangered, Endangered or Vulnerable but is considered as Conservation Dependent.

Trends of threat

The family Fabaceae ranks first in threatened category with 12 species in which 3 are Critically Endangered, 5 Endangered and 3 species are Vulnerable. Only one species, *Cynometra travancorica* is in the Conservation Dependent category. The species *Crotalaria clarkei*, *Derris thothathrii* and *Smithia venkobarowii* are the ones in Critically Endangered category. The species like *Indigofera constricta*, *Crotalaria barbata*, and *C.speciosa* are considered as Endangered. The family Rubiaceae stands second with 6 spp. in 5 genera of which only *Hedyotis ramarowii* is Critically Endangered and 2 (*Hedyotis membranacea*, and *Morinda reticulata*) are Endangered and 2 (*Mycetia acuminata*, and *Pleiocraterium verticillare*) are Vulnerable and one (*Ophiorrhiza eriantha*) is in Conservation Dependent category. This is followed by Apocynaceae with 4 species in 4 genera in which one (*Rauvolfia micrantha*) is Critical and the other 3 (*Chilocarpus atrovirense*, *Kamettia caryophyllata* and *Strophanthus wightianus*) are Endangered. The families Annonaceae, and Anacardiaceae are represented by 3 species each. In Annonaceae 2 species, *Sageraea grandiflora* and *Goniothalamus rhyncantherus* are Critically Endangered. In Ancardiaceae

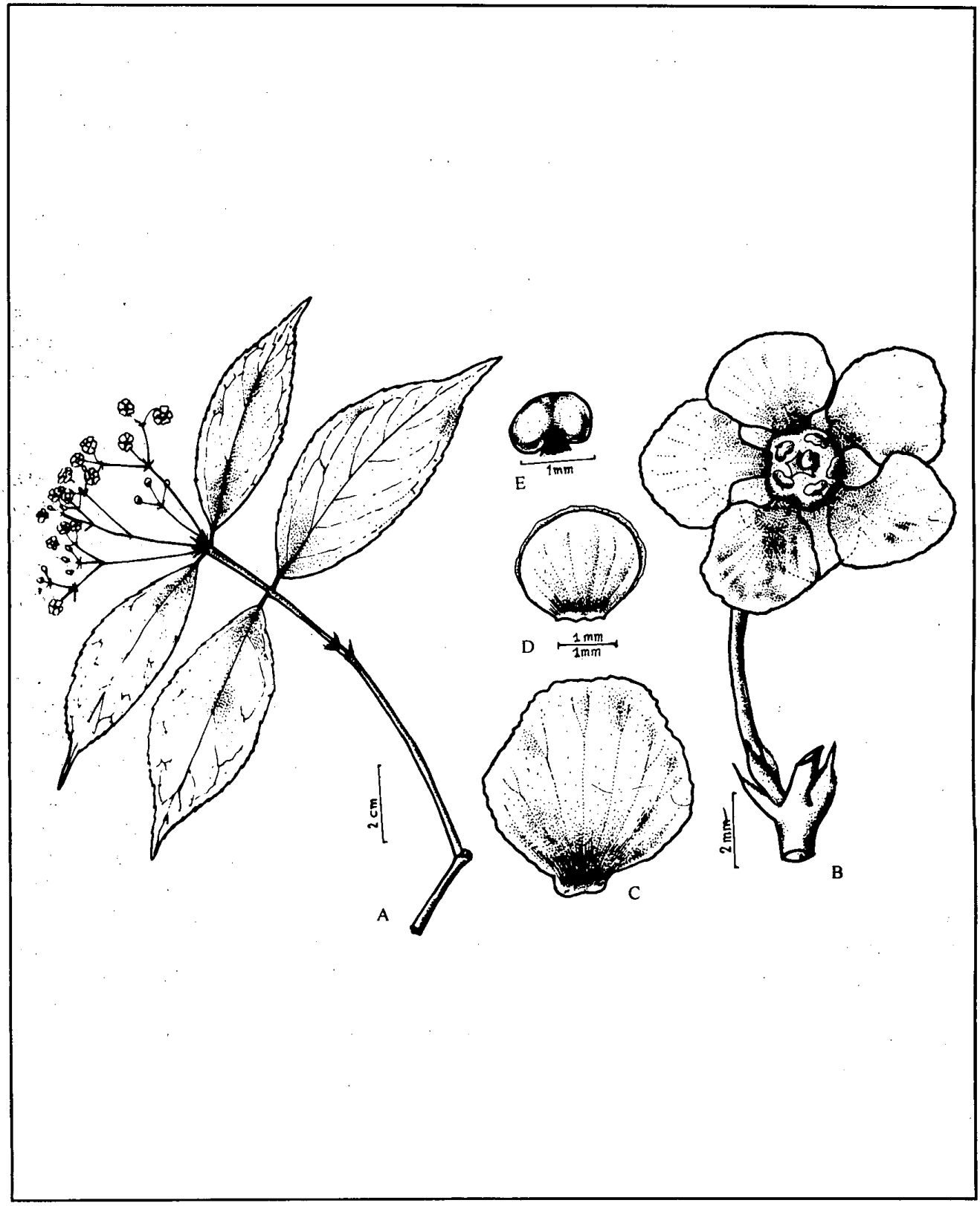
Nothopegia aureo-fulva and *N.beddomei* are the Critical ones. All other families are represented by less than 3 species each.

The geographic area of occupancy of these species is also analysed in detail. For this we have assumed the logic that the minimum area one can mark on a standard toposheet is 1mm which is 250 m (scale:1= 250000) which is roughly 6.25 ha. So if a species is known only from a single locality, its minimum area of occupancy would be 6.25 ha. Even if we consider there are 10 such localities for a given species, the area of occurrence will be only 62.5 ha, which is not sufficient for the survival of most of the species. The species viz., *Sageraea grandiflora*, *Euonymus serratifolius*, *Pogostemon travancoricus*, *Thottea dinghovii*, *Didymocarpus macrostachya* are known only from single localities. Of all these species, there are less than 50 mature individuals in their known localities. The species *Euonymus serratifolius* (Fig.2.2), of family Celastraceae which was located in Gudalur forest, Tamil Nadu for the first time after the type collection in 1882, is represented by only 2 individuals in that locality.

The physiognomic distribution of these families shows that 17 spp. are trees, 15 are shrubs, 24 are herbs and 19 are climbers. Almost all the climbers are herbaceous except *Strophanthus wightianus*, *Chilocarpus atrovirens* and *Kamettia caryophyllata*. This shows that herbaceous species are more threat-prone than others amongst this sample of species studied. The herbaceous annuals like *Eria albiflora*, *Didymocarpus macrostachya*, *Exacum courtallense* var. *laxiflorum*, *Dimeria kurumthotticalana* are at extremely high risk of extinction.

For assessing extinction threats, we need detailed data on threatend taxa based on recent census or population monitoring or from general field studies. Unfortunately we do not have sufficient data on the rare and threatend plants at the local level, based on recent field studies or by population monitoring. To solve this problem, intensive field survey is required to find the actual status of presumably threatened species . The studies should lead to a well-documented database on these species at the regional or local level. In this context MSSRF has initiated a database on threatened plants of Tamil Nadu and Kerala states, based primarly on field observations. This database is known as RAPID (Rare Angiosperm Plant Information Database). This database should lead to the publication of information on rare and endangered plants of the Western Ghats. We are also collaborating with Organisations like Kerala Forest Research Institute, Tropical Botanic Garden & Research Institute, Tamil Nadu Forest Department and several NGO groups.

Figure 2.2 : *Euonymus serratifolius* Bedd.,
A. Twig; B. Flower; C. Petal; D. Sepal; E. Stamen



Micropropagation techniques in saving endangered plant species

Protection of endangered plants, including those listed in the Red Data Book, plants of economic importance and mangroves, is being carried out at both the field level and using micropropagation techniques.

Micropropagation has been carried out using different approaches like axillary bud culture, meristem culture, callus culture, and somatic embryogenesis.

Detailed and complete protocols for the micropropagation of the endangered and endemic plant species including *Ceropegia jainii*, *Piper barberi*, *Crotalaria longipes*, *Hydrocotyle conferta* and *Syzygium travancoricum* have been developed. A complete list of plants under study is given in Table 2.5.

Table 2.5 : A list of plants under various stages of micropropagation at the MSSRF

No.	Plant species	Level of success in micropropagation
	Red Data Book Plants	
1.	*Ceropegia jainii*	Micropropagated plants in experimental plots
2.	*Crotalaria longipes*	Adventitous shoot multiplication achieved
3.	*Freria indica*	Callus culture established
4.	*Hydrocotyle conferta*	Complete protcol for micropropagation developed
5.	*Piper barberi*	Micropropagated plants in the nursery stage
6.	*Syzygium travancoricum*	Complete protocol for micropropagation developed
	Plants of economic importance	
7.	*Aristolochia indica*	Micropropagated plants established in green house
8.	*Aristolochia krisagathra*	Micropropagated plants established in green house
9.	*Caesaria rubescens*	Micropropagated plants established in green house
10.	*Ceropegia bulbosa* var. *bulbosa*	Micropropagated plants established in green house
11.	*Ceropegia bulbosa* var. *lushii*	Micropropagated plants established in green house
12.	*Hemidesmus indicus*	Micropropagated plants established in green house
13.	*Holostemma ada-kodien*	Complete protocol for micropropagation developed
14.	*Myxopyrum serratulum*	Micropropagated plants established in green house
15.	*Piper longum*	Micropropagated plants established in green house
16.	*Polyalthia suberosa*	Shoot multiplication achieved

Table 2.5 (contd.)

17.	*Rauvolfia micrantha*	Micropropagated plants established in green house
18.	*Rauvolfia tetraphylla*	Micropropagated plants established in green house
19.	*Tinospora cordifolia*	Micropropagated plants established in green house
20.	*Tylophora indica*	Micropropagated plants established in green house
21.	*Uraria picta*	Micropropagated plants established in green house
22.	*Porteresia coarctata*	Nodal segments and anther culture being attempted
	Mangrove Plants	
23.	*Acanthus ilicifolius*	Shoot multiplication achieved
24.	*Avicennia marina*	Protcol for micropropagation established but needs refining
25.	*Avicennia officinalis*	Protcol for micropropagation established but needs refining
26.	*Excoecaria agallocha*	Protcol for micropropagation established but needs refining
27.	*Heretiera fomes*	Axillary bud break achieved and callus induced
28.	*Rhizophora lamarckii*	Callus cultures established
29.	*Sesuvium portulacastrum*	Micropropagated plants established in green house
30.	*Xylocarpus granatum*	Callus cultures established

Ceropegia jainii a Red Data Book plant collected from Maharashtra, was one of the first successfully micropropagated plants to be introduced into the experimental plots at the Foundation. Successful protocols have been developed for micropropagating this species, using nodal segments. Multiple shoot production, regeneration from stem callus via somatic embryogenesis and rooting, both *in vitro* and *ex vitro* have been possible. After hardening, these plants were transferred into the experimental plots. The establishment and survival rates are being monitored.

Amongst the other plants listed in the Red Data Books, *Piper barberi* has been micropropagated using shoot tip cultures. Multiple shoot production has been achieved, but it has been difficult to harden the plantlets. Standardisation of the hardening methodology is underway. Protocol for multiple shoot production and regeneration from calli has been achieved in *Crotalaria longipes*. *Syzygium travancoricum* is a tree species endemic to Western Ghats and is listed as an endangered plant species. Reconfirmation of protocol to establish multiple shoot production is underway. Protocol for micropropagation has been standardised in *Hydrocotyle conferta*, a plant seen in high altitudes of the Western Ghats.

All the plant species in which micropropagation protocols have been established are being tested for their genetic stability. Comparative molecular analysis using the marker system of RAPDs are being applied to compare the genetic integrity of the micropropagated plants with those of the parents from which the explants were derived. Studies relating to aspects of reproductive biology, ecology to ascertain the reasons as to why these species have become endangered is underway. Several populations, when available, are being collected and experiments relating to their ability to micropropagate and understand the genetic divergence between such populations is currently being undertaken as the second phase of this research programme. This is to facilitate the authentication of whether lack of diversity is the reason for the rate of endangered status. All the results are compared in the light of their ecological characters also.

Sub-Programme Area 206
Protecting economically useful and medicinal plants

Micropropagation studies

Conservation of economically useful plants and medicinal plants is being attempted, using micropropagation. Some of the plants that are being studied are *Rauvolfia micrantha, R. tetraphylla, Tylophora indica, Holostemma ada-kodien, Casearia rubescense, Uraria picta, Hemidesmus indicus* and *Porteresia coarctata.*

Rauvolfia micrantha and *R. tetraphylla,* relatives of the sarpagandha plant *R. serpentina*, were collected from the wild. Multiple shoot production was achieved and the rooting of the plants was observed both *in vitro* and *ex vitro*. The plants have been hardened and are now ready for transfer into the field. *Tylophora indica* is an important medicinal plant. Somatic embryogenesis was possible through leaf callus. The hardened plants are to be transferred to the field. *Holostemma ada-kodien* is a threatened species distributed in Coimbatore, Madurai, Nilgiris and Tirunelveli. Nodal explants were used to achieve multiple shoot production and the plantlets are now in the mist propagation chamber for hardening. Another endemic species *Casearia rubescense*, has been successfully transferred for hardening after multiple shoot production was achieved.

Uraria picta, a medicinal legume distributed locally in the Himalayas and south peninsular India has been micropropagated using axillary buds. After hardening, the plants have been transferred into the green house for acclimatisation. These plants will soon be re-introduced into the natural habitats. The other medicinal plants of South India such as *Hemidesmus indicus* have been successfully multiplied by multiple shoot production using nodal explants.

Porteresia coarctata, a wild relative of rice growing in brackish waters is the only species of rice that is tolerant to salinity and submergence. Micropropagation of this species using nodal cuttings and anthers is underway to save this species that is fast disappearing from the Indian subcontinent.

Genetic characterisation of plants of economic importance

Amongst species of economic importance, *Tylophora indica*, a medicinal plant, was selected for detailed investigation. Other species being investigated are *Rauvolfia serpentina*, *R. tetraphylla*, *R. micrantha*, *Piper longum*, *Uraria picta*, *Aristolochia* spp. Protocols for obtaining quality DNA have been developed from these species.

In *Tylophora indica*, a total number of 40 plants belonging to five distinct populations were analysed, using 18 random primers for both inter-and intrapopulation diversity. The results clearly point out to the narrow genetic base in the species and low genetic differentiation at interpopulation level. The RAPD profiles of 21 genotypes representing three populations using a random decamer primer are given in Plate. These populations were analysed using 6 isoenzymes. Both intra and interpopulation differences have been worked out in the species using standard statistical methods. Preliminary results obtained for other species are detailed in Table 2.6.

Table 2.6 : RAPD analysis in species of economic importance

Species	No. of spp./pop.	No. of plants	No. of primers	No. of amplification products	
				Total	Polymorphic
Piper	2	3	10	46	31
Tylophora indica	5	40	18	148	35
Piper longum	IVR	10	9	69	42
Rauvolfia	4	6	10	41	32

IVR : *in vitro* regenerants

Genomic clones have been developed as per the methods described for the mangrove species from *Piper longum* and *Tylophora indica* and shall be used for the ongoing RFLP studies in this species.

Analysis of genetic stability in micropropagated plants

In vitro cultural conditions are known to induce variation in the genetic makeup of a species. As the major objective of utilizing micropropagation methods is to

reintroduce the *in vitro* raised plants to their original habitats, it is necessary to study the genetic stability/variability among the micropropagated plants prior to their reintroduction. Experiments were initiated in *Piper longum* where the first batch of the micropropagated plants are being maintained in the greenhouse at the Foundation ready for field transfer. We have undertaken RAPD analysis in 20 micropropagated plants of *Piper longum* and compared the observed profile with that of the mother plant. In the Plate, the RAPD profiles in the micropropagated and the mother plants using a random 10-mer primer are given. Studies on the other *in vitro* regenerants are underway.

Sub-Programme Area 207
Protecting Mangrove Plants

Genetic diversity studies

A number of mangrove species (*Acanthus ilicifolius, Excoecaria agallocha, Avicennia marina, A. officinalis, A. alba, Heretiera fomes, Xylocarpus granatum, Lumnitzera racemosa, Bruguiera cylindrica, Ceriops decandra, Aegiceras corniculatus*) were analysed for the assessment of nature and extent of intra- and inter- population genetic diversity. Samples were collected from 6-8 geographically distinct populations, both from the eastern and western coast of India. From each population at least 10 individuals were selected for the present study.

Cytological study

Chromosomes are the bearers of hereditary units and direct the growth, development and metabolism in an organism. Substantial information on the phylogeny and species relationships has been obtained in a number of plant and animal systems based on the analysis of the chromosomes. However, the available information on the chromosome analysis in mangrove species is scanty and no concerted efforts have been made to study the chromosome structure and evolutionary divergence in this group of plant species. It is in this context that we have initiated cytological analysis with an overall objective of preparing the chromosome atlas for mangrove species in India, that amount to about 60 per cent of the world's mangrove species. So far, somatic chromosome numbers have been determined for six mangrove species (*Avicennia marina*, 2n=58; *Rhizophora mucronata*, 2n=36; *Ceriops decandra*, 2n=36; *Acanthus ilicifolius*, 2n=48, *Sesuvium portulacastrum*, 2n=48; *Excoecaria agallocha*, 2n=140). Studies on other species are in progress. The Plate on the next page shows the mitotic metaphase complement in the somatic cells of *Acanthus ilicifolius*.

Probe preparation and characterization

We followed two approaches for generating probes for RFLP studies. The first was through PCR amplifications. Here prominent amplified fragments of varying sizes revealed through individual primers were eluted and used as templates for further amplification using the same primer. The amplified and eluted fragments were used as probes for RFLP analysis. The second approach was to develop specific probes by constructing genomic libraries. DNA samples from different species were digested to completion either with *Pst I* or *EcoRI*. After purification with phenol-chloroform the DNA fragments were ligated into *Pst I* or *EcoRI* digested and phosphatased pUC 18 or pUC 19 plasmid vector and transformed into *E. coli* (DH5 alpha) strain by standard procedure. Recombinant clones were selected on IPTG - X gal in ampicillin plates. Plasmids were isolated from the clones which had inserts (recombinant clones) in them by mini-prep alkaline lysis method. Recombinant plasmids were digested with either *Pst I* or *EcoRI*, as the case may be, and the inserts eluted from the gels were used as probes. Inserts of a few clones developed through genomic libraries along with the size markers are shown in the Plate. More than 500 genomic clones, with an overall size range from 0.4 to 4.6 kb, have been developed from five mangrove species so far.

RFLP studies

Total DNA from different species was digested to completion with a number of restriction enzymes (*Eco RI, Eco RV, Hind III, Pst I, Bam HI, Sac I, Sma I*). In each, about 8-10µg of genomic DNA was subjected to overnight digestion at 37°C with ten fold excess of restriction enzymes. The digested samples were electrophoresed on 1% agarose gel. After electrophoresis, the DNA was transferred to Hybond N+ membrane by capillary transfer method. Probe labelling was done using enhanced chemiluminescence (ECL. ver II, Amersham) Kit. Either the whole plasmids with inserts or the eluted inserts were labelled with fluorescein - 11 - dUTP as per the manufacturer's instruction. After hybridization, blocking, antibody and stringency washes, signals were detected on autoradiographic films. Table 2.8 gives the details of the RFLP analysis carried out in three mangrove species both at intra- and inter-population levels. The inter-population RFLP detected in *Acanthus ilicifolius* appears in Plate. Also, fingerprinting of different mangrove species using artificial minisatellite probing is underway.

Table 2.8 : RFLP studies in mangroves

Species	No. of populations analysed	No. of plants	No. of probes	No. of enzymes	No. RFLP Loci	
					Total	Polymorphic
Avicennia marina	4	32	5	3	48	7
A. officinalis	1	10	3	3	32	2
Excoecaria agallocha	1	5	2	3	22	6
	6	12	3	3	26	12
Lumnitzera racemosa	1	10	4	3	32	6
Acanthus ilicifolius	1	6	5	4	64	3
Total	18	16	5	4	216	152

Micropropagation of mangroves

Micropropagation of mangroves has been one of the major objectives in the conservation of coastal ecosystem and diversity. Their woody nature and the presence of enormous amounts of secondary metabolites make it difficult to establish successful protocols in most mangrove species. Success has been achieved in *Sesuvium portulacastrum* a herbaceous mangrove associate and *Acanthus ilicifolius* using shoot tip and axillary bud cultures. Protocols have been standardised for *Excoecaria agallocha* and *Avicennia marina* for the rooting of shoots obtained from nodal explants. However the rate of multiplication is very poor. Further experiments are underway to establish more workable protocols in these and other species of mangrove plants.

Collection, conservation and utilization of salt tolerant rice and its wild relatives : Genetic analysis of *Porteresia coarctata*

Porteresia coarctata (= *Oryza coarctata*; 2n= 48) is the only relative of rice that has inherited tolerance to salinity and submergence. This species is distributed along the coastal areas of India, Bangladesh and Pakistan. There has been very little information available about the physiology, biochemistry and genetics of this species. Studies on the genetic characterisation of the species are being carried out under a Darwin Initiative (Ministry of Environment, UK) programme. Collection of this species from different areas to maintain a wide genetic stock and to relate them with their salt tolerant nature using biochemical and molecular basis are being attempted.

We are now holding one of the largest collections (50 populations of which 30 are distinct ecotypes) of *Porteresia coarctata* collected from various sites in India. Studies relating to the physiological, biochemical and genetic characterisation of 30 accessions of *Porteresia coarctata* have been completed using isozymes, RAPDs, microsatellites and anchored minisatellites. Distinct ecotypes based on the morphological markers have been established in this species and are related to their areas of distribution. Physiological screening for the levels of tolerance of different populations have been completed and 6 individual groups have been identified to possess increased levels of tolerance. Genetic distance and related analysis have been completed using SMC analysis. Work on understanding the cytological aspects relating to both mitosis and meiosis is being carried out. Meiotic behaviour of the chromosomes gave interesting patterns with single anthers showing all combinations of quadrivalent chromosomes, bivalents, bivalents and quadrivalents, univalents, bivalents and quadrivalents. Karyotyping is being standardised.

