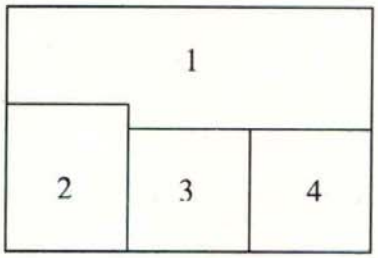
M. S. SWAMINATHAN RESEARCH FOUNDATION

1999-2000
TENTH ANNUAL REPORT

Centre for Research on Sustainable Agricultural and Rural Development, Chennai.



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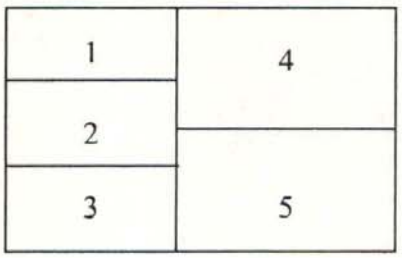

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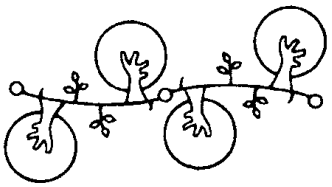
Tenth Annual Report
1999 - 2000



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Cover Design : *The Frontline*, Chennai

Printed at : Reliance Printers, Chennai

Citation : Tenth Annual Report : 1999-2000
M.S. Swaminathan Research Foundation

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Chairman's Introduction

This is the tenth Annual Report of the Foundation. A brief history describing the birth and growth of MSSRF is being published separately. In essence, the basic scientific mandate of MSSRF is to impart a pro-nature, pro-poor and pro-women orientation to a job-led economic growth strategy in rural areas. The first major activity of MSSRF, soon after its establishment at Chennai in 1989, was the organisation of an International Dialogue on Plant Genetic Resources (PGR) in collaboration with the Keystone Centre of the United States of America. This Dialogue, held from 29 January to 2 February 1990, resulted in several important recommendations such as the adoption of a global Convention on Biological Diversity, the establishment of a new financial facility for strengthening genetic resources conservation and the recognition of the rights of farmers and rural communities, particularly of women, who have greatly contributed to the creation, conservation, exchange and knowledge of genetic diversity and species utilisation. The Keystone–MSSRF Dialogue also recommended that germplasm collections should be carried out under an acceptable ethical code which should include procedures such as the explicit advanced clearance by the concerned country and agreement on sharing of benefits.

Ten years later, it is a matter for satisfaction that this very first activity of MSSRF helped in a small way to generate the consensus needed for several significant international developments. Thus, a legally binding Convention on Biological Diversity (CBD) was adopted at the UN Conference on Environment and Development held at Rio de Janeiro in June 1992. A Global Environment Facility (GEF) now exists as a major multilateral funding mechanism to stimulate and support biodiversity conservation efforts. At the national level, a Protection of Plant Varieties and Farmers' Rights Bill and a Biological Diversity Bill are currently being considered by the Parliament of India. The draft Indian Bill on Plant Variety Protection is the first in the world which recognises and rewards both the contributions of tribal and rural families to conservation, (i.e. farmers' rights) and of breeders to the commercialisation of PGR (i.e. breeders' rights).

MSSRF, having started its work with this major initiative, has subsequently continued its efforts in developing the necessary legal and public policy framework essential for promoting concurrent attention to the conservation and sustainable and equitable use of biodiversity. In January 1994, an interdisciplinary Dialogue was held to prepare a draft Plant Variety Protection and Farmers' Rights Act. The Madras Draft Act, as it was then known, served as the starting point of the efforts of the Ministry of Agriculture of the Government of India to get an integrated Bill on breeders' and farmers' rights prepared for the consideration of Parliament. In 1996, MSSRF, in collaboration with FAO, organised another Dialogue to provide inputs for the preparation of a Global Plan of Action for the Conservation of PGR, which was subsequently adopted at Leipzig in Germany in September 1996. A detailed strategy for the conservation of agrobiodiversity was prepared for GEF. Currently MSSRF is engaged in compiling the best practices adopted in different parts of the world

for operationalising at the field level the concept of equity in benefit sharing for the use of GEF/UNDP/GOI.

While working at the level of policy making, MSSRF was deeply conscious of the need to work with the primary conservers of genetic resources, namely tribal and rural women and men. Soon after moving into a rented building in Kotturpuram, Chennai, in April 1990, MSSRF began its work on Coastal Systems Research (CSR), designed to foster simultaneously the ecological security of coastal areas and the livelihood security of coastal communities. Priority attention was given to Coastal Mangrove Wetlands and to the unique marine ecosystem of the Gulf of Mannar area of Tamil Nadu. MSSRF's mangrove work resulted in an international project designed to identify and conserve the mangrove genetic resources of the Asia-Pacific and West African Regions. This work, supported by the International Tropical Timber Organisation (ITTO) with funds provided by the Governments of Japan, United Kingdom and Australia, led to a widespread realisation of the importance and urgency of mangrove genetic resources conservation. It also generated greater national and international attention to the need for saving mangroves to save the ecological and human security of coastal areas.

Baimuru in Papua New Guinea and Bhitarakanika in the State of Orissa, India, were identified as the two richest areas in the Asia-Pacific Region with reference to mangrove genetic diversity. MSSRF also helped to establish a Global Mangrove Ecosystem Information Service as well as an International Society for Mangrove Ecosystems (ISME), of which the Chairman of MSSRF was elected Founder-President.

The MSSRF programme in the field of CSR later led to a large research and development programme supported by the India-Canada Environment Facility for conserving the mangrove wetlands of the States of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. This programme was initiated in June 1997 and its progress was reviewed this year by an External Review Team. Among the major observations and recommendations of the External Reviewers are:

"The project has succeeded in creating sufficient awareness about conservation of mangroves in programme villages. Since mangrove dependant communities are either landless labourers or small and marginal farmers or fishermen, the sustainability of the programme is bound to receive greater support if poverty reduction is provided much more thrust in the remaining period of the project".

The Review Team has also recommended that the project should work proactively in the area of policy advocacy to assist State Governments in getting guidelines for Joint Mangrove Management (JMM) put in place at an early date. The team has further stressed the need for building the capacity of the local Forest Department personnel in JMM. The Team has recommended the extension of the project for a further period of two years in Tamil Nadu, Andhra Pradesh and West Bengal and for three years in the case of Orissa, since, in spite of the impressive progress made so far, additional time will be needed to consolidate the gains already made and to ensure the sustainability of the participatory management system being developed. The Review Team has paid a particular tribute to the efforts made to integrate attention to the role and needs of women within the project framework. Action is being taken to

implement the recommendations of the Review Team.

The ultimate objective of this Project is to develop and institutionalise participatory management systems resulting in symbiotic partnerships between Forest Departments and mangrove forest-dependant communities. The major aim is the generation of livelihood and ecological stakes in conservation. The severe cyclonic storm which affected coastal Orissa in October '99 provided avenues for converting this calamity into an opportunity for intensification of efforts to strengthen both ecological and human security in the cyclone-ravaged areas. The local families saw the beneficial impact of mangrove forests in mitigating the adverse impact of coastal cyclones. There is now widespread interest in rehabilitating the degraded mangrove areas and extending mangrove plantations to additional areas.

Confidence in the work of the young scientists of MSSRF working in the Coastal Mangrove Wetlands areas of Orissa was clear from the additional responsibility entrusted to MSSRF by CIDA-ICEF, the RD Tata Trust and the staff of M/s Pricewaterhouse Coopers and Lovelock and Lewes Services Pvt. Ltd. All these agencies/ staff associations have provided funds to MSSRF both to rehabilitate cyclone-damaged ecosystems and to improve on-farm and non-farm employment opportunities through the Biovillage model of sustainable livelihoods. Since the tasks ahead in linking ecological and livelihood security in a mutually reinforcing manner are huge and complex, a National Network on Biovillages and Community Banking was launched in February 2000 by the Hon. Shri Digvijay Singh, Chief Minister of Madhya Pradesh, at a workshop held at MSSRF, Chennai. The initial partners in the Network are the DHAN Foundation, Madurai, Bharatiya Agro-Industries Foundation (BAIF), Pune and the Society for the Promotion of Wasteland Development (SPWD), New Delhi. MSSRF will serve as the co-ordinating centre of the Network which will foster market-driven micro enterprises supported by micro credit and strive to achieve the twin goals of poverty eradication and natural resources conservation and enhancement. The strength of the Community Banking System flows from its low transaction cost, user-controlled system and linkages with appropriate support services. We are indebted to Dr Geeta Mehta of Tokyo for establishing a "Friends of MSSRF" Organisation in Japan for mobilising support for this Community-Banking-led poverty elimination movement.

The UNDP-supported Biovillage Project comes to an end in December 2000. A review of the project was made at a workshop held at Pondicherry in November '99. Inaugurating the workshop, the Lt. Governor of Pondicherry, Her Excellency Dr Rajani Rai, suggested that the Biovillage model of environment protection and poverty eradication be extended to all the villages numbering over 250, of the Union Territory by August 15, 2007, which marks the 60th anniversary of India's Independence. Steps have already been initiated in collaboration with the Pondicherry Administration to realise this objective. It is hoped that the Pondicherry initiative will stimulate all State Governments to plan and implement an Agenda 2007 programme, encompassing the urgent tasks of nature conservation and enhancement, poverty eradication, population stabilisation, gender equity and human resource development. In order to assist the spread of the Biovillage movement, MSSRF is organising a "Biovillage Corps" of rural women and men, who have

proved to be the prime movers and doers in Pondycherry Biovillages during the last 5 years. Several of them are semi-literate but possess enormous technical skill and iinovative spirit.

The work initiated in 1990 in Mangrove Wetlands had three major aims – first, to conserve mangrove ecosystems and genetic resources; second, to restore degraded mangrove forests and third, to transfer the salinity tolerance properties of mangrove species to non-mangrove species like rice, mustard and other crops through molecular mapping and breeding.

For achieving the third objective, a Molecular Genetics Laboratory was established in 1993 with financial support from the Department of Biotechnology, Government of India. The young scientists working in this laboratory have standardised protocols for transferring the genetic systems regulating sea water tolerance in mangrove species to annual crops like tobacco and mustard. Transformation work is currently in progress in rice. The programme started seven years ago to undertake anticipatory steps to meet the challenge of a potential rise in sea level caused by global warming, has thus yielded important results. Functional genomics research is being initiated in order to take full advantage of the availability of a "working draft" of the rice genome. Here again the emphasis will be on salinity tolerance. MSSRF is probably the first institution in the world to initiate a systematic anticipatory research programme using recombinant DNA technology to prepare for facing the enhanced coastal salinity problems that may arise from a possible rise in sea level during this century. To facilitate community involvement in the monitoring of the health of ecosystems rich in biodiversity, simple biomonitoring tools have been standardised involving bacteria and lichens.

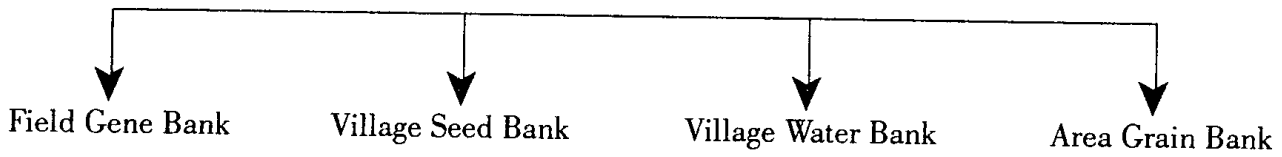
The January 1990 Keystone–MSSRF Dialogue on Plant Genetic Resources urged all countries to recognise and enhance the on-going efforts of women in both the conservation of PGR and selection of varieties suited to specific agro-ecological and socio-cultural needs. MSSRF's mandate also stipulates a pro-nature, pro-poor and pro-women orientation to technology development and dissemination. The draft legislation prepared by MSSRF for the protection of Plant Varieties and Farmers' Rights as well as Biodiversity includes specific provisions for integrating the gender dimension in such Acts. Also, the programmes of MSSRF in the field of biodiversity conservation and enhancement involve specific attention to the role of women in this vital area of human endeavour.

In collaboration with the FAO Regional Office in Bangkok, two major consultations have been held, one in 1997 and another in 1999, for examining and understanding gender roles in the conservation and improvement of bioresources. Case studies were undertaken in six biodiversity rich locations in India. Studies were also undertaken in Sri Lanka and Maldives with support from FAO. During 2000-2001, it is planned to undertake similar studies in Indonesia in collaboration with "Kehati", an Indonesian Biodiversity Foundation. Globally, MSSRF is regarded as a pioneer in the field of research relating to gender and biodiversity management.

Another significant activity during the year under report relates to an analysis of the role of women in sustaining and strengthening household food and nutrition security. A workshop

was held in February 2000, with support from the World Food Programme (WFP) to consider this issue. An important outcome of this Workshop was the development of a gender sensitive methodology which can facilitate community involvement and action in all links in the conservation, cultivation and consumption components of a sustainable and effective food and water security system, as shown above.

Community Food and Water Security System
(Operated by rural women and men self-help groups)



Rain water harvesting, conservation and sustainable use, so as to create a Village Water Bank, will be particularly important, since the burden of fetching water falls on women and since food security depends greatly on the availability of water both for agriculture and domestic consumption. The Field Gene Bank involving *in situ* on-farm conservation of agrobiodiversity will also minimise risks to crops arising from biotic and abiotic stresses. It is proposed to launch such a community-owned and managed Food and Water Security System during the year 2000 in the Kalahandi and Koraput districts of Orissa, with support from the interest of a generous endowment grant made by the Ford Foundation. Work is currently in progress, with support from the World Food Programme, to prepare a Food Insecurity Map/Atlas of India as well as to develop indicators for measuring vulnerability to chronic hunger at the level of each individual in Orissa.

The Panchayati Raj-led Hunger-Free Area Programme made further progress in Dindigul district of Tamil Nadu. Implemented through the Gandhigram Rural University and the Kovilur Panchayat, this pilot project indicates the scope for the rapid elimination of both under-nutrition and hidden hunger caused by micro nutrient deficiencies in the diet. Special attention is being paid to eliminating maternal and foetal undernutrition, since this is the primary cause for the birth of children with low birth weight (LBW). LBW children are handicapped at birth in achieving their full genetic potential for mental and physical development. The UN Commission on Nutrition in its report, in the preparation of which MSSRF played an important role, has stressed the urgent need for attention to the nutrition of pregnant women belonging to the economically and socially underprivileged sections of the human family, since denying opportunities for mental development even at birth represents the cruelest form of inequity (*Ending Malnutrition by 2020: an Agenda for change in the Millennium*; Report of the UN Commission on the Nutrition Challenges of the 21st Century, February 2000).

Three major workshops highlighted links between gender and biodiversity, agricultural education, and food security. A collaborative

programme is being developed with Kerala Agricultural University to strengthen the gender dimension in undergraduate curricula. The gender dimension is being slowly internalised in all the activities of the Foundation through the processes of training, sharing, capacity building and audit. In connection with the child-related issues, research has focused on development and validation of tools, firstly to measure the quality of care and education being offered in child care centres dealing with young children and secondly to measure the costs and benefits of such services. Capacity building continued and involvement of Panchayat leaders in child care services was taken up as an action-research. A strong demand from Government Departments (Social Welfare and Rural Development) for resource and training materials related to the young child peaked this year with the reproduction and distribution by UNICEF of some of these materials to 15,000 communities.

Nearly two-thirds of the population of India depend for the security of their livelihoods on both on-farm and rural non-farm activities. These cover the areas of crop husbandry, horticulture, animal husbandry, fisheries, agro-forestry and agro-processing. It is clear therefore that agricultural strategies should be designed not only to produce more food but also to generate more income and opportunities for skilled employment. A detailed strategy as well as a Vision Paper in this area were prepared at the request of the Ministry of Agriculture of the Government of India (Department of Agriculture and Co-operation). The Vision Paper and the operational strategy were discussed and finalised at a meeting of State Agriculture Commissioners held at New Delhi on January 28 and 29, 2000.

The MSSRF strategy for agricultural renaissance comprises the following three components:

- *Consolidating and deepening the gains* already achieved in irrigated areas
- *Extending the gains* to rainfed, dry-farming and hill areas as well as to the Andaman and Lakshadweep group of islands.
- *Making new gains* in the areas of farming systems diversification, value-addition to primary produce and conferring the power of scale both in production and post-harvest technologies to resource-poor and small-scale farm and fisher families.

Based on a request from the Planning Commission, Government of India and with financial support from UNDP, MSSRF had submitted in 1996 proposals for organising Small Farmers Agri-business Consortia (SFAC) in twelve States of the country. During 1999, a National Association for Agri-business Development was launched as a Registered Society, in collaboration with the Central Food Technological Research Institute (CFTRI), Mysore. With guidance from Prof Joseph H Hulse of Canada, who serves as a Distinguished Visiting Professor at MSSRF, and with financial support from the Food Links Programme of the International Development Research Centre of Canada (IDRC) and the Hindustan Lever Ltd, systematic efforts have been initiated to link rural producers and urban consumers in a mutually beneficial manner. The initial efforts centre round minor millets and pineapple from Kolli Hills in Tamil Nadu, and mushrooms in Pondicherry. The minor millet programme has the further advantage of stimulating the revitalisation of the earlier traditions of tribal

and rural families to conserve and utilise a wide range of grains belonging to genera such as *Paspalum*, *Panicum* and *Setaria*. This helps to widen the food security basket. Many of these underutilised plants are rich in iron, calcium, vitamins and other micronutrients and hence can make an important contribution to fighting hidden hunger caused by micronutrient deficiencies. TRIFED (Tribal Cooperative Marketing Development Federation of India) and various food industries have come forward to purchase both minor millets and organically grown pineapples.

The work of the JRD Tata Ecotechnology Centre on integrated intensive farming systems is making excellent progress and this programme has helped to integrate principles of ecology, gender equity and employment generation with those of economics in small scale agriculture and aquaculture. Household ornamental fisheries gave very poor *dalit* families in Keelamanakudi an additional income of Rs. 500-1,000 per month.

The work of the JRD Tata Centre in the area of establishing Pulses and Seed Villages and household biopesticide production units reached a stage during 1999 when farm men and women took over the responsibility for managing these enterprises through their own Associations. In the Pondicherry Biovillages also, the work will be continued from January 2001 by a local Biovillage Society. The long-term sustainability of the initiatives of the JRD Tata Ecotechnology Centre has thus been ensured.

The work of the CAPART Technical Resource Centre was completed this year. A resource Centre for Precision Farming for Poverty Alleviation was established with financial support from NABARD at Kannivadi in the Dindigul District of Tamil Nadu. The aim of this centre is to develop and disseminate practices which can result in the most efficient and economic use of inputs like land, water, energy and nutrients. What to apply, when to apply, how much to apply, where to apply and similar field-level issues are being addressed at this NABARD Resource Centre with reference to inputs like water, nutrients and pesticides. The Centre has the benefit of collaboration with the Arava R&D Centre in Israel. Collaboration is also being developed with the Ohio State University in USA, with financial support from the Sir Dorabji Tata Trust, for developing management practices to help improve the productivity, profitability, stability and sustainability of red soils (alfisols), vertisols, alluvial soils characterised by rising or receding water table, and coastal sandy soils. A workshop was held in June 2000, to finalise the experimental design and programme priorities. This programme will be a collaborative one involving the Punjab Agricultural University, Ludhiana, the Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur, the Indian Council of Agricultural Research, and the Ohio State University, USA. MSSRF will serve as the Co-ordinating Centre. Thus, MSSRF's mandate to promote sustainable agriculture and rural development is being addressed from several different directions.

Besides the areas of conservation of mangrove genetic resources and operationalisation of the benefit-sharing provisions of the Convention on Biological Diversity, an area of field research undertaken by MSSRF scientists which has attracted global attention is the use of modern information and communication technology for the elimination of rural poverty. This programme was initiated in 1998 with financial support from the IDRC of Canada. The

Rural Knowledge Centres functioning in eight villages in Pondicherry are controlled, driven and managed by the users. The transaction costs are low but the technology is the most advanced.

An integrated wired and wireless system and arrangements for uninterrupted power supply through a solar photovoltaic system help to introduce to rural women and men living in poverty the power and value of two advanced technologies–information and solar. The uniqueness of the MSSRF system has attracted global attention and there have been detailed reports of these women-managed Knowledge Centres in the *New York Times* and the *International Herald Tribune*. With the help of the "Friends of MSSRF" in Tokyo and IDRC, it is proposed to expand this system and to integrate it with the Biovillage and Hunger-Free Area Programmes. It is also planned to link the computer and the Internet-aided knowledge system with a community radio network, so that relevant information can be spread speedily in the right language and at the right time and place.

In the linkages being developed between science and the segments of society whose basic human needs are unfulfilled, a significant step was taken by the Department of Atomic Energy in establishing at MSSRF a Homi Bhabha Chair for Nuclear Sciences and Rural Society. Several important results including the identification of improved varieties of pulses and oilseeds from among the radiation induced mutants produced by scientists of the Bhabha Atomic Research Centre at Trombay, have been obtained under this programme. New opportunities have been opened up for rural families living in the vicinity of Atomic Power Plants for improving their income through the cultivation of superior strains of pulses and oilseeds and by taking to horticulture, agro-forestry and aquaculture. Steps are being taken to foster similar linkages between space science and rural societies. This is in keeping with MSSRF's goal of bringing the best in modern science and technology to the rural poor and working with them in participatory research programmes to achieve suitable blends of traditional knowledge and frontier science.

Information and Communication Technology for Poverty Alleviation will be the theme for the January 2001 inter-disciplinary dialogue. It was at the Dialogue on Information Technology held in January 1992, under the series "New Technologies: Reaching the Unreached", that the concept of Information Villages and Rural Knowledge Centres, where generic information is converted into location specific ones, was developed. To quote Dr Bruce Alberts, President of the US National Academy of Sciences, "The MSSRF Information Village programme increases the status and influence of women by making them the primary local knowledge providers. Drawing on this concept, I envision a global electronic network that connects scientists to people at all levels – farmers' organisations and village women. The network will allow them to easily access the scientific and technical knowledge that they need to solve local problems and enhance the quality of their lives, as well as to communicate their own insights and needs back to scientists" (from *Science and the World's Future*, Presidential Address of Dr Bruce Alberts at the US National Academy of Science, delivered on April 26, 1999).

The Media Resource Centre set up at MSSRF by *The Hindu* group has developed into

another powerful mechanism for both interaction with media and for mobilising the printed and electronic media to spread the messages and methods of ecotechnology and sustainable food and livelihood security. Besides Millennium Lectures and media training courses, several interactive media workshops on themes like "Genetic Modification" and "The Challenge of the Impending Water Crisis" were organised. In August this year, *The Hindu* Media Resource Centre will host a National Media Workshop on *Media and the Gene Revolution* with a focus on the human and rice genomes and genetically modified foods.

In keeping with the MSSRF philosophy that the work of the Foundation should be characterised by inclusiveness and not exclusiveness, MSSRF scientists are currently working with the Government of Tamil Nadu (through TIDCO) and the Department of Biotechnology, Government of India, in establishing a Womens' Biotechnology Park at Kelambakkam, near Chennai. Women entrepreneurs will take to a career of self-employment at this Park by undertaking enterprises based on marketing opportunities in the areas of food, agricultural, medical and environmental biotechnology. This Park has opened up opportunities for married women who, after taking University degrees, have not been able to take to a professional career for personal and family reasons. Girl students are invariably toppers in school and University examinations. Social compulsions often do not help them to realise in later life the full expression of their intellectual brilliance. As a part of its pro-woman research and training strategy, MSSRF is endeavouring in a small way to ensure that promising women professionals are provided with opportunities to convert their early academic accomplishments into entrepreneurial excellence. A Women's Eco-Aquaculture Park is also being developed at Karaikal, with support from the Department of Biotechnology, to enable fisher and landless labour women to take to prawn farming. MSSRF is also assisting in the realisation of the vision of the Hon. Chief Minister of Tamil Nadu that Tamil Nadu should harness biotechnology to convert its rich bioresources into economic wealth.

The work described so far would not have been possible without sustained financial and management support. It has been the endeavour of the management of MSSRF to build a Corpus Fund, the interest from which will help to maintain the research and training infrastructure, on the one hand, and meet the salaries of core professionals, on the other. Substantial progress was made during 1999-2000 in building the Corpus, thanks to a generous grant from the Ford Foundation. We are deeply indebted to Ms. Susan Berresford, President, and the Trustees of the Ford Foundation for this timely assitance. We are particularly indebted to the Hon. Chief Minister and Government of Assam for a generous contribution to the Corpus Fund. Many others, whose names are listed in this report, also made contributions. The RD Tata Trust has made an endowment grant which will help the JRD Tata Ecotechnology Centre to undertake programmes designed to strengthen in a sustainable manner the economic and environmental security of families living in the cyclone ravaged villages in coastal Orissa. As mentioned earlier, MSSRF was chosen by several agencies to assist in the ecological and economic rehabilitation of these cyclone-affected areas. Our sincere thanks go to all our donors, national and international, institutional and individual, and to government

and non-governmental organisations. We can only assure them that we shall try our best to prove worthy of their trust.

The scientists of MSSRF also reviewed during this year the programme priorities for the period 2000-2005. The priorities identified together with a note on guiding principles and goals are given as an *Annexure* at the end of this Report.

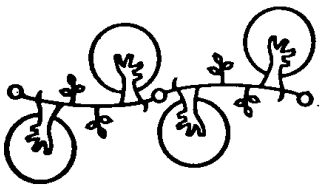
Finally, sustained institutional dynamism needs for its sustenance creative and dedicated individuals. MSSRF has been fortunate in this respect. The Foundation has over 200 outstanding young women and men scholars and scientists. In addition, it has several reputed and senior scientists working as Distinguished Fellows. The administrative, financial and supporting staff are equally competent and dedicated. Because of the emphasis given to human resource development, several young scientists who joined MSSRF seven to eight years ago have now become nationally and internationally recognised leaders in their respective fields. Personnel and management policies are designed to foster innovation, dedication and commitment to serving the economically and socially underprivileged sections of society. During the last ten years, over ten staff members have taken their Ph D degrees working at the Foundation. The emphasis is on inter-disciplinary team work designed to solve field problems within a specific time frame. The management culture is a collegiate one with all staff members and scholars having a sense of participation in management decisions. Authority and accountability are linked at every level.

During 1999, the Trustees of MSSRF took a major step in strengthening the administrative and management sustainability of the institution. After an extensive global search, Prof P C Kesavan, Homi Bhabha Chair in Nuclear Sciences and Rural Society, was appointed as the Executive Director of MSSRF. He joined this position in August '99. Prof Kesavan brings to this position rich experience in the areas of strategic research, post-graduate education and research administration. He has his roots in agricultural science having taken his Ph D degree from the Indian Agricultural Research Institute, New Delhi, over 30 years ago. Thus, steps have been taken to ensure both the management and financial sustainability of MSSRF.

The Trustees of MSSRF have given their time, vast experience and knowledge generously for the work of MSSRF. Various departments of the Central and State Governments have assisted in numerous ways. UN Agencies particularly UNDP, GEF, FAO, WFP, UNICEF and UNIFEM, have been very supportive both technically and financially. Our particular gratitude goes to the Hon. Chief Minister, other Ministers and officers of the Government of Tamil Nadu for their generous encouragement and support.

Dr Nandhini Iyengar edited this report, while Drs V Balaji and Sudha Nair coordinated its preparation. Particular thanks go to Mr N Ram and the staff of *Frontline* for designing and printing the cover.

Programme Area 100



Coastal Systems Research

The critical importance of Coastal Mangrove Forests to human and ecological security became evident in the areas of Orissa affected by a severe cyclone in October 1999. Steps were initiated for the ecological and economic rehabilitation of the affected areas. Progress was achieved in developing Participatory Mangrove Management Systems. New opportunities for improving the livelihood security of coastal communities were opened up in areas adjoining Atomic Power Plants and in the Gulf of Mannar Biosphere Reserve region of Tamil Nadu.

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Sub Programme Area 101

Coastal Wetlands : Mangrove Conservation and Management

The project is a people-centred, process-oriented and science-based development project, supported by the India-Canada Environment Facility. It is being implemented in the States of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. The purpose of the project is to build capacity in local communities, voluntary organisations, grassroot level democratic institutions, the Forest Department (FD), MSSRF and government agencies to restore, manage and conserve mangrove wetlands through participatory analysis and action. The important output expected from the project is a model for Joint Mangrove Management, which can be adopted and replicated by the FD, which manages the mangrove wetlands in a state.

There are 42 targeted demonstration villages for Joint Mangrove Management in the four states and the project is currently being implemented in 24 villages. In Orissa the target was initially five villages but after the super cyclone (October 1999) 10 more villages have been included.

In each of the villages where the project is being implemented, a community-based organisation (CBO) has been promoted with one adult male and female member of willing families who constitute the General Body. This General Body elects an executive committee with due representation to marginalised groups, women, local NGOs, FD and MSSRF. These CBOs are the ultimate decision making bodies in the project villages and they meet regularly to discuss the issues related to mangrove conservation and management as well as other developmental issues of the village and take collective decisions. Accordingly, annual micro plans are prepared and implemented jointly by the partners. The CBOs are known variously as Village Development and Mangrove Councils in Tamil Nadu, Eco-Development Committee (EDC) or Forest Protection Committee in Andhra Pradesh, Mangrove Protection Committee in Orissa and Forest Protection Committee in West Bengal.

Details of the major components of the project, the strategy developed to mobilise the community, organise them into a CBO and develop partnership with the FD and other agencies have been given earlier, and this report describes the activities undertaken in the demonstration villages with reference to

- mangrove conservation and management
- poverty alleviation
- land based alternatives and
- gender issues

Details on training, the study of hydrology of the mangrove wetlands of Pichavaram, Godavari and Krishna sites and efforts to develop Geographical Information System applications are included.

101.1 Tamil Nadu

Mangrove conservation and management

Each demonstration village has a Mangrove Management Unit, consisting of degraded and healthy mangrove forests. Activities in these management units are related to restoration of

degraded area, maintenance of canals constructed for restoration, establishment and monitoring of plantations and protection of healthy mangrove forest. Table 1.1 gives details of area under restoration and protection by the community based organisations and activities carried out during the reporting period.

Table 1.1 : ***Area of mangroves restored and under protection in Tamil Nadu sites***

Demo village	Area under restortion (ha)	No. of seedlings planted	Survival rate (%)	Area under protection (ha)	Joint activities during the current year
MGR Nagar	19	2,00,000	82	62	Replacing casualties, desilting of canals, monitoring and protection
Vadakku Pichavaram	32	3,00,000	74	54	Canal construction and planting in restoration area
Veerankoil	100	-	-	525	Canal construction completed; planting to be done in Dec. 2000

Both in the MGR Nagar and Vadakku Pichavaram management units, the canal method developed and demonstrated by MSSRF was followed in restoration whereas in Veerankoil of Muthupet, a traditional method called "canal fishing" which integrates mangrove and fisheries development was adopted. This method could not be followed in Pichavaram since it is applicable only to a large stretch of degraded area whereas in Pichavaram degraded areas are present in small patches. In the restoration area *Avicennia marina* was planted, based on studies of its distribution pattern and also because it can withstand high soil salinity.

The following are the important initiatives taken by the community regarding restoration and protection:

- In MGR Nagar, the people themselves have purchased a boat to monitor plantation in the restoration area as well as to protect their management unit against grazing. Two members of the community, from different families, patroll the entire management unit daily.
- In Vadakku Pichavaram village, the people themselves have appointed a village watchman to protect their management unit and deposited Rs. 60,000, saved from restoration work, in a scheduled bank, the interest from which is used to pay the village watchman.

Poverty alleviation

In each demonstration village the specific causes for poverty were analysed jointly during Participatory Rural Appraisal (PRA) and action taken through micro planning. Some of the major causes were lack of a resource base to meet expenditure relating to consumption and production, perpetual indebtedness to moneylenders and lack of employment opportunities during the lean season of fishing and agriculture.

Self-Help Groups : Organising Self-Help Groups (SHGs) in the villages and linking them to banking institutions as well as to various government development programmes was adopted as a strategy to alleviate poverty. The money saved and loans obtained from the banks and government agencies by the SHGs were utilised to start on- and off- farm employment generation activities as well as to meet consumption related expenditure. This helped to avoid taking loans from moneylenders. Currently 24 SHGs are functioning in the three demonstration villages and the total savings of these groups is about Rs. 4,71,000. Out of 24 SHGs, 13 are women SHGs whereas 11 are men SHGs and their total membership is about 338. The purpose for which the savings are utilised is monitored in all the demonstration villages. Table 1.2 gives the purposes for which savings of the 13 SHGs are utilised in Vadakku Pichavaram. For other villages it is being analysed.

The Table also indicates that in Vadakku Pichavaram alone about 142 families (total number of families 181) were benefited by taking loans from the SHGs and avoided taking a loan from the moneylenders. However, most of the money was utilised for consumption purposes and only a small amount of money was utilised for self employment. During discussions with the villagers it was revealed that the first priority of the villagers was to avoid taking loans from the mon- eylenders and the second was repaying the loan. Once this task was completed more savings will be utilised for self-employment purposes.

Table 1.2 : ***Purpose of loans disbursed by the SHGs in Vadakku Pichavaram***

Group		Purpose					
		Agricultural operation	**Self-employment**	**Repaying loan**	**Education**	**Social function**	**Medical expenses**
Women SHG	Number	29	4	14	14	14	19
	Amount disbursed	59,000	5,500	33,000	10,000	25,500	26,000
Men SHG	Number	21	3	7	6	4	7
	Amount disbursed	30,000	5,000	10,000	9,000	7,000	10,000

Micro enterprises: Introduction of micro enterprises is another strategy for poverty alleviation in the demonstration villages. Table 1.3 gives details of the micro enterprises started with the help of various agencies and MSSRF during the current year in 3 of the demonstration villages.

Table 1.3: ***Micro enterprises started during the current year in the demonstration villages in Tamil Nadu***

Micro enterprise	No. of families	Ownership	Funding source
Vadakku Pichavaram			
Dairy farming - cross bred cows	18	Women members of SHG	Indian Bank
Palm candy production	12	Palm candy production society-joint ownership	Indian Bank and DRDA*
MGR Nagar			
Coir rope making	2	Women members of SHG	Central Bank of India
Small provision shop	1	Women members of SHG	Central Bank of India
Veerankoil			
Coconut thatch making	8	Families headed by women	MSSRF
Dry fish marketing	1	Families headed by women	MSSRF
Fresh fish marketing	1	Families headed by women	MSSRF
Rice, flower, vegetable and food stall	4	Families headed by women	MSSRF

*District Rural Development Agency

Thus about 47 poor families are being benefited by the micro enterprises, most of which have local markets. Since the micro enterprises were started recently, activities to sustain them need to be taken up in the coming year.

Creating additional resources in the mangrove wetland for income generation: In the Muthupet mangrove wetland, fishers follow a traditional method of fishing called canal fishing. In this method long canals are dug across the mangrove wetland from the sea and fish and prawn juveniles coming into these canals and adjacent pits and puddles during the high tide are trapped using a pen that allows only water to pass through. The trapped fish and prawn are harvested periodically for about 5 months. By this method, fishers get about Rs. 20,000 to 25,000 per year as additional income from each canal apart from their income from sea fishing. Since this method facilitates free flow of tidal water in and out of the mangroves it also helps the establishment and growth of mangrove plants. Already 80 such canals exist and currently 20 new canals were constructed jointly by the community, FD and MSSRF to restore 100 ha of degraded mangroves. Each canal is allotted to a fishing family, which does not have a canal, and thus, for 20 families a new source of income from mangrove wetland has been created. The Forest Department has appreciated this method since it provides an opportunity for benefit sharing with the participating community and is planning to adopt the canal fishing method in future Joint Mangrove Management programmes.

Other services to alleviate poverty

- In Vadakku Pichavaram village three farmers' irrigation societies formed last year are functioning well resulting in a 30% increase in groundnut yield during the current year.
- An abandoned irrigation canal renovated last year is providing irrigation to about 60 acres of land. During the current year strengthening the bund of this canal was undertaken.
- Kitchen garden was introduced successfully among 20 families in MGR Nagar.

Gender issues

In all the demonstration villages, gender segregated data was collected using PRA and group discussion as tools. The main concerns identified are:

- lack of social empowerment for women at community level decision making
- limited economic empowerment
- drudgery both in the domestic chores and livelihood activities and
- specific needs of women such as separate bathing facility in community pond, toilet facility etc.

During the current year a number of activities were undertaken to address these issues.

Women empowerment in social domain: Traditionally women have been excluded from active participation in social issues, but with recent interventions this attitude is changing.

In decision making : Before project intervention, men monopolised community level decision making. After the formation of the Village Development and Mangrove Council, with 50% representation of women in the General Body and 33% in the Executive Committee, women have started participating in the decision making process along with men. Now men and women jointly take decisions on issues that are related to community development and mangrove conservation. Regarding the participation of women in the decision making process, there was hesitation among the women in the beginning and there was subtle opposition from men. Training in leadership and membership skills was given to both women and men of this village. Women were persuaded persistently to take an active part in the decision making process while sensitising the men.

In planning, implementation and monitoring : An attitudinal change is conspicuous in the project villages. Previously these activities were conducted wholly by men but now women are being accommodated. In the project villages men and women jointly prepare the micro plan along with the FD and MSSRF and these activities are executed jointly by them. Some examples are given below:

- Both men and women participated in identifying the mangrove management unit and they together prepared the design for restoration activities. While men took the responsibility of digging canals women took the responsibility of planting. Monitoring of restoration plantation was done jointly in two villages. Earlier women were involved only as labourers planting seedlings.

- During the procurement of crossbred cows by 18 families in Vadakku Pichavaram village, both men and women visited the dairy farms located near their villages and jointly selected the cows and decided the price. These cows are now looked after by both men and women - previously men used to buy the cattle and women used to take care of them.

- In Veerankoil, both men and women identified providing toilet facility for women as the primary concern of the village and accordingly a micro plan was prepared and implemented.

- In MGR Nagar, three men and women have been given training in traditional Indian medicine (Siddha) by experts from Santhimalai Trust and women were given special training to deal with problems which are particular to them. Previously traditional medical practitioners used to be only men.

- In MGR Nagar, a primary school was opened by the project. A committee in which both men and women are given equal representation manages it. The school is run according to decisions taken by the committee.

Women empowerment in the economic domain : In all the 3 villages, it was found that a financial resource base for women was completely lacking and there were very limited ownership rights to household property. In order to create a resource base for women, separate self-help groups were formed for them. Out of 24 SHGs formed in the demonstration villages, 13 belong to women. All these SHGs are linked to service banks.

Similarly, ownership of most of the micro enterprises started in the villages was given to women members of the SHGs. In some of the micro enterprises full ownership was given to women, as desired by them, whereas in others such as palm candy production, ownership is held jointly by men and women. In MGR Nagar women are now given the ownership title of land given by the government to construct houses, while ownership of the boats bought through the support of banks is shared by male and female partners.

Reducing drudgery of women and addressing their specific needs: The following are the important steps taken to reduce the drudgery of women :

- A separate bathing facility was constructed for women in the community pond in Veerankoil, the cost of which was shared by both MSSRF and the villagers equally.

- In Veerankoil 25 toilets were constructed for 25 families, which have the highest number of young women. The cost was shared by MSSRF, the villagers and the Panchayat.

- In Veerankoil, women have to walk about 5 km everyday to collect fuelwood for domestic use. Now access to prosopis, growing near the village, but owned by Salt Corporation, Govt. of India, will be given to the village on lease due to the initiative of the project.

- In Veerankoil, about 15 destitute women and widows earned their livelihood by illegally collecting and selling firewood from mangrove wetlands for which they had to walk about 15 km daily in the marshy land. Apart from physical drudgery they also faced mental agony because

they were treated harshly whenever they were caught. Alternative employment generation activities for these women were identified jointly and financial support was provided by MSSRF to start them. These women are no longer involved in illegal fuel wood collection from mangroves.

- In MGR Nagar, women are involved in hand fishing for which they have to stay in brackish water for a long period of time. In order to reduce their drudgery some of the women were provided with a boat and net for fishing, which they now use with their male partners. But most of the women are still undergoing suffering and one of the ways to reduce their drudgery is providing alternate income generation activities. Due to limited skills no other income generation activity could be started. However, a woman recently has learned skills in making special coir and started a small unit.

Thus, a visible change is taking place in the demonstration villages, particularly in the attitude of both men and women, and because of this women are given space in many of the social and economic domains, which are normally monopolised by men. In order to evaluate the activities and results it is planned to conduct a gender sensitive-participatory evaluation in the coming year.

101.2 Andhra Pradesh

In Andhra Pradesh, work is progressing in five demonstration villages, three in the Godavari area and two in the Krishna area. In all the demonstration villages a Joint Mangrove Management process, similar to that in Tamil Nadu, is being followed. In three villages MSSRF formed community-based organisations (CBOs), which are legally recognised by the Forest Department whereas in two other villages CBOs had already been formed by the Forest Department in which representation was given to MSSRF in the Executive Committee. Such a legal recognition by the Forest Department is necessary to sustain the community-based organisations.