Work on comparative mapping using RFLPs and RAPD based characterisation will be undertaken. Studies relating morphological markers with biochemical markers are being undertaken. Micropropagation of the species using nodal segments has been successful but is to be standardised further.

Sub-Programme Area 208
Monitoring Ecosystem Health Using Bioindicators

Studies on the following are being carried out at Pichavaram to locate probable indicators of disturbances. They are (1) microbial (bacterial and fungal) diversity, (2) soil enzymes as an indicator of soil health, (3) lichens for air quality (refer last annual report) and (4) benthic fauna for aquatic monitoring. The whole area was divided into three zones on the basis of vegetation density-Periaguda (densely vegetated); Nedu odum (partially degraded); and Kudianthittu (almost degraded).

Microbial Indicators

Bimonthly sampling was done to study the distribution of bacterial guilds in relation to functional aspects (Table 2.9). Almost all the strains (culturable) have been isolated and are being maintained. They have been classified to the generic level (Table 2.10). Some of these strains have been tested individually for their responses to heavy metals. The effect of heavy metal Cd, Cr, Pb, Hg, Cu, and Zn, potential hazards have been studied by creating *ex situ* microcosms. Interesting results have been observed for mercury.

Table 2.9 : Distribution of various bacterial guilds in the different zones at Pichavaram (cfu x 10^4 per mg soil)

Seasons	Zone	Guilds					
		THC	Ammonifiers	Nitrifiers	Sulphur	Iron	Phosphorous
Summer	P	320	140	110	18	3	7
	N	223	110	96	10	2	3
	K	43	13	43	3	nd	nd
Monsoon	P	373	156	114	6	4	3
	N	261	143	103	4	3	2
	K	204	27	26	nd	1	1
Post Monsoon	P	170	83	76	14	6	3
	N	101	64	53	8	3	2
	K	60	20	13	1	1	2

P- Periaguda; N- Nedu odum; K- Kudianthittu ; THC- total heterotrophic count ; Cfu- colony forming units ; nd- not determined.

Table 2.10 : Major Genera found among the bacterial isolates

No.	Genera	Occurrence
1	Pseudomonads	+++
2	Achromobacter	+++
3	Vibrio	++
4	Bacillus	+
5	Arthrobacter	+
6	Flavobacterium	+
7	Corynebacterium	+
8	Micrococcus	+
9	Morexella	+

+++ dominant ++ moderate + scarce

The mangrove ecosystem, being intertidal in nature, often faces various stresses from the marine environment also. Consequently, for monitoring the marine

conditions, the microbial populations involved in the decomposition of mangrove litter (microbial guilds) have been studied and an attempt has been made to use the fungal guild involved in cellulose degradation. Since this is an important ecosystem function, this guild can be used for monitoring stresses from marine environment. Table 2.11 gives the details of the total number of fungal species and their occurrence percent over three seasons, in three regions of Pichavaram mangroves. It also gives an idea of the cellulose degrading capability of these fungi assayed based on their ability to decompose carboxy methyl cellulose. In general the cellulase activity of litter samples has been consistently low at Kudianthittu while it is comparable between the other two zones.

Table 2.11 : Mycoflora of mangrove litter (intertidal) at Pichavaram

			Percent occurrence of fungal species												Total no. of colonies
		Area	1	2	3	4	5	6	7	8	9	10	11	12	
		P	10	-	<5	74	5	-	-	-	-	5	-	-	4050
S	Summer	N	5	<5	10	64	7	<5	<5	<5	-	6	5	-	1250
E		K	<5	-	-	15	9	-	-	-	<5	10	6	57	371
A		P	15	5	5	70	<5	-	-	-	-	<5	-	-	9266
S	Monsoon	N	5	<5	<5	60	8	10	<5	-	-	<5	<5	10	789
O		K	5	<5	10	<5	20	<5	-	<5	5	10	20	25	351
N		P	<5	<5	-	49	<5	<5	<5	-	<5	40	<5	-	2266
	Post Monsoon	N	-	-	-	56	<5	-	-	-	<5	26	7	5	700
		K	-	-	-	-	25	<5	-	<5	<5	13	-	55	208
	*Cellulase activity			0.193	0.613	0.653	1.000	0.908	0.259	0.389	0.231	0.410	0.532	0.840	0.614

P - Periaguda; N - Nedu odum; K - Kudianthittu

1 - *Aspergillus flavus;* 2 - *A. fumigatus;* 3 - *A. nidulans;* 4 - *A. niger;* 5 - *A. terreus;* 6 - *Chaetomium globosum* 7 - *Chaetomium* sp.; 8 - *Curvularia lunata;* 9 - *Fusarium* sp.; 10 - *Penicillium citrinum;* 11 - *P. oxalicum;* 12 - *Trichoderma viride*

* Activity (OD ml^{-1} culture filtrate) based on carboxy methyl cellulose degradation

This fungal guild along with the litter when treated with $HgCl_2$ (as heavy metal) and plated showed a change in the community structure. *Aspergillus niger* which is usually dominant in Periaguda region under natural conditions was replaced by *A. terreus* at 100 ppm concentration. In other regions there was a drastic decrease in the fungal colonies at 100 ppm concentration. This observation can be used as an indication of Hg^{++} toxicity from marine environment. Similar studies with other heavy metals which are of potential hazard are underway. Studies with the pesticide endosulfan gave varied results.

The above study will be extended to a selected rainforest ecosystem at Siruvani Hills in the Nilgiri Biosphere Reserve.

Benthic fishes as bioindicators

As a continuation of the study on selected groups of benthic fishes to be used as estuarine bioindicators, data have been collected from Pichavaram on the methods by which different species belonging to the relevant groups (eg. eels, catfish) are caught. This information is essential to compare the populations of the benthic fish groups in different sites since all the methods are not equally efficient in sampling the different species. The methods which have been used are cast net, long line with clam as bait, long line with prawn as bait and by searching and catching certian species with bare hands from the mud (by the Vedar community). The study, which commenced in August 1994, was continued during regular field visits upto December 1994. The results are given in Table 2.12 on the reverse side.

Table 2.12 : Benthic fishes caught by the different methods

Local Name	Binomial	Method			
		CN	LL-C	BH	LL-P
Mannulli	*Pisodonophis boro*		+	+	
Vilangu	*Anguilla bicolor bicolor*			(+)	
Kedutha/Irungkeluti	*Plotosus canius*			+	+
Munjikeluthi	*Arius subrostratus*	(+)			
Venkeluthi	*Arius* sp.	+	+		+
Kattakeluthi	*Mystus gulio*	(+)			
Udupathy-1	*Platycephalus* sp.	(+)			
Udupathy	*Platycephalus indicus*	(+)			
K. Kalluzha	*Glossogobius biocellatus*	+		+	
Uluvai/Kalluzha	*Glossogobius giuris*	+		+	
Poochimaetti	*Oxyurichthys* spp.	(+)			
Vellamaetti	*Oxyurichthys* spp.	+		+	
Vellaparavatta	Oxyurichthys spp.			(+)	
Maetti	*Oxyurichthys* spp.	+		+	
Paravatta	*Oxyurichthys* spp.			(+)	
Yelloparavatta	*Acentrogobius* spp.			(+)	
Pullimaetti	*Acentrogobius* spp.	+		+	
Pullimetti	*Acentrogobius* spp.			(+)	
Paravatta	*Acentrogobius* spp.			(+)	
Paravatta	*Boleophthalmus boddarti*			(+)	
Sivappumaeti	*Gobioid* sp.	+		+	
Maetti New	*Gobioid* sp.	(+)			
Maetti	*Gobioid* sp.			(+)	
Paravatta	*Gobioid* sp.			(+)	
———	*Callogobius* sp.			(+)	
Mottakalluzha	*Butis* sp.	(+)			
Naakumeen	*Cynoglossus punticeps*	+		+	
Manathirukkai	Sting ray	(+)			
Kezhanga	*Silago sihama*	(+)			
annimeen	*Promicrops lancoelatus*			(+)	

+ = Species caught by the given method (+) = Species unique to method

CN = Cast net; LL-C = Long line with clam bait; BH = By hand; LL-P = Long line with prawn bait

Programme Area 300

Sustainable Agriculture and Rural Livelihood Security

Contemporary development pathways are associated with three distressing features. These are: increasing rich-poor divide in per capita income, damage to the basic life support systems of land, water, forests, biodiversity and the atmosphere and jobless economic growth. Such pathways of development are both environmentally destructive and socially disruptive. There is hence a search today for an alternative developmental paradigm which will foster job-led economic growth rooted in the principles of ecology, equity, economics, energy efficiency and employment generation. The biovillage model of rural development described in this report provides one such alternative, since it pays concurrent and integrated attention to natural resources conservation, productivity improvement and poverty eradication. The model is based on the identification and promotion of market-driven small scale enterprises, which lend themselves to decentralised production supported by a few key centralised services. Economic viability is essential for replicability, while environmental soundness and gender equity are essential for ecological and social sustainability. Integrating factors relating to production efficiency, economic viability, environmental soundness and equity, is not an easy task at the field level. Often, undesirable trade-offs are involved. It requires a process of learning through doing. Such doing, to be effective and meaningful, has to be done jointly with rural women and men. Thus, the biovillage project is cast on a participatory action research mode with resource-poor farm families, scientists and financial institutions working and learning together.

The work on the field testing of integrated pest management (IPM) procedures in cotton, groundnut and soyabean made good progress. A "green cotton" movement based on IPM techniques was initiated in the Theni region of Tamil Nadu in collaboration with a leading textile mill. The eco-horticulture programme was strengthened in the Chengai-MGR District of Tamil Nadu with the help of the change agents trained under this programme. The Integrated Intensive

Farming Systems Programme resulted in two detailed case studies on farmers' practices which can help to promote the intensification and diversification of farming systems on an ecologically sustainable and economically profitable basis. This study has now been enlarged so as to build up a multimedia database on the ecological farmers of India. The results of these studies are given in this section.

Sub-Programme Area 301
Biovillages

The biovillage programme was initiated in 1991 in Kizhur, Sivaranthakam and Pillayarkuppam villages of Pondicherry, to promote a new development paradigm which addresses concurrently the twin development concerns of the present times : rural poverty and the degradation of the natural resource base, the former through technological empowerment of the resource poor and the latter through integrated resource management systems including recycling and value addition. The pilot biovillage programme implemented until last year with financial support from IFAD and the Hunger Project is being enlarged during 1995 with support from UNDP to cover 19 villages.

Current status of the project

The IFAD support for two years (1993-95) ended in March'95. The emphasis so far has been on testing and adaptation of eco-technologies and training with UNDP support. The project covers two clusters of villages, the first cluster consisting of twelve villages and the second of seven villages. The nineteen villages come under twelve revenue villages. The following activities have been initiated:

- Participatory socio-economic baseline survey.
- Development of an action research programme for promoting sustainable agriculture and rural development.
- Identification and location of a Biocentre designed to provide a few key centralised services to support efficient decentralised production.

Through technological empowerment, the resource poor are accessed with new market-oriented skills which strengthen their livelihood security. Towards this end, two kinds of activity were undertaken. On-farm research and demonstration help the rural poor to understand new trends in agricultural production. At the same time enterprises are encouraged to enhance the security of their livelihoods.

I. On-Farm research and demonstrations

Seed production

Pure Seed Production : With the objective of providing pure seeds of new rice varieties to the farmers, a trial was carried out with the varieties ADT 36, ADT 37, ASD 18, IR 64 and PY 3 in an area of 0.9 hectare during *navarai* season. ADT 36 and ADT 37 produced a paddy yield of 4050 and 4680 kg/ha respectively, while ASD 18, IR 64 and PY 3 yielded 4375, 4000 and 4950 kg/ha respectively.

Training : Training programmes in seed technology were arranged for the farmers during December '94. The farmers were taken to six seed farms located in the Thanjavur and Nagai-Quaide-Milleth districts. This helped to promote farmer-farmer exchange of experience and of the eight farmers trained, two are multiplying seeds of the rice variety ADT 42 in an area of 0.4 hectare.

Certified seed production : This programme was started both for spreading awareness of the value of good seed and for adding value to the time of women by converting them into seed producers. The Department of Agriculture provides buy-back arrangement for the procurement of certified seeds. They pay Rs.6/kg of seed as against Rs.4/kg in the local market. Regular inspection was done by the officer in- charge of the seed certification programme. The trial was carried out during *navarai* '94 season in an area of 1.5 ha in all the three villages, and during *kuruvai* '94 season in an area of 0.4 ha in Pillayarkuppam village with ADT 37 and IR36 varieties respectively.

Hybrid rice seed production : Production of hybrid rice seeds continued in the second year. The 'CMS' (Cytoplasmic Male Sterile) lines IR 58025A and IR 62829A were multiplied. The best restorers for the two 'CMS' lines were identified based on the F_1 performance in test cross nursery. The hybrid seed production by crossing IR 62829A and IR 10198-66-2 was taken up in an area of 1000 sqm during *navarai* '95. Apart from evolving hybrid rice seeds, five hybrids from Pioneer Seed Company namely PHB31, PHB71, HBD6, HBD7, and HBD8 were tested during *samba* season for adaptability. The results showed that HBD7 followed by HBD6 had the highest yield of 8000 kg and 7600 kg per hectare respectively. Hybrid rice seeds of PR 92016 from the Pro-Agro company are also being tested in Pillayarkuppam village in an area of 0.2 ha, during the *navarai* season.

Evaluating the suitability of biofertilisers and green manures

Azolla : An analysis of data from two years of Adaptive Research trials (25 trials) with 15 participants revealed that (a) *Azolla* application resulted in an increase in net profit (Rs. 1249/ha) which was partly due to the improvement in

yield (average 6%) and partly savings (25%) in nitrogen fertiliser used (38 kg of nitrogen/ha). The performance of *Azolla* is not subjected to microenvironmental conditions when the crop is grown under irrigated conditions.

Since the maintenance of *Azolla* in the nursery plots throughout the year was found to be difficult, 20 cement tubs of the size of 100 cm in diameter and 60 cm in depth were installed to maintain the *Azolla* inoculum so that interested farmers can collect the *Azolla* from the tubs to raise the nursery. In Sivaranthakam and Kizhur villages, *Azolla* inoculum was available in the water channels where it grew luxuriously. The participants in both the villages collected *Azolla* when required periodically from the channels.

Sometimes in the nursery plot and the cement tubs, *Azolla* was completely devastated by snails and other grazers. This was controlled by the application of Furadon. Prevalence of high temperature (35-38°C) during May-July was not found to be conducive for cultivating *Azolla*.

Sesbania rostrata : Trials were carried out in the farmers' fields, one in each of Pillayarkuppam and Sivaranthakam villages, during *navarai* '94 season. In the first crop, the increase in yield and net income were 6% and 16% respectively; in the residual crop (*kuruvai* '94), the respective figures were 9% and 22%. The saving of nitrogenous fertilisers was 25% (38 kg/ha nitrogen) and 50%.

Vermicompost : A vermicompost research and demonstration centre was started in Pillayarkuppam village to assess the feasibility of organic fertilizer. Different organic wastes like slaughter wastes from poultry and fish, groundnut shell, bagasse and pressmud were gathered. The activity commenced from September'94, on a small plot of land (15 cents or 600 sq.m), under a thatched shed of area 20 x 3 meters. Pits (14 No.) of size 1.8 m x 0.9 m x 0.45 m were dug for composting the different wastes. The actual composting process started in the month of December'94. Studies on the nutrient content of different wastes, efficacy of vermiwash on different crops and culturing different species of earthworms are in progress at this centre.

During this year, the technology of producing vermicompost from the used-up straw from mushroom production was perfected. In addition to improving the general sanitary condition around the households, compost production also brought supplementary income (Rs.400/annum) to the participants.

A stall for the sale of vermicompost was put up at the flowershow organised by the Government of Pondicherry in February '95. It served to educate the public on the potentials and opportunties of vermicomposting. The mushroom participants sold the vermicompost.

Environmental sanitation

The 5 single house model toilets constructed last year with the help of Sulabh International led to a demand for more toilets in Pillayarkuppam village. This year 15 more toilets in Pillayarkuppam, 5 toilets in Kizhur and 8 toilets in Sivaranthakam were constructed, with 30% contributions from the residents. The use and maintenance of these toilets are being monitored.

Two soak-pits were constructed in Pillayarkuppam for individual households to avoid the stagnation of sullage water on the road. This is a simple and effective method to dispose of waste water from the kitchen and bathing area.

While the toilets were being built, four masons from the village were trained in the construction of this particular model (two pit pour-flush) of toilet, to construct more toilets in the future, and to train others.

II. Enterprises for enhancing the security of livelihoods

Mushroom production by rural women

Mushroom production continued for the second year with 10 landless women from Kizhur participating, in addition to the first batch of 10 landless women from Sivaranthakam. The second batch of participants were initially trained by the participants of the first batch. They then underwent an intensive training programme on mushroom production at the Tamil Nadu Agricultural University, Coimbatore. Owing to space constraint, the 'uri' (hanging system) was adopted and it was observed that rat infestation was comparatively less. On-line production training for growing two batches of mushrooms was completed. Each participant produced 4-5 kgs of mushroom per month on an average, obtaining a net income of Rs.150/month. The mushrooms are presently being sold at Rs.40/kg in the market.

Group sericulture

The mulberry garden (0.4 ha) established in Gloria Land was severely attacked by powdery mildew (*Phyllactinia corylea*) resulting in leaf dropping when the leaves were ready for rearing. This garden was abandoned since other constraints like lack of irrigation water affected the growth adversely. In January '95, 0.20 ha of mulberry garden was started in the land of one of the farmers in Pillayarkuppam. About 6000 disease-free MR2 cuttings were planted at a spacing of 60x60 cm. A small nursery was maintained for gap filling. The participants were trained in the cultivation of mulberry. A credit management group was formed among the participants.

Goat rearing and fodder shrub based biofences

Ten landless women were identified for the goat rearing programme and they were organised into a group. To house the goats, thatched sheds were constructed in the backyard. Each participant was supplied with two female goats belonging to a local breed and for the group as a whole two bucks of improved breeds were supplied to upgrade the indigenous breeds. All the goats have been insured. The participants will each provide two female kids in the coming two years for distribution to additional participants. Despite protracted efforts and willingness on the part of the various agencies of the government concerned, it has not so far been possible to secure the public land identified in Pillayarkuppam for establishing the fodder plantation, because of the legal hurdles in leasing public land to non-governmental organisations.

In the meantime an alternative was explored. Fodder trees were planted along the fences of homesteads to provide fodder for stall fed rearing of goats.

Fodder banks for landless dairy farmers

A group of ten landless women were identified and formed into a group in Pillayarkuppam. They were linked to the two fodder banks established earlier to ensure regular supply of green fodder. A chaff cutter was installed for common use. These participants were brought into contact with the officials of the service area bank to avail of credit for procuring cows. The bank granted a medium term credit (5 years) amounting to Rs. 4,750. On an average, a good cow costs Rs. 6,000 including the premium for insurance cover (3 years). A revolving fund was created with the support of the Hunger Project to provide the balance amount required. The participants were given intensive training in the management of cows. Continuous veterinary support was provided with periodic check-up. Artificial insemination service is available through the Animal Husbandry Department. Five out of the ten cows bought have already conceived. Three cows have given birth, one to a male calf and two to female calves. Milk produced is marketed through the Milk Cooperative Society which has established a collection centre in the village. The participants were organised in the form of a thrift and credit group. The participants have so far repaid 25% of the bank loan. The service area bank has extended credit for the procurement of a second cow to ensure a regular source of income. The milk output per day averaged 6.6 litres of which 5.5 litres was sold and the rest was retained for household use.

Aquaculture in community ponds

The nine women participants in the aquaculture group in Kizhur village continued their work. The Fisheries Federation helped to stock the pond and in August 1994, 2500 fingerlings were stocked (Table 3.1).

Table 3.1 : Fish stock in the community pond

Fish Type	Quantity
Catla	400
Rohu	700
Mrigal	400
Silver carp	200
Grass carp	300
Common carp	500
Total	**2500**

In April'95 the first batch of harvest yielded a total of 104.5 kg of fish which produced a gross income of Rs. 3257 and a net income of Rs.2489. The marketing was carried out by the participants with the help of the Pondicherry Fishermen Co-operative Marketing Federation Ltd & Fish Farmers Development Agency. Fodder grasses grown on the sides of the pond yielded a net income of Rs.1200.

Broiler chicken production for small farmers

This continued in Pillayarkuppam, with the farmer opening a shop in a neighbouring village to increase his profit margin. The farmer has so far completed 8 batches of rearing getting an average net income of Rs.3000/batch of 100 birds.

Jasmine cultivation

The cultivation of jasmine flower was introduced in Sivaranthakam as an income generating activity for the women of landless and marginal farm households. Jasmine is a perennial bush and flowers 8-9 months in a year. The Pondicherry town provides a good market. The participants were trained in the various aspects of jasmine cultivation in the Farm Science Centre at Pondicherry and also by visits to other jasmine farms. Jasmine gardens established extend to 910 sq.m numbering 330 bushes. The jasmine growers have formed an association to organise marketing and to obtain credit and other inputs.

Since jasmine is a perennial crop and starts economic flowering only from the second year, several participants have gone in for an inter-cropping of jasmine with Crossandra flowers which provides a supplementary source of income.

Homestead nutrition garden

Both production and training continued for the participants who have developed nutrition gardens in the spaces available in the backyards of their houses. This has helped to enhance household nutrition security. A credit management group was organised with 12 members in Sivaranthakam. In the other two villages steps for the formation of groups have been initiated. The major constraint faced in this project is the lack of good quality seeds and planting material. It is proposed to organise a seed village to overcome this constraint.

Commercial vegetable production

The vegetable growers association formed last year was strengthened with 13 new members. A vegetable seed bank was established with the revolving fund to ensure the supply of good quality vegetable seeds. The marketing link up with PAPSCO was continued on the same terms and conditions as last year. The area under vegetables in the village grew from 0.2 to 2.43 hectares and production went up to 32 tonnes per year. The association sold vegetables worth over Rs.30,000 through PAPSCO, who also gave a dividend of Rs. 4000 to the producers, as the additional share of the profit. Experimental trials and demonstrations are being carried out in improved and hybrid vegetable varieties of chillies (K.2), tomato (CO.3), bhendi (Parbhani kranti and Hybrid NO.7) and brinjal (Palur.1 and Round.14). Each member of the vegetable growers association saved Rs.50 per month on an average.