Mangrove conservation and management

Activities undertaken in the mangrove management unit of the demonstration villages are given in Table 1.4

Table 1.4 : ***Activities in the mangrove management unit of demonstration villages in Andhra Pradesh***

Demonstration village	Restoration area (ha)	No. of seedlings planted	Survival rate (%)	Area under protection** (ha)	Joint activities during the current year
Matlapalem	4.2	7,000	90	502	Planting, protection
Bhairavalanka	4	5,000	80	700	Protection
Dheenadayalpuram	4	1,00,000	90	2049	Planting, protection
Corangi-Dindu	23*	Nil	-	750	Protection
Nakshatranagar	-	-	-	400	Protection

*In this area the Forest Department has constructed canals and planted *Avicennia marina;* under the project, these canals were reoriented for proper tidal flushing; **revised figure.

Mangrove nursery: Seedlings for planting in the restoration site are not available in large quantities during the monsoon season and hence, both in Godavari and Krishna areas, mangrove nurseries have been established jointly with the community and the Forest Department. In the Godavari mangrove nursery, a total number of 22,000 seedlings of nine different species were raised and used for plantation. In the Krishna area, a mangrove nursery with 40,000 seedlings of *Avicennia marina* has been established, out of which 25,000 seedlings were planted in the joint restoration area, 10,000 given to the Wildlife Division and 5,000 to Social Forestry Division of the Forest Department.

the National Women's Development Board. The number of groups formed by the project and their savings are given in Table 1.5.

Micro enterprises: Four women belonging to Dindu village and one to Matlapalem were trained in coir rope making and rattings machines were installed at their houses. MSSRF provided a loan of Rs. 2,750 for the motorised ratt and the Coir Board provided Rs. 7,250 as subsidy. The enterprise was started recently and the impact is yet to be analysed. Prawn and fish pickle making was identified as a suitable micro enterprise for women and 70 women from both Nakshatranagar and Dheenadayalpuram were trained by experts from Bapatla Home Science College and 15 women have started selling the products.

Table 1.5 : ***Details of SHGs organised in Godavari and Krishna areas***

Name of the village	No. of SHGs	Total members	Amount saved (Rs.)
Godavari			
Matlapalem	5	60	10,000
Dindu	2	40	5,000
Corangi	2	30	5,000
Bhairavalanka	1	13	1,560
Krishna			
Dheenadayalpuram	6	90	15,000
Nakshatranagar	12	40	75,000
Total	28	273	1,11,560

Poverty alleviation

Self-help groups were organised as a strategy for poverty alleviation and linked to District Rural Development Agency (DRDA) and NGOs like Visaka Jilla Nava Nirmana Samiti (VJNNS). Both these institutions have promised to provide financial support to women SHGs through

Land-based alternatives

In both the Godavari and Krishna areas, local communities use mangroves extensively for firewood, house construction, fencing and fishing

poles. In order to reduce this pressure, land-based alternatives are being undertaken. Most of the wastelands near villages are being utilised with the approval of the concerned agencies for community plantation. A total number of 43,000 seedlings donated by the Social Forestry Division of the Forest Department have been planted.

In the Godavari region, casuarina, bamboo, subabul and eucalyptus for fuel wood and timber were planted in homestead areas. Fruit yielding saplings like guava, mango and citrus were distributed to the villagers along with seeds of vegetables like drumstick, ladies finger, ridge gourd, bottle gourd and green leaf.

Community Plantation in Godavari : In Bhairavalanka, casuarina plantation was raised in 40 acres of land given to the community-based institution (EDC) by the Forest Department. The villagers maintain the plantation. In Dindu 0.5 acre of community plantation was raised with casuarina and eucalyptus. Casualties were replaced in 1.1 acre and saplings were planted at Matlapalem.

Community Plantation in Krishna : In Dheenadayalpuram, a plantation of casuarina and bamboo was raised in one acre of community land. The villagers provided free labour and fenced the land with prosopis for protection. The village committee agreed to contribute 50% of the cost of irrigation and an equal contribution was provided by MSSRF. Neem cake and gypsum were added while planting the seedlings to introduce eco-friendly agronomy practices.

Gender issues

In the community based institutions of all the villages in the Godavari area, 50% representation of women has been ensured in the executive and general bodies of the committees while in the Krishna region 33% representation has been ensured. With reference to the specific needs of women the following activities were carried out during the year:

- In the Godavari area 100 smokeless chullahs were provided in three villages to reduce fuel consumption and smoke, thus providing better health conditions. All these chullahs were given by the Forest Department. However, each was sold for Rs. 25 and the money was deposited in the account of community-based organisations as part of a common fund.
- A water tank of 1500 litre capacity was provided to the village of Bhairavalanka to store drinking water as well as to reduce the drudgery of women who have to cross the river every day to bring potable water.
- The same village project facilitated one Anganwadi teacher to provide nutritive food for children and health care for pregnant women.
- A Continuing Education Centre was established in Matlapalem to encourage literacy among women. The women contributed Rs. 10,000 for establishing the centre.

In the demonstration villages of Krishna, 54 gas connections were facilitated under the *Deepam* scheme. The project also helped a woman to get an artificial Jaipur leg through the Jaipur Limb Camp at Chilakaluripet.

101.3 Orissa

The project is being implemented in five demonstration villages (four in the Mahanadi delta and one in the Devi mouth mangrove site). In each of the villages, the village level organisation, namely the Mangrove Forest Protection Committee, had been formed earlier. The current year marks the implementation of activities in the villages as per micro plans developed in each demonstration village. The process is similar to the Joint Mangrove Management process followed in Tamil Nadu and Andhra Pradesh.

Mangrove conservation and management

Restoration and protection : Each of the project demonstration villages has a well-defined mangrove management unit. Activities undertaken in these units are given in Table 1.6.

Table 1.6 : ***Activities in the mangrove management unit of the demonstration villages in Orissa sites***

Demonstration Village	Restoration area (ha)	No. of seedlings planted	Survival rate (%)	Area under protection (ha)	Joint activities during the year
Kandarapatia	5. 5	31,300	70	80	Plantation, protection, creek digging
Kharinasi	5	22,000	90	65	Plantation, protection
Sanatubi	2. 5	20,500	90	12	Plantation, protection
Kajalapatia	-	-	-	95	Area demarcation
Bandar	-	-	-	130	Area demarcation

Mangrove Genetic Resource Conservation Centre (MGRCC) : The Forest Department of Orissa has requested the project to establish a genetic resources centre in the Mahanadi area with the mangrove species available in the country and elsewhere. Accordingly, four sites were assessed jointly and one site in Kansaridiha forest block in the Mahanadi delta was selected. A nursery with 14 species is being maintained for plantation in the MGRCC.

Preparation of Mangrove herbarium: Herbarium specimens of 18 mangrove and associated species have been prepared in the sundry method. Herbarium specimens for another 30 species are under preparation. Field staff of the Forest Department have also been trained on herbarium preparation methodology.

Poverty alleviation

Causes of poverty of the villagers have been identified as irregularity of income from the existing income sources (agriculture and fishing), lack of income alternatives, permanent indebtedness to moneylenders and no possibility of availing of help from formal sources of credit like banks etc.

Promotion of Self-Help Groups: SHGs have been promoted in the villages to facilitate savings by the rural families. Help from the financial institutions has been arranged to provide them with capital for initiating alternative income generating enterprises as well as for increasing the income of the existing sources. A total of 24 SHGs has been promoted in all the five demonstration villages, out of which 21 are women SHGs and 3 are men SHGs. The SHGs have been provided with the necessary training in book keeping and management with the help of the local bank officials. The savings are used for providing loans to the members for consumption as well as productive purposes. Repayment of loans taken from moneylenders is also allowed in a few cases. Total savings of all the SHGs till May 2000 is Rs. 93,092 (Table 1.7).

The Cuttack Gramya Bank, which provides loans, has inspected the functioning and account of several of the SHGs and has found the operations satisfactory. Proposals already submitted by four SHGs to the bank are being processed.

Micro enterprises : Several micro enterprises have been started in the demonstration villages. The feasibility of the enterprises has been assessed after discussion with the villagers, relevant Government Departments and the Forest Department staff. External resource persons from Government Departments and NGOs (International Development Enterprises) have also carried out exercises to identify feasible enterprises along with the staff of the project before promoting them. Suitable training has been imparted to the entrepreneurs with the help of Government Departments, local NGOs and project staff. Table 1.8 provides the details of different micro enterprises in the demonstration villages.

Table 1.7 : ***Details of SHGs in the project demonstration villages in Orissa***

Village	Total No. of SHGs		Total number of members	Savings (Rs.)	Operations
	Men	Women			
Kandarapatia	1	3	45	31,612	Intra loaning, loan proposal submitted to bank
Kharinasi	0	3	53	5,040	Intra loaning
Kajalapatia	0	11	236	37,200	Intra loaning
Sanatubi	1	1	32	16,240	Intra loaning
Bandar	0	3	55	3,000	Savings started recently

Table 1.8 : ***Micro enterprises promoted during the current year in the demonstration villages in Orissa***

Micro enterprises	No. of households	Funding	Technical Support
KB paddle pump for irrigation	18	BDO*, MSSRF	IDE#
Low lift hand pump for irrigation and pond desilting	6	BDO*, MSSRF	District Agriculture Officer
Poultry	131	MSSRF, villagers	Central Poultry Breeding Farm, Bhubaneswar
Nursery raising of multipurpose tree species	26	MSSRF, villagers	Social Forestry Division
Apiculture	10	MSSRF, villagers	KVK, Kendarapara
Sweet potato farming	20	CTCRI**	CTCRI, Bhubaneswar
Kitchen gardening	20	Villagers	KVK, MSSRF
Fresh water fish farming	31	MSSRF, villagers	-

* Block Development Officer # International Development Enterprises

** Central Tuber Crop Research Institute

Rural families in Kandarapatia and Kharinasi have been oriented regarding facilities/ schemes available in the Block Development Office for the villagers. About 15 families have applied for availing of the facilities related to old age pension, widow pension and pregnancy allowance.

Land - based alternatives

Local communities in the project areas are dependent on the mangrove forest resources for meeting their needs for fuel, building materials, fencing materials, agricultural implements, fodder for livestock, weaving materials etc. The resource overuse and consequential damage to the mangrove forest areas have been established through PRA in these villages. Dependence of the local communities on the mangrove forests is found to be mainly due to the reasons of non-availability of alternatives and poor economic status. Alternatives have been promoted in the demonstration villages for fuel, building materials, fencing materials and agricultural implements.

Plantations of multipurpose tree (MPT) species in the villages : Plantations of MPT species have been taken up in all the demonstration villages in the available common lands and also in household lands. Seedlings for the plantations have either been raised in the village or have been procured from private nurseries. The cost incurred in purchasing the seedlings has been shared by the villagers and MSSRF. The villagers manage the plantations by formulating rules and sharing responsibilities for care and watering. The species planted are casuarina, eucalyptus, acacia, bamboo, teak, sissoo, coconut, arecanut, subabul, etc. (Table 1.9).

Table 1.9 : ***Plantation of MPT species in the demonstration villages in Orissa***

Village	Total no. of seedlings planted	
	Common land	Homestead land
Kandarapatia	7,690	1,213
Kharinasi	150	835
Kajalapatia	2,133	578
Sanatubi	2,101	268
Bandar	302	498

Promotion of improved portable chullah: In order to provide alternatives to the fuelwood collected from the mangrove forest areas, improved portable chullahs developed by the Orissa Renewable Energy Development Authority (OREDA) have been demonstrated in a few households in all the demonstration villages. The units are priced at Rs. 260 of which the user pays Rs. 50, and the project contributes the balance. After assessing the efficiency of the chullah the villagers opted for the units. A total of 580 chullahs have been provided to cover all the households of the demonstration villages.

Gender concerns

The concerns related to gender roles in the demonstration villages were identified during the PRA exercises. Some of the important findings were:

- no role for women in decision making at the community level
- drudgery of household chores
- lack of recognition of the work done by women (as many of them are not quantifiable in economic terms, like childcare or household work)
- lack of income earning opportunities for women
- more time and energy spent in fuel collection due to the degradation of mangroves

In order to bring about gender equity, the importance and necessity of women's participation was stressed and the villagers were convinced. Now women constitute 50% of the total membership of the village level Mangrove Forest Protection Committee and 35-50 % of the Executive Committee. Some of the important achievements related to gender aspects are as follows:

- Women are able to participate actively from the micro plan preparation to the monitoring stage in four demonstration villages. A feeling of 'being wanted' has been created in the villages and this is encouraging the women to participate.
- Responsibilities are fixed (for implementation of the agreed micro plans) irrespective of sex.
- In activities related to mangrove restoration, plantation and aftercare of the common land plantations, management of fi-

nance etc., women have been able to contribute significantly and this has helped in changing the traditional attitude of men as well as women regarding fixed roles.

- The women and men SHGs formed in the villages have helped the households to avail of loans at a very low interest rate and thus avoid being exploited by the moneylenders. Apart from financial help, women have also organised themselves for taking decisions pertaining to SHG management.
- Suitable training programmes/orientation/ exposure visits have been conducted for the villagers and only the persons who will benefit from them are selected, irrespective of their sex.
- Income earning opportunities like poultry, fresh water fish farming, kitchen gardening, raising MPT nurseries etc. have been promoted in the villages, helping the household economy as well as reducing drudgery of women. The enterprises are managed entirely by women or jointly as a family venture.
- Several women who have a flair for communication, have been encouraged to take lead roles in project activities and seeing these role models, more and more women are participating in the activities and are able to contribute effectively.

Super cyclone in Orissa : impact in the demo villages and measures taken

- High wind with a speed of 250 to 300 km/hr and torrential rain ravaged the coastal districts, including the project sites, on 29 and 30 October 1999.
- In the project villages about 17 human lives and 2,295 livestock were lost, and standing paddy crops in about 885 acres of land was flooded with tidal water; about 490 families have become homeless; 44,000 economically useful trees in the homestead lands were uprooted or damaged.
- As a short-term relief measure, food and food grains, utensils, clothes, blankets, medicine and tarpaulin sheets were provided to all the families in the five project villages and six other villages by MSSRF.
- As a long-term measure, community ponds, drinking water wells and tube wells are being renovated and saline banks, which stop tidal water flooding into agriculture lands and villages are being strengthened. In one of the villages low cost toilets are being installed.
- Agriculture development activities such as using power tiller for ploughing are being introduced since all the draught animals have died in the cyclone.
- A book-bank for primary education has been started in the demo villages since the students lost all their books in the cyclone.
- In all the villages multipurpose community centres are being constructed.

101.4 West Bengal

It was decided in the initial stages of the project implementation that interventions in Sunderbans of West Bengal will be taken up in the later stages of the project since the West Bengal Forest Department had already introduced Participatory Management Systems in the mangroves of the Sunderbans. Preliminary reconnaissance studies were done in the Sunderbans and after discussions, the FD gave proposals for project interventions with emphasis on strengthening the ongoing Joint Forest Management (JFM) activities. The Project is implemented in 15 villages in 4 forest ranges of the 24 Parganas (South) Forest Division. In 11 villages, Forest Protection Committees (FPC) under JFM had been registered as per provisions of an earlier Forestry Project. In other villages, Beneficiary Committees with a structure similar to that of FPCs have been formed to play the role of FPCs.

The Forest Department has agreed that mangrove plantations other than experiments will be raised only in non-forest vested lands (mostly accretions along riverbanks or embankments) under the control of the Zilla Parishad. The 24 Parganas Zilla Parishad has agreed for the FPCs/Beneficiary Committees to take up mangrove plantations in these non-forest lands. The benefit arising out of these plantations, particularly usufructs and timber will be shared in a ratio of 75% (community members): 25% (Panchayat). As per the above agreement, micro plans, which had been prepared earlier by FD and villagers formed under JFM, have been revised jointly by the community, MSSRF and FD and activities of the project are being taken up on the basis of the revised micro plans.

Mangrove conservation and management

Four different activities namely, i) joint mangrove afforestation, ii) field trials of alternative regeneration techniques and spacing, iii) developing new techniques in raising mangrove nursery and iv) reintroduction of threatened mangrove species were carried out towards mangrove conservation and management.

Mangrove afforestation with community participation : An area of 25 ha of vested-land was planted with about 3,00,000 mangrove seedlings during the year and the survival rate is 92%. The Forest Protection Committees of the participating villages manage these plantations. The cost of plantation was mostly borne by the project, while the community protects and maintains it. The usufructs will be shared on a 75:25 basis by the beneficiaries and Panchayats.

Field trials of alternative regeneration techniques and spacing : Apart from the usual methods of afforestation, it is necessary to find alternative modes of regeneration through stem cutting and other methods supported by biotechnology. This operation was started during the year in about 6 ha. In addition to this, field trials to find the optimum spacing between the seedlings of different mangrove species was undertaken for four locally endangered species namely, *Heritiera minor, Nipa sp., Carapa obovata, Carapa molucensis* and other common species like *Sonneratia apetala* and *Avicennia* sp. Experiments with four different spacing categories, 1m x lm, 1.5 m x 1.5m, 2m x 2m and 2.5 m x 2.5 m are being undertaken in 9 ha and growth performance is being assessed.

Developing new techniques in raising mangrove nursery : The objective of this experiment is to find ways to increase productivity and growth in nurseries through the use of biofertilisers and other modern nursery techniques. The following are the steps involved:

- Use of biofertiliser : Three nursery beds were taken up, one of which was control and the other two beds were applied with 5 grams and 10 grams of biofertiliser per plant respectively. The growth data was collected once in 3 months.
- Use of bigger polythene tubes : Experiments are being conducted to find out whether seedlings grown in bigger polythene tubes (9 inches in length) show better growth performance than seedlings grown in polyphone tubes (4 inches in length).
- Use of hycopots : Hycopots rested on a stand are used for this experiment. In this method, roots of the seedlings are air pruned thereby avoiding coiling and twisting of roots. This experiment was conducted in an area of 5 ha with about 12,500 seedlings but the results were found unsatisfactory.

Reintroduction of threatened mangroves : In about 9 ha, 1,000 seedlings of each of the four endangered species, *Heritiera minor, Nipa fruticans, Carapa obovata, Carapa molucensis* and other common species like *Sonneratia apetala* and *Avicennia* sp. are being raised with the objective of enhancing the natural stock of these species. In the areas where these species are planted, small channels are dug for daily tidal flushing. So far, the average survival rate is about 62%.

Land based alternatives and entry point activities

Entry point livelihood support activities: The following are the entry point activities undertaken in the project villages. All these activities are related to the main concern of the people as per provisions of the micro plan.

- Construction of five new freshwater ponds for irrigation, drinking water and other use
- Construction of new irrigation canals, from 370 to 750m in length in four villages
- Construction of tube wells for drinking water, being utilised by about 150 families

Farm forestry, horticultural development : Under farm forestry seedlings that can cover about 100 ha of land with timber, fuel wood and fodder trees have been raised. They will be maintained and supplied after the onset of the monsoon. In addition, 4,000 seedlings of the best quality fruit tree grafts are being maintained in the nursery along with 3,000 seedlings of bamboo. These will be planted in homestead land of the participating villagers.

101.5 Training and Human Resource Development

The project conducted a number of important training and exposure visits to enhance the capacity of the community, personnel of the Forest Department and project staff.

Training to project staff

Training was given to project staff of Andhra Pradesh and Orissa on micro credit and community banking (Table 1.10).

Table 1.10 : ***Training programmes conducted for the project staff***

Theme	Resource Agency	Target Group	Duration	No. of participants
Reorientation, Monitoring & Evaluation	Options and Solutions	Co-ordinators & all staff of Andhra Pradesh	4 days	18
Documentation and Reporting	ASK *	All Project Staff	4 days	20
Exposure visit to Micro credit	VJNNS	Staff of Andhra Pradesh	1 day	5
Group Formation	ASK	Staff of Orissa	3 days	10
Micro credit	ASK	Staff of Orissa	3 days	10

* Association for Stimulating Know-how

Training to the community

The people belonging to the demonstration villages have been trained in various aspects, most of which were identified by them, with the help of NGOs and in-house trainers (Table 1.11). The following are the important training provided to the community:

- *Micro credit :* The President, Secretary and the willing members of SHG from the demonstration villages of Pichavaram and Muthupet were taken on an exposure visit to Panchapatty in Tamil Nadu, where the micro credit programme is implemented by an NGO namely, LEAD. The trainees were given exposure in conducting group meetings, taking decisions and in bookkeeping. This exposure visit increased the confidence of the local communities in SHGs and micro credit and improved their efficiency.

- *Micro enterprises :* One male and one female member from 10 families were trained in palm candy making. At a trial run, they produced high-quality palm candy. DRDA and Indian Bank have given loans to the trainees to start their own units.

Awareness/sensitisation programmes on mangroves : A series of street theatre programmes was conducted in different strategic locations of the project sites with the help of the group 'Natya Chetana' from Bhubaneswar. The theatre aimed at provoking thought among different sections of the local community towards the causes of mangrove degradation and its consequences. The plays were based on intensive field surveys undertaken by the group regarding relevance of the issues, local customs and language, apart from social and cultural aspects. The locals accepted the play and many of them have contacted the project staff to participate in mangrove restoration and conservation.

Table 1.11 : ***Training programmes conducted for the community***

Theme	Resource Agency	Target Group	Duration	No. of participants
IPM on ground nut	MSSRF	Vadakku Pichavaram - selected farmers	1 day	25
Seed treatment techniques on ground unit	MSSRF	Vadakku Pichavaram - selected farmers	1 day	40
Leadership and Membership skills	Trust for Hope	MGR Nagar CBO members	2 days	40
Study visit to Micro credit areas	LEAD	SHG members Tamil Nadu	2 days	40
Leadership and Membership skills	GORD*	SHG members Godavari	1 day	45
Restoration and redevelopment	MSSRF	Community of Godavari area	1 day	35
Disease and pest control for crop and livestock	KVK	Community of Kendrapara area	1 day	25

*Gandhian Organisation for Rural Development

Training to the Forest Department personnel

Only limited training was organised for the staff of the Forest Department (Table 1.12). One important training programme was the use of remote sensing data and GIS in planning and monitoring mangrove conservation activities, imparted to the staff of the Andhra Pradesh Forest Department. Similarly, Forest officers and important members of the panchayat institutions from West Bengal jointly visited the Pichavaram mangroves and demonstration villages for exposure.

Table 1.12 : ***Training conducted for Forest Department staff***

Theme	Resource Agency	Target Group	Duration	No. of participants
Orientation to the Project	MSSRF	Orissa FD Staff	1 day	15
Orientation to the Project	MSSRF	Orissa FD Staff	1 day	15
Exposure visit to mangrove restoration and village socio-economic activities in Tamil Nadu mangroves	MSSRF	Members from Zilla Parishads, Panchayats & Forest Department	2 days	11
GIS and Remote Sensing Tools	Anna University	FD Field staff of Andhra Pradesh	2 days	6
Restoration and redevelopment	MSSRF	FD field staff of Pichavaram area	1 day	5

101.6 Geomorphological, Hydrological and Sedimentological Studies

Geomorphological, hydrological and sedimentological studies play a significant role in developing long-term management plans for mangrove wetlands. These aspects are being studied in the mangrove sites of Tamil Nadu and Andhra Pradesh.

Tamil Nadu

In the Pichavaram mangrove wetlands the following physical processes affect the health of the mangroves:

- closure of the estuarine mouth of the Uppanar river
- reduction in fresh water inflow

The problem of the closure of the estuarine mouth was modelled using wave refraction study. The sites favourable for deposition of sediments seasonally in the segment of the coast between Coleroon inlet and Vellar River were identified. In addition, tidal data was collected close to the restoration areas. In order to examine the possibilities of keeping the mouth of the Uppanar open, tidal data and current data are being collected at four stations along with measurements of changes in inlet geometry, by a consultant. Discharge data on the Coleroon River was collected from State Public Works Department for the period 1934 to 1999 and the data is being analysed. The analysis shows that there was significant reduction in the amount of freshwater discharged from 1930 to 1994 into the Coleroon river, from where fresh water reaches Pichavaram mangrove wetlands.

Andhra Pradesh

In Krishna mangroves, studies were conducted on tidal variations near the restoration areas of Dheenadayalapuram and Nakshatranagar. Salinity and temperature variation in the three distributaries of the Krishna are being studied seasonally. Current data on the volume of water flowing in different sections of the estuary is being collected twice a year at seven stations along with the measurements of cross sections. The first phase of the measurement was completed.

In Godavari mangroves, tidal data and water quality data on salinity and temperature in the mangrove estuary were collected in the restoration sites of Bhairavalanka, Matlapalem and Ramannapalem. Water quality data was collected seasonally. The tidal data was used for designing canals for the restoration areas. In addition, salinity and temperature maps of the Kakinada Bay were prepared during different seasons. The fresh water discharge data from the barrage of Dowaleswaram was collected for a period of 40 years. This data is being analysed to study the reduction in fresh water flow into the Godavari mangrove wetland.

101.7 Remote Sensing Applications and Geographic Information System

The preparation of an atlas for the mangrove wetlands of Tamil Nadu is in the final phase. The atlas contains 30 maps each for Pichavaram and Muthupet mangroves and they are divided into 4 groups namely: i) Location and general information inclusive of the location of the mangroves and remote sensing imagery, ii) Environment and resources inclusive of geomorphology, changes in coastal configuration, hydrological related maps, oceanographic and

wetland maps, iii) Resource utilisation pattern which includes user villages with infrastructure, hamlets with population and occupation, livestock population, income range, types of fish catch, cropping patterns, dependency on mangrove wetlands-grazing areas, firewood collection and fishing practices and iv) Management issues and options with details on mouth closure, freshwater resources and grazing and firewood collection. The Forest Department of Tamil Nadu provided its inputs in the preparation of the maps.

Sub Programme Area 102

Nuclear and Biotechnological Tools for Coastal Systems Research

This research programme, designed primarily to integrate conservation and development in the rural farm communities of the coastal areas in Southern India, was initiated in 1998 as a partnership between the Department of Atomic Energy (DAE) and M. S. Swaminathan Research Foundation. It is a joint endeavor of the Biosciences and Radio-isotope Groups of the Bhabha Atomic Research Centre (BARC, Mumbai) and MSSRF and aims at evolving models of sustainable development in the coastal regions. This programme was further strengthened with the institution of DAE-Homi Bhabha Chair on Nuclear Sciences and Rural Society at the Foundation. Prof. P. C. Kesavan is the first appointee to this Chair.

Combining frontier sciences and biotechnology with the traditional wisdom of the rural communities, the programme seeks to strengthen the livelihood security of the rural communities. It has been designed to evolve a practical methodology for arresting natural resources degradation and alleviating rural poverty in the coastal regions. The objective is to develop crop varieties with greater tolerance to salinity and enhance soil fertility and crop productivity while emphasising the reclamation of saline soil in coastal areas. It also intends to use radiotracer technology for monitoring water quality parameters in the coastal aquifer. In addition, the project lays emphasis on popularisation of the improved pulse crop varieties through capacity building and extension activities in the coastal region. Accordingly, the primary focus of the programme is to:

- address the problems of the coastal rural communities of Kalpakkam, Chidambaram and Kudankulam
- introduce nuclear and biotechnological tools for the sustainable development of agriculture, fisheries and animal husbandry in these regions
- study the molecular biology of abiotic stress (mangroves, nitrogen fixers-Photo autotrophs and Heterotrophs) and introduce the knowledge for stress management at the farm level in these coastal regions
- evolve grassroot level institutions and strengthen them through capacity building and knowledge empowerment and facilitate these institutions to play a major role in spreading the sustainable development process to the various parts of the coastal regions
- strengthen the human resources in various agencies of the Department of Atomic Energy in the development process with the help of the models in Kalpakkam, Chidambaram and Kudankulam.

Isolation of stress induced genes

Substantial progress has been made in understanding the molecular mechanisms of salt tolerance in mangrove species *Porteresia coarctata*, a species growing in the mangrove locations that have been selected for the present study. This plant grows in high saline conditions and can tolerate high salinity levels. The long-term goal of this component is to isolate salt tolerant genes from this species and provide pre-breeding material to grassroot level breeders for developing locality specific crop species of importance to the coastal ecosystem.

Porteresia coarctata plants were collected from Pichavaram mangrove forest and grown in a nutrient medium for seven days. The plants were then treated with 1M NaCl solution for 48 hours. Total RNA from the leaf tissues of salt treated plants were isolated following a protocol developed by us. The mRNA for making complementary DNA (cDNA) was purified from the total RNA using oligo-dT cellulose column. Using reverse transcriptase enzymes the double stranded cDNA was made and ligated with pSPORT 1 vector. The ligated cDNA was transformed into *E. coli* (DH5α) to enrich the library. About 1,00,000 colonies obtained from the cDNA library from this species are being used for further investigations.

Preliminary screening of this library has been initiated using heterologous probes specific for salt tolerance as well as through random sequencing of the ESTs (Expressed Sequence Tags). A number of potential cDNA clones which have practical bearing on abiotic stress were isolated. Details of two isolated genes are given below.

Metallothioneins gene : Metallothioneins (MTs) are low-molecular-weight, cystein (Cys) rich proteins, identified in animals, fungi, cyanobacteria and plants. The main function of the MT involves metal homeostasis and detoxification of heavy metals. The MT genes coding for metallothionein-like proteins not only play a role in metal detoxification, but are also involved in stress responses. Through large-scale sequencing of randomly selected clones of the *P. coarctata* cDNA library, a cDNA clone homologous to the MT gene was isolated. Based on its homology to MT genes, the isolated clone was named as *Por*MT, i.e., an MT gene from *P. coarctata*. The sequence data of this gene has been deposited in the Gene Bank Nucleotide sequence database under Accession No. AF257465.

The isolated gene is 581 bp in length, with a single largest open reading frame (ORF) of 192 bp. The deduced amino acid sequence consists of 64 residues and an approximate molecular mass of 6.5 kDa, and consists of 10 Cys residues. Northern analysis showed the presence of a single transcript of about 0.6 kb corresponding to the size of isolated cDNA. Hybridization of the RNA from leaves and root indicated expression of this gene in both leaves and roots. However, the level of expression in the roots was about three times more than that in the leaves. Studies indicate that the isolated gene from *P. coarctata* belongs to class I MT and encodes a novel type of MT-related protein. This gene is quite distinct from type 1-4 MT-like proteins reported from other organisms. The mRNA level of *Por*MT gene was more abundant in roots than in leaves. The Southern blot analysis suggested the presence of a single copy of type 5 MT in *P. coarctata* genome. The uniqueness of this gene, it is

hoped, could reveal more about the structure, organisation and regulation of plant metallothioneins and studies are being undertaken in this direction.

Histone H3 gene: A cDNA clone (PCD 6) which encodes *Porteresia coarctata* histone H3 protein homologous to various animals and plants was isolated from a plasmid pSPORT 1 cDNA library constructed using poly (A) mRNA from leaf tissues. The cDNA insert includes a 5' non coding sequence of 70 nucleotides and an open reading frame of 408 nucleotides. The deduced amino acid sequences from the PCD 6 show 100 % identity with the amino acid sequences and 86%, 85%, 84%, 83%, and 82% identity with *Lycopersicon esculentum, Gossypium hirsutum, Nicotiana tabacum, Oryza sativa, Lolium temulentum* and *Medicago sativa* nucleotide sequences of histone H3, respectively.

Soil biological criteria and bioremediation

Salinity is responsible for major crop losses, particularly in semi-arid and irrigated agriculture. High salinity in soil results from naturally high salt levels or from local salt accumulation due to irrigation or the application of chemical fertiliser. Most crop plants exhibit considerable hypersensitivity to saline environments due to intracellular accumulation of Na+ that is toxic to the cellular metabolism and osmotic component of salinity stress causing water loss and inhibiting growth. Breeding plants that are resistant to stress is therefore a thrust area of contemporary research. An alternate approach to practising crop cultivation in saline environments is the amelioration of soil salinity in agricultural habitats, using biological approaches. A better understanding of the role of microbial osmotic adaptation will help us in harnessing these microbial species in amelioration studies.

Isolation and screening of beneficial organisms with tolerance to salinity have been undertaken. Salt tolerant wild rice, *Porteresia coarctata,* from the Pichavaram mangrove forest in Tamil Nadu, was analysed for possible associative and endophytic diazotrophs. Salt tolerant *Azospirillum* sp. was isolated from different parts of the plants. All the isolates were able to grow and fix nitrogen without any quantitative decrease upto a salinity level of 250mM NaCl and were found comparable to control. One of the isolates (PSA2) showed enhanced nitrogenase activity and growth in the presence of 250mM NaCl thereby proving to be a potential candidate for amelioration of such salt affected soils. To understand the osmoadaptation mechanisms, protein profiles of two halotolerant *Pseudomonas* species e.g. *P. alcaligenes* and *P. pseudoalcaligenes* were analysed. Proteins with the size range of 25-210 kDa were found to be induced under conditions of increased salinity, heat and osmotic stresses, all three of which are prominent in the coastal systems. Four of these proteins (25, 45, 85 and 110kDa), which are common to all stresses have been purified and will be sequenced.

Culture of *Anabaena torulosa*, a salt tolerant strain, is being tested along with AL31 (from BARC) and demonstrated in the southern coastal region for efficiency in fixing nitrogen and sequestering NaCl. The study was conducted at two sites, Mettupalayam (a site with canal irrigation) and Poondiyankuppam (with well irrigation). Both the sites were chosen for their higher EC valu ., which were conducive for the growth of *Anabaena torulosa* (A.t). The study plot of 21 cents was divided into 1-cent

experimental plots and the Random Box Design (RBD) was used. A.t was released in two concentrations of 1000ml/cent and 500ml/cent. The release was done both prior and after transplantation of rice. Soil profiles were analysed both before and during the experiments. The establishment of released A.t was checked against the local one and it was observed that the population had more then 70% of the released variety thereby confirming good establishment. Due to non-availability of water for irrigation the paddy dried up and the experiment had to be stopped at this stage. The acetylene reduction assay for the nitrogen fixing efficiency performed with the samples of both treated and untreated soil showed enhanced nitrogenase activity in the former. There seems to be a competition between the local prevalent strain and the one that is being tested. This could be because of a natural selection. The possibility that the increase in nitrogenase activity is due to synergistic effect cannot be ruled out. Future experiments with respect to the sequestering will be undertaken.

Activities initiated in the experiment-cum-demonstration plot at Kalpakkam

One of the major objectives of the ongoing project is to develop demonstration plots along the coastal areas. The first project demonstration site development activity has been initiated at Kalpakkam. In collaboration with the Indira Gandhi Centre for Atomic Research (IGCAR) authorities, a 10-acre plot has been developed for experiment cum demonstration in the IGCAR campus. The basic model applied in the development of the demo plot was that of the Integrated Intensive Farming System model developed by MSSRF. The salient feature of this demonstration plot is the possibility of diverse activities related to agriculture and aquaculture, establishing a forward-backward linkage, water use efficiency and organic agriculture. Integration of cultivation of rice, millets, groundnut, blackgram, greengram, vegetables, floricultural species and a site for semi-intensive aquaculture with various other ecotechnology options is the key feature of the demonstration plot. The soil samples of the plots have been tested for their micro- and macro-nutrients and also for soil microbial populations (with special reference to beneficial organisms).

Construction of all the four water harvesting structures (used as fish ponds for a period of about 5 months in a year) has been completed. While in two of these ponds polyculture of a number of fresh water fish was tried, one pond was used for prawn breeding, using the seeds obtained from the MSSRF nursery. The other pond was used for local fish varieties. Basic data with respect to the growth rate, fecundity rate, feed intake, mortality, hatching rate and water exchange rate have been collected and is being analysed. Along the fish pond, banana plants (both *in vivo* and *in vitro*), annual moringa and other green leafy vegetables are being grown. Castor seeds have been sown around the experimental field to serve as trap crops for insects and pests. Along each rice field blackgram seeds have also been sown as trap crops.

Activities initiated in the experiment-cum-demonstration plot at Kudankulam

The ongoing project also intends to develop models for sustainable natural resources management and development in Kudankulam, a semi-arid region in coastal south Tamil Nadu, with severe water scarcity. It may be noted

that in Kudankulam, the National Power Corporation of India Limited (NPCIL) is building a nuclear power reactor. The proposed interventions are intended to evolve practical methodologies for the effective use of the natural resource base and ways and means to link it with the livelihood security of the fishing and farming communities in the region.

As the first phase of the activity, an experiment-cum-demonstration plot has been established in Kudankulam with active cooperation from the National Power Corporation of India. The identified area falls under the buffer zone of the proposed power plant and has a total area of 12 acres. Activities in this demonstration plot were initiated in October 1999. Soil analysis with respect to the major and micronutrients and beneficial organisms have been carried out. The layout of the experimental plot is given in Fig. 1.1. Initial activities included selection of crop species that have low water requirements. A blackgram variety (TU-94-2) developed at BARC was the initial crop taken for demonstration. Groundnut varieties developed at BARC (TG24 and TG26) were also grown in the demonstration field in the first phase. In addition cluster beans and green amaranthus were also grown in the demonstration plot. Work has been initiated for converting about 2 acres of the demonstration field into water harvesting structures and aquaculture ponds. More activities will be initiated during this year starting with capturing the monsoon rains.

Major emphasis, however, was placed on developing a model for green belt development around the Atomic Power Plant in Kudankulam. A model demonstration plot was identified in the buffer zone of the proposed plant area. Initially a stretch of 700 meter land with 50 meters width was identified for green belt development. During the last 5 months about 7,000 seedlings of neem and tamarind have been planted in the area. The survival rate is more than 85%. In addition, possibilities are also being explored to include some cash crops like cashew, guava and others that could be linked with the livelihood security of the communities residing near the area.

Popularisation of pulse crop varieties of BARC

Field trials for the improved pulse crop varieties developed by BARC were initiated at Kottam, Paraikulam and Pudukkudi during the months of October and November '99. The trials were conducted primarily to test the response of Blackgram (var. TU: 94-2) and Greengram (var. TARM) developed by BARC under semi-dry conditions in Tamil Nadu and to ascertain the critical watering regime for the above mentioned variety. In addition, it was intended to assess the impact of different sowing methods and to select suitable conditions of irrigation, sowing and phosphorous application to enhance the pulse productivity. The seed material multiplied in these areas is being grown in the demonstration plots both in Kalpakkam and Kudankulam and in a few farmers' fields at Chidambaram. In addition the performance of two more improved varieties of blackgram (TSR 1) and greengram (TARM 1) are being studied at Kudankulam and Kalpakkam region this year.

Hydrodynamics of fresh water-saline water interface in coastal aquifers

In recent years hydrological studies in relation to ground water have become essential to monitor pollution and prevent seawater ingress. The

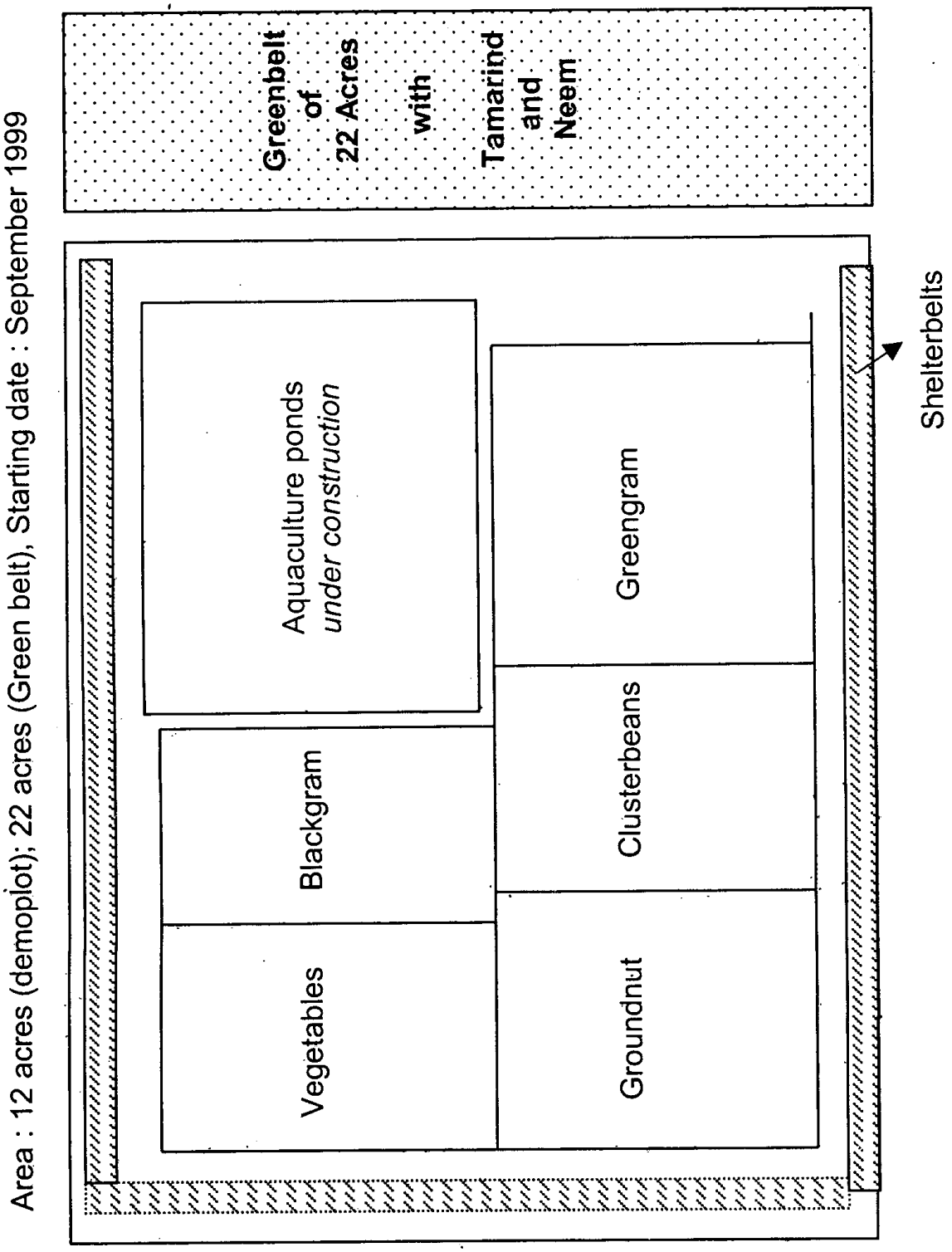


Fig. 1.1 : *Experimental-cum demonstration plot in Kudankulam*

use of radio tracer techniques has been proved to be quite useful in monitoring the hydrological status and water quality. A detailed analysis of water quality parameters of the aquifer, understanding the causes for salinity of the coastal aquifers and monitoring the variation in water quality and water table fluctuations in the aquifers are being undertaken in collaboration with the Central Ground Water Board (CGWB), Southern Region, Chennai with the technical expertise of the Radioisotope group of the BARC.