Group organisation and management

Group action for ensuring cost effective supply of inputs, marketing of outputs, securing credit from financial institutions, building infrastructure facilities and institutionalising group action for identifying and initiating market-driven enterprises are essential in sustaining and replicating the activities initiated under the biovillage programme for the resource-poor. A group formation methodology in the participatory mode has been evolved during the course of implementing the various activities. The informal groups formed earlier to begin with have been formalised though they do not have a legal personality. So far 9 different enterprises-centred associations have been organised whose total membership

is 90 (Table 3.2). Apart from regular periodical meetings, elected participants are assuming leadership roles. All of them have taken up savings as an important activity.

Table 3.2 : Credit management groups in the biovillages

Name of the Association	No. of participants	Month and year of commencement	Average income/ month/ individual (Rs.)	Group savings as on May '95 (Rs.)
1. Mushroom Growers (Sivaranthakam)	11	Oct '93	150	2280
2. Mushroom Growers (Kizhur)	10	Oct '94	150	1430
3. Pisciculture (Kizhur)	10	Dec '93	150	180
4. Kitchen garden (Sivaranthakam)	10	Oct '94	50	770
5. Vegetable Growers (Pillayarkuppam)	10	Nov '94	-	1950
6. Dairy Association (Pillayarkuppam)	10	Jun '94	300	300
7. Goat rearing Association (Pillayarkuppam)	10	Nov '94	-	180
8. Jasmine Growers (Sivaranthakam)	9	May '94	-	812
9. Sericulture (Pillayarkuppam)	10	Oct '94	-	180

Marketing and support services

Producer-oriented marketing has been recognised as the most critical support service in sustaining the activities initiated under the biovillage programme. The market driven approach is pursued in determining the interventions which would help to improve the livelihood security of the resource poor. Market surveys were conducted to determine the demand and supply of mushrooms, fresh water fish, cocoons, vegetables, and broiler chicken in the Pondicherry region. Producer oriented market strategies were designed and prices fixed for these products. The strategies and prices fixed are reviewed periodically to bring about adjustments consistent with changes in the market. Market promotion activities were undertaken to expand the market for mushroom. Market information regarding these products is disseminated to the participants.

Community programmes

Dental camps were organised with the support of the Indian Bank, Pondicherry, in all the three villages. About 350 participants were screened and treated for dental problems.

Government programmes

As a follow up of the training programme, four participants purchased 'rattas' (spinning wheel) to start their own production units - 2 in Pillayarkuppam and one each in Sivaranthakam and Kizhur. To encourage these participants, the District Industries Centre (DIC), appointed them as trainers to train 5 women in each village. The monthly average net income for each of these participants was Rs.350-400 from the production centre. They earned an additional Rs.500 as stipend from the DIC training programme.

Biovillage project advisory committee meeting

The first project advisory committee (PAC) meeting was held in December'94. At this meeting the biovillage concept, the work done during the year 93-94, and the work plan for 1995 were reviewed under the chairmanship of the Development Commissioner of Pondicherry. Representatives from the UNDP, the Government of India, representatives of the Pondicherry Administration and scientists from the M.S. Swaminathan Research Foundation attended the review meeting. Areas requiring interventions and help were identified and responsibilities were assigned.

The work done so far under the biovillage project has proved to be an exciting adventure in participatory research and action, involving scientists and rural families as equal partners in the quest for integrating the principles of ecology, equity and economics in programmes aiming to enlarge sustainable livelihood opportunities. The lessons learned from the three villages so far would help to promote a self-sustaining and self-replicating model of poverty alleviation in the additional villages being covered under the UNDP supported project.

Sub-Programme Area 302
Biological Software and Sustainable Agriculture

Technology Assessment and Demonstration of Rice IPM (FARM — FAO/UNDP)

The term "biological software" is used to indicate a wide range of biological inputs which can help to replace chemical inputs in areas like pest management and soil fertility improvement. The programme on technology assessment and demonstration was implemented in Sriperumbudur taluk of Chengai MGR district during 1994-95. The project site comes under the coastal area of the north-eastern agroclimatic zone of Tamil Nadu. The programme offered scope for evaluation of various strategies for management of rice pests and diseases in wet, semi-dry and dry conditions.

The main objective of the project is the assessment of the potentials of new biotechnologies to contribute to the characterization, conservation and utilization of bio-diversity for the integrated management of rice pests and diseases. The emphasis was given mainly to the following aspects, *viz.*, resistant cultivars specific to the three cropping seasons and situations, cultural practices, pest and disease surveillance, use of plant products, conservation and utilization of natural enemies, pest avoidance and mechanical and behavioural methods of management in order to enhance environmental protection and sustainability.

The sites were located at Kuthambakkam (3-crop wet system), Irunkattukottai (1-crop dry system) and Beemanthangal (2-crop semidry and wet system). Technology demonstration and evaluation has been conducted during the *samba* and *navarai* seasons. During this period the physiographic conditions of the sites, socio-economic situations and levels of awareness and adoption of IPM technologies were studied. Cultural control practices including crop sanitation and water, nutrient and weed management were followed.

Pest and disease surveillance was conducted twice a week. The number of insects collected in 25 standard net sweeps were recorded. The rice yellow stem borer incidence was noted as deadhearts and white ears. Other pests and natural enemies were recorded *in situ*. The diseases generally recorded were blast, brownspot, sheathrot, sheath blight and bacterial leaf blight. The percent disease index and percentage incidence were worked out.

During *samba*, vector indexing was done for Rice Tungro Virus (RTV) identification. But the seedlings showed no symptom of RTV indicating that the insect vector was not viruliferous. During *navarai*, mechanical control of case worm was carried out in Beemanthangal. The field was irrigated fully, and a rice

straw rope was passed from one side to the other. The cases which were dropped in the water were collected and destroyed at the drainage end.

Biofertilizers and other organic manures were applied in the project sites, and the reduction in fertilizer nitrogen levels also led to reduced pest and disease incidence. During *samba* Azospirillum seedling root dip treatment and soil application were given, and during *navarai* Azospirillum seedling root dip was given by using five strains obtained from SPIC Science Foundation. Similarly neem cake and neem seed kernal powder were also applied. In these fields the pest and disease incidence was generally low when compared to adjacent non-IPM farmers' fields. Bund crops such as cowpea, soyabean and greengram were raised and this enhanced the population of natural enemies of pests.

Light traps and pheromone traps were set up to monitor the activity of rice yellow stem borer. Sex pheromone traps were used for yellow stem borer moth but there was no attraction. Large scale release of egg parasitoid, *Trichogramma chilonis* for the management of rice leaf folder and stemborer was carried out. In all the three systems the natural enemy populations were significantly higher. The ground beetle *Ophionea nigrofasciata* was very common in all the three areas. Need-based applications of plant products such as neem seed kernal extract and the bacterial biopesticide, *Bacillus thuringiensis* were also carried out. Also entomogenous fungi, *Beauveria bassiana* and *Metarhizium anisopliae* collected from different research centres were used against adult earhead bugs under field condition. But the fungi did not result in any mortality of the pest. The use of IPM tactics could avoid the application of chemical pesticides in the *samba* season in all the three systems of cultivation compared to 2-3 rounds of application of chemical pesticides in the non-project areas and result in normal rice yields.

Weekly Farmers' Field School (FFS) training programmes conducted by the State Department of Agriculture were also attended by the MSSRF scientists, which enabled the farmers to acquire knowledge on pest/disease and natural enemy identification, surveillance and improved technologies in pest management. A pre-season training programme on rice IPM was conducted at Sriperumbudur for the benefit of extension functionaries and farmers, which was inaugurated by the Commissioner for Agriculture, Govt. of Tamil Nadu, Madras. A 2-day farmers' workshop on "Ecological Agriculture : Role of IPM" was conducted at the Foundation which was attended by farmers from the project sites.

Development of Microbial Pathogens for Integrated Management of Pests of Cotton and Groundnut

Several studies for developing technologies for the management of major pests of cotton under rainfed and irrigated conditions in the winter season and groundnut under rainfed conditions in kharif and rabi seasons were carried out under the ICAR National Professor Project in 1994-95. The Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu State Department of Agriculture, SPIC Science Foundation, Madras, Thiagarajar Mills, Kappalur, other agencies and farmers in Sriperumbudur and Theni areas helped in the implementation of this programme. Benchmark survey was conducted to identify the areas and farmers. Two field laboratories were established at Srirengapuram, Theni and Beemanthangal, Sriperumbudur in Tamil Nadu to produce the biocontrol agents for laboratory and field studies. These laboratories also functioned as IPM technology dissemination and training centres. A multi-disciplinary approach was adopted in tackling the major pests through integrated nutrition management, water management and integrated pest and disease management along with other sound agro-techniques. The entire programme was farmer-centred and farmer-participatory from programme planning to implementation and assessment of technologies.

I. Cotton

A 100-acre technology development and demonstration programme was carried out during the rabi season at Srirengapuram village, Theni taluk. It was possible to reduce the number of rounds of chemical pesticide application from ca 17-19 times in the non-project area to 7-9 times in the project site. Biological inputs can often replace chemical pesticides for the management of pests and diseases. Traditional practices were flexible and could be blended with the modern agricultural practices, and farmers' participation was responsible for the success of IPM. The data collected in the field experiments revealed the following results:

Polyculture in cotton greatly enhanced the diversity of beneficial insects. The ecosystem was fertile with self propagating defenders. For example, cotton intercropped with cowpea or sunflower could enhance the density of predators like coccinellids and chrysopids. Till 70 days of crop growth no intervention was required. Biotic factors regulating the leafhopper population were negligible. Damage rating was very high after the *rabi* showers. The application of neem preparation such as Nimbicidine 3% or NSKE 5% effectively checked the leafhopper population.

The bollworm complex was dominated by the American bollworm *Helicoverpa armigera*. Bio-monitoring throughout the season indicated that intermittent monsoon showers were favourable for continued oppressive activity of the pest. Within the plant canopy the distribution of the eggs revealed as many as 35 eggs on a single leaf in the terminals. Under polycrop situations the onset of *H. armigera* was first observed on sunflower intercrop and maize border crop. Light and pheromone trap catches were observed. Of the different light sources tested mercury vapour lamp (160 W) was found to be the best in attracting the adults of *H.armigera*, leaf caterpillars *Spodoptera litura* and *Anomis flava* and the leafhopper *Amrasca biguttula*. Collection of moths on white screens under light source minimised the pest attack on the crop.

Field populations of *H.armigera* clearly showed resistance to synthetic pyrethroids, viz., fenvalerate and cypermathrin. Application of NPV with adjuvants like cotton seed kernel extract or crude sugar gave greater control of young stages of *H. armigera* than any other adjuvant tested. Protection to fruiting parts was also seen. A dose of NPV at 500 LE was found satisfactory. Preponderance of natural enemy *Chrysopa* sp. was more in bio-pesticide applied plots. NPV and *B.t.* applied either separately or together against *H. armigera* indicated that they were as effective as chemical insecticide and showed additive synergism. Laboratory studies indicated that a combined application of NPV and boric acid significantly resulted in higher mortality of *H. armigera* than NPV alone. Studies with two sources of NPV obtained from TNAU, Coimbatore and Biological Control Laboratory, Bangalore tested against *H. armigera* on cotton showed no variation in virulence. Similarly different *B.t.* products showed no variation in control of the pest.

II. Groundnut

The project site is situated at Sandhavelur village, Sriperumbudur taluk. Groundnut is frequented by season-bound problematic insect pests like red-hairy caterpillar, *Amsacta albistriga* and leaf miner *Aproarema modicella* during the *kharif* season and gram caterpillar *H. armigera* and leaf eating caterpillar *S. litura* during the *rabi* season. Large scale co-operative measures were adopted for the management of *A. albistriga* which emerged after the early S.W. monsoon showers from the soil after a 9 - month diapause in menacing proportions. The following are the salient observations :

Summer ploughing to unearth and collect the diapausing pupae was the effective preventive measure in managing *A. abistriga*. About 40,000 pupae were collected in shady areas adjoining the fields in Sandhavelur and destroyed. Setting up of bonfires immediately after the S.W. monsoon showers attracted waves of

A. albistriga moths which were killed. Flourescent light traps were appreciably effective in attracting the moths.

Cropping system approach indicated that groundnut + cowpea in the ratio of 10:1 effectively checked the population on groundnut. Cowpea was an excellent ovipositional host plant. More egg masses were found on the cowpea intercrop than on the groundnut main crop. Mechanical control could be integrated effectively with cropping system approach. Handpicking was very easy on the intercrops such as cowpea, sunflower and soyabean.

Bio-pesticides including *B.t. kurstaki, B.t. galleriae* and neem preparations were tested under different situations. The studies revealed that : (a) *B.t.k.* was effective in controlling the early instars, (b) Nimbicidine 3% acted effectively as phagodeterrent. Larval mortality was evinced within 72 hours after application, (c) Inclusion of adjuvants such as crude sugar and soyflour 0.5% enhanced the activity of *B.t.* preparations by 30%, (d) *B.t.* preparations and NPV combined with larval cadaver homogenate mycosed by *Nomuraea rileyi* and *Beauveria bassiana* when tested against *Spodoptera* larvae exhibited compatibility, (e) Sub-lethal doses of insecticides such as endosulfan, quinalphos etc. synergised the potency of B.t. preparations against full grown *Spodoptera* larvae, (f) *B.t.* products were equally effective in controlling *A.modicella*, (g) Significantly higher yield was obtained when *B.t.k.* was applied at the rate of 8 ml/lit. The results were comparable to insecticide application and (h) Seed treatment with fungal antagonist, *Trichoderma viride* reduced the root rot to 8.5% from 44.6% in untreated control.

During the *rabi* season, the weed *Cleome monophylla* L. in the rainfed groundnut ecosystem attracted the moths of *H.armigera* to lay eggs on the terminals at least one week before the egg laying commenced on groundnut. The weed served as a bioindicator for the early detection of the pest. Surveys on the prevalence of insect disease indicated that fungal mycosis due to *N. rileyi* and *B. bassiana* were the important regulatory factors on *H. armigera* and *S. litura* during *rabi* season following copious N.E. monsoon rains. Low temperature and high humidity were favourable for the epidemics. The disease epicentre was located in Sandhavelur. The intensity was found to be lesser at Senthamangalam though the pest load did not vary in these locations.

Management of *H. armigera* and *S. litura* through combined application of *B.t.* and respective NPVs resulted in significant reduction of the pest load and increased foliar protection. Yield was significantly higher in biopesticide applied plots compared to control. Plots receiving a combined application of *B.t.* and endosulfan at half the recommended doses registered higher yields.

Sub-Programme Area 303
Eco-Horticulture

Long term ecological sustainability rather than short-term productivity and increase in the income of farmers is the focus of this project which commenced in 1992. To empower the farmers to analyse the usefulness of eco-techniques and to select the technologies most suited to their own situation, a stream of grass root level change agents were trained in Kattangulathur and Kancheepuram blocks of Chengalpattu MGR District. As part of this capacity building appraoch, an additonal 46 change agents were trained during this year.

Quality of service

A questionaire was prepared to collect information on the quality of field extension especially to find out how much time was spent in solving farmers' problems, how effective the proposed solutions have been so far in meeting farmers' needs, and the actual level of satisfaction among farmers with regard to assistance provided by the field staff. In general, farmers considered that the field staff were providing reasonable assistance in solving their problems. All the farmers interviewed emphasised that they were constantly in need of advice from the field staff on issues related to agriculture such as pest control, crop production, soil borne diseases, land preparation, application of fertilisers, and so on.

Further the quality of service rendered by the field supervisors can be visualised by the fact that many client farmers have gone in for diversification with horticultural crops and started eco-practices like organic manuring, nutrient recycling, bio-fertilizers and bio-pesticides.

Two case studies in each block were undertaken to assess the change in the cropping pattern and to evaluate the advantages of diversification with horticultural crops. It is evident that a transition is taking place and location specific ecological practices are being recommended and adopted. The area under different vegetable crops has increased considerably in the two project sites after the introduction of the project. (Figs. 3.1 and 3.2).

Marketing

Marketing of horticultural products, which are highly perishable, was found to be the major constraint in extending the area under horticultural crops in both the blocks. To analyse the present marketing constraints and to suggest suitable interventions for implementation at the block level, a market study has been

undertaken during this year. Apart from this, the study also focusses on marketing of eco-products and cottage scale processing of fruits and vegetables.

Figure 3.1 : Area under vegetables (acres) in Kancheepuram Block

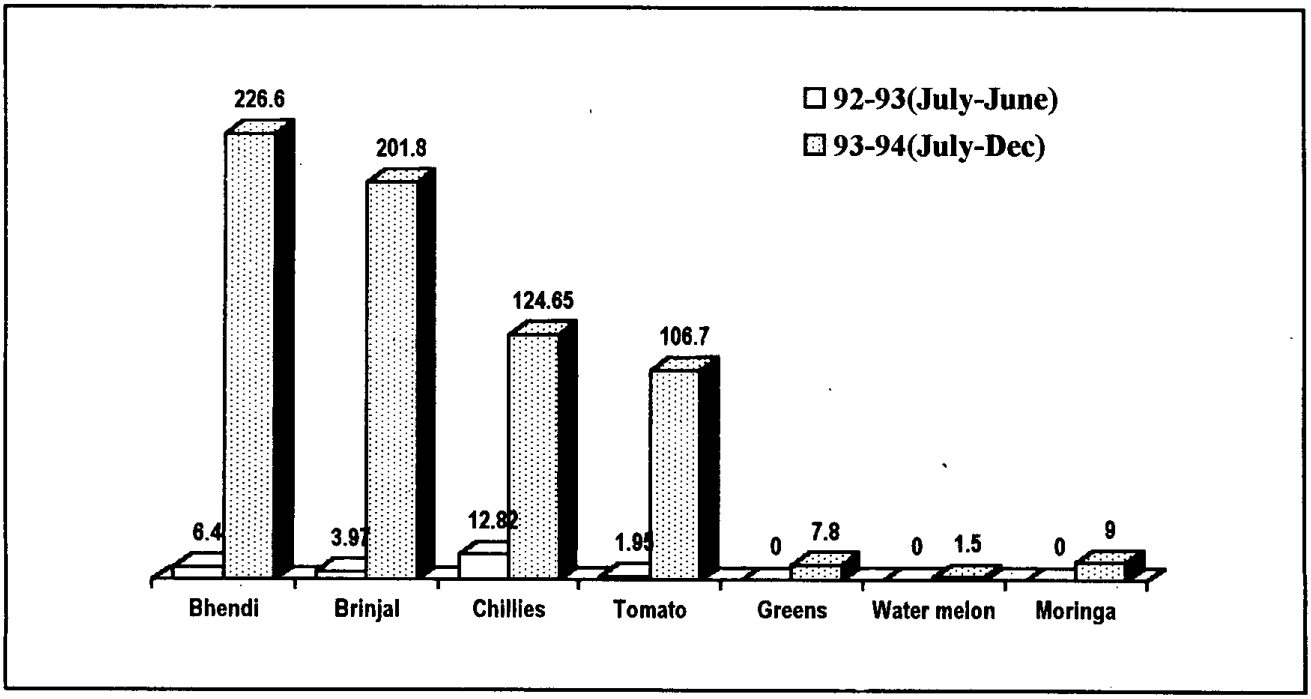
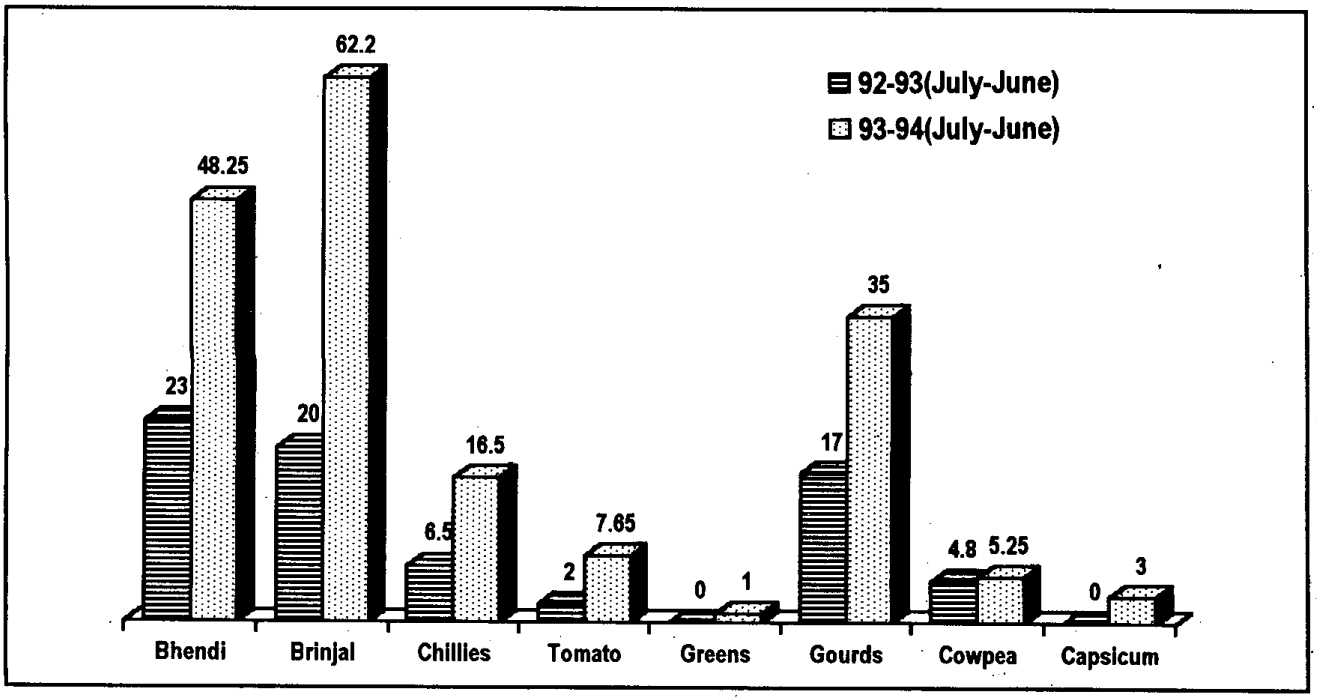


Figure 3.2 : Area under vegetables (acres) in Kunrathur Block



Extension support

Seeds and planting materials of improved varieties of vegetables and fruits were distributed through the field supervisors for cultivation. The types and quantity of seeds and planting materials distributed during this year are summarized below :

Table 3.3 : Seeds / Planting materials distributed

Sl.No	Crop	Variety	Quantity (kg)
Vegetables			
1.	Bhendi	Pusa Sawani	229.00
		Parbani Kranti	88.00
		Arka Anamika	24.00
2.	Brinjal	Palur -1	5.47
		Arka Kusumakar	5.55
3.	Chillies	Pusa Jwala	18.25
		X-235	7.00
4.	Tomato	Co-3	2.00
5.	Snake gourd	Pandri Pudal	4.20
6.	Bitter gourd	Green Long	16.50
		Coimbatore Long	1.80
7.	Ribbed gourd	Pusa Nasthar	10.80
8.	Bottle gourd	Local	1.20
9.	Ash gourd	Local	4.00
10.	Water melon	Arka Manik	4.00
11.	Cowpea	Pusa Komal	12.00
12.	Cluster beans	Pusa Navbahar	3.60
13.	Amaranthus	Co-2	8.00
14.	Cucumber	White	0.50
15.	Annual Moringa	Periyakulam-1	0.25
Fruits			
16.	Mango	Neelam	1680 nos.
17.	Acidlime	Seeded	220 nos.
		Seedless	720 nos.
18.	Sapota	Periyakulam-1	128 nos.
19.	Guava	Lucknow-49	680 nos.
20.	Pomegranate	Ganesh	160 nos.
21.	Jack	—	67 nos.
22.	Custard Apple	—	330 nos.