Based on the initial discussions involving BARC, MSSRF and CGWB, the Thiruvanmiyur aquifer that extends to the coastal regions beyond Kalpakkam, has been identified as the study area for the pilot experiments. This aquifer system extends south of Chennai along the coastal belt of the Bay of Bengal, in Quaternary alluvium underlaid with Archaean complex. Owing to the pressure of population and increased urbanisation and industrialisation, the demand for water supply to Chennai city and adjoining areas is ever increasing and this aquifer is likely to be indiscriminately exploited by large scale pumping which could result in sea water intrusion. The present study therefore involves collection of baseline hydrochemical (major, minor and trace chemical species) and isotope data based on geological, hydrogeological and geophysical information. The baseline data (isotope and hydrochemical) will help in evaluating present / past sea water intrusion. Injected radiotracer method could be used to estimate the intrusion rate of the sea water - fresh water interface, hydrodynamics of the system, surface water – ground water interaction etc. Small-scale artificial recharge experiments and monitoring of the hydrological status of the aquifer are being undertaken.

In the first phase the area of study extends from Besant Nagar in the North to Kovalam creek in the south and from the coast in the east to 2 km from the coast in the west (12°48':13°00'; 80°12':80°17'). A total of 30 piezometers have been constructed to monitor the water levels and water quality. It is expected that upon completion of the studies in the current year, substantial information could be obtained with regard to the freshwater - saline water interface, origin of salinity, interconnection between the aquifers, dating of the groundwater, velocity of flow across the boundary, effect of porosity of the formations and source and rate of recharge. In the subsequent stages it is intended to extend these studies upto Kalpakkam and monitor the hydrological status in this aquifer.

Application of Rare Earth Elements

In recent years application of rare earth elements (REE) in agriculture has been gaining popularity. Experiments carried out since 1933 in the Soviet Union, Romania, Bulgaria, China and a few other countries have shown enormous promise for the supply of essential nutrients and have assumed significance as manure substitutes. Several studies have shown that REE in the form of chlorides, nitrates and oxides are beneficial to the growth, development and yield of crop plants.

Application of REE to Indian agriculture gives new hope of increasing productivity. India has the potential reserve of 4.5 million tonnes of monozite of which 60% is rare earth oxides. Till recently REE applications in advanced countries were limited to industries only. For example, 37% of the total REE produce is utilised

by ceramic and glass industries while 33% is used in metallurgical industries.

As an integrated approach, initial studies on the effects of various REE in agriculture are being undertaken in Kudankulam experimental plot and will subsequently be extended to other regions.

Capacity building and training

The major emphasis of the ongoing project is on the dissemination of the developmental models among the rural families of the coastal area. The project staff have been imparting regular training to the farmers of the nearby regions in Kudankulam and Kalpakkam in resource mapping, development planning and other methodologies. In Kalpakkam, about 160 farmers, in eight batches, were given exposure training in various activities being undertaken in the demonstration fields. Similarly, in Kudankulam 4 batches of 20-25 trainees were trained. In all these training programmes equal participation of both men and women was ensured.

A technical consultation on "Integrated Natural Resources Management in Coastal Areas" was organised by the Foundation on 26 July 1999 to evolve practical methodologies for effective use of the natural resource base and ways and means to link it with the livelihood security of the fishing and farming communities in the Kudankulam region and also to develop a technical consortium for effective eco-management in coastal areas *(details in PA 500)*.

Sub Programme Area 103

Promoting Alternative Options for Livelihood Security in the Gulf of Mannar Region

The Foundation proposed a plan for strengthening the management of the Gulf of Mannar Marine Biosphere Reserve, which was approved by the Global Environment Facility (GEF) in May 1999. This plan will be implemented by the Gulf of Mannar Biosphere Reserve Trust, which is promoted by the Government of Tamil Nadu as a multi-stakeholder body. A key component of the project involves development and demonstration of new livelihood options for families residing in the vicinity of the Reserve so that the biological resources can be sustainably managed. The Ministry of Rural Development (MORD) of the Government of India, and the United Nations Development Program (UNDP) have approved a proposal specifically in relation to generating viable new options for sustainable livelihood security for implementation during the next three years. The proposal has two components: (a) technology demonstration and access and (b) provision of micro credit and establishment of community banking with strong links to technology utilisation to improve options for sustainable livelihood security. The Foundation is the lead agency for the livelihood security project, and has invited the DHAN Foundation, known for its pioneering and extensive work in micro credit, to be the partner in implementing the project. The plan, approved by the MORD and UNDP in June this year, has been drawn up jointly by the two organisations namely, MSSRF and DHAN Foundation.

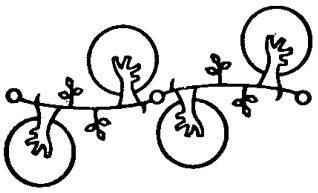
The project area has been divided into three tiers, based on the primary occupation of the majority of the families living in the hamlets. The primary occupations have been identified as fishing, salt manufacture and agriculture. A total of 466 hamlets, comprising approximately 63,000 families, are found within the project area. Just over one fourth of the families are entirely dependent on fishing. These, together with families declared as living below the poverty line, constitute the potential project partners, estimated at about 23,000 rural families. The current project is an effort to complement the technology demonstration and dissemination component of the Gulf of Mannar Trust's programmes.

This project aims at generating the following outcome :

- Establishment and operationalisation of training and demonstration centres in pearl culture, oyster farming, seaweed culture, agar production, fish pickle manufacturing and use of artificial reefs in the coastal hamlets. These will act as one-stop technology and credit access points for the families living on the shore of the Gulf of Mannar
- Stabilisation and arrest of decline in farm incomes in the predominantly agricultural hamlets through renovation and upgradation of tanks (71 of them covering about 3,100 ha)
- Formation and/or strengthening of 766 Self-Help Groups (SHGs) and linking them to entrepreneurial activities derived partially from technology access points
- Promotion of local institutions such as clusters (50) federations (5), and SHGs and creating links between them as also with the formal financial system of banks

At the end of the project period, it is hoped that about one-third of the rural partners in the project area would have moved above the poverty line. A national Steering Committee comprising senior representatives of MORD, UNDP, Govt. of Tamil Nadu, MSSRF, DHAN Foundation and the Gulf of Mannar Biosphere Reserve Trust will guide the project activities. Current consultations reveal the readiness of rural families, especially women, to take to viable new livelihood options and this will be fully reflected in the phased implementation of project activities.

Programme Area 200



Biodiversity and Biotechnology

The community agro-biodiversity conservation and management programme made considerable progress in Tamil Nadu, Kerala and Orissa. The value of commercialisation in stimulating greater interest in the in situ on-farm conservation of minor millets, medicinal rices and other under-utilised crops became evident in Kolli Hills and Wayanad. Further progress was made in the field of molecular breeding involving the transfer of genes conferring resistance to salinity from mangrove tree species to annual crops. Research in the area of biomonitoring gave rise to dependable bioindicators of ecosystem health.

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Sub Programme Area 201

Conservation Traditions : Chronicling and Revitalisation

Building upon the insights gained in the previous years, the strategy has been to focus on biodiversity conservation and launching of NGO networks at the regional and district levels.

201.1 Kolli Hills, Tamil Nadu

In-situ on-farm conservation

Seed multiplication : Interactions with the tribal communities in Kolli Hills revealed that seed multiplication was hindered by shortage and non-availability of seeds at the right time. Activities were initiated to revive traditional crops such as minor millets to strengthen the agro-biodiversity and revive the traditional farming practices. There used to be a practice among them of taking one unit of seeds and returning two units after the harvest in the next season. Strengthening of the minor millets seed exchange system has also been initiated under the project. For this purpose an irrigated land was selected for seed multiplication in on-farm trials (OFT) in the plain areas of KC Patti. So far, from 1.3 acres of land, 870 kg of quality traditional landraces of minor millets have been produced. In another 2.3 acres of land the crops are ready for harvest. During the last year around 150 kg of seeds were exchanged in the stalls during the traditional festival seasons. In the coming season around 2,500 kg of minor millets seeds would be ready for seed exchange, with the participation of the self help groups. Around 250 acres of land can be additionally cultivated by using these minor millets seeds.

Minor millets were grown for demonstration and seed multiplication in one acre of land in Neduvalampatti village of South Kolli Hills, Thenoorpatti colony in Gundur Nadu of North Kolli Hills and Semmedu Higher Secondary School. From these three acres of rain-fed land only around 150 kg of minor millets could be harvested. Poor rainfall and pests such as rats and parrots affected the yield adversely.

Largely due to the efforts of biodiversity networking, two acres of land was given to the MSSRF by the Veterinary College in Namakkal for minor millets seed multiplication. Similarly a plot of land belonging to TANUVAS in Kattupakkam was used for seed multiplication.

Minor millets procurement was carried out with the help of the people in Kolli Hills. Around 13,200 kg of minor millets were procured, which could lead to an additional 25 acres of land under minor millets cultivation.

While continuing the documentation of farming practices, it was learnt that *Karu Nel* and *Karu Vazhai* (Black Paddy and Black Banana) used to be offered to the Goddess *Kongayi Amman* and that when the black banana is ripe the smell wafts to a long distance. It is believed that the Goddess came to Kolli Hills drawn by the smell of the black banana. Only the Poojari families used to cultivate the black paddy. Efforts were made to find out whether they are available now in Kolli Hills. The black paddy is available in small quantities with one or two farm families. But the location of the black banana plant could not be traced. The search continues.

Black paddy seeds were obtained for a farmer from the Poojari family in Neduvalampatti and seeds were multiplied in the multiplication plot at the foot-hills (KC Patti) and now 346 kg of black paddy have been harvested and are ready for seed exchange. The Sellammal family (farmer) was also encouraged to cultivate the black paddy in half an acre by giving inputs for the cultivation.

Seed exchange: Last season, 150 kg of seed was exchanged in the stalls during the traditional festival seasons and the following lessons were learnt:

- Seed exchange should be prior to *Adi 18 Festival* (August 3)
- Generally men visit the stall at *Val Vil Ori Festival* (a local festival)
- Women may also participate in exchange programmes if local festival occasions like *Chitthirai Festival* are selected
- Weekly markets and Self-Help Groups may be utilised profitably

Community seed storage system : Traditionally the people of Kolli Hills store their grains in a storage system 'Thombai' made of mud, wild straw and wood. An attempt was made to construct small ones (5′ x 5′ x 5′) for the purpose of keeping minor millets seeds and other traditional seeds for seed exchange. A community seed storage system was constructed in Thenoorpatti colony of Gundur Nadu by using local wisdom and local resources. The following point has been noted from creating the community seed storage system: women suggested that these bins should have doors. Though the men who constructed them disagreed at first, they have now agreed to the improvement after realising the advantage. Two self-help groups have come forward to construct *bins* with doors in their villages.

Greenhouses : The idea of growing minor millets in the off-season in the low-cost mist chamber for meeting the seed demand did not work well. The two structures put up in Thenoorpatti colony in Gundur Nadu were blown down by the heavy wind and the yield was poor.

Farming practices : While documenting it was learnt that leaves like *Pena Thalai, Ana Thalai, Devakanni Thalai* and *Vilari Thalai* are used as green manure. The staff and the local participants observed that the "kadir navai poochi" affects the little millets fields in the Kolli Hills and this in turn affects the production. Generally, local cultivators spread ash to control them. This time neem oil extract was also sprayed in the demonstration plots. During this activity the local cultivators, participants in our project activities, pointed out that neem is not widely grown in the area. The participants suggested that green leaves with a bitter taste were used to control insects in the soil and help increase the production and taste of the paddy. These leaves were taken to be tested as biopesticides in the place of neem oil at the laboratory at the MSSRF.

Sacred groves : The previous year's survey indicated that there are 15 sacred groves in Kolli Hills (only groves of more than 2 acres are considered) and they are roughly 300-400 years old. In this year's survey, the local participants were contacted to learn about the status of the groves. Lantana has invaded the sacred groves in some areas. Some of the groves are in degraded condition. So conservation efforts are being planned. Four groves have been selected in the first round (Table 2.1) out of which two

will be selected for conservation after getting the consensus of the local stakeholders. Also, to involve young men and women in the sacred grove conservation and to spread information about its importance, a model has been created in one acre of the school land in Semmedu by planting sacred grove saplings. Further it is planned to involve the community, especially school children, to prepare herbarium sheets of sacred grove plants found in the 15 sacred groves in Kolli Hills.

tivities. One acre of land was used for creating a model traditional fruit garden. 150 hill banana (nemaran vazhai) were planted with the help of both labourers and school children as part of the nature club activity. In between the plants, traditional crops like red beans, black beans and coriander were cultivated. An acre of land was used for developing a model minor millets field and *samai* was harvested. Another acre of land was used for creating a model sacred grove.

Table 2.1: ***Sacred groves selected for conservation***

Village	Panchayat	Sacred grove	Status	Plan
Nathukuzhi	Gundur	Ettukaiamman Koil	Relict of past vegetation found; conservation needed	Introducing sacred grove plants; fencing; identifying institution to manage
Oorpuram colony	Thinnanur	Peruman Koil Solai	Relict of past vegetation found in patches; conservation needed	Introducing sacred grove plants; fencing; identifying institution to manage
Valapur	Asakkadu	Mariamman Koil	Degraded; conservation needed	Introducing sacred grove plants; fencing; lantana bush clearance; identifying institution to manage
Devanur	Arippalapatti	Kaliamman Koil	Degraded; conservation needed	Introducing sacred grove plants; fencing; lantana bush clearance; identifying institution to manage

Capacity building

100 students (54 boys 46 girls) in classes VI to XII participated in the activities of M S Swaminathan Nature Club in the Higher Secondary School, Semmedu, Kolli Hills. The government tribal residential school has given 3 acres of land for biodiversity project ac-

Around 50 plants were planted. The income from the model fields and gardens will be used for the activities of the Nature Club.

The creation of M S Swaminathan Nature Club in the tribal school in Kolli Hills and involving them in biodiversity related activities has helped to spread an awareness of biodiversity

among them. Altogether around 75 days were spent on capacity building among 1,500 men, women and students. The tribes were taken to the minor millets on-farm trial plot in KC Patti for participatory monitoring and evaluation. In Vasaloorpatti village quiz competitions on environment were conducted even for primary school children.

Capacity building on gender concerns

Gender orientation was given to members of 4 Self-Help Groups, both men and women, and to the staff who are working in the Kolli Hills. The results of one orientation exercise are given as an example as well as the inferences. The results show that the manual pounding of minor millets is the women's job. During the focus group interview the women expressed that drudgery reduction should be attempted by providing machines to dehusk minor millets. An NGO was approached for developing a prototype model machine that can be operated manually at the household level. The machine powders minor millets in addition to removing the husk. Efforts are on to develop and acceptable model. In the mean time, installing a diesel-and-electricity driven machine is being planned.

201.2 Wayanad, Kerala

The activities on Biodiversity Conservation aimed at the collection, analysis and categorisation of medicinal plants and endangered plants and documentation and validation of knowledge associated with such plant species continued. The focus was on mobilising people with the help of NGOs, Grama Panchayat, District Agri-Horticultural Society, women's groups and youth in the district.

"Green Health" campaign for saving medicinal plants

Under this programme attempts were made to collect known medicinal plants and collate and analyse the information available on such species. Popularisation of all "green health" plants was carried out through an awareness campaign. Other activities included training for primary health care medicine preparation and their wider distribution (Fig. 2.1). For the green health kit, the ten most useful species have been selected after verifying their uses with traditional healers (Table 2.2). These species can be cultivated easily like any other horticultural plant. The campaign activities were extended to nearby villages and focused on women's groups, largely housewives and mothers. The training in the preparation of a number of simple herbal formulations helped women to earn some extra income. In addition to the regular awareness campaign, Green Health plant exhibitions were conducted on 12 occasions for diverse groups of people. Participating in the district horticultural festival and the farmers' festival during the year, the Foundation won the first prize in both. Fourteen programmes have been conducted on the preparation of herbal formulations such as a *balm* for headache; *Uraguliga*-tablet for stomach complaints of children; *Murivenna* a soothing oil for minor cuts/boils and wounds; iron tonic for anaemic children; *Sadavari gulam* a health tonic for women; *Karkidaka lehiyam* for consumption during the monsoon season to prevent common ailments; an oil for toothache and earache; *Brahmi lehiyam* for memory enhancing and *Thaleespathram*, a powder for curing cough.

This programme has had an impact as is evidenced by the regular visits of people to the Centre even from distant places to learn

more about medicinal plants and see rare plants. Many local healers have asked the Centre to help them in improving and perfecting their knowledge on medicinal plants. Invitations are being received from many groups to conduct exhibitions. The women who received training in the preparation of medicine have started selling their products in a small way. More women groups are now interested in the preparation of herbal formulations. People recognise the Centre as an institution that stands for the conservation of medicinal plants and native heritage.

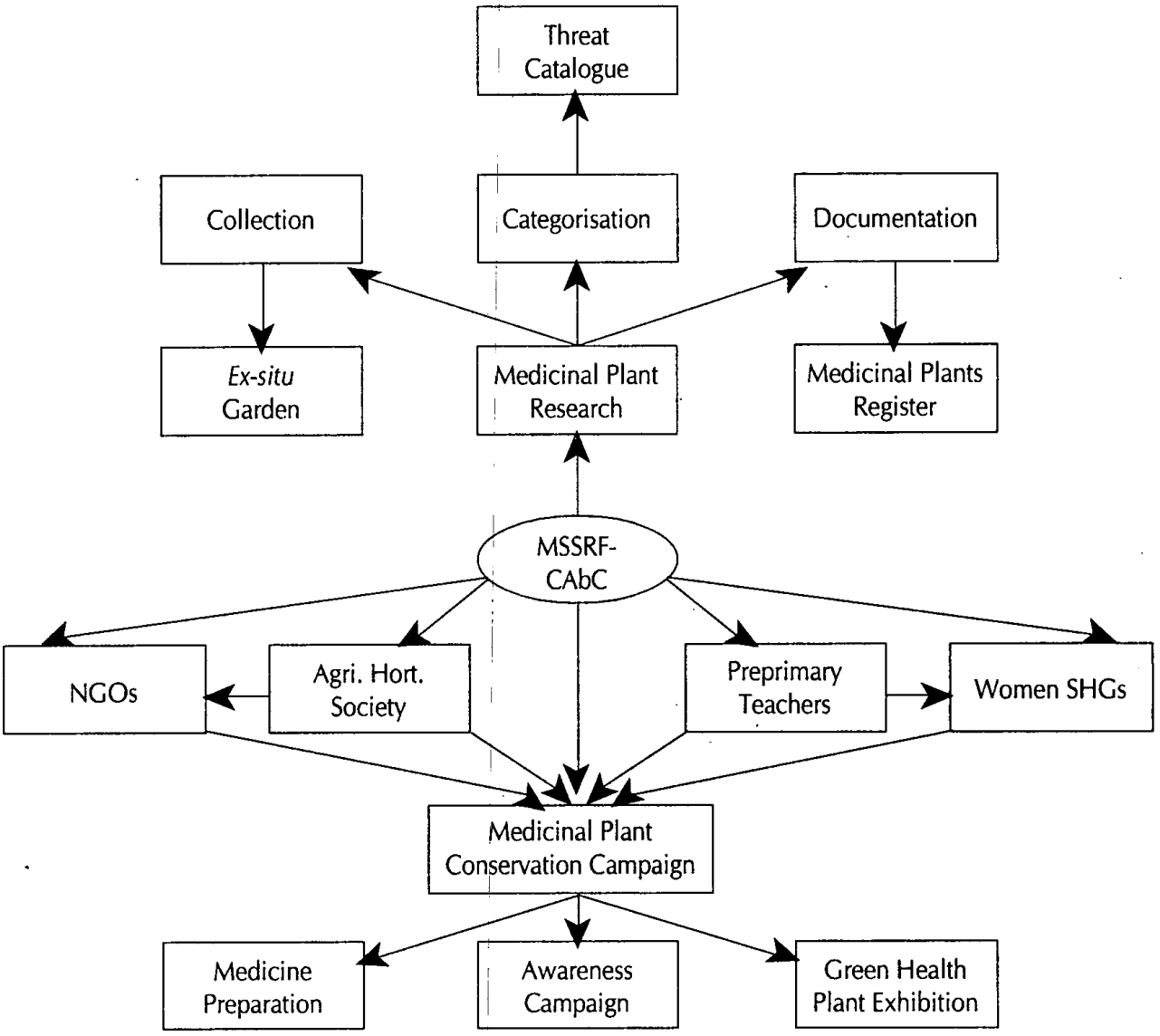


Fig. 2.1: ***Diagram showing the methodology of green health campaign and research***

Table 2.2 : ***Plants in the green health kit***

Name	Local Uses	Propagation material
Eupatorium triplenerve Ayyampana	Used in preparing *Uragulika* which cures stomach ache and piles	Tender branches
Brahmi *Bacopa monnieri*	Used in preparing *Brahmi lehiyam* and hair oil. Used as a coolant and to enhance memory	Tender branch tips
Kodangal *Centella asiatica*	Used in making *Brahmi lehiyam* and iron tonic. Enhances intelligence and prevents constipation	Rooted stolons
Murikootti *Blepharis colorata*	Used in making *Murivenna*. Heals cuts and wounds	Branch tips
Panikoorka *Coleus zeylanicus*	Used in making balm for headache. Cures fever	Tender branches
Poocha Meesa *Orthosiphon stamineus*	Helps cure diabetice	Stem cuttings
Sadavari *Asparagus racemosus*	Roots are used in making *Sadavarigulam*, which is a health drug for women	Root tubers
Neela Ummam *Datura innoxia*	Applying crushed leaves found to be useful against bites of small flies	Seeds
Vathamkolli *Justicia gendarussa*	Used against rheumatic pains	Stem cuttings
Vasambu *Acorus calamus*	An important plant needed in every household. Chewing dried rhizome improves digestion and memory	Rhizome

Saving endangered species

750 taxa in 987 accessions were collected from an area of 100 sq. km. Of these 500 plants have been identified at the species level, 170 at the genus level and 78 at the family level. About 90 (12% of the total) species collected are endemic to Western Ghats/Peninsular India, 10 of which are restricted to Kerala (Table 2.3). These species were subjected to a thorough analysis in order to identify the threat status and categorised into groups as Critically Endangered (CEn); Endangered (En); Vulnerable (Vu); Conservation Dependent (Cd); Data Deficient (Dd) and Low Risk (Lr). A checklist of 45 such species is given in Table 2.4. Voucher specimens mounted for over 2,000 are kept in the herbarium. The aim is to develop a herbarium exclusively for the rare and threatened species of this region. Specific information on 25 rare and threatened species was generated and useful tips for conservation of such species were developed. A summer school training programme on various aspects of plant taxonomy, herbarium preparation and field identification was conducted for college teachers

and students. Many such trained girls and boys are collaborating with the Centre in the preparation of the biodiversity registers of their respective villages.

Table 2.3 : ***Endemic species collected in Kerala***

Name	Family	Remarks
Acampe conjesta	Orchidaceae	Endangered
Bulbophyllum aureum	Orchidaceae	Vulnerable
Cucumella silentvallei	Cucurbitaceae	Conservation dependent
Goniothalamus wynaadensis	Annonaceae	Endangered
Hedyotis wynaadensis	Rubiaceae	Critically Endangered
Ixora lawsonii	Rubiaceae	Rare
Ixora sivarajiani	Rubiaceae	Rare
Jerdonia indica	Gesneriaceae	Vulnerable
Oberonia chandrasekharani	Orchidaceae	Conservation dependent
Osbeckia wynaadensis	Melastomataceae	Vulnerable

Table 2.4 : ***List of rare and threatened plants collected in Kerala***

Name	Place of collection	Status
Acampe conjesta	Kurichiarmala	Endemic & Very Rare
Acanthophippium bicolor	Talimala	Endemic & Very Rare
Aerides cylindricum	Chembara	Endemic & Rare
Aponogeton appendiculatus	Banasurasagar	Endemic & Rare
Ariopsis peltata	Manikkunnumala	Rare
Begonia integrifolia	Meenmutti	Rare
Beilschmedia wightii	Periya	Endemic, S. Western Ghats
Bulbophyllum fischeri	Kurichiarmala	Endemic & Rare
Bulbophyllum neilgherrense	Thalimala	Endemic
Cappris rheedi	Manikkunnumala	Endemic & Threatened
Crotalaria beddomeana	Kainatti	Endemic
Cynometra beddomei	Vythiri	Endemic & Rare
Dendrobium crepidatum	Periya churam	Endemic & Very Rare
Dendrobium haemoglossum	Banasuramala	Endemic & Very Rare

(Table 2.4 Contd...)

Dendrobium nutantiflorum	Kurichiarmala	Endemic & Threatened
Derris brevipes	Kurichiarmala	Endemic & Rare
Derris brevipes var. coriaceae	Chooralmala	Endemic & Rare
Dipterocarpus bourdilloni	Vythiri	Endemic & Rare
Gluta travancorica beddome	Periya Churam	Endemic & Very Rare
Goniothalamus wynaadensis	Vythiri, Periya	Endemic & Rare
Hedyotis sisaparensis	Kurichiarmala	Endemic & Very Rare
Hedyotis wynaadensis	Chambra Peak	Endemic & Very Rare
Humboldtia brunonis	Vythiri, Periya	Endemic & Rare
Impatiens gardneriana	Manikkunnumala	Endemic & Threatened
Ixora elongata	Banasuramala	Endemic & Rare
Ixora lawsonii	Kurichiarmala	Endemic & Rare
Ixora sivarajiani	Kurichiarmala	Endemic & Rare
Jerdonia indica	Periya-Chanthanathode	Monotypic & Endemic Genus-Rare
Luisia macrantha	Banasuramala	Endemic & Rare
Medinilla beddomei	Vythiri	Endemic & Rare
Miquelia dentata	Vythiri-Wyanad Ghat	Rare
Myristica malabarica	Periya	Endemic to S. Western Ghats
Orophea erythrocarpum	Vythiri Churam	Rare
Osbeckia wynaadensis	Banasuramala	Endemic & Rare
Phaeanthus malabaricus	Vythiri	Endemic & Very Rare
Quisqualis malabarica	Vythiri	Endemic & Rare
Salacia beddomei	Kottathara	Endemic & Threatened
Sonerila rotundifolia	Manikkunnumala	Endemic
Sonerila versicolor var. axillaris	Thalimala	Endemic & Rare
Sonerila wallichi	Chambra Peak	Endemic
Swertia beddomei	Chambra Peak	Rare
Syzygium stocksii	Vythiri	Endemic & Rare
Trichosanthus nervifolia	Vythri	Rare-medicinal
Tylophora macrantha	Chambra peak	Rare & Threatened
Zeuxine gracilis	Kurichiarmala	Endemic & Rare

Biodiversity for income generation: mushroom cultivation by women farmers

Funded by the Department of Biotechnology, the project *"Mushroom cultivation for the economic benefit of SC and ST families in Wayanand"* has been completed. The cultivators formed a society called Mushroom Society of Wayanad (MSW) with 80 members, including all the mushroom growers from the weaker sections of society. They were able to produce an average of 10 kg of mushroom per day. The Society has been linked with the nearby Gramin Bank and marketing agencies. The spawn production unit, established under this project, has so far produced more than 2,000 bags of the best variety of spawn available in the district at present. The Society is working to provide credit and support services in income generation for poor women. The vision of the project is to promote economic independence for women in the weaker sections through a set of packages of mushroom cultivation and preparation of value added products. CAbC has collaborated with local NGOs, the regional agricultural station and women's groups for developing a training curriculum to impart skills and knowledge in mushroom cultivation, spawn production and the preparation of value added products.

A survey using the questionnaire method has been completed among the consumers of mushroom in the district to assess the consumption pattern among different classes of people. Articles on the medicinal and nutritive value of mushrooms have been published in leading local magazines that deal with medical care and indigenous medicine systems. This has had an impact on the general public. Training has been given in 16 different villages in the target panchayats and a total of 800 people have been trained in mushroom production during the year. Linking the producers and consumers of mushroom in an effective manner played a key role in the success of the project. The Centre has created a steady local market for mushroom. Different areas of the district were surveyed to collect samples. During the year about 45 specimens of various macro-fungi were collected, of which 10 have been identified at the family level, 10 at the genus level and 25 at the species level. A booklet explaining the various features of mushrooms (diversity of both edible and medicinal mushrooms from Wayanad, cultivation, post harvest technology, preparation of value-added products of Oyster mushroom and nutritive and medicinal value) has been prepared.

Collection of traditional rice varieties

The intra-specific variability in rice (*Oryza sativa)* was enormous in Kerala until the recent past. The peasants of this State had adopted various eco-friendly farming techniques to protect these varieties. A number of these varieties have been collected during this study. At present there is a collection of 61 varieties in 98 accessions from Thrissur, Malappuram, Calicut, Kannur and Kasaragode districts. Kerala has lost nearly 50% of its paddy fields within a span of 40 years. In 1975-76 the area under rice accounted for 30% of the gross cropped area; it declined to 24% in 1985-86 and to just 15% in 1995-96. The paddy fields are being recklessly used for the cultivation of other crops, which are economically more attractive and less labour absorbing. In Kerala there were not less than 300 traditional varieties of rice being cultivated before the advent of the green revolution. The people of

this State have carefully chosen many varieties of the kind that take care of both their food needs as well as health requirements.

Selection of a medicinally known rice variety

Generally, scientists and farmers hardly ever exchange their ideas and experiences in crop improvement with each other. But now the participatory approach is being practised in breeding and selection. The selection process in the rice variety *Njavara* is being continued. An experimental farm was maintained during the year for one season in one acre of land. Regular visits were made to farmers' fields. Care was taken to see that all agricultural operations were jointly done by the farmer and CAbC field staff. The regular visits to farmers' fields helped in exchanging knowledge and experience effectively. The initial selection of the seeds will be done in all these fields (the crop is now in the field). The farmers will be invited to the Centre's farm to make the selection. The *Njavara* variety could be cultivated successfully in one season only. The problem was the scarcity of summer showers, which are very essential for this seasonal crop, causing farmers to lose interest in cultivating it this season.

The farmers in all the Participatory Plant Breeding (PPB) sites were motivated in favour of rice cultivation as the paddy fields are being converted into banana plantations. The encouragement from scientists to continue rice cultivation convinced them about the importance of rice cultivation.

Farmers are willing to cultivate *Njavara* in more acreage, if they are assured of better procurement price. The Centre has taken efforts to link the farmers with the market. Many local doctors and manufacturers of medicine are approaching the Centre to get the seeds of this variety. The current market price for this is Rs 22, which is three times higher than that of the ordinary variety. The price sometimes goes up to Rs 40. One of the important results of this attempt was locating different strains of this variety. A separate study has been conducted to collect different strains from various places of Kerala and has resulted in the possession of 37 accessions. An effort has been made to understand the different strains of this variety at the biochemical level, and has resulted in prioritising the varieties based on their amino acid composition.

Njavara is normally not subjected to chemical fertilisers and pesticides, as it is believed that then it will lose its medicinal qualities. The cultivation of *Njavara* therefore brought back the use of several traditional agricultural practices like ploughing with bullocks, manuring with green leaves and cow dung, using herbal pesticides and so on in the PPB sites. This encouraged other farmers in the PPB sites to join in this movement.

Networking and capacity building

Four more grassroot level organisations have joined the NGO network formed in the district. Many of the partners participated in the activities of the Centre by organising awareness, orientation and training programmes. They are co-ordinating with the Centre in forming women's groups in Meppady through the micro credit system. These groups were given training in mushroom cultivation, primary health care, medicine preparation, and soap making. During the year 20 self-help groups have been formed, each with 10-15 women. Several youths were trained in the identification of scientific plants.

A newsletter named *"Vayal"* (paddy field) has been started to keep the network informed about the activities and conservation issues.

201.3 Jeypore Tract (undivided Koraput district), Orissa

The biodiversity area of south Orissa, in particular, the Jeypore Tract comprising undivided Koraput, a major portion of undivided Ganjam district, Kalahandi district and Kandhamal district, is experiencing severe habitat destruction due to many developmental interventions and a few natural causes. Hence, many species of environmental and economic importance are being depleted in this area. This region is of great importance from the point of view of biological diversity. This is known as the *"area of primary origin of Asian cultivated rice"*. The number of rice varieties in Jeypore Tract was more than 1,800. Paradoxically, this biodiversity rich area has been experiencing utter poverty and malnutrition. Primary conservers such as poor tribals and natives of this region are in a state of utter neglect. If strategies and interventions are adopted to make a substantial rise in the yield of indigenous crop varieties, there will be a definite and positive change in food security at the grassroot level.

Revitalisation of in-situ on-farm conservation

Initiatives were taken to establish Community Medicinal Plant Gardens (CMPG) in three villages, as a participatory approach to conserve and grow the medicinal plants commonly used by the tribals. An initiative of far reaching consequence under this project, is the Traditional Healthcare Practitioners (THP) Meet 2000 and the Field Exercise. The objectives were to design a process of documentation of the prevailing indigenous knowledge system and rare medicinal plants and to develop a methodology for conservation, preservation and maintenance of rare and endangered medicinal plants of this area with the help of THP.

There were 104 participants, including 43 THPs, 19 Traditional Birth Attendants (TBA), elderly villagers, knowledgeable individuals of nearby villages and members of NGO Co-ordination Council. There were 11 NGOs from 7 blocks of three districts *viz.*, Koraput, Nabarangpur and Malkangiri who actively contributed to this process. The six different tribes who attended the programme were: Gadaba, Paroja, Bhumia, Kandha, Rana and Bhatra.

The participants formed 10 groups (9 THP groups and 1 non-THP group) and discussed PRA documentation about plants used for curing diseases by different group members, and demonstrated and shared their knowledge about medicinal plants through PRA.

Teachers' networking: teachers' training programme at Jeypore, Orissa

As part of the strategy for capacity building and networking, a workshop was conducted for teachers from M E Schools of Jeypore from 7 to 9 March 2000, with the following activities (co-sponsored by WWF-India, Chennai) *viz.*, introducing and popularising environmental education, taking stock of the environmental status of undivided Koraput district, preparation of educational materials, field trips to nearby forests and making learning enjoyable for children, and interaction with local resource

persons and MSSRF staff on a future plan of activities on biodiversity conservation.

This workshop strongly advocated conservation measures to arrest the hunting of flying squirrels in the region. It was found that certain communities from Malkangiri and Boipariguda block usually hunt this innocent animal on a large scale. In addition, during the festive period many tribes engage in a spree of mass hunting. The forest department has therefore initiated necessary steps.

Capacity building

The activities under the capacity building component are training and regular orientation to opinion leaders, farmers, NGO leaders, teachers, students and women on biodiversity conservation, enhancement and equitable use and sensitising them on seed insecurity and depletion of rice varieties through exhibitions and separate programmes for different groups.

The ongoing efforts resulted in the formation of the Gram Panchayat level Biodiversity Management Committee (BMC) in Mohuli and Dangarchhinchi Panchayats and in providing orientation for seed improvement to members of four Community Seed Banks (CSB) in four villages.

Networking

A Co-ordination Cell for 30 NGOs addressing biodiversity-related issues is at the formative stage. With the help of NGOs, exhibitions were organised on seeds, plants of great medicinal value, ethnobotanical information and different rice varieties.

Sub Programme Area 202

Participatory Plant Breeding : Path to Secure Livelihood

In tune with the objectives set earlier, Participatory Plant Breeding (PPB) activities for the kharif (rainy) season of 1999 concentrated on participatory evaluation and selection of local varieties. The two hypotheses sought to be demonstrated were:

- Formal technology can fine-tune farmer practice of crop cultivation
- Improvement in various traits including grain and stover yield from formal practices can be observed in farmers' fields by farmers themselves

To test these hypotheses, experiments were designed with crop varieties selected on a participatory mode out of those tested last year in farmers' fields. Farmer and formal practices of rice cultivation were the main treatments in these experiments.

Participatory evaluation of the experimental results would be the base to select varieties for optimal performance, to be tested in a number of large plot demonstrations during kharif 2000.

202.1 Jeypore

5 villages and 9 sites, comprising three upland, medium land and low land conditions respectively (Table 2.5), were selected by the farmers in a PRA conducted in May '99. The experimental plots were assigned by farmers in each village. The experimental field layout suiting the topography of the site was mutu-

ally agreed upon for planting selected varieties of rice. Plot sizes and the length of experimental rows (restricted to north-south direction) varied. Such variable sizes were inevitable in farmers' fields but the variation was not too high to vitiate the results. Formal intervention used a randomised block design with 3 replications. Farmer practices used area equal to the formal ones but each variety was assigned a plot thrice as big as a formal plot of a replication (to conform to the 3 replications under formal practices). The layout of farmer plots was unreplicated since farmers were yet to become conversant with field designs and their layout.

iii). Number of panicles, iv). Panicle length (cm), v). Number of filled and total grains per panicle and vi). Grain and stover yield per plant.

Grain filling index (= number of filled grains/total number of grains) and Harvest index [= grain yield/(grain + stover)yield] were computed. Thus a total of nine traits were used for drawing inferences. Multivariate methods of assessing the performance across traits were employed and varieties were ordered separately on the basis of overall performance across traits and grain yield *per se*.

Table 2.5 : ***The distribution of PPB farmers' plots for kharif 1999 experiments***

		Upland		Medium Land		Low Land	
District	**Block**	**Village**	**Dist**	**Village**	**Dist**	**Village**	**Dist**
Koraput	Jeypore	Barangput	12	Patraput	17	Patraput	17
						Pujariput	21
	Boipariguda	Tolla	22	Tolla	22	-	
		Mohuli	20	Mohuli	20	Mohuli	20

Village – Name of village; Dist – Distance in km from MSSRF, Jeypore

Both formal and farmer treatments were managed by the respective farmers with the collaboration of research personnel. Formal plots were prepared, sown, supervised and harvested under the direction of research personnel. There was no monitoring of farmer plots and farmers planted and harvested the material following their traditional practices.

The following yield and its component traits were recorded by the research personnel utilising farmers' help where possible: i). Plant height (cm), ii). Number of effective tillers

Salient results

Out of the 26 local varieties tested by farmers in their fields during 1998, only nine were retained for re-testing in 1999. The decision was the result of a participatory discussion of the 1998 results in a PRA held during May '99 before the planting season. Though inferences were drawn from the performance of these 9 varieties across two seasons, they held good, in general, for the remaining 22 varieties tested in the three growing conditions of upland, medium land, and lowland (Table 2.6).

Table 2.6 : ***Local varieties tested in PPB experiment during kharif 1999 in the Jeypore Tract***

Land type	Varieties	Land type	Varieties
Upland	Mora	Medium land	Sapuri
	Pandakagura*		Veliyan (from Kerala)
	Paradhan*		Parijat
	Matidhan*	Low land	Machchakanta*
	Osagathiali		Bayagunda*
	Pathara		Kalachudi@*
Medium land	Gathia		Gadakuta*
	Mer		Barapanka*
	Limbachudi		Kalajira
	Bodikaburi*		Veliyan
	Haladichudi		Lalata

*: selected from 1998 experiments; @: farmers corrected the identity of a variety tested as Umriachudi in 1998, as Kalachudi on experimental verification in 1999

The following formal practices were extended to farmers' fields :

- Some farmers used to apply FYM during sowing. The application of FYM at least a month in advance and incorporating it into the soil by light ploughing was advocated.
- Farmers were raising nurseries in uneven patches of land and broadcasting seeds in a haphazard manner. Raising nurseries in fairly level lands, under appropriate moisture levels, adopting line sowing was suggested.
- Selection of seeds by soaking them in water and planting only those which sink was an intervention which resulted in a uniform stand and contrasted with the gappy and uneven stand in farmers' fields.
- Farmers were practising broadcasting of seeds or thick sowing of seedlings (seed rate approx. 60-80 kg/ha). Line sowing with proper spacing (20 cm) between rows and (10 cm) between plants within a row was the modification advocated. Saving in seeds was found to an extent of 80% through this practice.
- The rows were set in North-South direction so that the plants in a row could intercept maximum sunlight.