With the improvement of irrigation facilities in the nursery established at Livestock Research Station, Kattupakkam, the production of planting materials of lime, pomegranate, mango and sapota has been started and the elite materials will be ready for distribution during November-December 1995.

Satellite model eco-farms

Even though the contact farmers have started adopting certain ecological practices, the project team felt that there was still some resistance. To capitalise on the awareness created, and to sustain the interest of the farmers as well as convince them, each field supervisor has been asked to lay a demonstration plot in his own field, so that it will act as a training ground for others in the process of transition. This activity was commenced in January 1995. These plots are continuously being monitored by the project team, to assess, document and offer technical assistance.

Sub-Programme Area 304
Integrated Intensive Farming Systems (IIFS)

IIFS, with its components like irrigated rice along with fish, other crops in mixed or rotational practices, vegetables, fruit trees, poultry, livestock and apiary in appropriate combinations in different types of land holdings, is a viable option to meet the challenge of the ever-increasing population of the world and the need to feed the teeming millions. Especially in Asia, where there is increased pressure on productive land and water resources, this type of farming system could provide both food security and livelihood security to the rural workforce on an ecologically sustainable basis.

The project, funded by the Food and Agricultural Organisation of the United Nations, conducted detailed case studies to highlight existing practices in the country and the possibilities of the wider practise of this system in the future. The other countries chosen were Bangladesh, China, Kampuchea, Philippines, Thailand and Vietnam. The studies culminated in a workshop held in February 1995 at MSSRF, Madras.

An effort is also being made to chronicle the practices of integrated intensive farming with ecological principles in different parts of the country and to store them as multimedia database to provide an idea about the prevalence of such systems and also to learn from the farmers their indigenous and replicable practices, specific to different agro-ecological zones. This would provide useful training material for extention workers in promoting such practices to other

farmers as a basket of technological options. At present there are 12 such farms from different States of India.

At the request of the FAO, two Integrated Intensive Farming Systems from different agro-ecological zones were studied in detail. One was a rice-fish based lowland farming system identified as the family farm of Mr.S.Ganapathy from Pudukottai district in Tamil Nadu and the other a multi-storey multi-species upland farming system in the family farm of Mr.A.J.Joseph of Kerala.

Mr.Ganapathy's family farm consists of 4 hectares in 3 different plots. The crops grown were rice along with fish in 0.2 hectares, finger millet - rice - sorghum raised in rotation in another 0.2 hectares and groundnut intercropped with redgram and vegetables in 0.4 hectares. The living space and orchard area was 0.8 hectares and 1.6 hectares was left fallow. The other enterprises were dairy, goat rearing, duck rearing, poultry and cattle rearing. Mr.Ganapathy, his mother and his wife Rajeswari alone worked in the field. Cost estimates showed an annual profit of Rs.13,530. Ecological farming is practised. His production costs are almost nil. He does not depend on credit. Over the years he has banked his savings or invested in more lands. The constraint here is labour restricting the scope of cultivation in his newly acquired lands which are left fallow.

The family farm of Mr.A.J.Joseph is in an area of 2.66 hectares. There are 36 different crops with fodder and a nursery with 100 medicinal plants. The cropping system includes three crops of rice, tapioca, arecanut and coconut intercropped with pepper, banana, pineapple, turmeric, vegetables and rubber monocrop. The integration included enterprises like cows, fowls, ducks, turkeys, quails, guinea fowls, rabbits, pigs, doves, bees and fish. The main source of irrigation is the Chaliar river flowing just next to the farm. The employment generating capacity of this type of farming system is put under practice. Cost estimates reveal the farm's profit as Rs.40,292 per year.

Both the farmers have adopted certain indigenous practices which are replicable and both are held in high esteem in their respective villages.

Similar case studies from the other countries were presented in the workshop on Integrated Intensive Farming Systems held in February. The workshop concluded on the note that integrated intensive farming practices in an ecologically sustainable way would be the starting of the "second phase of the Green Revolution" and a viable option for the future. Plans for a second phase of IIFS were drawn up with certain governing principles for the follow up work.

An effort is on to study the energy flow, the human supporting capacity, productivity per cubic metre of soil, water and air and development of indicators for sustainability of the two case study farms.

Sub-Programme Area 305
Pilot Bio-Pesticide Feed Stock Model of Wasteland Development

Growth in population and industry has not only led to rapid decline of forest resources in India but has also put enormous pressure on agricultural lands to produce more food. In order to meet the ever increasing demand for food, more chemical fertilizers and pesticides are being used in agriculture. In order to reduce the environmental problems associated with over dosage of chemical fertilizers and pesticides and to bring more wastelands into rational use, a demonstration project entitled "Bio-pesticide Feed Stock Model" has been undertaken from 01/04/1995 with the following objectives:

- to convert non-forest wastelands (both private and Government) into a resource through soil conservation and agro-forestry techniques
- to produce feed stock for bio-pesticide and manure units
- to generate more employment opportunities
- to enhance the capacity of local people in wasteland development.

In order to demonstrate the benefit of this technological intervention, Pudupatty revenue village in Pennagaram Taluk of Dharmapuri District has been selected. In the first phase, Panchayat wastelands have been jointly identified by technical staff and Government officials. In the next phase, farmers with wastelands will be identified and motivated to convert them into a useful resource.

Programme Area 400

Reaching the Unreached

The Project "Multiple Approaches in Early Childhood Care and Education" led to four detailed case studies on innovative child care programmes in different parts of the country. Training modules were prepared for Panchayati Raj leaders to orient and equip them in dealing with issues relating to women and children. The Tamil Nadu Council for Sustainable Livelihood Security initiated an exercise for developing an implementable strategy for ending chronic hunger in selected areas. The project for developing market-driven proposals for extending the benefits of agri-business to resource poor families in 12 districts of the country was practically completed. This study has shown the immense opportunities that are available for increasing the income of marginal and small farm families through improved production and post-harvest technologies and through producer-oriented marketing. Studies were also initiated to promote symbiotic social contracts between resource-poor rural families and the corporate sector. A beginning has been made in the seed industry, starting with the development of Seed Villages in Dharmapuri district of Tamil Nadu. The results of these studies are presented in this section.

Sub-Programme Area 401
Tamil Nadu Council for Sustainable Livelihood Security

Hunger free area programme

The Tamil Nadu Council continued to work on the problem of chronic hunger, its causes and manifestations, at the micro and macro levels. The individual in a household (especially women and children) is the focus of the micro level analysis, while the district is the focus of the macro level analysis. As part of the micro-level analysis, a study was undertaken in village Pattukonampatty, Pappireddipatty block of Dharmapuri district. A multidisciplinary team consisting of a social anthropologist, a community nutritionist and a social worker from the

Foundation studied the various aspects that characterise chronic hunger, namely the lack of physical and economic access to balanced diets and safe drinking water.

Implications of the study

- Hunger is more than a problem of consumption of two square meals a day.
- Any (re)definition of hunger should take into account conditions that ensure biological utilisation of balanced diets - clean surroundings, safe disposal of human waste, safe drinking water and adequacy of micro-nutrients and vitamins in the body.
- Shifts in traditional food practices caused by development activities and gender discrimination cause imbalances in the dietary pattern of an individual.
- To achieve a sustainable end to hunger, empowerment of people with information on their entitlements, along with technical, social and political empowerment, will be needed. Also, the existing programmes and resources, both governmental and non-governmental, need to be brought together to create an environment favourable to sustainable food security.

Agenda 1997

At a joint meeting of the State Councils, the Hunger Free Area Programme was adopted as Agenda 1997, dedicated to the late Shri Ramkrishna Bajaj who pioneered the work of the Hunger Project in India. Agenda 1997 is a commitment made by every State Council to create a Hunger Free Area in each of the states of operation by 1997, which marks 50 years of India's Independence.

A concept paper on the creation of Hunger Free Areas was presented at a meeting held in April 1995 at the Planning Commission in New Delhi. The Planning Commission proposes to include the Hunger Free Area Programme in the Ninth Five Year Plan. A committee has been set up to look into the various aspects of this programme.

A five year report on the activities of the Council has also been published, and project design document is currently under preparation.

Sub-Programme Area 402
Project ACCESS

Project ACCESS focussed this year on activities at the macro level, concerned with advocacy, networking, training, research and documentation related to child care. At the same time project staff were involved in strengthening the social sciences component in other projects of the Foundation, to ensure a holistic approach to the mandate of the Foundation.

Preparation of training modules for Panchayati Raj Leaders in Tamil Nadu

Project ACCESS, along with the Tamil Nadu Council, undertook the task of preparing training modules for Panchayati Raj leaders, with special focus on issues relating to women and children (in Tamil Nadu the Chief Minister's 15-point programme for child welfare provides the frame work) in collaboration with UNICEF to help the elected representatives to play effective roles in planning and decision-making in the context of the 73rd Amendment to the Constitution. Drawing on the two-year experience of Project ACCESS in decentralisation and involvement of parents in the management of child care services in Chengai-MGR District, three 5-day training modules were proposed initially for training of Panchayat Presidents and Vice-Presidents, Block level officials (trainers) and for village level functionaries. In addition, training in methodology and skills for the trainers was also planned. The methodology proposed for training was participatory, promoting equality of relationships, respect for people and trust in people's ability to solve their own problems. The content of training was the Eleventh Schedule to the 73rd/74th amendments (including in its scope the 15-point programme). It was later decided to concentrate exclusively on the 15-point programme for the last two days of the 5-day module as well as training skills for the trainers, while the State Institute of Rural Development (SIRD) would focus on the general orientation and subject orientation relating to structure and functioning of Panchayati Raj institutions. The Steering Committee for the curriculum development process included representatives of UNICEF and the SIRD.

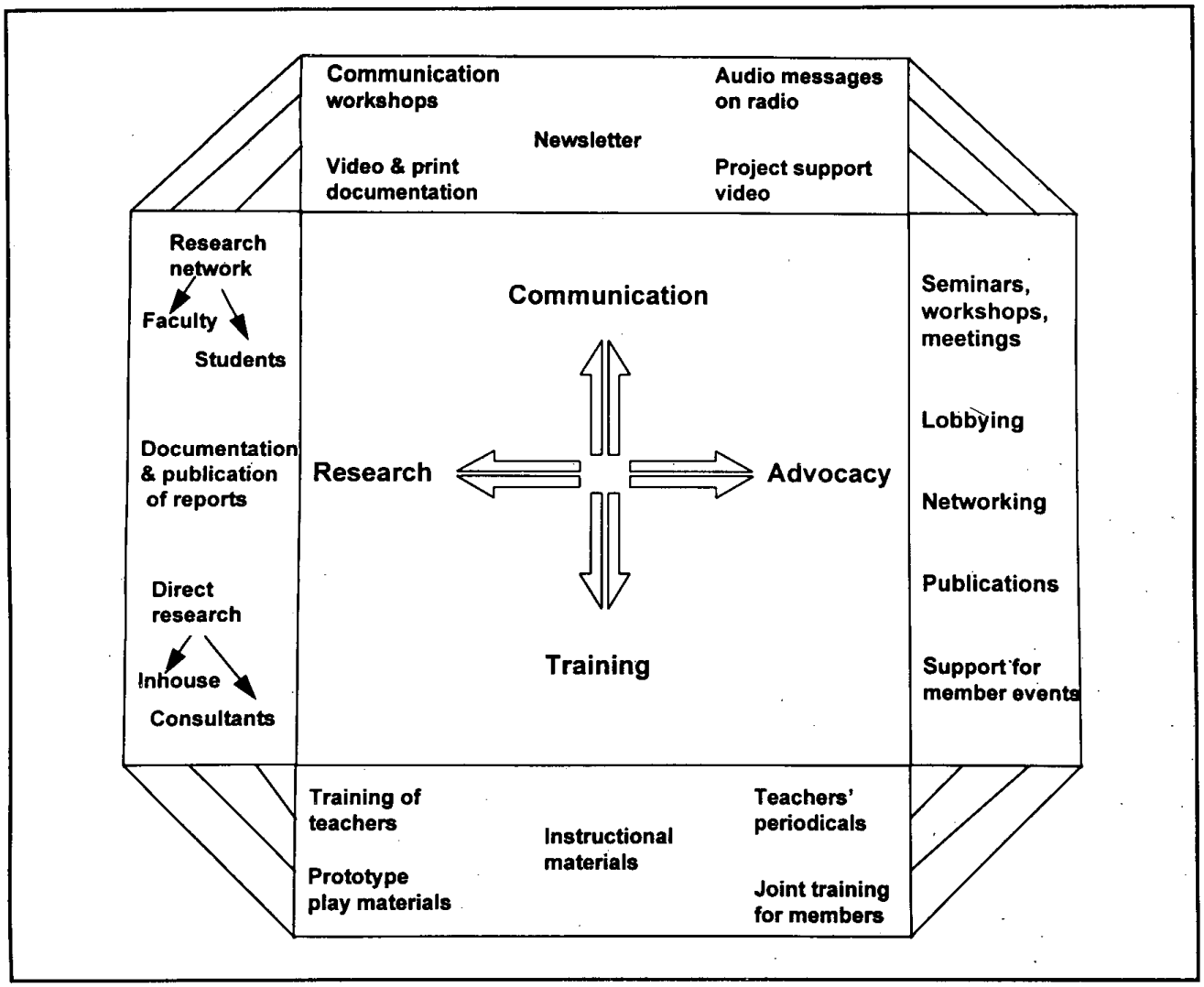
The draft module contained a detailed section on the process of training, with games and exercises on issues of participation, planning, decision-making and communication. Four critiquing sessions were held with experts in the field, individual feedback was compiled, and relevant resource materials collected. A list of NGOs was drawn up for the districts of Chengai-MGR, Dharmapuri, Kamaraj, Pudukottai and Salem for possible involvement in training, but their willingness and capability have not been assessed. The modules could not be field-tested as there is no elected Panchayat in the State at present.

Sub-Programme Area 403
Children on the Agenda

Introduction

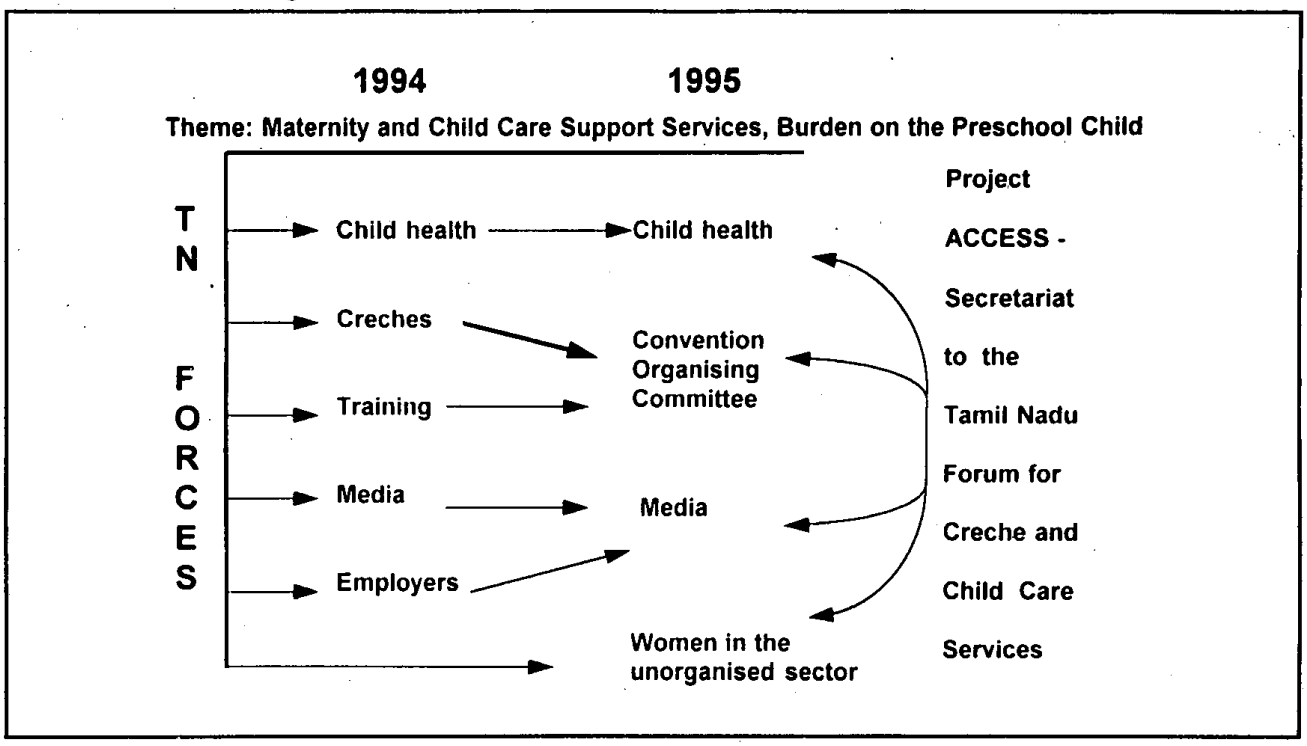
In 1992, Project ACCESS took the initiative for the facilitation of the network TN-FORCES (Tamil Nadu Forum for Creche and Child Care Services), a pressure group to lobby for better child care services for women of the poorest groups. The network inlcudes women's organisations, trade unions, resource agencies, child welfare organisations and academic institutions. The project *Children on the Agenda,* which commenced in July 1993, grew out of the experience of co-ordinating the network activities and the felt need for a secretariat. Fig. 4.1 gives the activities undertaken in each of the four dimensions of the project.

Figure 4.1 : Activities of 'Children on the Agenda'



The Forum, whose membership now stands at 58, meets once a year. In December 1993, the members decided to observe 1994 as the year of Campaign for Maternity and Child Care Support Services. At the annual meeting in December 1994, it was decided to continue the campaign and to take up a second theme for action : the Burden on the Pre-school Child. Fig. 4.2 summarises the structure, themes and mode of functioning of the Project.

Figure 4.2 : Structure and activities of the network



The project outcomes this year can be summarised in terms of events, products and above all, processes, which inform and sustain the movement towards its objectives.

Processes

Networking is the core activity, and base for advocacy. The network acts as a common platform for information sharing, capacity building, strategising and joint activities. Strengthening the network itself thus became an important process, by supporting sub-groups based on common interests. The research network is an example of an independent network which is providing support by undertaking empirical research relating to child care which can produce tools for advocacy. Advocacy was carried out through staff participation in events organised by members, through facilitation, sharing of responsibilities, providing materials and logistic support, and through providing resource expertise, or documentation

support. The quarterly newsletter *"..mma"* was a vital link in communication within the network.

Dialogue with government is another basic process, with interaction sought and pursued at various levels and on various occasions, in different forums, and by being alert to opportunities to react as well as initiate. The preparatory and follow-up activities for each organised meeting, such as the policy seminar, were found to be very productive. Goodwill was also built up by identifying and freely sharing resource expertise whenever required.