Farmers could observe, in their own sites, the crop growth both under formal and their own practices. They realised that seedlings in the formal nursery had a robust growth and their uprooting was comparatively easier (due to row planting) than in the farmer nursery. There was a significant saving in the quantity of seeds required to plant one hectare of a crop (15 to 20 kg under formal compared to 3 to 4 times more used in farmer practices). Weeds were relatively low in formal plots; possibly dense sowing in farmer plots encouraged high weed growth un-

der competition. Formal plots had low incidence of diseases and several were free of them. Only bacterial leaf blight controlled by a spray of Plantomycin (3g/l water) and case worm controlled by a spray of Metacid 50 (2 ml/l water) were observed on a low scale around 45 days after sowing/transplanting.

To encourage a healthy crop growth in transplanted plots, the water management schedule was optimised (Table 2.7). This schedule enabled high saving of precious water in formal plots, leading to a better benefit: cost.

mance across these 5 traits and on grain yield alone.

The rankings varied widely (Table 2.8). For example, the variety Matidhan in upland was found in the 2nd group based on all traits; but it was relegated to the 4th group based on yield alone. Such discrepancies result when grouping is made solely on a single trait, like grain yield. In fact, grain yield is the final outcome of the manifestation of component traits across the crop growth duration. Environmental modifications, particularly rainfall pattern in Orissa, and biotic

Table 2.7: ***Water management schedule in transplanted plots from PPB experiment in Jeypore Tract***

Stage	Formal Method	Farmer Method
Ploughing of land	Water as needed	Standing water
Puddling	2 to 5cm SW	>5cm SW
Transplanting	A thin film of water	>5cm SW
After transplanting to seedling establishment	2 to 5cm SW	>10cm SW
Seedling establishment to tillering	Alternate wetting and drying	
	wetting = 2 to 5cm SW	>10cm SW
Tillering to dough stage	5cm SW	>10cm SW

SW: Standing Water

Based on the level of significant variation for the 9 traits, five, namely, plant height, grain filling index, grain yield, stover yield and harvest index, were found to be important in evaluating the genetic potential of varieties. The varieties–6 in upland and 8 each in medium and low lands–were then ranked on overall perfor-

and abiotic stresses would significantly affect final yield. Therefore the potential of individual component traits of the varieties would not receive due weightage. An overall assessment across yield and its component traits would remain free from those deficiencies and provide a logically justified ranking.

Table 2.8 : ***Differences in ranking of varietal performance based on multiple traits and on yield alone in PPB experiment in Jeypore Tract***

Up Land			Medium Land			Low Land		
All traits	OV	YD	All traits	OV	YD	All traits	OV	YD
1. Paradhan	1,173	1	1. Sapuri	3,515	1	1. Barapanka	3,438	3
2. Matidhan	939	4	2. Limbachudi	2,915	3	2. Kalajira	2,459	6
3. Pandakagura	1,027	3	3. Haladichudi	2,964	2	3. Lalata	3,130	1
4. Osagathiali	1,133	2	4. Veliyan	2,901	6	4. Bayagunda	3,679	4
5. Pathara	898	6	5. Bodikaburi	2,455	4	5. Veliyan	2,856	2
6. Mora	1,046	5	6. Mer	2,847	7	6. Kalachudi	2,562	5
			7. Gathia	2,334	5	7. Machchakanta	1,671	8
			8. Parijat	1,913	8	8. Gadakuta	1,523	7

OV- overall traits; YD- grain yield kgs/ha

Table 2.9 : ***Comparative benefits of formal over farmer practices in PPB experiment in Jeypore Tract (kharif 1999)***

Land type	Variety	Yield (kg/ha) 1998	Av. Yield (kg/ha) 1999			FO/FA	DF	DM	RP
			FO	FA	*				
Lowland	Machchakanta	2,189	1,671	1,418	0	1.2	106	132	26
	Bayagunda	1,755	3,679	2,321	2	1.6	130	161	31
	Gadakuta	1,352	1,524	961	2	1.6	106	132	26
	Barapanka	1,643	3,438	2,533	2	1.4	132	162	30
	Kalachudi	1,309	2,562	2,007	2	1.3	108	144	36
Medium land	Bodikaburi	1,261	2,838	1,736	2	1.6	96	131	35
Upland#	Pandakagura	393	1,188	1,178	0	1.01	65	115	50
	Paradhan	562	1,028	622	1	1.7	63	103	40
	Matidhan	839	1,199	1,133	0	1.06	74	112	38

FO – Formal; FA – Farmer; DF – Days to 50% flower; DM – Days to mature; RP – Reproductive Phase (days); * - No. of locations out of three in which significant differences were observed between formal and farmer plots; # - Data on farmer plots from only one location, Tolla; Medium land: Late transplanting; Upland: Low germination, disease incidence

An analysis of comparative benefits of formal practices (Table 2.9) brought to focus a number of important findings :

- The yield variation in tribal tracts in the two years 1998 and 1999 reflected the critical impact of climate fluctuations (day temperature, amount and distribution of rainfall) on rice crop yield
- The above observation was confirmed by the yield of Machchakanta for example, which dropped substantially in 1999 from its top position in 1998 (Table 2.9)
- Compared both to the yield level in 1998 and those under farmer practices, the yields under formal practice were consistently superior ranging from 6 to 70% (Table 2.9). Delayed transplanting and aged seedlings (45 days) were the reasons for relatively low yields in upland plots. Reliable and consistent results in lowland confirmed the beneficial role of formal practices
- The reproductive period available to local varieties was as low as 26 days, though it was relatively higher for upland which is characterised by direct seeding and pure rainfed conditions. It would be interesting to understand the underlying causes and apply remedial measures to increase the reproductive phase duration
- Veliyan, a variety introduced from Kerala, was found to perform exceedingly well (Table 2.10) for fodder yield. It also gave good grain yield, though it was found to be of long duration (approx. 180 days). This variety serves as a good example of the role of extended adaptation for a trait not perceived at the native habitat of the variety. In essence, this example opens up a new paradigm of participatory varietal selection, namely, disruptive ecological selection, described earlier (AR, 1998-99).

The results would be discussed in detail with farmers before setting up large scale participatory demonstration of the role of an optimal variety combined with associated formal practices in tribal sites of Jeypore Tract of Orissa.

Table 2.10 : ***Performance of Veliyan, a popular variety from Kerala at Jeypore in PPB experiment (kharif 1999)***

Land type	Location	Grain yield (kg/ha)	Harvest Index
Medium Land	Tolla	1,906	NA
	Mohuli	4,300	39
	Patraput	2,497	NA
Low Land	Mohuli	2,874	33
	Patraput	2,979	NA
	Pujariput	2,714	NA

NA- Not available

202.2 Kolli Hills

In this site, in addition to the two hypothesis set earlier for the Jeypore Tract, a third hypothesis was also sought to be tested, namely, long non-cultivation of little millets would contribute to the depletion of their genetic diversity. Cultivation of millets, in general, and little millets, *samai*, in particular at Kolli Hills has been on the wane due to commercial exploitation of tapioca at the cost of millets. When attempts were made to restore *samai* cultivation, there was a lurking fear, based on preliminary evidence, that genetic diversity among the landraces was eroded on account of long non-cultivation. In our experiment aimed at seed multiplication reported earlier (AR 1998-99), it was found that the fear was unfounded and that there were four distinctly divergent groups (Table 2.11). This year, therefore, genetic diversity was again evaluated from the data on varietal experiments at Kolli Hills.

The seven landraces experimented with and reported earlier (AR 1998-99) were evaluated under formal and farmer practices, as in Jeypore Tract. Of the 7 landraces, 3 were short duration varieties (SDV) and 4 of long duration (LDV). Only 5 farmers came forward to do this varietal evaluation, one of whom tested both SDV and LDV. But the experimental plot sizes were relatively small (10-15 sq.m). Formal practices were adopted in plots laid in a RBD with 3 replications while plots under farmer practices were unreplicated. Multivariate evaluation across 5 component traits – plant height, number of nodes, panicle length, grain yield and harvest index – was utilised to draw inferences.

The site did not receive timely rain; hence sowing was delayed by more than a month. Plot yields were beset with unexplainable variation. So the inferences were based on data from random samples of five competitive plants in each plot.

It was found that there was significant variation among the landraces for all the component traits. This would indirectly suggest that they should be genetically divergent. Evaluation of inter-landrace genetic diversity, using a multivariate measure of genetic divergence based on the 5 component traits, has brought

Table 2.11: ***Clustering of landraces of little millets based on genetic divergence***

1998 (Kattupakkam)		1999 (Kolli Hills)	
Group No.	**Landraces**	**Group No.**	**Landraces**
I	Malliasamai	I	*Malliasamai* *Birsa Gundli 1*
II	Thirikulasamai *Perunsamai*	II	Thirikulasamai *Sadansamai*
III	Kattavettisamai *Vellaperunsamai*	III	Kattavettisamai Perunsamai *Vellaperunsamai*
IV	Sadansamai *Kottapattisamai*	IV	*Kottapattisamai*

to light four distinctly divergent groups (Table 2.12). It was interesting to observe similarity in the cluster composition in the 2 years, 1998 and 1999, despite highly differing locations in which the landraces were grown. In Kattupakkam near Chennai, the crop was raised in an off-season, November – April, under life-saving irrigation. In Kolli Hills, the crop was raised in its native habitat under purely rainfed conditions. The soil at Kattupakkam was better in constitution and fertility than that at Kolli Hills. Further, Kolli Hills experienced deficient weather conditions, as stated earlier. Despite these contrasting conditions, genetic diversity among landraces was present disproving the null hypothesis proposed.

Formal practices adopted in this crop were similar to those in rice crop modified to the site and the farmer's practices (Table 2.12). There was significant improvement in grain yield/plant of short duration varieties under formal practices (Table 2.13). In some cases, the improvement was of a very high order since yields were drastically reduced under farmers' deficient practices. However, there was no significant improvement in long duration varieties even under formal practices. Since the crop season was non-normal and rainfall was scanty and not properly distributed, the results need repeat verification. Yet, it was evident that, in small millets cultivation, there is considerable scope to improve productivity by introducing scientific cultivation practices at no extra cost.

Studies conducted in two different sites, by two different farmer tribes of two different crops during the crop year 1999-2000 have led to the following important conclusions:

- Farmers' traditional practices of cultivation and indigenous knowledge can be improved with formal scientific principles to more than double the current productivity at no extra cost
- This perceptible improvement observed in farmers' fields has helped a mass awakening among farmers who volunteer not only to practice formal methods but also to persuade the community to adopt them
- Based on this progressive trend, a number of demonstrations in large plots have been planned at both the sites in farmers' fields during the ensuing kharif season

Table 2.12 : ***Formal–Farmer method of cultivation of little millets evaluated in kharif 1999***

	Formal	Farmer
Seed	From plants selected in the last season	From saved seed
Spacing	25 cm between rows	
	10 cm between plants	Thick broadcasting
Weeding	Twice	Weeding, thinning and harrowing by cross ploughing
Organic fertiliser	FYM to supply 20 kg N	Whatever available
Planting direction	North - South	Non-specific

Neem (3% *azadiractin*) spray against ear-head bug in both formal and farmer plots

Table 2.13 : ***Grain yield in formal and farmer plots of little millets***

Farmer	Varieties		Grain yield / plant (g) FO	FA	S	FO/FA	Productivity range (kg/ha)
2	SDV	1	32	22	*	1.45	
		2	29	9	*	3.22	
		3	35	19	*	1.85	
		4	37	19	*	1.95	
5		1	24	16	*	1.50	212 – 969
		2	29	15	*	1.93	
		3	30	14	*	2.14	
		4	29	10	*	2.90	
6	LDV	1	53	47	-	1.13	
		2	50	42	-	1.19	
		3	53	51	-	1.04	280 – 596
		4	56	45	-	1.24	

FO – Formal; FA – Farmer; S – Sig. @ 5% level

Sub Programme Area 203

Integrated Gene Management

Community gene bank

Integrated Gene Management is a comprehensive *in-situ* and *ex-situ* approach involving farm families, integrating various strategies such as activities under community gene bank (*ex-situ* conservation, medium-term storage), community seed bank (*ex-situ* conservation at the field), participatory conservation (*in-situ* conservation), and establishment of community medicinal plant garden.

Revival of lost crops of Wayanad

To revive the lost crops of Wayanad, traditional paddy varieties such as *Mannuveliyan*, *Thavalakkannan*, *Velumbala* and *Kuttiveliyan* were obtained from the National Bureau of Plant Genetic Resources (NBPGR), Regional Station, Trichur. They were given to the field site office at Wayanad for distribution to the farm families and testing in the field. Feed back from the field is yet to be received.

Field multiplication

One hundred traditional paddy varieties collected in Orissa and stored in the Gene Bank were taken for multiplication at Cuttack. Except a few all the others were affected by the recent super-cyclone in Orissa. This natural disaster caused a major setback in multiplying gene bank accessions in Orissa in 1999. Another set of Gene Bank accessions of paddy collected from Jeypore, has been taken for multiplication.

42 accessions stored in 1998 were taken for multiplication at Kattupakkam field centre, of which 31 responded well. But the quantity after multiplication varied from 5 to 50 gm. The result of the trial has also been sent to Prof S Dana of West Bengal, who contributed the wild Vigna collection to this bank in 1998. He collected these wild varieties from Madhya Pradesh, West Bengal, Rajasthan, Gujarat, Orissa, Kerala and Bihar. A request has also been made to him to send us some of the accessions, which did not germinate. *Vigna* accessions are yet to be stored after multiplication.

Traditional paddy varieties such as *vadan samba, samba, kullangar, seethapakkam, kicchadi samba, mottai kar, poovan kar, kappakar, madumulungi, pitchannakarai, vazhaipoo samba kar, chingleput sirumani, kalarpalai, thuyamalli, jeeraga samba, bangalore kar* and *chinna samba* have been taken for multiplication at Kattupakkam. This traditional paddy collection was contributed to the Community Gene Bank in 1997 by an NGO called Save Eastern Ghats Organisation based at Chengam in Tamil Nadu.

Processing

Systematic processing of the traditional paddy collection from Wayanad and Jeypore has been done.

Rearrangement of packets and checking of all the packets at the Gene Bank have been done this year. A separate format has been developed to issue receipts and acknowledgement at the time of collection. A revised Gene Bank brochure in English and Malayalam has been printed for circulation among the farmers and NGOs.

Wild collection

The Foundation has taken up a four-year project, the "National Agricultural Technology Project on Plant Biodiversity", operating through NBPGR, New Delhi as a Co-operating Centre. This involves extensive field collection of wild crop species in the states of Kerala (Wayanad), Orissa (Jeypore Tract) and Tamil Nadu. Exploration trips focused on medicinal plants, minor fruits, dye-yielding vegetables, *Sesamum* sp., *Brassica* sp., and traditional crops. Since February 2000, exploration programmes covering areas such as Perambalur, Chidambaram, Pondicherry, Thiruvannamalai, Pudukkottai, Erode and Villupuram in Tamil Nadu and Sultanbathery, Mannanthavadi, and Vythiri at Wayanad were undertaken. A total of 130 wild species has been collected from Wayanad and Tamil Nadu. They have been deposited with NBPGR. Networking with NGOs like MRV Global Foundation, Perambalur, Tamil Nadu in exploration is an added strength to this programme. As of now holdings at the Gene Bank have been substantially increased to 850.

Community herbarium

Classification of the collection in the herbarium at the Gene Bank is underway. This year 20 voucher specimens belonging to the families, viz., *Apocynaceae, Eleocarpaceae, Lythraceae, Euphorbiaceae, Tiliaceae* and *Myrtaceae* were added to the Community Herbarium.

Participatory conservation

This year a collection of 72 traditional paddy cultivars, comprising 13 upland, 24 medium land and 35 lowland cultivars, has been made

under the Participatory Conservation programme. After harvest, a minimum of 100 gm in each accession has been given to the Community Gene Bank. Optimal utilisation of land and seed for maximum yield has been clearly spelt out and the duration of certain cultivars has been determined. Tribal farmers in the villages such as Daleiput and Pujariput and the village committee selected the land. Under this programme farmers are trained in methods of line sowing, line transplantation, weeding and so on. They also learn that the quantity of seed taken for sowing should be optimal with a good return of harvest. Sharing of knowledge was enabled through this programme.

Community medicinal plants garden

Community medicinal plants gardens were established at four villages namely, Tolla, Mohuli, Barangput and Patraput, for documentation, revitalisation and distribution of plants to the community. The villagers were co-operative as they realised that medicinal plants would be available in the forest adjacent to the village. In Barangput and Patraput villages Participatory Rural Appraisal was conducted to enquire about the availability of space for the establishment of the garden. Collected medicinal plants and a few medicinal plants from the Foundation's Greenhouse are now housed there. Documentation of traditional knowledge is also underway.

Community seed bank

Meetings with the sarpanch, central village committee and panchayat were organised to interact with the villagers at different levels. Generally tribal farmers showed collective interest. Preservation of local landraces at the villages will make these cultivars readily available to farmers and help to conserve existing genetic diversity. Poor farmers need not depend on small and marginal farmers for seed material. Crop species such as paddy, millets, pulses, oilseeds, vegetables, greens and cashew are being stored as well as hybrid varieties. The traditional mode of storage such as bamboo baskets, gunny bags, small cloth bag and so on are being used. Multiplication of the cultivars stored in this seed bank was carried out. A separate format has been developed to document information pertaining to storage. Steps have been initiated to store all this material with the Community Gene Bank at Chennai.

Sub Programme Area 204

B R Barwale Chair in Biodiversity

The Centre has many projects concentrating on rural development in Tamil Nadu and neighbuoring states. One such programme is developing the Agrobiodiversity Conservation Corps (ACC). Its primary objective is to identify local youth/volunteers and train them in the various aspects of agrobiodiversity conservation.

204.1 Strengthening the Knowledge Base and Role of Communities: Agrobiodiversity Conservation Activities

Agrobiodiversity includes diversity in traditional agriculture and conservation practices, seed collection and preservation, crop varieties and land races, and the knowledge of rural people.

Activities were planned under four components *viz.*, Research, Training-Capacity Building, Communication and Dissemination and Institutional support. During the reporting period the following activities were pursued :

Research : The knowledge base was expanded by engaging ACC volunteers in the collection of traditional seeds in their respective regions. Herbarium collection and preparation were done and inventories of plants and animals prepared. Besides this, resource mapping, monitoring and appraisal of programmes were done by participatory methods.

Training and capacity building : Ongoing training programmes were continued and fresh training material prepared, based on local needs and requirements. The effectiveness of training was enhanced by actively involving the volunteers in the preparation of charts and posters, taking them on exposure visits and making them participate in workshops and capacity building sessions.

Institutional building : Facilities for training were upgraded and strengthened. Support was provided for the creation of an ACC fund and the ACC groups were integrated with new volunteers through structured programmes.

Conservation and dissemination : Discussions were organised in the surrounding villages by ACC volunteers. The different groups were networked through meetings and other activities like folk plays, songs, display of signboards and banners in the villages. Activities such as involvement in nurseries were promoted.

This project is operated in 5 sites *viz.*,

- Karikattanur (Dharmapuri, Tamil Nadu)
- Kolli Hills (Namakkal, Tamil Nadu)
- Wayanad (Kerala)
- Jagatjori (Kendrapada dist, Orissa)
- Lakshadweep Islands (Union Territory of India)

In each site 10 volunteers (local youths) have been identified and trained in the various aspects of conservation of agrobiodiversity since May '96. These volunteers are paid a monthly stipend of Rs 500 during the training period. In future it is proposed that volunteers deposit part of the stipend amount in a bank and a fund be created which could be operated by the members of the Corps, as a Community Biodiversity Fund.

The programme concentrates on building individual and group capacities in the areas of identification, characterisation and conservation of agrobiodiversity amongst the local youth. These youth are also expected to spread the message through a variety of activities including one-to-one interaction and group meetings. The ultimate purpose is that the local variability in crops and livestock in agrobiodiversity-rich areas is conserved for sustainable development. The programme aims to empower the local youth in the area of sustainable agriculture through capacity building.

Dharmapuri

Kesarkulli Dam is surrounded by dry forest dominated by thorns (Acacia) and low statured deciduous trees. A traditional form of dry land agriculture is generally practised in the surrounding villages. The use of commercially available pesticides is rare. In this locality, Karikutanoor village was chosen to identify and

train young people in the conservation of agrobiodiversity of traditional crops and cropping practices, which while being adequately productive are eco-friendly. During the years 1997-2000 we had 3 batches of volunteers from different adjacent villages who covered 8 villages during their dissemination programme. The volunteers have produced significant results through this programme in the past 4 years. The second and third batches of volunteers especially have brought about many changes in perceptions and attitudes and created an awareness in the nearby villages. They saved their monthly stipend amount and created a fund by opening an account. On 15 November 1999 these volunteers registered a society called (*Velanmai uiruna padukapu sangam*) *Agrobiodiversity Conservation Society*. With their two years' savings amounting to Rs. 7,500 they have bought a small plot of 20 ft. x 35 ft. The rest of the amount was spent for construction of the Awareness Centre. This Centre was inaugurated on 15 April 2000 by the village Gounder.