Table 4.1 : Events 1994 - 1995

Date '94-95	Event	Location	Co-Sponsor	Participants	Objectives	Outcomes
May	Interaction with legislators	M	Sub-group on Child Health	MLAs and MPs	To orient legislators on need for change in laws and schemes relating to maternity and child care	Memorandum submitted to government. Support of other groups sought
June	Interaction with Trade Unions	M	-do-	Trade Union leaders	-do-	Signature campaign launched
June	Regional network formation	N	—	NGOs invited to join network	To set up a regional network to meet needs of members	Regional network formed with two Co-ordinators
June	Trainers' Training in ECCE I	M	—	Trainers/ instructors of TINP, ICDS and selected NGOs	To help create a cadre of trainers for implementing PLAY FOR CHILD DEVELOPMENT and to introduce participatory training strategies	Manual preparation begun. Ongoing contact with group maintained
August	Breastfeeding Day video release	M	Sub-group on Child Health	Health-related professionals, NGOs and Govt. officials	To advocate support services to enable working women to breastfeed	Wide publicity and awareness. Official support sought
August	Research guides meeting	C	Avinashilingam Institute	Research guides from academic institutions/ departments in the network	To stimulate student research on topics related to child care	Several student research topics agreed upon. Research methodology workshop requested.
Sep.	Child Care Convention	G	Organising Committee	350 child care workers from 93 NGOs running creches	To bring together child care workers in theNGO sector state-wide, for training and sharing experiences	Video and print documentation. Follow-up activities planned

Table 4.1 (contd.) : Events 1994 - 1995

Date '94-95	Event	Location	Co-Sponsor	Participants	Objectives	Outcomes
October	Research Methodology Workshop	T	Bharathi-dasan University	Students (M.Sc., M.Phil. and Ph.D.) along with guides	To orient students on research methodology and enable them to prepare proposals	11 student proposals prepared and critiqued.
October	Seminar on Policy for the Young Child	M	Professional Social Workers' Forum	NGOs, academics and government officials	To bring together NGOs, professionals and policy makers to critically review policies and identify strategies for change	Report published. TN-FORCES members involved in several Govt.- initiated consultations
November	Writers' Workshop - I	M	—	Young writers across Tamil Nadu	To sensitise writers and print media on issues of women and children and stimulate writing	23 pieces (poems, short stories, articles, plays) written and critiqued
December	TN-FORCES Annual meet	M	TN-FORCES	Members of TN-FORCES	To review activities of the previous year and identify activities, goals and strategies for 1995	Plan of action for 1995 formulated. Sub-groups set up, regional networks approved.
December	Regional Training in ECCE	N	Regional TN-FORCES	Child care workers, trainers, supervisors and managements of creches	To strengthen quality, develop appropriate curriculum and skills at 3 levels in NGOs	Play curriculum introduced. Some skills developed. Managements commited support. Resource group formed.
February	Soft Toys Orientation	M	—	Balwadi teachers from TINP and ICDS	To orient selected teachers on use of soft toys in play activities as preparation for evaluative study.	20 kits distributed. Evaluation to follow in 3 months.
March	Writers Workshop - II	M	—	Young writers across Tamil Nadu	To stimulate writing on women's triple roles for publication on Labour Day.	16 stories and 17 articles critiqued. Revised materials published (4).
April	Trainers' Training in ECCE - II	M	—	Trainers from TINP, ICDS and NGOs	To complete training based on feedback about gaps, difficulties and needs.	Manual content completed. Plans for field training worked out.
April	Management of Creches - Seminar	M	Organising Committee	NGOs involved in running creches	To review objectives and status of creche programme, supervision and monitoring and morale and motivation of workers.	Report published and distributed.

Location : M - Madras ; N. - Nagercoil ;
C - Coimbatore ; G - Gandhigram ; T-Trichy

Table 4.2 : Products 1994 - 1995

Date '94 -'95	Name	Nature	Content	Objective	Distribution Audience	Feedback
May	Every Child's Birthright	2 - page campaign pamphlet in English and Tamil	Recommendations for support services for maternity and child care	A	Legislators, womens' organisations, trade unions, conferences	Widely distributed Reprinted in journals of several members. Used for signature campaign
August	Anguish	18 min. video film in English and Tamil	Problems of working mothers in breastfeeding	A	Educational institutions, NGOs and women's groups	Over 100 copies distributed at cost price. Telecast on Doordarshan
April	Chittu Kuruvi supplement	Six 4 page supplements on ECCE for child care workers	Suggestions for classroom activities for children prepared by network members	TIM	30,000 copies published by Directorate of Social Welfare for field workers	Two out of six supplements printed and distributed. Rest awaited.
December	Policy for the Young Child (Tamil Nadu)	Published report in English	Proceedings of the Seminar	A	Policy makers, NGOs, academ-ics, donors etc.	Widely distributed Several govt. - initiated meetings followed
February	Soft toy kit	Prototype toy kit with accessories and guidebook	Set of four ethnic dolls for imaginative and social play	R & D	Balwadis selected for evaluation. Orientation completed.	Evaluation ongoing
Ongoing	Playing to Learn	Manual for trainers in English and Tamil	Training strate-gies and methods related to play based curriculum	TIM	Trainers in Tamil Nadu and other States	Interest expressed indicates strong demand

Objective : A - Advocacy ; TIM - Training and Instructional Materials ; R & D - Research and Documentation

Sensitising the media, an important aspect of advocacy, was given attention. Placing of features, news and materials in the press and electronic media, as well as the in-house news bulletins of members, liasing with other issue-based media-watch groups, ensuring media coverage of important events and sensitising young writers and journalists were some of the strategies adopted.

Data base building is an ongoing affair, ranging from maintenance of a clippings file related to child care issues and building up the reference library, to coordination of a multi-centric research study involving six academic institutions, which is currently under way.

Capacity building centred around instructional materials and people. A resource library of training materials is being built up, now including nearly forty video and several audio cassettes, some of which are being dubbed in Tamil, as well as materials in print. Regular contact is maintained with participants in training courses and workshops, and activities are devised in response to the feedback received about their needs and interests.

Monitoring and evaluation are both essential to enable efficiency, stay on course and change direction when needed. Monitoring has been going on continuously with the help of carefully devised tools and regular in-house reviews. This year, an additional input was the mid-term participatory evaluation by an external consultant, which was a very enriching and insightful exercise.

Documentation

The project *Multiple Approaches in Early Childhood Care and Education in India* initiated in April 1993 with support from the Aga Khan Foundation, is documenting innovative child care programmes in India as a series of in-depth case-studies through a network of concerned agencies. During the year, the process of documentation included a workshop (held at Delhi in December, 1994) in addition to the usual procedures of reviewing, revision, editing and production of the manuscripts.

The first three studies in the series, entitled SURAKSHA, were released at a special function on April 13, 1995, coinciding with MSSRF Foundation Day. The distinguished gathering included eminent specialists, members of the Advisory Committee, Trustees, some of the authors, editors, and reviewers connected with the SURAKSHA series, NGOs, academics, the media and others.

The Advisory Committee recommended that the print order for the series be raised to 1,000 to meet the anticipated demand and that the volumes be made available in sets of four. The remaining studies are expected to be ready by the end of the year.

Status of Case-studies in ECCE

Home Away from Home *January 1995*
Family Day Care in Bombay
Vrinda Datta

In sight - On Site *February 1995*
Day Care for Construction Workers' Children
Mobile Creches, Delhi
Margaret Khalakdina

Little School on the Hill *March 1995*
Child Education in Community Development
Society for Integrated Dev. of the Himalayas (SIDH), Mussoorie
Vasudha Joshi

For the Sake of the Children *April 1995*
NGO-Government Partnership in Child Care
URMUL Trust, Bajju, Rajasthan
Kashyap Mankodi

Children of the Union *In press*
Creches for Women Tobacco Workers' Children
Self Employed Womens' Association (SEWA), Ahmedabad
Harshida Pandit

Moving up to School *Revision ongoing*
Community Preschools for the Rural Poor
Palmyrah Workers' Dev. Society (PWDS), Martandam, TN
S.J.P. Karikalan

Another Kind of Child Care *Revision ongoing*
Alternatives for Rural Women
Mahila Samakhya, Gujarat
Rajalakshmi Sriram

Working Hand in Hand *Review ongoing*
NGO Government Partnership in Child Care
Bal Niketan Sangh, Indore
Jyoti Sharma

Sub-Programme Area 404
Household Nutritional Security

The socio-economic survey conducted in 37 villages in the preceding year (reported in the Fourth Annual Report) revealed a significant presence of under and malnutrition amongst the vulnerable groups. To intervene on this issue, a representative group of households was selected from each of the villages The woman head of the household was trained intensively on

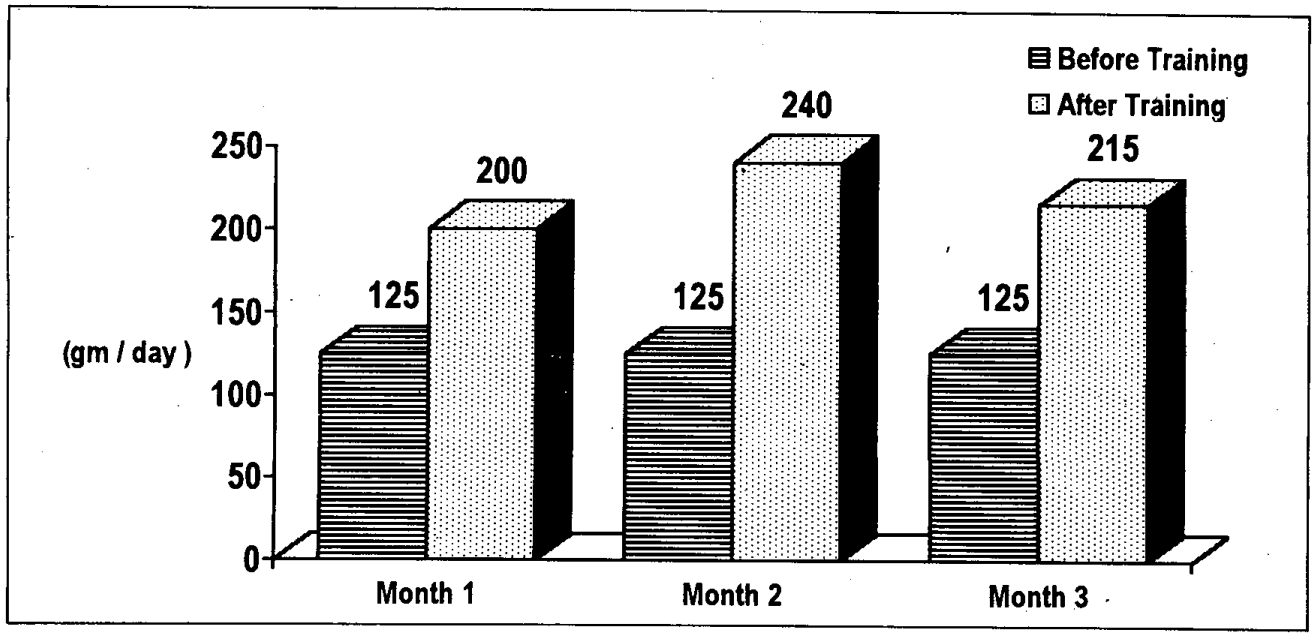
- nutritional maladies and remedial measures through horticulture
- the layout and maintenance of nutrition gardens.

A package of seeds and planting materials was given to each of the participants at the end of the training. The establishment and progress of the nutrition garden was monitored by the local field supervisor. In all, of the 383 women trained, 326 women established gardens in their backyards.

Comparative consumption pattern of family members

It has been estimated that from a well established nutrition garden of 2 cents area, each household would be able to get half a kilogram of vegetables/day. Initial assessment on the consumption patterns in the community through the 24 hour recall method revealed an average intake of 125 grams of vegetables and fruits/day. A two-fold increase in the consumption of vegetables and fruits (average of 240 gm/day) was observed after the intervention (Fig 4.3).

Figure 4.3 : Consumption pattern before and after intervention



Skill empowerment

To increase the purchasing power of the household by increasing their income, the field supervisors also gave them training to enhance their skills through activities like production of grafts and layers in fruit crops like mango, sapota, guava, pomogrenate etc. A group of 6-10 landless women were mobilised in 6 villages in Kancheepuram and 6 villages in Kattangulathur blocks respectively and trained for two days to impart knowledge and skill. The women who owned some land and who were growing traditional crops were given training on seed production so as to shift from their traditional crop cultivation to seed production. We have also identified a cluster of villages where hybrid vegetable seed production could be taken up initially on a small scale. The modalities for the supply of parental materials for the selected vegetable crops and buy-back arrangements are being worked out with the private seed companies who are interested in entering into this new social contract.

Sub-Programme Area 405
Agribusiness for Small Farmers

In his budget speech in 1992, the Finance Minister of India said, "We must begin a new chapter in our agricultural history where farm enterprises yield not only more food, but more productive jobs and higher income in rural areas". Recognising this need, the Government of India registered an autonomous body, Small Farmers Agri-business Consortium (SFAC) as a Society in December,1993. The mission of the SFAC would be to extend the benefits of modern agri-business to resource poor farm families on an ecologically sustainable basis.

The UNDP/Planning Commission sponsored project on "Planning for full Employment: Strategies for the Small Farmers Agri-business Consortium"(SFAC) initiated in 1992 for assisting in the preparation of action plans designed to promote agri-business for farm families with small holdings moved from planning towards implementation in the 12 pilot districts.

The national SFAC located in Krishi Bhawan, New Delhi, convened a meeting on Feb. 10-11, 1995 to build on the work done so far and organise collaboration with State Governments and the Financial Institutions, so that a few district level SFAC's could begin to function without further delay. NABARD submitted a banking plan for 1995-96 for the Districts of Dharmapuri, Pondicherry, Ernakulam and Pithoragarh. The State Governments have identified the Agriculture Department as the nodal Department for implementing the SFAC project.

Outcome of the project

- The project design framework is conceptualised to foster a replicable job-led economic growth strategy rooted in the principles of ecology, economics and equity.
- A participatory mode of project formulation based on a market driven identification of enterprises has been developed, considering farm families as producers and shareholders and not just as beneficiaries.
- The project design is structured on a *'modular mode'* based on the initial learning exercise so that the SFAC enterprises can grow rapidly. Such a structure will offer scope for SFAC enterprises to gain a self-replicating and self propelling momentum.
- It is envisaged that the control of SFACs should vest in the primary stakeholders, namely farming families and financial institutions. The participating small farm families should be viewed as producers and shareholders and not merely as "beneficiaries".
- *Organisational structure :* Three alternatives are suggested.

  i) Formation of a company under section 25, private limited company or joint-stock company managed by the farm families participating in different enterprises.

  ii) Identifying a suitable organisation already in existence which can take up this work immediately.

  iii) Formation of farmers' or producers' society under Societies Registration Act of 1860 which will be supported by government agencies, financial institutions, central SFAC, other funding agencies, NGOs and corporate sector.

In all models, the hope is to vest the control and management of the District SFAC with the principal stakeholders, namely farm families and financial institutions.

This can be accomplished by setting up a tripartite arrangement, with the nodal department, project design agency/ local NGO's and funding agencies, in which the government nodal agency will provide co-ordinating and administrative support at the State and District levels and ensure timely delivery of State funding for the activities where applicable. For instance DPAP schemes, horticulture, watershed development etc. may support the proposed enterprises. The project design agency will be a lead promoter and catalyst and act as a Technical and Information Resource Centre (TIRC). It will network with other NGOs and

encourage producer group formation in the potential clusters. It will also foster the growth of village level thrift and credit societies, which can provide credit at a lower transaction cost. The TIRC will take up training and demonstration exercises in collaboration with the farmers identified as *'change agents'*. To ensure remunerative marketing opportunities, the TIRC will promote a symbiotic social contract between private companies and the producer groups.

Status of Individual SFAC Projects

Dharmapuri, Tamil Nadu

Prepared by	:	CRSARD, MSSRF, Madras
Completed	:	February 1994
Enterprises	:	Horticulture - mango-grafting, papaya, organic vegetables; floriculture; sericulture; wasteland development enterprises; fodder, dairy, biopesticide - nitrification inhibitors; raw material for furniture; toys.
Coverage (Farmers)	:	2500
Employment (Lakh)	:	15.00 person days
Outlay (Rs. Crores)	:	10

The plans outlined in the report were accepted and Dharmapuri District Development Corporation (DDDC) was assigned the task of implementing the project. Convergence and synergy will be generated by channelling existing funds with the different departments schemes. NABARD has prepared the 1995-96 credit plan.

Pondicherry, U.T. of Pondicherry

Prepared by	:	CRSARD, MSSRF, Madras
Completed	:	February 1994
Enterprises	:	Horticulture, oilseeds (groundnut) and poultry
Coverage (Farmers)	:	1200
Employment (Lakh)	:	7.00 person days
Outlay (Rs. Crores)	:	6

The plan outline was accepted by the Govt. of Pondicherry and implementation is being carried out by Pondicherry Agro Products Sales Corporation (PAPSCO). NABARD has prepared the 1995-96 credit plan.

Pithoragarh, Uttar Pradesh

Prepared by	:	CRSARD, MSSRF, Madras
Completed	:	January 1995
Enterprises	:	Medicinal plants; legume farming; food processing; ringal agroforestry; cold water fisheries; community ecotourism; essential oil distillation; polyhouse vegetable cultivation.
Coverage (Farmers).	:	2000
Employment (Lakh)	:	1.04 person days
Outlay (Rs. Crores)	:	8.7

A tripartite arrangement for joint implementation is planned by which the Uttrakhand Vikas Vibhag, credit agencies and a NGO body will jointly implement this programme. NABARD has prepared the 1995-96 credit plan.

Ernakulam, Kerala

Prepared by	:	Centre for Management Development (CMD), Trivandrum
Completed	:	April 1994
Enterprises	:	Coconut development (oil-extraction, dessicated cocount unit, coirmat and cocount charcoal units), aquaculture and floriculture
Coverage (Farmers)	:	12,500
Employment (Lakh)	:	31.00 person days
Outlay (Rs. Crores)	:	15.00

The plans have been approved by NABARD. The State Govt. of Kerala has registered a Small Farmers Agri Business Consortium, Kerala, as a society with its headquarters at Ernakulam.

Valsad, Gujarat

Prepared by	:	Institute of Rural Management (IRMA), Anand
Completed	:	November 1994
Enterprises	:	Horticulture (mango & chikku orchards); aquaculture (inland & marine)
Coverage (Farmers)	:	1200
Employment (Lakh)	:	0.68 person days
Outlay (Rs. Crores)	:	3.00

The plans have been approved by NABARD. The Govt. of Gujarat has selected Gujarat State Agro Industries Corporation to implement the project.

Bikaner, Rajasthan

Prepared by	:	Institute of Development Studies (IDS), Jaipur
Completed	:	November 1994
Enterprises	:	Horticulture, seed multiplication (groundnut) collection & processing of non-traditional oil seeds
Coverage (Farmers)	:	450
Employment (Lakh)	:	0.30 person days
Outlay (Rs. Crores)	:	3.20

The plans have been approved by NABARD. The State Government has requested URMUL trust to implement the project and finalize the modalities.

Ganjam-Gajapathy, Orissa

Prepared by	:	Management Faculty, Berhampur University, Berhampur
Completed	:	January 1995
Enterprises	:	Horticulture (fruit nurseries, kewda and aromatic plantations, and vegetable seed production); inland coastal aquaculture
Coverage (Farmers)	:	3700
Employment (Lakh)	:	2.65 person days
Outlay (Rs. Crores)	:	9.00

The plan has been evaluated by NABARD. The State Department of Agriculture will be the co-ordinating agency. The bye laws for the SFAC, Ganjam society have been completed.

Dharwad, Karnataka

Prepared by	:	Institute of Social & Economic Change (ISEC), Bangalore
Completed	:	November 1994
Enterprises	:	Cotton ginning & pressing, Chilli oleoresin extraction and particle board making
Coverage (Farmers)	:	8000
Employment (Lakh)	:	0.20 person days
Outlay (Rs. Crores)	:	8.50

NABARD is evaluating the financial viability of the plan. The State Level Committee has been organised with Devpt Commissioner-cum Agri-Prod-commissioner as chairman. A district level steering Committee has also been formed with the Chief Executive of Zila Parishad as chairman.

Mahabubnagar, Andhra Pradesh

Prepared by	:	Andhra Pradesh Academy of Rural Development (APARD), Hyderabad
Completed	:	May 1995
Enterprises	:	Horticulture, castor seed production, sericulture, sheep & dairy farming, wasteland development
Coverage (Farmers)	:	3200
Employment (Lakh)	:	3.00 person days
Outlay (Rs. Crores)	:	5.00

SFAC in A.P should be a joint stock Company and the NGO's at Mahbubnagar could be facilitators for the programme. Convergence of State plan / non-plan for effective implementation of the programme.

Jabalpur, Madhya Pradesh

Prepared by	:	M P Agro Industries Corporation, Bhopal
Completed	:	—

Enterprises	:	Horticulture (organised vegetable cultivation and trading, potato seed multiplication); poultry; wasteland development
Coverage (Farmers)	:	2000
Employment (Lakh)	:	2.00 person days
Outlay (Rs. Crores)	:	9.00

M.P. agro will register a company under the companies act to be owned and managed by the small farmers. The final plan is being evaluated by NABARD for financial viability.

Mednipur, W.Bengal

Prepared by	:	Centre for Women's Development Studies (CWDS), New Delhi
Completed	:	June 1995
Enterprises	:	Organised vegetable & flower marketing ; wasteland development (tassar culture)
Coverage (Farmers)	:	3000
Employment (Lakh)	:	1.50 person days
Outlay (Rs. Crores)	:	8.00

Help of a network of NGOs is sought in starting agri-business producer groups. The Government of West Bengal has agreed to a grant of Rs.20 lakhs, after NABARD approval. This fund is akin to pre-operative expenses to be incurred by the NGO for making the project bankable.

Barapetta, Assam

Prepared by	:	North Eastern Institute of Bank Management (NEIBM), Guwahati
Completed	:	—
Enterprises	:	Sustainable intensive farming (SIF), includes :
		— crop production (cereals, pulses, oilseeds, vegetables and spices)
		— horticultural and plantation crops (coconut, banana, papaya, pineapple marigold, medicinal plants and floriculture)

— farm enterprises (pisiculture, duckery & piggery)

— infra-structure to provide essential support to the SIF project areas, (farm mechanisation, water service enterprises, setting up agribusiness complexes)

rural crafts (non-farm) sericulture, bell & brass metal, eco-tourism to harness natural and social-ecological advantage for income and employment gains of indigenous communities

Coverage : 3000 farmers (620 farm families)

Outlay (Rs. Crores) : 30

So far no specific view has been taken on the implementing agency. NEIBM feels that a number of institutions should get together and implement the project at the district level.

Sub-Programme Area 406
Social Contract between the corporate sector and the rural poor

The seed industry offers scope for value addition to time (the working hours) of the women belonging to poor households. Besides improving the livelihood security of the rural poor, it will provide elite planting materials to the farming community. Hence the project on "social contract between the corporate sector and rural poor", is being taken up with the following objectives:

- To link farm families with the private seed companies, in order to provide small farm families the benefit of scale in seed production and marketing.
- To train unskilled women labourers in production of quality seeds and planting materials.
- To improve the capacities of the farm women in seed processing and packaging.

Village surveys and discussions with farm families have shown that women belonging to resource poor families can master the art and science of seed technology provided the training methodology is *'learning by doing'*. A cluster of villages in two taluks (Denkanikota and Hosur) of Dharmapuri district, Tamil Nadu, has been selected for developing into *'seed villages'*. The identification of potential villages and the participants are being carried out.

Programme Area 500

Education, Communication, Training and Information Services

Work relating to training, organisation of workshops and inter-disciplinary dialogues and mobilisation of folk media for the communication of environmental and gender-related messages was continued. The CD-ROM library was continuously updated and training programmes were organised for users. The library services were extended to scholars from different universities and institutions. Short-term training facilities were provided to scholars from within and outside the country. The foreign scholars included graduate students from UK, USA, Germany and Norway. A Research Fellow and a staff member completed their Ph.D. work for the Madras and Osmania Universities. MSSRF was accorded recognition by the Anna and Tamil Nadu Agricultural Universities for research, leading to the Ph.D degree, being undertaken by post-graduate students.

The Information Service was expanded to include several new Multi-media databases. The MEIS, IIFS and IPR databases have received high commendation with reference to their value and innovativeness. Several steps were taken to disseminate widely the information contained in the databases. The results of these activities are reported in this section.

Sub-Programme Area 501
Training programmes in Eco-Horticulture

The programme on ecological horticulture was initiated in 1992 with the help and support of the International Agricultural Training Programme (IATP), U.K., CAPART (New Delhi) and the Hunger project (India). The three aims of this programme are: (1) to give small cultivators the advantages of scale by organising them in the form of an Eco-horticultural Estate and the (2) training of trainers, to provide grass-root extension service, and (3) to strengthen the nutrition security at the household level by providing appropriate horticultural remedies to the nutritional maladies. Training of trainers to provide grass root extension services

which was reported in the Fourth Annual Report was continued, and an additional 46 field supervisors were inducted from both blocks viz. Kancheepuram and Kattangulathur. The training programmes were conducted in our newly established, well equipped rural resource centres located in Kattupakkam and Kancheepuram. The draft training manual has been tested and the final version has been compiled and distributed. A series of technical training programmes have also been organised for the field supervisors on paddy, groundnut, tuberose, rose and jasmine cultivation to promote integrated land use and to establish model eco-farms.

The successful participants of training programmes were awarded certificates on 17-3-95. A field guide for the grass root level extension worker, showing various ecological techniques, pests, diseases and communication methods was released on that occasion by Mr.W.P.A.R. Nagarajan, a progressive farmer of Pattiveeranpatti (Madurai Dist., TN).

Farmer-Farmer interactions

The field supervisors recruited in the previous training programme continued to provide extension service on an estate basis. Day-release training programmes on basic ecological techniques like soil sampling, bio-fertilizers, vermicomposting, green manuring and integrated pest management were also conducted to create awareness among the contact farmers. In all 2579 farmers have benefited from such interactions in both the blocks. The impact of such a movement was seen in marked increase in income from brinjal (94%), capsicum (21%) and paddy crops (67%) after the training.

Net income of a client farmer (Mr.Kadirvelu - Vadagal village) increased through the training as the plant protection costs declined in the cultivation of brinjal (Rs. 200), Capsicum (Rs. 320), Paddy (Rs. 680) contributing in a sizeable measure to increase in net income.

This is due to significant reduction in the usage of chemical pesticides by the farmer due to increased usage of botanical pesticides and other IPM methods on the advice of the field supervisors resulting in a marked decrease in plant protection costs.

Sub-Programme Area 502
Conferences/Workshops

As in the past, the Foundation organised a number of conferences and workshops with the overall objective of providing a forum for stimulating

discussions on problems that require multi-disciplinary solutions. Many such conferences are integrated into the main stream of activity. In this section, reports on some of the major conferences are given.

Workshop on Women, Biodiversity and Seed Industry (June 13-14, 1994)

Along with horticulture, aquaculture, medicinal and aromatic plants, the seed industry is regarded as a "sun rise" industry with reference to its potential for increasing rural income and employment. Women have been traditional seed selectors and conservers and there is need for strengthening and enlarging their role in genetic conservation and seed technology. The experience of the last 20 years shows that India can be a world leader in the seed industry, provided opportunities are created for tribal and rural women to make contributions in this area.

In this context, the Foundation organised a workshop with the support of the National Commission for Women, the National Foundation for India, the International Federation for Women in Agriculture and the UNDP. The distinguished participants included Mrs. Jayanti Patnaik, Chairperson of the National Commission for Women, Mr. C. Subramaniam, Former Finance Minister of India and Chairman, NFI, Dr. Jayant Patil, Member, Union Planning Commission and Dr. V.L. Chopra, (then) Director-General of ICAR. Representatives of seed companies and credit institutions also participated in the workshop. The participants outlined an Agenda for Action that stresses the role of Panchyati Raj institutions and the need to form macro-micro linkages in the organisation of seed enterprises. On this basis, the Foundation has initiated a programme on a compact between the corporate sector in seed-industry and women (reported under SPA 406).

Workshop on strategies for Sustainable Rural Livelihood and Household Nutrition Security Systems in the Asia-Pacific (Aug. 12 - 13, 1994)

The Foundation underlook a study, on behalf of the UNDP, on generating an agenda for a food secure Asia-Pacific by 2010 AD. This study involved critical analysis of the experiences of countries in the Asia-Pacific, notably China, Indonesia and India, in evolving strategies to provide livelihood and food security through agriculture-based enterprises. The study was conducted by Dr. K.N.N.S. Nair under the guidance of Dr. M. S. Swaminathan. The findings of the study were presented in a specially convened workshop. The workshop included participants from India, China, Indonesia and Bangladesh besides those from intergovernmental organisations. Many eminent social scientists reviewed

the findings of the study in this 2-day workshop and made significant suggestions. The document was revised and has been published by the Foundation under the title "Agenda for a food-secure Asia Pacific Region by 2010 AD".

Dialogue on A New Deal for the Self-employed : Role of Credit, Technology and Public Policy (Jan. 30 - Feb. 2, 1995)

In the series of annual dialogues organised by the Foundation, the theme this year was self-employment and credit. Nearly 90% of the people in India depend on different forms of self-employment for their livelihodd. (The Sixth 5-year Plan placed emphasis on this). However, the recent patterns in economic growth reveal that it is characterised by job-less accumulation. There is need to create a paradigm of production by masses, particularly in the context of the opportunities available through agriculture-based enterprises. Evolution of a comprehensive public policy framework, in particular, one which stimulates growth in self-employment in farm and non-farm sectors is urgent. Access to credit plays a pivotal role in addition to access to technology in such a context. This Dialogue addressed a number of issues related to credit, technology and self-employment.

The Dialogue was supported by UNDP, UNESCO, CAPART and the Reserve Bank of India. Participants were primarily from the South-Southeast Asian Region. Distinguished participants included Ms. Ela Bhatt (SEWA, India), Dr. L.C. Jain, Prof. Wang Liazheng (China), Prof. Bo Bengtsson (Sweden), Prof. Saad Ibrahim (Egypt), besides senior representatives from FAO, UNDP, Government of India, State Bank of India and NABARD. Detailed analyses were made of the potential of various technologies, ranging from aquaculture to leather goods manufacture, to generate and sustain a paradigm of viable self-employment. Based on the experiences of leading organisations such as SEWA, the participants formulated a policy statement for the consideration of Parliament and the National Development Council. This document stresses the unique opportunities available for promoting sustainable job-led growth strategies, and points out the potentially disastrous consequences if this problem is not urgently and adequately addressed. (The proceedings of this Dialogue will be published by Macmillan India in the latter part of this year).

Workshop on Integrated Intensive Farming Systems in the Asia-Pacific Region (Feb. 25 - 28, 1995)

The nature and importance of Integrated and Intensive Farming Systems (IIFS) have been described under SPA 304. In addition to carrying out in-depth studies on IIFS in India, the Foundation organised a workshop on IIFS in the Asia-Pacific Region, with the support of FAO. The FAO commissioned studies on IIFS in

China, Thailand, the Philippines, Indonesia and Bangladesh besides India. All these studies were presented in this workshop, which had participants from a wide range of disciplines and organisations. An interesting aspect of the meeting was the presence of two farmers from India whose farms had been studied and documented for the IIFS programme. The variety in practices and operations was particularly significant. Based on the suggestions made in the workshop, the studies are being revised and will be brought together by the FAO.

In addition to these conferences, the Foundation has also co-sponsored several meetings and workshops with other organisations on topics of direct interest to the Foundation. Some of these are:

- Workshop on the role of information technology in the changing economic environment in India (30 June 1994) was organised jointly with the Ranganathan Centre for Information Studies, Madras, under the Chairmanship of Mr. C. Subramaniam. Hon'ble Dr. Manmohan Singh, Finance Minister of India, addressed the workshop participants.

- Workshop on finalising the common format for a Community Register (21-22 December 1994), was jointly organised by the Foundation for the Revitalisation of Local Health Traditions (FRLHT), Bangalore, with the support of CAPART, New Delhi. This meeting brought together representatives from 18 organisations from all over the country. A format for recording data on the biological resources of communities starting from hamlet level was discussed and adopted in this meeting. The FRLHT is now in the process of field-testing. This format in over 100 sites spread all over India.

- National Workshop on transfer of technology for sustainable shrimp farming (9-10 January 1995) was jointly organised with the Central Institute of Brackishwater Aquaculture, the Union Ministry of Agriculture and the Marine Products Export Development Authority. Participants in this workshop included representatives of the state and the central governments, industry, and experts and farmers. A number of papers were presented, and a Working Group formulated recommendations emphasise integrated aquaculture development that considers duly the environmental impact and gender and equity factors in transfer of technology.

- Workshop on technical writing in English (17-19 February 1995) was organised jointly with the British Council Division, Madras, and the SPIC Science Foundation. The workshop was conducted by Ms. Maggie Jo st John from the Birmingham University, UK and the participants included scientists from the SPIC Science Foundation and MSSRF.

- Workshop on applications of frontier technologies in agriculture (5 April 1995) was organised with the Indian Overseas Bank (IOB). This workshop was addressed by Dr. C. Rangarajan, Governor of the Reserve Bank of India, who also inaugurated IOB's Hi-tech Agro branch. Many experts presented scenarios and potential for the applications of frontier technologies such as remote sensing, informatics, and tissue culture.
- Workshop on applications of Geographic Information Systems(GIS) in aquaculture was jointly organised with the FAO Bay of Bengal Programme (3 May 1995), which was attended by representatives of government departments and non-governmental organisations from states on the Bay of Bengal.
- Workshop for inaugurating a Green Health Movement was jointly organised with the Lok Swastya Parampara Samvardhan Samiti (LSPSS), Coimbatore (8 June 1995). Dr. G.V. Satyavati, Director General, Indian Council of Medical Research (ICMR), delivered the inaugural address. Senior officers of the State Governments in South India participated in this workshop.

Sub-Programme Area 503
Communication for Development

I. Folk theatre for Development Communication

The Foundation continued to support performing artists in the *Koothu* tradition in the dissemination of development messages. Performances of the play *Pancha Bhootam* on the theme of sustainable development and the role of forests in conservation were sponsored in ten villages and the script of the play published for use by a larger group of artists.

II. Voicing Silence

This project aims to use the contemporary theatre idiom as a medium for the expression of Women's Voices. In its second year *Voicing Silence* concentrated on performances of the two plays evolved in the first year and the development of one new play.

1. *Chuvadugal* (Footsteps) is a docu-drama based on the real life-story of a woman agrarian leader from East Thanjavur region in the mid-20th century. This play was expected to reach out to activists' groups, women's groups, educational communities and those involved in conscientising programmes. There have been four shows of this play so far.

Table 5.1 : Performances of Chuvadugal 1994 - 1995

No.	Date	Place	Audience	Occasion	Sponsor
1.	April 1994	Tirunelveli	University teachers	Orientation Programme on Women's Studies	M.S. University, Tirunelveli
2.	April 1994	Ambasamudram	Party activists	National Executive Committee meet Communist Party of India (C.P.I.)	C.P.I.
3.	August 1994	Coimbatore	Women activists	National Conference of All-India Democratic Women's Federation (AIDWA)	AIDWA
4.	September 1994	Tirunelveli	Students and teachers	Mano Book Fair	M.S. University, Tirunelveli

2. *Mouna-k-kuram* (Silenced Prophecies) is a contemporary adaptation of the Tamil literary classic *Kuravanji*, in which traditional Puranic images of women are filtered through the perceptions of the autonomous gypsy woman. There have been thirteen performances.

Table 5.2 : Performances of Mouna-k-Kuram 1994-1995

No.	Date	Place	Audience	Occasion	Sponsor
1.	Jul. 1994	Coimbatore	General urban	Subhamangala Theatre Festival	Subhamangala
2-5.	Dec. 1994	Madras (4 shows)	General urban	Madras theatre audiences	——
6.	Dec. 1994	Madras	Students	Value Education programme	Stella Maris College
7.	Dec. 1994	Calcutta	General urban	Nandikar Theatre Festival	Nandikar
8.	Jan. 1995	Thanjavur	Tamil scholars	World Tamil Conference	Conference Committee
9.	Feb. 1995	Madras	Students	International Women's Week	Madras Christian College
10.	Mar. 1995	Madras	Students	-do-	Stella Maris College
11.	Mar. 1995	Madras	Members of Women's Organisation	-do-	Joint Action Council for Women
12.	Mar. 1995	Madras	Members of Slum Welfare Association	-do-	Madras Council of Christian Social Services
13.	Mar. 1995	Kancheepuram	General rural and semi-urban	Annual Kattaikoothu Festival	Kattaikoothu Kalai Valarchi Munnetra Sangam

Responses

Mouna-k-kuram received wide and appreciative press coverage, as it was played to general audiences. *Chuvadugal* evoked powerful emotional responses and requests for performances, which the group was unable to meet. *Voicing Silence* intends the plays to be not merely shows, but pretexts for discussion; but however these could be held only on a few occasions. Efforts are being made to build up the tradition of discussing the play and its import. It is to be noted that *Voicing Silence* has to break through not just the "silences" traditionally imposed by socialisation, but silences of groups, organisations and audiences.

3. Development of a new play - A play based on the theme of female infanticide has been evolved in a workshop held at Madras in August 1994 for which Ms. Rati Bartholomew, a senior theatre and social activist from New Delhi was the Resource Person. The play is designed as a street - play, and plans are on to complete the play and begin performances from July 1995, travelling in a *jatha* in rural areas.

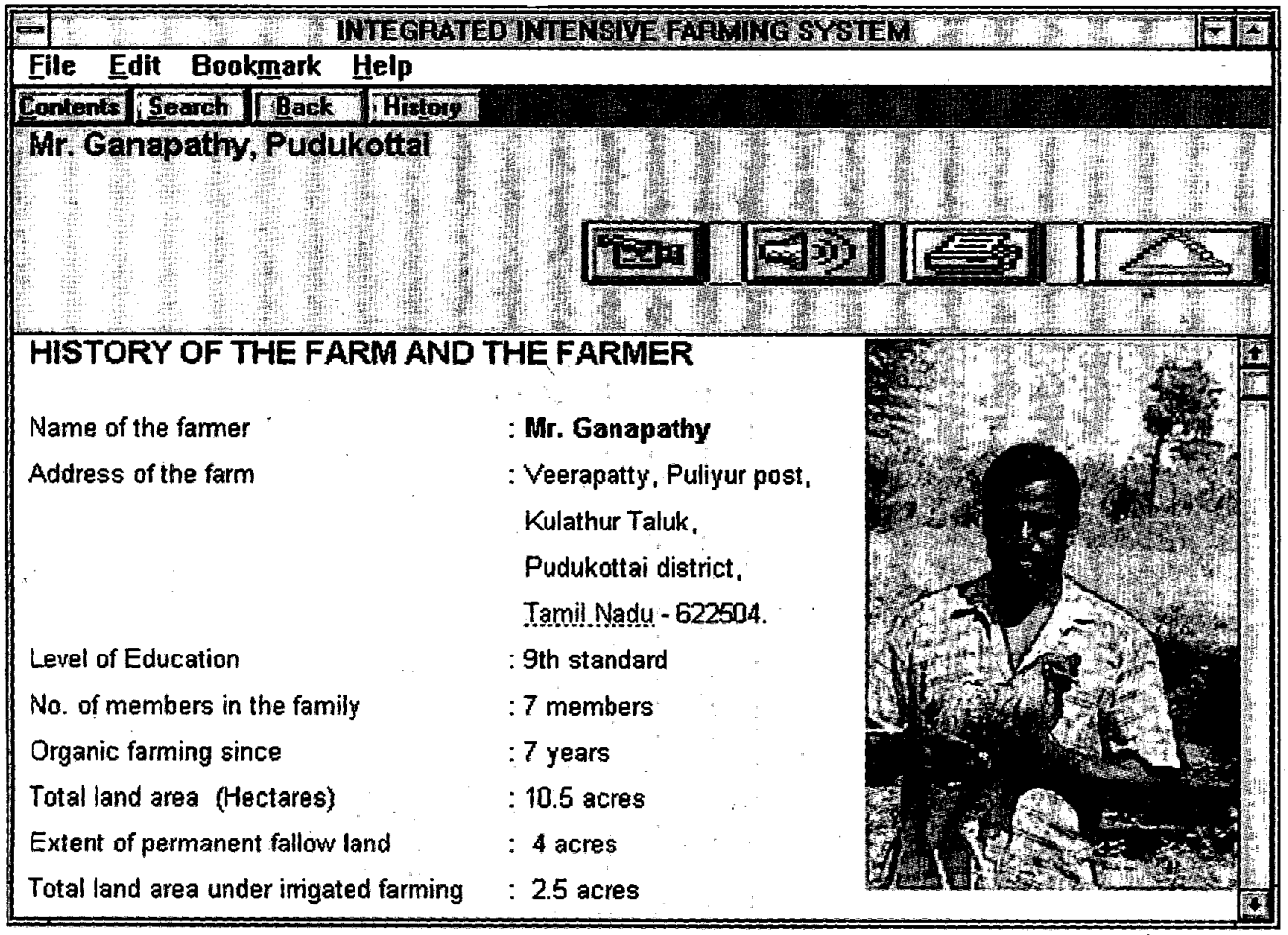
Sub-Programme Area 504
Informatics, Information Services and Database Design & Development

The Foundation has taken up information technology as one of the frontier technologies that can be appropriately applied to enhance capabilities in biodiversity conservation and utilisation. Information technology applications can be blended with existing skills among the rural population to further advance the process of sustainable agriculture and rural development. With these twin objectives, activities in informatics were undertaken to take forward the gains from the design and development of Mangrove Ecosystems Information Service(MEIS) which is a unique global-level database. During the current year, two groups of databases were developed and released, besides initiating software design that will further enhance MEIS.

Multimedia database on ecological farmers of India

This database has been designed using data generated from the study on Integrated Intensive Farming Systems(IIFS), reported in SPA 304. It covers farmers in Karnataka, Kerala, Tamil Nadu, Orissa and Pondicherry. It has been developed with multimedia capability by addition of voice, video clips, animation besides textual information, containing farm history, practices, pest/disease management,

crop-live stock integration, soil & water management and farm inputs, etc. (Sample screen below).



This database has been developed as an object oriented database having hypertext, and multilingual features. It was developed under MS WINDOWS using the Visual C++. A Tamil version of the database is also now available. In the current phase, data coverage will be at the state level, with the purpose of developing a CD-ROM database in Tamil for agricultural extension workers.

Database on intellectual property rights of tribal community plant genetic resources

Following the dialogue on Farmers' and Breeders' Rights, organised by the Foundation in January 1994, need for carefully structured information on community practices in plant genetic resource conservation was keenly felt. Such information should be of a form and quality that will be potentially useful for the processes under the Plant Variety Protection Act when it comes into force. With

this purpose in view, this database has been developed as a collection of three modules : 1. Tribal Information, 2. Ethnonbotanical Features, 3. Sacred groves in Plant Genetic Resources. The data have been generated through work described in SPA 201 and 202.

Tribal information database : This module has been developed to store and retrieve information on the tribal communities in the State of Tamilnadu. It provides information on social customs, life styles and knowledge of medicinal plants, besides other useful plants.

Ethnobotanical features : This module contains the taxonomy of plants and the details of use. Exact details on usage, forms of use and related information are included along with photographs and floral diagrams. This module also contains data on conservation practices relating to cultivated plants.

Sacred groves in PGR : This module maintains detailed information on sacred groves in Tamil Nadu. Details of the history of the sacred grove, taboos, vegetative composition, animals found in the grove, scientific importance, studies on the groves are provided. It provides photographs of the sacred grove, the temple associated with it and surroundings of the sacred grove.

Rare Angiosperm Plant Information Database : This database has been developed for maintaining information on the Rare and Endangered species. It provides information on taxonomy, IUCN status, site and geographic distribution of the plant, observation details, references, besides colour photos, illustration and distribution maps. It will be linked with the *Computer Aided Plant Identification System*, which is under design.

Besides the above activities, the computer readable form of the 4th Annual Report has been created. The electronic Annual Report has been developed with hypertext and hyper imaging features so as to view both text and graphics. User can view, download and print articles found in the 4th Annual Report. The Annual Report can be read in any computer running MS WINDOWS. The entire Annual Report can be distributed in one floppy diskette itself. The current Annual Report is also available in this form.

Update of specialised databases, such as the FAO's AGROSTAT or the WRI 95, was continued. The CD-ROM collection has been updated to the end of 1994, and now provides access to approximately 3.3 million records.

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Swaminathan, M.S. 1995. Population, Environment, and Food Security. *Issues in Agriculture* **7**. Consultative Group on International Agricultural Research. Washington. pp.16.

Uma, G. 1994. Sustainable livelihood security of villages surrounding the Pichavaram Mangrove Forest, India. *The Indian Geographical Journal, Special Issue on Sustainable Development: Issue & Opportunities* **68(1)** : 33-47.

Participation in Conferences/Symposia/Training Programmes

Anand, Ajith and P.C. Josekutty. 1995. Micropropagation of rare medicinal plant *uraria picta L.* Paper presented at *International Conference on Current Progress in Medicinal and Aromatic Plant Research*. Calcutta. 30 December - 1 January.

Balaji, V. 1994. Organising Secretary, *Pacem in Maribus - XXII*, Annual Conference of the International Ocean Institute, Madras. 4-8 December.

Balaji, V. 1995. Organising Secretary, *Dialogue on A New deal for the Self-employed : Role of Credit, Technology and Public Policy*. Madras : MSSRF, 30 January-2 February.

Balaji, V. 1994. Organising Secretary, *Planning Workshop on Community Register*, FRLHT. Madras: MSSRF. 21-22 December.

Balaji, V. 1995. Participated in the international steering group meeting on ecotechie, UNESCO and Equipe Cousteau, Paris. 13 - 14 April.

Balaji, V. 1995. Participated in the international planning meeting for the development of a South-South network on land degradation and biodiversity. Third World Network of Scientific Organisations. Trieste, Italy. 9-10 May.

Balaji, V. 1995. Participated in the international workshop on education for sustainable development in the Black Sea region. UNESCO/CEPES and the University of Bucharest. Bucharest, Romania. 30 June - 1 July.

Balakrishna, P. 1994. Participated in advanced training programme on molecular markers at University of Naples, Italy. June-July.

Balakrishna, P. and Finch, Robert P. 1995. A molecular analysis of biodiversity in *Porteresia coarctata. 3rd IRRI International Rice Genetics Symposium.* IRRI, Philippines.

Brinda, N. and N. Latha. 1995. Women and seed industry:need for capacity building, trade and credit linkages. Paper presented at the *Dialogue on A New deal for the Self-employed : Role of Credit, Technology and Public Policy.* MSSRF. Madras. 30 January-2 February.

Brinda, N. 1994. Participated in the training programme on *Ex-situ conservation of plant genetic resources*. NBPGR. New Delhi. 8-23 November.

Daniels, R.J.R. 1994. Participated in the *Asian Round Table on Assessment, Conservation and the Sustainable Use of Genetic Resources*. Indonesia. 11-13 October.

Daniels, R.J.R. 1995. Participated in the editorial committee meeting on *UNEP-Global Biodiversity Assessment*. Washington D.C. 30 January-2 February.

Daniels, R.J.R. and M.S. Swaminathan. 1995. Biosphere reserves in the 21st century. Paper presented at *MAB-UNESCO Conference on Biosphere Reserves*, Seville, Spain. 20-25 March.

Daniels, R.J.R. 1995. UNEP-Global Biodiversity Assessment-Peer review meeting. Panama. 12-16 June.

Deshmukh, Sanjay V. 1994. Recognising indigenous knowledge system in relation to sustainable management of mangrove forests. Paper presented at the *First Conservation Congress*. WWF-India. New Delhi. 21-23 November. (In press).

Deshmukh, Sanjay V. 1994. Participated in the *Workshop on Geographical Information Systems (GIS)*. Jawaharlal Nehru Technological University, Hyderabad. 1-2 December.

Geetharani, M. 1994. Attended *Documentation Training Course for Genebank Managers* at MARDI, Serdang, Malaysia. 22 August-9 September.

Geetharani, M. 1995. Attended training programme on *Exchange and Quarantine of Plant Genetic Resources*. NBPGR, New Delhi. 10-24 January.

Gnanappazham, L. 1995. Participated in the national symposium on *GIS Technology, Applications and Resource & Facility Management* : Madras-Waterloo University Linkage Programme. Madras. 22-24 February.

Hoon, Vineeta and Latha. N. 1994. Emerging trends and prospects for women in agriculture. Paper presented at *State Level Workshop on Women in Agriculture*. Thiruvananthapuram. November.

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Hoon, Vineeta and A. Shaleesha. 1995. Women's role in shrimp farming, technology needs & mechanisms for transfer of technology. Paper presented at the *National Workshop on Tranfer of Technology of Sustainable Shrimp Farming*, CIBA & MSSRF, Madras. 9-10 January.

Jayaraj, S. 1995. Biopesticides and integrated pest management for sustainable crop production. Platinum Jubilee Lecture delivered in the *Section of Agricultural Sciences of the 82nd Indian Science Congress* Calcutta. 3-8 January.

Jayaraj, S. 1995. Biological software for sustainable agriculture. Paper presented at the *Dialogue on A New deal for the Self-employed : Role of Credit, Technology and Public Policy*. MSSRF. Madras. 30 January-2 February.

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Jayanthi, M. 1994. Participated in the training programme on *In vitro Conservation and Cryopreservation*. NBPGR. New Delhi. 9-19 October.

Jayanthi, M. and Viswanath M. Patil. 1995. Micropropagation studies of some medicinal plants of Western Ghats. Poster presented at the *International Conference on Current Progress in Medicinal and Aromatic Plant Research*, Calcutta. 30 December - 1 January.

Johnson, K. 1994. Visited Israel to study the water management techniques. 21 August - 8 September.

Johnson, K. 1994. Participated in the *Coastal Zone 94 Conference*, Halifax, Canada. 17-26 September.

John Joseph, S. 1994. Combining development and biodiversity conservation objectives. *RECOFTC*, Seminar Publication, Kasetsart University, Bangkok.

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John Joseph, S. 1994. Participated in the WWF - India. Silver Jubliee Seminar. New Delhi. November.

John Joseph, S. 1995. *FAO Consultation on Nonwood Forest Products*. Yogyakarta. Indonesia.

John Joseph, S. 1995. Expert in Biodiversity, *IFAD International Expert Mission for the Preparation of a Resource Management Plan for the Tribal Areas of the North Eastern Region in India*. May-June.

Kanvinde, Hemal. 1995. Participated in Swiss Federal Institute of Technology organised seminar on Indigenous Knowledge on Forests, New Delhi, March.

Kumar, N. Anil. 1994. Participated in the *NRSA workshop on Remote Sensing and Computer Mapping*. Department of Geography, University of Madras. 11-12 November.

Kumar, N. Anil. 1995. Participated in the FRLHT / CBSG / SSC-IUCN *Workshop on Conservation Assessment and Management Plan for Medicinal Plants of South India*. Bangalore. 23-25 February.

Kumar, N. Anil. 1995. Participated in the IISC / JNC / CES *Inventory, Monitoring and Information Systems : Summer School on Biodiversity*. Bangalore. 4-14 April.

Lakshmi Narasimhan, E. 1994. Participated in the *International Conference on Information Systems and Management of Data*. INSDOC. Madras. 26-28 October.

Lakshmi Narasimhan, E. 1995. Design of novel bibliographic database on Micro CDS/ISIS. Paper presented at *Sixth National CDS/ISIS User Group Meet*. Madurai. 10-13 January.

Lakshmi Narasimhan, E., E. Padmanaban, S. Senthilkumaran and V. Balaji. 1995. A Multimedia Database on Integrated Intensive Farming Systems (IIFS) in India. Paper presented at *National Conference on Informatics for Sustainable Agricultural Development*. New Delhi. 24-25 May.

Latha, N. 1994. Participated in the *Southern Regional Peasant Women's Conference*. NAARM. Hyderabad. 28-30 October.

Latha, N. 1995. Participated in the training programme on *Evaluation & Management of Plant Genetic Resources of Vegetable Crops*. NBPGR. New Delhi. 7-21 February.

Mohan, M.S.S. 1995. Participated in the *Third National Conference on Mycorrhizas*, Tata Energy Research Institute. New Delhi. 13-15 March.

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Narayan, L.R.A. 1994. Participated in the *Sixteenth Indian Geography Congress*, National Remote Sensing Agency, Hyderabad and National Association of Geographers, New Delhi. 26-29 December.

Narayan, L.R.A. and Sanjay V. Deshmukh. 1994. Remote sensing as a tool for biodiversity studies. *International Conference on Remote Sensing and GIS*. Jawaharlal Nehru Technological University, Hyderabad. 3-6 December.

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Natarajan, R. 1995. Microbial corrosion in the aquatic environment. Presented at the *National Seminar on Electrochemistry in Marine Environment*, SAEST Madras Chapter, CECRI, Madras. 7-8 February.

Natarajan, R. 1995. Global impact on biosphere. Presented at the National Symposium on Recent Trends in Indian Wildlife Research. Mannampandal. 22-24 February.

Parida, Ajay. 1994. Participated in the *3rd International Conference on DNA fingerprinting*. Hyderabad. 13-17 December.

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Ravishankar, T. 1994. Participated in the meeting on *UNEP-Global Biodiversity Assessment*. Bandarawela, Sri Lanka. 24-28 October.

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Shaleesha, A. 1994. Extension training-an effective tool for technology transfer in aquaculture. Paper presented at the *National Symposium on Aquaculture for 2000 A.D.*. Madurai Kamaraj University. Madurai. 28-29 November.

Shaleesha., A. 1994. Culture of shrimp in an eco-suitable way. Paper presented at *National Workshop on Shrimp Farming-Problems and Solutions*. Madurai Kamaraj University. Madurai. 30 November.

Shaleesha, A. 1995. Environmental impact of shrimp culture. Paper presented at *National Workshop on Transfer of Technology for Sustainable Shrimp Farming*. Organised by CIBA & MSSRF. Madras. 9-10 January.

Shaleesha, A. 1995. Participated in the training programme on *Technical Aspects of Producing Penaeus monodon Seeds*. S & S Aquatech Industry-Hatchery Division. Sirkazhi, Tamil Nadu. 21 February - 10 April.

Shaleesha, A. 1995. Participated in *National Seminar on Aquaculture*. Institute of Ocean Management. Anna University. Madras. 12-13 April.

Sivakumar, N and Vineeta Hoon. 1994. Development of degraded lands for downstream employment. Paper presented at *International Conference on Sustainable Development of Degraded Lands through Agroforestry in Asia and Pacific*. New Delhi. November.

Sivakumar, N. 1994. Participated in international training program on *Biological and Physical Aspects of Crop Production in Arid Zone*. Ben-Gurion University of Negev, Israel. 6 December 1994 - 25 January 1995.

Sivakumar, N. and P.T. Umashankar. 1995. Nature and scope of introducing non-traditional tree crop (neem) for agribusiness. Paper submitted for *National Seminar on Policies for Agribusiness Development*. Agricultural Economics Research Association, IARI. New Delhi.

Subhashini, H.D. and K. Natarajan. 1995. Carbon and nitrogen utilization of *Amanita muscaria* and *Suillus brevipes* and their association with Pinus patula. Presented at the *Third National Conference on Mycorrhiza*. Tata Energy Research Institute. New Delhi. 13-15 March.

Sudha Nair. 1994. Participated in short term training course on *Modern Techniques in the Identification of Bacteria and Filamentous Fungi*. International Mycological Institute. U.K. 31 October-11 November.

Venkataramani, G. and Sanjay V. Deshmukh. 1994. Gulf of Mannar marine biosphere reserve : strategies for conservation and management. *Proceedings of the First Conservation Congress*. WWF-India. New Delhi. 21-23 November.

Articles in Popular Journals and Special Lectures

Balaji, V. 1994-95. Resource person. *International Training Programmes on Coastal Zone Management as a Sustainable Process*. International Ocean Institute. Operational Centre. Indian Institute of Technology, Madras.

Balakrishna, P. 1994. Biotechnology : its role in the conservation and enhancement of biodiversity. *16th International Union of Biochemistry and Molecular Biology Satellite Symposium*. Hyderabad.

Balakrishna, P. 1994. Conserving biological diversity for sustainable agriculture. Plenary lecture at IICT *Golden Jubilee seminar on Emerging Trends in Applied Biology*. IICT. Hyderabad.

Balakrishna, P. 1994. Advances in conservation biology. *International Conference of SCB*. Hatfield. U.K.

Balakrishna, P. 1995. Salt tolerant rice cultivars. *Rice Biotechnology Quarterly*. January. pp 11.

Balakrishna, P. 1995. Darwin Initative Projects help conserve crop biodiversity around the globe. *Diversity* **10(4)** : 27-29.

Deshmukh, Sanjay V. 1994. (a) Understanding genetic diversity in mangroves. (b) Mangrove forest genetic resources:strategies for conservation and management. Lectures delivered as resource person during UGC-sponsored refreshers' course for post graduate teachers. Department of Botany. University of Poona. Pune. 5-31 October.

Deshmukh, Sanjay V. 1994. Plants for mine waste reclamation. Lecture delivered as resource person during UGC-sponsored course in environmental management for post-graduate students, Department of Chemical Engineering. Anna University. Madras. 13-16 November.

Kumar, N. Anil. 1995. Indigenous communities contribution to the conservation of threatened plant genetic resources-case study, India. *The Bulletin. Issue 25. A publication of the Centre for Our Common Future*. p 57.

Narayan, L.R.A. 1995. Application of remote sensing in ocean management. IOI Operational Centre, Indian Institute of Technology, Madras. 21 April.

Parida, Ajay., 1995. Biotechnology and Microbial Diversity. Association of Indian Microbiologists. Madras University. January 8.

Parida, Ajay, 1995. *Experience with Mangroves : The little known group of plant species*. University of Naples, Italy. 18 July.

Sankaram, A. 1994. A new vision for Indian Agriculture in the context of new economic policies. Silver Juiblee Souvenir. College of Agrilcultural Banking. Pune.

Sankaram, A. 1995. Redesigning cropping patterns of India: An ecological approach. *Industrial Economist*, Madras. March.

Sankaram, A. 1995. Sustainable development of farming systems of developing countries: An overview with sharp focus on health promotion and monitoring. The World Bank, Washington D.C. July.

Selvam. V. 1995. Coastal ecosystems and biodiversity. Lecture at International Ocean Institute Operational Centre, IIT, Madras. 19 April.

Selvam, V. 1995. (a) Ecology of the Coastal Ecosystems. (b) Biodiversity and Biomass of Coral and Seagrass Ecosystems. Lectures at *International Training Programme In Coastal Zone Management*. International Ocean Institute Operational Centre, IIT, Madras.

Awards Received

Swaminathan, M.S. 1994. *The UNEP-Sasakawa Environment Prize* in recognition of over 4 decades of service to the conservation of biodiversity and for initiating the economic ecology movement.

Swaminathan, M.S. 1994. *Distinguished Service Award.* World Academy of Arts and Sciences, Maastricht, The Netherlands, for contributions to science and for harnessing science for human welfare.

Swaminathan, M.S. 1995. *The Asian Productivity Award*, Asian Productivity Organisation, Tokyo, for significant contributions to the improvement of agricultural productivity in Asia.

Jayaraj, S. 1995. The ICAR Team Research Award for 1991-93 for the development of microbial pesticides as alternatives to toxic chemical pesticides (with Dr.R.J. Rabindra and Dr. S. Easwaramurthy of Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu).

C. Srinivasa Rao, Vishwanth M. Patil, P.C. Jose Kutty and Sanjay V Deshmukh. 1995. Micropropagation of some mangrove plants through shoot tip and nodal cultures. Poster presented in *All India Symposium on Recent Advances in Biotechnology Applications of Plant Tissue Culture*. 22-24 June. Won First Prize in the micropropagation section.

About the Foundation

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Ms. Andal Damodaran, Hon. General Secretary, Indian Council for Child Welfare, Madras
Dr. A. Desai, formerly Director, Tata Institute of Social Sciences, Bombay ; Chairperson, University Grants Commission, New Delhi
Dr. Vina Mazumdar, Senior Fellow, Centre for Women's Development Studies, New Delhi
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*Project concluded December 1994

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Prof. C. Monti, University of Naples, Naples, Italy

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Dr. R.S. Rana, Director, National Bureau of Plant Genetic Resources, New Delhi

Mr. S. John Joseph, M.S. Swaminathan Research Foundation, Madras

Dr. Sanjay V. Deshmukh, M.S. Swaminathan Research Foundation, Madras (Member-Secretary)

Tamil Nadu Council for Sustainable Livelihood Security

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Dr. Asha Krishnakumar, *Frontline*, Madras

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Ms. Geetha Ramaseshan, Lawyer, Madras

Fr. Joseph Xavier, s.j., Department of Social Work, Loyola College, Madras

Ms. Khin-Sandi Lwin, State Representative, Kerala and Tamil Nadu, UNICEF, Madras

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Dr. C. S. Ramachandran, Governor, Rotary International 3230, Madras

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Ms. Shanti Duraiswamy, Director, Asian Youth Centre, Madras

Ms. Vasantha Surya, freelance writer, Madras

Mr. William D'Souza, Project Coordinator, MYRADA Dharmapuri Plan Project, Dharmapuri

Secretary, Planning and Development Department, Government of Tamil Nadu, Madras

Member Secretary, State Planning Commission, Madras

Secretary, Rural Development Department, Government of Tamil Nadu, Madras

Secretary, Social Welfare Department, Government of Tamil Nadu, Madras

Secretary, Information and Tourism, Government of Tamil Nadu, Madras

Secretary, Health and Family Welfare Department, Government of Tamil Nadu, Madras

Secretary, Education Department, Government of Tamil Nadu, Madras

Additional Secretary, Health and Family Welfare Department, Government of Tamil Nadu, Madras

Secretary, Housing and Urban Development Department, Government of Tamil Nadu, Madras

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Programme Areas and Staff#

Prof. M.S. Swaminathan	Chairman / Hon. Director

I. Administration and Support Services

Mr. R.S. Kuppusamy	Manager (Personnel & Admn.)
Col. (Retd.) Ashok Choudry*	Manager (Estate)
Mr. C.K. Ramachandran	Manager (Budget & Accounts)
Mr. N. Parasuraman	Assistant Manager (Estate)
Ms. V. Sridevi	Secretary
Ms. Usha Kumar	Secretary

II. Programme Area 100 : Coastal Systems Research

A. Integrated Conservation and Development

Dr. L.R.A. Narayan	Distinguished Fellow
Dr. R. Natarajan	Emeritus Scientist (CSIR)
Dr. Sanjay V. Deshmukh	Sr. Scientist & Coordinator
Dr. V. Selvam	Sr. Scientist & Coordinator
Dr. Hemal S. Kanvinde	Sr. Scientific Officer & Coordinator
Ms. L. Gnanapazzham	Research Associate
Ms. S. Rajalakshmi*	Research Assistant
Mr. K.K. Ravichandran	Research Fellow
Mr. N. Sivakumar	Sr. Research Fellow
Ms. G. Uma	Scientist
Mr. S. Neethi Manickkam	Farm Manager
Mr. G. Rajashekar	Research Associate
Ms. M.R. Neelavathi	Research Associate
Mr. P. Sampathkumar	Research Associate
Mr. Prafulla Kumar Mishra	Research Associate
Mr. T.E. Krishnan	Driver

B. Eco-Aquaculture

Mr. A. Gopalakrishnan	Research Associate
Ms. A. Shaleesha	Research Associate

C. Model Coastal Systems

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Mr. Singaravel	Research Scholar
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#As on 1st July, 1995
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III. Programme Area 200 : Biodiversity

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Dr. T. Ravishankar	Scientist (Ethnobiology)
Dr. L. Veda Valli	Scientist (Social Anthropology)
Dr. G.N. Hariharan	Scientist (Lichens)
Dr. Smita Tripathy	Research Associate
Mr. A. A. Nambi	Scientist (Sacred Groves)
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Ms. R. Vidya	Administrative Assistant
Ms. R. Vijaya	Administrative Assistant
Ms. G. Anuradha	Administrative Assistant
Ms. T. Vijayasulochana	Administrative Assistant
Mr. E. Thiruvengadam	Administrative Assistant (Electrical)
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Mr. Christ Daniel Toppo	Technical Assistant
Mr. P.V. David	Technical Assistant
Mr. G. Sureshkumar	Technical Assistant
Mr. S. Gopalakrishnan	Driver
Mr. K. Pandi	Driver
Mr. R. Ondiveeran	Farm Assistant

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Dr. Ajay Kumar Parida	Sr. Scientific Officer
Dr. C. S. Anuratha	Sr. Scientific Officer
Dr. M.S.S. Mohan	Sr. Scientific Officer
Dr. H.D. Subhashini	Scientist (Molecular Biology)
Dr. P. Balakrishna	Sr. Scientific Officer
Dr. Sudha Nair	Sr. Scientific Officer
Dr. P.C. Jose Kutty*	Scientist (Tissue Culture)
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Mr. Vishwanath M Patil	Research Fellow
Mr. S. Elango	Research Fellow
Mr. Ajit Anand	Research Fellow
Mr. M. Parani	Research Fellow
Mr. C. Srinivasa Rao	Research Fellow
Ms. Jyothi Kurian	Research Fellow
Ms. M. Lakshmi	Research Scholar
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Mr. S. Purushothaman	Office Assistant
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Mr. R. Rajasekara Pandy	Project Associate
Mr. L. Sathiya Narayanan	Project Associate
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Ms. R. Sowmya	Project Associate
Mr. D.K. Sridhar Babu	Project Associate
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Ms. Shanthi Subramanian*	Project Associate
Mr. M. Suresh*	Project Associate
Mr. D. Tiroutchelvame	Project Associate
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Mr. R. Jeeva	Field Assistant
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B. ICAR National Professor Project

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Mr. M.A. Ansar Ali*	Senior Research Fellow
Mr. M. Gunalan	Senior Research Fellow
Ms. R. Mahalaxmi	Senior Research Fellow
Mr. S. Varadarajan	Senior Research Fellow
Mr. S. Balaji	Junior Research Fellow
Mr. V. Sudalai Kumar	Junior Research Fellow
Ms. S. Sumathi	Administrative Assistant
Mr. G. Ganesh	Driver

C. Eco-Horticulture

Dr. A. Sankaram	Distinguished Fellow
Mr. K. Sekar	Project Leader
Mr. V. Vijayakumar	Consultant (Marketing)
Ms. N. Brindha	Research Associate
Mr. K. Karthikeyan	Research Associate
Mr. C. L. Mohan Ram	Research Associate
Ms. N. Parvathi	Administrative Assistant
Mr. S. Mohan	Driver

D. IIFS

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Mr. L. Pandiarajan	Research Associate
Ms. Sudha Umapathy	Research Associate

E. Wasteland Enterprises

Dr. D. Dhanapal	Project Leader

F. Social Contract between Seed Industry and Rural Women

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V. Programme Area 400 : Reaching the Unreached

A. Tamil Nadu Council for Sustainable Livelihoods

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Ms. S. Sharada	Research Associate
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Ms. K. Sheela	Administrative Assistant

B. Project ACCESS

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Mr. A. Sarvesan	Joint Project Coordinator
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Ms. E. Rajeshwari	Secretary
Ms. K. Annammal	Secretary
Mr. R. Venkataramanan	Accountant
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C. Small Farmers Agri-business Consortium (SFAC)

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VI. Programme Area 500 : Education, Training, Communication and Information Services

A. Informatics Centre & Electronic Library

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C. Communication

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Ms. Anuja Gulati	Project Associate

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Mr. E. Padmanaban*	India
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Ms. Yamini Chandrasekhar	India
Ms. Priya Raman*	India
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Ms. Malathi Ramdas	Alappuzha
Ms. Sarada Ramdas	Alappuzha
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Dr. Rohini Iyer	Kasaragod

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Blue Star Limited	Pondicherry
FICCI	New Delhi
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Labmate (Asia) Limited	Madras
Bio-tech Consortium India	New Delhi
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Mrs. Malathi & Mr. K. Sankar Narayanan	California
Dr. Paul R. Ehrlich	California
Mr. Shivji Velji Kothari	Tokyo

*Donations in kind.

Sources of Project Support

Programme Area	National	International
100 Coastal Systems Research	Sir Dorabji Tata Trust, Bombay Council of Scientific & Industrial Research, New Delhi Department of Biotechnology, Government of India	International Development Research Centre, Canada Canadian International Development Authority Norwegian Agency for Development Co-operation (NORAD)
200 Biodiversity	Department of Biotechnology, Government of India Ministry of Environment & Forests, Government of India Rajiv Gandhi Foundation, New Delhi	International Plant Genetic Resources Institute, Rome and the Government of Italy Swedish International Development Agency The Darwin Initiative, UK United Nations Development Programme Ramon Magsaysay Foundation (Programme for Asian Projects)
300 Sustainable Agriculture and Rural Livelihood Security	Indian Council of Agricultural Research, New Delhi The Hunger Project (India), Bombay Department of Wastelands Development, Govt. of India	International Fund for Agricultural Development, Rome The Hunger Project, Japan The Hunger Project, Sweden United Nations Development Programme Food and Agriculture Organisation, UN Canadian Hunger Foundation

Sources of Project Support

Programme Area	National	International
400 Reaching the Unreached	The Hunger Project (India), Bombay Council for Advancement of People's Action and Rural Technology (CAPART), New Delhi	Aga Khan Foundation Bernard van Leer Foundation United Nations Development Programme MacArthur Foundation, USA
500 Education, Training and Communication	Indian Overseas Bank Council for Advancement of People's Action and Rural Technology (CAPART) Indian Farmers' Fertiliser Company Ltd. (IFFCO) Reserve Bank of India State Bank of India National Bank for Agricultural and Rural Development (NABARD) National Commission for Women Society for Social Forestry Research and Development, Tamil Nadu Foundation for Revitalisation of Local Health Traditions (FRLHT), Bangalore	International Agricultural Training Programme, UK UNICEF International Development Research Centre, Canada International Atomic Energy Agency, Vienna

Annexure

Next Five Years : 1995 - 2000*

We started in a small way in 1989, in guest faculty rooms in IIT and the Anna University but that was a really a planning stage. In April 1990, we moved into rented buildings in Kotturpuram and three years later, we shifted to our own building in Taramani, constructed on land kindly made available by the Government of Tamil Nadu. We have been working on five major programme areas. Our programmes on mangroves and biovillages have been in operation since the beginning. The programmes in our Centre are generally not of a short duration type, except for reports and seminars / dialogues. Achieving the goals of our work requires both sustained work and sustained support. In this talk, I shall give an account of what I consider to be significant areas we should be concerned with during the next five years.

MSSRF & CRSARD

Research and Training Programmes

1995 - 2000

- **Guiding Principles**
  - Social relevance
  - Scientific excellence
  - Special advantages
- **Pathways**
  - Concentration : scientific depth
  - Cooperation : partnership
  - Consolidation : taking the study to a state of visible impact
- **Research Methodology**
  - Development and dissemination of ecotechnologies
  - Action and participatory research
  - Strategic research
  - Anticipatory research

Box - 1

The guiding principles of our work are in Box 1. The principle of social relevance means in the Indian context poverty eradication. We have about 360 million people living below the poverty line, which is itself austerely defined only in terms of minimum caloric requirements unlike such definitions in industrialised countries where several other quality of life indicators are added. This size is roughly equal to the population of India at the time of Independence. Today, with so many people below the poverty line, we need to focus on those who are truly assetless - those men and women who have no access to land, water or fishing ponds and so on. The other aspect of social relevance is gender equity. India is unfortunately unique in having an unfavourable sex ratio of 927 women to 1000 men, according to the 1991 census. All states except Kerala reveal this imbalance. Therefore, women's empowerment and gender equity, must also be guiding principles in our work.

*Talk delivered by Dr. M.S. Swaminathan at the time of concluding the annual review of programmes in 1994. Delivered on 4th Jan. 1995.

The other principle is *scientific excellence*. We are called Centre for *Research* on Sustainable Agricultural and Rural Development, and we will be ultimately judged by our scientific excellence. The inscription in our building proclaims the need to integrate the twin concerns of conservation of natural resource base and securing sustainable livelihoods. It is important that scientific excellence is maintained in improving the livelihood security of the poor. Also, we can be a resource centre for other NGOs only if we maintain scientific excellence. One more principle is the maintenance of our special advantage as a NGO, as an organisation with flexibility and freedom to form partnerships with other organisations. This enables achievement of our goals in a shorter time compared to highly structured organisations, say a government department.

What are the pathways to achieving our goals ? The first is *concentration*, having scientific depth in our studies. We know that trees with shallow roots get easily uprooted in a storm. Most of our staff are young, in the age group 20-30, and they need to cultivate scientific *depth* in their work. This will enable presentation of work with the authority that results from direct experience. Possession of width alone is not adequate. Next is *cooperation*, both within and outside the organisation. We need to create a mechanism to back up cross-disciplinary projects with the in house social science capacity of our institution. We have one National Professor and several Distinguished Fellows in our centre who can provide such support and we must derive maximum benefit from them.

The value of partnership and networking with other institutions is evident from the work of ACCESS and SFAC groups. We must emphasize networking and building partnerships with other organisations who share our goals. Such partnerships have to be built first with institutions in the Taramani area (which has been designated as the "Science City" of Madras) and with institutions countrywide. We already have excellent collaboration with many ICAR institutes, agricultural and general universities, government departments, voluntary organisations, industry and financial institutions and this must be further strengthened.

Now, after five years of work, we must *consolidate* our gains. We must choose areas where we can lead and where our work can produce a visible impact. It is very important that we do not lose the leads already established, as for example in mangrove genetic resources conservation and multi-media database development. We must make all efforts to strengthen our lead, and produce a visible impact. This is applicable both to short-term programmes, such as preparation of reports, as well as to long-term programmes such as biovillages.

The methodology by which we generate such an impact is based on our choice of technology, which is mainly eco-technology. We held a Dialogue on ecotechnology in 1993 in collaboration with the Chinese programme on Rural Township Enterprises, and the results of this Dialogue have already started having effect. The Director-General of UNESCO, Prof. Federico Mayor, is planning the creation of twelve chairs worldwide on ecotechnology. Ecotechnology is broadly defined as the blending of traditional wisdom and the ecological prudence of people with advances in modern technology. We started with biotechnology, and have further identified information technology, space technology (such as remote sensing), renewable energy technology and management technology as

areas relevant to our work. It is not often realized that management is an important technology, since performance in any field at the national, institutional or at the level of a farm will depend on good management.

Also, our work in villages must be *participatory* in a genuine way, from the time of conception to the time of execution. Then we have *strategic research*, such as our research on the application of molecular biology to studies on biodiversity. There is a purpose in the use of such advanced techniques in our work ; we use them to gain information which conventional techniques may not be able to provide. The same is the case with our work on tissue culture - we do not engage in research in these areas only for the sake of doing research. We have created expensive facilities which are also expensive to maintain, and they should be put to meaningful use. Besides all this, we have *anticipatory* research. Now, this research is difficult as far as obtaining support is concerned. We initiated our work on mangrove genetic resources centres because of increasing scientific evidence of potential rise in sea levels and changes in climate. When sea level rise occurs, only relief work can be done. This is why we started our work on mangrove genetic resources centres in anticipation of such eventuality. This methodology has come to be appreciated widely, and has been commended in the recommendations of the "Pacem in Maribus" Conference held at Madras in December, 1994.

We want to be a *mission-driven* organisation, and *not a donor-driven* one. As long as the donor agency shares our goals and our mission, we shall accept funding from them, not otherwise. While we do need finance for sustaining our work (as conservation without resources is only conversation !), we must nevertheless stick to the basic principles which the institution stands for.

Programme Area 100

Coastal Systems Research

- Coastal Land Use : Agroforestry
- Eco-redevelopment of selected degraded areas
- Eco-aquaculture
- Integrated land and ocean surface planning

Box - 2

Our first programme area is Coastal Systems Research (CSR) (Box 2). The component of CSR on which we have already started work is coastal agroforestry. The model developed so far has a wide extrapolation domain. The next one is on eco-redevelopment of selected degraded mangrove ecosystems. This work should lead to a demonstration of the scientific principles and practices of eco-redevelopment. The project on eco-aquaculture which we have planned to start in Karaikal has come up in an important context. Aquaculture is economically highly viable, and is called a "sun rise" technology. Yet in parts of coastal Tamil Nadu and Andhra Pradesh, it has created serious social conflicts. We have emphasized that a technology must have viability on three counts, environmental, economic and social. A sustainability matrix must be drawn up to perform such an

assessment. Our project on eco-aquaculture in Karaikal is designed to bring this about. The other project on integrated land and ocean surface planning is also important, in view of the Law of the Sea which defines 12 nautical miles from the shoreline as territory and 200 nautical miles as the Exclusive Economic Zone of a country.

Programme Area 200

Biodiversity

Group A : Biotechnology and Biodiversity

- Saving endangered plant species and "Protected" Areas
- Coastal Biodiversity with particular reference to mangrove ecosystems
- Monitoring techniques : Biomonitoring, Remote sensing and GIS

Group B : Local Communities and Biodiversity Conservation and Enhancement

- Community Biodiversity Conservation Alliance
- Intellectual Property Rights of Tribal and Rural Families with reference to Plant Genetic Resources
  - Conservation of land races and intra-specific variability
  - Conservation through sacred groves
  - Genetic enhancement
- Community Gene Bank and Herbarium
- Women, Biodiversity and the Seed Industry

Box - 3

We shall now consider programmes under *Biodiversity* (Box 3). This is one of our earliest programmes and it has gone into two streams, (a) Biotechnology and Biodiversity and (b) Community Biodiversity Movement.

This division is based more on concepts and philosophy, than on the source of funding. Biodiversity conservation is defined at three levels of habitat, species and intraspecific variations. We are engaged in biodiversity studies at all the three levels. Protection of protected areas through a *National Biodiversity Alliance* is an example of our activity at the habitat level, while our work with land races (or variations in mangroves as detected using RAPD techniques) is an example of our work in conservation of intraspecific variability. We started our genetic conservation programme with saving the endangered plant (ie., Red Data book) species. Coastal Biodiversity is our niche in the area of biodiversity as a whole. We have focussed on mangroves, and on coral reefs and sea grasses, and we have gained a considerable lead in this area. We have developed good capability in biomonitoring, and in the use of remote sensing and GIS as tools for analysis and monitoring. Bioindication technology has many applications including those in pest management. In respect of remote sensing and GIS, we must stress that they are only analytical and diagnostic tools and their utility will depend on their linkages with field application.

Under the umbrella of the *Community Biodiversity Alliance*, we have developed partnerships with many NGOs. Our major emphasis is in the area of safeguarding the intellectual property rights of tribal and rural families in relation to plant genetic resources. Starting 1st January this year, the World Trade Organisation has come into existence along with various associated instruments and provisions, such as the Trade Related Intellectual Property Rights (TRIPS). This means that agricultural research which has functioned in a non-IPR environment for over 10000 years (that is, since the domestication of plants) may have to be organised hereafter in a new environment of commerce and competition. The implications for agricultural practices and research of this new environment were considered in our Dialogue last year, and we developed a Draft Plant

Resource Centre for Farmers' Rights

- Multimedia data base on IPR contributions of Tribal and Rural Families in the area of genetic resources conservation and enhancement
- Community Gene Bank
- Community Genetic Resources Herbarium
- Tribal Youth corps for *insitu* conservation of agri-biodiversity

Box - 4

Varieties Protection Act that provides an implementable and transparent method of legally protecting the interests of women and men who have identified, preserved and improved the basic genetic stocks which go into the making of successful varieties. We are now organising a resource centre for farmers' rights (Box 4). We must assemble all relevant information that can help defend the tribal women's interests in courts. The legal expertise is available to do this, and we must assemble this information into a database.

Our programme for keeping seeds of land races and intra-specific variation in our Community Gene Bank is for purposes of both preservation and identification. Related to this is the issue of genetic enhancement. Our scientists must identify how the tribals and others have applied their mind, identifying uses for species and varieties in different forms. At the same time, we should help to preserve the multiple models of *in situ* and *ex situ* conservation charasteristic of tribal and rural families. Interest in the economic exploitation of biodiversity is growing. There should be equal interest in creating an economic stake in conservation.

Then we look at programmes under Sustainable Rural Livelihoods (Box 5). Our work on biovillages is a good example of participatory action research designed to promote sustainable livelihood security among resource poor families. The IPM is an important ecotechnology and we have considerable strength in this area. Horticulture, like aquaculture, is also a ôsun riseö technciogy. In the last four or five years, India has increased its foreign exchange earning through export of fruits which have come mainly from dry lands. Eco-horticulture is a method of adding value to land through blending water conservation and high value cropping. The programme on Intensive Integrated Farming Systems (IIFS) has been initiated with support from FAO. The programme presently is a compilation of case studies of farmers who practise (a) intensive farming (they have high yields) and (b) integrated farming (of crop-livestock,

Programme Area 300

Sustainable Rural Livelihoods

- Biovillages
- Integrated Pest Management
- Eco-horticulture
- Sustainable intensive and integrated farming practices

Box - 5

crop-crop or crop-fish) on an ecologically sustainable basis. The last aspect is crucial for sustaining rural livelihoods. These studies are fascinating because we are learning from farmers, whose knowledge comes fresh from real life experience. We should always remember that one ounce of practice is worth tons of theory.

Programme Area 400

Reaching the Unreached

- Women and Children
- Social contract between private sector industry and resource poor rural families
  - Seed production
  - Marketing
- Agri-business for families with small holdings

Box - 6

The next programme area is Reaching the Unreached (Box 6). The programme on children and women assumes importance in the context of the growing feminisation of poverty and the persistence of sex ratios adverse to women. There is need for a social contract between the private sector industry and the rural poor. This contract should not be such as to burden the poor with additional unskilled work but to add value to their time. Women in particular are over-worked. They do not need more hours of work but they need more economic value to each hour they work. Fortunately, we have many industrial groups in India, who are willing to adopt such a model. We have chosen the seed industry as an example where such a social contract can work. The other approach is through marketing. Whatever we suggest to the rural poor must be economically viable. This approach is also relevant for agri-business for small farmers.

Programme Area 500

Training, Information & Communication

- **Multi-media Databases**
  - Mangrove Ecosystem Information Service : Global
  - Ecological Farmers of India
  - Intellectual Property contributions of tribal and rural families in relation to the conservation and improvement of agri-biodiversity
- **Training**
  - Farmer to farmer
  - ***In situ*** training in special skills
  - Structured farmer level training
  - Special high level training courses
  - International training programmes
- **Workshops and Dialogues**
- **Publications**

Box - 7

Programme Area 500 (Box 7) relates to information, training and workshops. What I have listed here are the areas where we have credibility and leadership, and which I believe should be our long-term concerns. The multimedia databases on mangoves are global in scope. They have been praised by all those who have seen them but praise in words without financial support is not adequate. The funding support for the Mangrove Ecosystem Information Service ended last year. The other database is on ecological farmers of India, created from the IIFS data (mentioned in Box 5). This has the potential to influence syllabi and curricula. This is one example of how a small effort, like compilation of information, can have a large downstream benefit. Some of our scientists have on their own started creating

Programme Area 600

Special Short Duration Projects

- Voicing Silence
- FAO FARM Programme
- IFAD Study on Agricultural Research
- UNDP Study on Food Security issues in the Asia-Pacific Region

Box - 8

databases and this is important. The one on tribal IPR is a significant contribution and will be one of our core concerns in the long term. We have one of the best CD-ROM collections in agriculture and environment in the country and all research workers should make full use of this unique facility.

As for training, we shall continue with multiple models of training. Our biovillage programme has spearheaded farmer-to-farmer learning. Our eco-horticulture programme has developed innovative methods of *in situ* training of change agents. This will enable participation of women in training programmes, and can provide a stake to the change agents and village-level trainers to live in villages. Similarly, training programmes for promoting a tribal youth corps for *in situ* conservation of agri-biodiversity are very important. We have had structured farmer-level training programmes, and special high-level training such as the one on CD-ROM use or on bioindicators. Besides, an international training programme was organised on mangroves. Our annual dialogues are important because they bring together social scientists and hardcore technologists. The variety and range in our publications should also be maintained. Emphasis on quality must be an overriding concern in all our publications.

MANAGEMENT

- **Aim** : Cooperative and collegiate management which can provide unfettered opportunities for creative, socially relevant and output oriented work
- **Structures**
  - **Policy Oversight**
    - » Trustees
    - » Management Committee
    - » Research Advisory Committees
  - **Task Implementation**
    - » Purchase Committee
    - » Library Committee
    - » Computer Committee
    - » Building and Research Infrastructure Committee
    - » Staff Welfare Committee
    - » Seminars
    - » Social and Housekeeping Committee

Box - 9

We have undertaken some short-term studies (Box 8). Besides *Voicing Silence*, an action-research in gender and cuttore we have done three major studies. All these have the potential for future build up. The reports prepared for IFAD and UNDP have been peer-reviewed. They offer considerable insights into methods of promoting food security at the level of individuals within a household.

I shall now take up the question of management (Box 9). Management technology is as important to this centre as biotechnology or information technology. Our aim is to perform creative and socially relevant work while being conscious of output and accountability. This is important because we

have only limited resources and we should be output oriented in our work. Regarding structures, we have several bodies - the Trustees, the Management Committee, and Research Advisory Committees. The Research Advisory Committees are important for continuous peer review. We should have committees where the members are willing to spend time and apply their minds and give us suggestions and guidance.

We have several committees for task implementation, some functional, some non-functional. The purchase committee is important in streamlining purchases and in rendering us trust-worthy. Then we have other committees each one looking after an important task. I suggest that the committee members meet among themselves and take decisions. Individual staff members may choose the committees on which they wish to serve, depending on interest, or can opt out. Our building's upkeep is extremely important and we have dedicated helpers who keep the building clean and we must keep it up. In all our work, we should keep the principle of *accountability* uppermost in our mind and remember what Gandhiji once said, "The most important lesson I have learnt in my life is from my illiterate mother, who taught me that all rights accrue from a duty well done"

How do we finance our programmes ? (Box 10). Our building and facilities are expensive to maintain. Our first floor is airconditioned and is expensive in terms of electricity consumption. Our genebank is also expensive to maintain. Here I suggest that all relevant programmes, biovillage, ecohorticulture etc., should also contribute significant collections to our genebank. We should also have core staff - scientific and supporting, who are not dependent on projects for funding. Some of our support staff are indispensable. These expenses, however, cannot be met from projects. We have to have core funds to support them. This is why we are striving to build a corpus fund. My own estimate is that we require a corpus of Rs. 10 crores, since Rs.1 crore per year will be needed to support core staff and facilities. Maintenance of building, water and electricity alone cost us Rs. 24 lakhs per year now. We should therefore continue our efforts to raise corpus funds to the tune of Rs. 10 crores which will place us on a secure financial footing. We should not have less, but we should not have too much money either. We should have sufficient funds to generate a critical mass of effort in the areas we have chosen. Over and above the corpus, the project leaders can bring in resources to support projects, which they are doing now. *Concentration* rather than "chasing too

FINANCE

- **Core : Donations to the Corpus**
  - Maintenance of research infrastructure
  - Core staff - scientific and supporting
- **Special Projects : Time-bound projects supported by national and international agencies**
  - Strict observance of Programme - Budget linkages
  - Timely submission of Technical and Fiscal Reports

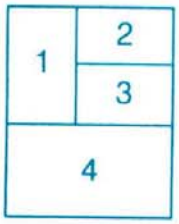
Box - 10

many butterflies" should be the motivating factor in developing new projects. In seeking project support, I must stress that we only look for support where we can build on the lead we have established, and not diversify. If we chase too many butterflies, we may not have one in the net in the end!

The special projects we take up are time-bound projects supported by national and international agencies. In dealing with them, we must be strict in ensuring programme-budget linkages. The budget should always be programme-driven. If we have been sanctioned money for a particular purpose, we must use it only for that purpose. If we want to, say, utilise savings, we must do so only with the concurrence of the funding agency. We must be very particular in ensuring timely submission of technical and fiscal reports to the concerned agencies. We should send reports a month before the due date. Timeliness and high standards of integrity in these matters inspire confidence in the donors.

I have tried to present a synthesis of our past 5 years' activities, areas where we have established credibility and leadership, and my views on how to carry our work forward. All this is for discussion, as I do not believe in command performance. Consensus and cooperation must become our twin major strengths. I am confident that if we work together and combine social concerns with commitment to scientific excellence and integrity, we can build an Institution of which we can all be proud.

Back Cover



1. Girl who has dropped out of school to take care of younger child while parents are out earning a living.
2. *Piper barberi* Gamble, a critically endangered species restricted to southern Western Ghats, successfully micropropagated for reestablishing in its natural habitat.
3. An eel in the genus *Muraenesox*; this benthic fish collected in Pichavaram is amongst the estuarine organisms which show promise as bioindicators of aquatic pollution.
4. *Ex situ* conservation of *Rhizophora mucronata* from various coastal regions of India at the first mangrove genetics resources conservation centre, Pichavaram.

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