During the inaugural function the villagers were invited, and a display of posters, charts, seeds, medicinal plants, PBR registers etc., was organised by the ACC group. Cultural programmes reflecting the importance of the conservation of agrobiodiversity were arranged by school children and ACC volunteers. After the establishment of the Centre there has been an enormous change in the local people and most of them are aware of the local biodiversity and its importance in sustainable livelihood. Many villagers who had participated in this programme have come forward and promised to donate the traditional varieties of seeds to the centre for reference. This Centre has a large seed collection.

As a sequel to this a Society was formed for taking up issues relevant to sustainable agricultural development and social welfare. The overall mission of the Society is to conserve agrobiodiversity and the main objectives are:

- involve the educated youth in agricultural activities, which improve their livelihood
- create an awareness of the usefulness of agrobiodiversity in the village
- identify naturalised and native crop varieties and medicinal plants and create an awareness amongst the local people of the usefulness of agrobiodiversity
- integrate sustainable agriculture and development programmes, environmental programmes, health, childcare, adult education and literacy missions
- promote training for women in fruit processing, nursery raising, livestock raising, silk and mushroom production and biopesticides
- fight for issues such as child labour, drug addiction, AIDS etc.

Kolli Hills

The ACC of Kolli Hills has also structured and organised a Community Agrobiodiversity Fund. During the dissemination process, 11 villages were covered and traditional seed varieties collected. In August '99, during the Aadi festival, a stall was arranged in Kolli Hills for describing the concept of sustainable management and natural resources to the local people. There was an enormous response and more than 2,500 people visited this stall. Many queries were raised by the local people about ACC activities. ACC volunteers interacted with the

people and explained the concept and importance of biodiversity.

A two-day workshop on launching a National Association for Agribusiness Development was organised by the Foundation on 10 and 11 September 1999. ACC volunteers participated and acted as resource persons during the second summer course on "Principles of Biodiversity and Sustainable Management", which was organised by the B R Barwale Chair of the Foundation. They were taken to Trichy for training on running a Co-operative Society.

Jagatjori (Orissa)

The ACC volunteers are showing an enormous interest in spreading the concept in the area. With the help of the local people, school children, teachers and senior citizens, activities like monitoring and inventorying the coastal ecosystem and the surrounding mangroves are being undertaken. 23 villages in three panchayats have been covered. The volunteers have prepared herbariums of medicinal plants and collected landraces of cultivable seeds, both traditional and hybrid. Data documented by the volunteers on crops, plants, birds and animals includes 59 varieties of paddy, 52 varieties of weeds, 23 varieties of grass and 32 varieties of mangroves.

On 29 October '99, a super-cyclone hit the Jagatjori field site, and caused severe destruction. All the herbarium sheets, seeds, registers and photographs were washed away. A consolidated report has been prepared by the field staff and the ACC volunteers, about their experiences, views, problems and loss of property, animals, crops, cultivation and prawn fields. Most of the vegetation was also washed away. But it was interesting to note that the mangrove plantation, raised by the Foundation during the NORAD project, was able to withstand this super cyclone. The credit goes to the ACC volunteers for protecting it from local villagers and cattle.

Lakshadweep

MSSRF staff visited the Lakshadweep Islands of Minicoy and Kavaratti and with the support of the Department of Science and Technology and Environment identified and trained 20 youth. Training has been imparted on identifying and monitoring plant resources on the islands and the health of the coral reefs in selected islands. The Agrobiodiversity Conservation Corps concentrated primarily on the fishery resources of the islands and developed guidelines for monitoring and sustainably managing these vital components of biodiversity.

The ACC programme was closed in Lakshadweep due to various reasons. Problems of transport and communication and the amount of time spent on obtaining permit to visit the island from the UT Administration office at Cochin were enormous. Another is the migration of the trained young men for working outside the islands especially as seamen. The third problem is that of culture, which is orthodox, making it generally difficult to involve women in the project.

Kalpetta (Wayanad)

The ACC has helped in building up a strong network of NGOs in the district by involving 10 committed grassroot level groups working for the goal of a sustainable future. At the panchayat level, they assisted the team to form Biodiversity Management Committees (BMC) in all the three sites. This body comprises the

panchayat president, panchayat members, retired teachers, local leaders and MSSRF representatives. Their activities are constructive:

- They are working among the people to spread the message of conservation and the importance and value of biodiversity. A library named *Vayal* (field) has been set up by the volunteers of Kottathara with the help of the Centre to extend information on environment and culture.
- They have helped women to form land care groups in the three village panchayats. They have been asked to identify and collect the seeds/propagules of the most important, but threatened crops for commercial cultivation. Two such groups (10 women in each group) are successfully cultivating various legumes, spices, yams, Musa cultivars and a variety of paddy. Similar groups are being formed in Meppady village. There are now 10 such teams each consisting of 10-15 members.
- They have identified farmers who still follow traditional agriculture in this district and rewarded two such farmers with the help of an NGO (Organic Farmers & Cultivators Organisation) at a function.

204.2 Forum for Sustainable Management of Biodiversity

People's Biodiversity Register (Kolli Hills)

The Forum undertook the following activities :

- The Trained Core Group members selected 52 new members from 7 new villages (24 men and 28 women)
- The new members were given orientation for preparing the Peoples' Biodiversity Register (PBR) by core group members. The new members prepared the Biodiversity Register for Gundathu Solai and resource map of Oyangulipatti. Women's knowledge and perception of biodiversity was recorded
- It was felt by the group that the institutionalisation process should be initiated for protecting the existing PBR, instead of preparing a new PBR (where, who, how)
- The group suggested that PBR can be kept in the existing Panchayat office room or in a new building on 'patta land' or 'poromboke land' or 'temple land' (but not in the temple premises) and responsible persons can be selected from the trained Core Group members to be in charge
- The key issue raised was getting monetary and legal support for protection and updating of PBR

Preparation of Biodiversity Register (Kalpetta, Wayanad)

Scientists and farmers collaborated as partners in the preparation of location specific biodiversity inventories. It has resulted in the compilation of PBR of two panchayats-Kottathara and Meppady. To encourage the local youth, training has been given in inventorying biodiversity of habitations and thereby spreading the message of conservation and sustainable development. They have been given a small sum as incentive on a monthly basis to keep up the enthusiasm. The approach of PBR was the study of biological diversity in two broad categories, as

forest landscapes and habitations. The survey in forest areas has been done directly by their scientists with the help of forest officials and tribal communities. Habitation surveys are useful to understand the biodiversity known to and used by the people. People have done this with guidance from the scientists of the Centre. Several posters, handouts on traditional paddy varieties, medicinal plants, mushrooms, and a training manual on PBR have been prepared. PBR of Kottathara and Meppady village panchayat have been completed. The work is progressing in the other two sites. The results of the study are being shared with others. NGOs and farmers have been alerted on the potential danger of present day agricultural practices in the district.

Sub Programme Area 205

Conservation and Utilisation of Biological Diversity : Marketing Study

Formation of Self-Help Groups (SHGs) and market tie-ups

So far the people of Kolli Hills have used minor millets only for their food security and home consumption. Thus minor millets have never been considered for market purposes. Now a steady demand for minor millets is planned under the sub-component of the project *viz.*, marketing. If market tie-ups are established and a steady demand is created, minor millets cultivation can go up. So a market tie-up with the Tribal Federation for Marketing Development Corporation (TRIFED) was established.

Tie-up with TRIFED

A market tie-up was established with TRIFED, which works exclusively for tribal marketing development with groups of people rather than with each individual cultivator. Ten SHGs have been formed and both men and women are members in the SHGs. In all the groups the leaders, namely, the animator and representative are a man and a woman. This is a deliberate attempt to give leadership to women also. The 10 SHGs have sold around 12.8 tons (Table 2.14) of minor millets during this season to the TRIFED without middlemen. For the first time the underutilised species at Kolli Hills has entered the market.

The women leaders of the self-help groups also participated in signing the MoU with TRIFED and negotiated the procurement price. Due to the efforts of the groups and MSSRF, TRIFED for the first time included other minor millets like finger millets, Italian millets, kodo millets and common millets whereas previously it procured only Little millets from the tribes. The initiative will help in the conservation and utilisation of minor millets.

A plan was prepared to create a demand for minor millets by involving the local cultivators and interested tribes. Both men and women participated in a Focus Group Interview. During the discussion, a list of traditional food items and recipes were given by the participants. It was decided to popularise those items even among the people of the plains, during Aadi 18 festival when people from the plains come in thousands to Arappaleswarar Temple. All the group members came forward to prepare the items. Around one lakh people visited the temple and 5,000 visited the stall. Apart from the food items, dehusked grains and flour

of little millets and Italian millets were also sold. The local participants did not come to the stall as expected due to the festival work and distance. The second day *Aadi 19* was used to sell not only minor millets food items but also minor millets seeds under the seed exchange system and biofertiliser.

Further it was planned to create a demand for minor millets by using them in the preparation of breads. A private limited company and Modern Bread Company were contacted. They succeeded in preparing bread with the addition of little millets flour. Modern food items and traditional food items prepared from minor millets were also sold at the Aadi 18 festival. The Bread Company wants to procure little millets flour. The planning and arrangement for market tie-up needs further study. Since the TRIFED is tied up with the minor millets cultivators, discussions are underway to link the TRIFED and the Bread Company.

Sub Programme Area 206

Molecular Mapping and Genetic Enhancement

High population pressure, low agricultural productivity, depleting natural resources and increasing abiotic stress conditions in the region are affecting the basic life support system in the coastal ecosystem. The rich biological diversity of the regions, conserved both naturally and as a result of the long cultivation practices over the years, could be utilised profitably for enhancing its stability, sustainability,

Table 2.14 : ***Panchayat-wise sale of minor millets (in kg) to TRIFED through SHGs in Kolli Hills***

Panchayat (Nadu)	*Little millets*	*Italian millets*	*Kodo millets*	*Common millets*	*Finger millets*	Total (kg)	No. of farmers
Chithoor	60	120	—	-	-	180	2
Bail	764	10	-	-	-	774	9
Thiruppuli	749	-	-	-	-	749	13
Gundur	1,464	-	-	-	-	1,464	11
Ariyur	986	-	-		-	986	4
Devanur	925	422	15	77	1,206	2,645	37
Selur	745	982	45	-	625	2,397	33
Valappur	161	-	-	-	204	365	7
Vazhavanthi	103	31	-	-	7	141	5
Alathur	3,005	-	-	-	121	3,126	50
Total	**8,962**	**1,565**	**60**	**77**	**2,163**	**12,827**	**171**

Little millet- Samai (*Panicum sumatrense*), Italian millet- Thinai (*Setaria italica*), Kodo millet- Varagau (*Paspalum crobiculatum*), Common millet- Pani varagu (*Panicum miliaceum*), Finger millet- Ragi (*Eleusine coracana*)

productivity and profitability. The molecular mapping and genetic enhancement programme, therefore, concentrates on addressing the twin problems of depleting natural resource and decreasing agricultural productivity, through modern biotechnological interventions. The objective is to consolidate genotypes capable of adapting to the problems of rise in sea levels and also develop practical breeding material that could offer tolerance/resistance to coastal salinity. Essentially the major emphasis of the programme is to:

- analyse genetic diversity and species relationship among the Indian mangrove species and other economically important crop species using molecular marker technology as a prelude to genetic conservation, and
- isolate and characterise stress tolerant genes, particularly salinity, to develop salt tolerant crop varieties for coastal agri-ecosystems.

206.1 Molecular Marker Assisted Genetic Indexing of Coastal Agrobiodiversity

Genetic diversity and species relationships among Indian mangrove species: For many reasons, both physical and technical, investigations pertaining to the genetic characterisation, composition and diversity in the taxa occupying the coastal estuarine ecosystem have not been undertaken earlier. Molecular marker based analysis has been carried out for genetic indexing of the most predominant mangrove vegetation occupying the coastal regions along the Indian coastline. Substantial progress has been made in studies related to the analysis of the nature and extent of genetic diversity at intra- and inter population and intra- and inter-specific levels, species relationship and phylogenetic trends in a number of mangrove species, in addition to standardising protocols for molecular analysis in this group of plant species. These studies, among others, have provided sufficient insight into the genetic characterisation and identification of 28 mangrove species and species relationship and underlying evolutionary differentiation in 22 mangrove genera, using various marker systems. They have also helped in identifying priority areas and species for conservation and consolidation of mangrove genotypes.

Intra-specific diversity analysis in the mangrove species *Aegiceros corniculatum* and *Lumnitzera racemosa* were carried out using Random Amplified Polymorphic DNA (RAPD) and restriction fragment length polymorphism (RFLP) markers for elucidating the level of intra-specific genetic diversity. A total of 122 and 132 RAPDs were observed on amplification with 20 random primers in *Aegiceros* and *Lumnitzera*, respectively. Of these 29 were polymorphic in the former and 24 were polymorphic in the latter. A total of 40 and 48 RFLPs were recorded in *Aegiceros* and *Lumnitzera* respectively, with 12 probe/enzyme combinations. It was observed that the overall variability was very low in these two species with a diversity of 21.6% in *Aegiceros* and 16.1% in *Lumnitzera*. The low population size of these species encountered in the Pichavaram forest ecosystem makes them priority species for conservation.

Genetic diversity and species relationships among Cajanus and allied genera: Pigeonpea (*Cajanus cajan*) is one of the most important legumes cultivated in the dry seasons along the coastal ecosystems. Limited information is

available with respect to the genetic identity, genotypic variability and relationships among the *Cajanus* and allied genera. Detailed studies have therefore been initiated in this group of species to develop marker systems for species identification, diversity measurement and phylogenetic and evolutionary trends. Genomic DNA from eight species of *Cajanus* and six accessions and varieties of *Cajanus cajan* were digested with 10 restriction enzymes and probed with full length ribosomal gene (pTA71) from wheat and rDNA intergenic spacer region (IGS) flanked by 25S and 18S rDNA gene of *Vicia faba*. Among the 10 restriction enzymes used, *Eco*R V showed single smallest fragments in all the species. The length of the rDNA repeat units in *Cajanus* flanked by *Eco*R V sites was between 10.9 kb and 11.9 kb. Among the eight species, three rDNA repeat unit length classes were identified. RFLPs between the species were readily detected in all the enzyme-probe combinations. However, RFLPs could not be detected between the accessions and varieties of *C. cajan*. The interspecific RFLPs were used to construct a dendrogram for analysing the genome relationships. The dendrogram revealed a close relationship between the cultivated species *C. cajan* and the wild species, *C. scarabaeoides*. Our data did not support the view that *C. cajan* could have evolved from a hybridisation between *C. scarabaeoides* and *C. lineatus*. The Australian species *C. scarabaeoides* and *C. reticulatus* were closely related to the Indian species *C. cajan* and *C. platycarpus*, respectively. Therefore, the observation that Australian species of *Cajanus* are less closely related to the Indian species could not be favoured. Among the species studied *C. goensis* and *C. lineatus* were distantly related to the cultivated species and other wild relatives.

Twenty eight species belonging to five genera of the sub tribe Cajaninae, *Dunbaria*, *Flemingia*, *Paracalyx*, *Cajanus* and *Rhynchosia*, were analysed for variation in the four chloroplast gene regions, *rbc*L, *trn*S-*psb*C, *trn*L-UAA and 16S. Inter-specific analysis was carried out in fifteen species of the genus *Cajanus* and ten species of the genus *Rhynchosia*. The gene regions were amplified with specific primers and subsequently digested with 15 restriction enzymes. It was observed that the *rbc*L and 16S regions of the chloroplast are conserved among the analysed genera and had no specific or generic differences. The *trn*S-*psb*C region revealed genus-specific profiles only in the *Pst* I digests. The *trn*L-UAA gene region restricted with *Eco*R I revealed differences only in the profile of *Dunbaria* while the species belonging to *Cajanus* and *Rhynchosia* showed a similar profile. *Paracalyx* and *Flemingia* lacked sites for this enzyme. Ten species belonging to genus *Rhynchosia* did not show any inter-specific differences within the four gene regions. In *Cajanus* except for the *Pst* I digests of *trn*S-*psb*C gene region, the PCR-RFLP profile for other digests and gene regions was similar. The present study points to the limited divergence of the cpDNA regions among the genera belonging to the sub-tribe Cajaninae thereby suggesting a congeneric evolution of the taxa.

206.2 Genetic Enhancement

The major emphasis of the ongoing programme is to develop characterised pre-breeding genetic material capable of offering resistance/tolerance to coastal stress for grassroot level breeders for developing location specific crop varieties. The emphasis, therefore, has been on developing genetic material containing

novel genes for resistance to abiotic stress, particularly salinity.

Isolation of stress induced genes: The first approach involves exposing target mangrove species to varying degrees of abiotic stress and identifying and characterising stress induced proteins. The second approach involves developing gene libraries enriched with stress induced genes and screening for potential genes conferring stress tolerance. It also involves characterisation, evaluation and controlled expression of the promising genes. The results obtained so far include identification of a 22kDa salt-stress induced protein from the mangrove species *Avicennia marina*. Three cDNA libraries have been constructed from the salt treated *A.marina*. By screening with heterologous probes from other organisms or through RT-PCR probes, a few potential stress tolerant genes were isolated from the cDNA libraries and fully sequenced. Details of three such genes isolated from the library are given below:

40S ribosomal protein S7 gene (Accession No. AJ091589): A cDNA clone from the library that had strong homology with 40S ribosomal protein S7 gene was identified and was named as Am S7. Complete sequencing of Am S7 revealed that it is of 836 bp length. It includes 5′ noncoding sequence of 65 bp, an open reading frame (ORF) of 570 bp which encodes 190 amino acids and a 3′ noncoding sequence of 183 bp followed by a poly (A) tail. The ORF is terminated by stop codon UGA at position 636-638 while the 40S ribosomal protein S7 genes from animals and humans are being terminated by the most frequently used stop codon UAA. Though the typical plant polyadenylation signal AATAAA is not found, a putative signal AATATA is located at position 683-688 in the noncoding region. It has been reported that an exact AATAAA signal for polyadenylation could be found in only about 1/3 of plant genes, and 4-5 of 6 base matches for this sequence could be found in an additional 50% of plant gene 3′ region. The length of the noncoding sequences and the position and sequence of polyadenylation signal present in Am S7 may be of interest from the evolutionary point of view. The deduced protein of Am S7 showed 57 % identical and 76 positive amino acids with the 40S ribosomal protein S7 of African clawed frog (*Xenopus laevis*), rat (*Rattus rattus*, R. *narvegicus*), mouse (*Mus musculus*) and human. The initiation codon of the ORF starting at 66 bp aligns with the initiation codon of the 40S ribosomal protein S7 from the above mentioned species and covers the complete coding sequence (encoding 190 amino acids) with only four amino acids as a gap starting at position 402. The size of the mRNA which encodes Am S7 is about 900 bp as revealed by Northern blot analysis. Southern blot analysis revealed that it is a single copy gene.

Betaine Aldehyde Dehydrogenase gene (Accession No. AF 170094): Sequence analyses of the clone isolated from the cDNA library showed strong homology with Betaine aldehyde dehydrogenase gene. The cDNA had a longest open reading frame (ORF) of 1,488 encoding a protein of 496 amino acids. The ORF began at 16 bp and terminated at 1,503 bp. The ORF was terminated by one of the nonsense codons, UGA present at 1,503-1,505 bp. Typical polyadenylation signal, AATAAA was present at 1,547-1,552 bp. A 17 bp long poly (A+) tail was present at 1,700-1,717 bp. The cDNA included 15 bp in the 3′ noncoding region and 211 bp (excluding the termination

codon) in the 5′ noncoding region. The deduced protein encoded by the cDNA includes 496 amino acid residues. The amino acid sequence present at position 5-11 residues, QLFIDGE is a typical putative transit peptide found in most plant BADH proteins. A decapeptide, VTLELGGKSP which is conserved not only among the BADH but among all the reported aldehyde dehydrogenases was present at 253-262 residues. The deduced amino acid sequence of the cDNA showed a significant level of homology with all the plant BADH protein sequences deposited in the EMBL database. The highest homology was found with BADH protein of *Amaranthus hypochondriacus*. The deduced amino acid sequence of *A. marina* BADH showed more homology with the BADH of dicots like *A. hypochondriacus, S. oleracea, B. vulgaris and A. hortensis* than with that of monocots like *O. sativa, H. vulgare* and *S. bicolor.*

Enoyl-CoA hydratase: A number of clones with inserts above 800 base pairs were randomly selected from the cDNA library and were subjected to single-pass automated sequencing from the 5′ ends for the purpose of generating expressed sequence tags (ESTs). One such EST, AMC 4012 showed significant homology with putative 3-hydroxyisobutyryl-CoA hydrolase from *Arabidopsis thaliana*, 2-enoyl-CoA hydratase from *Prunus armeniaca* and 2-enoyl-CoA hydratase like proteins from *A. thaliana* and *Caenorhabditis elegans*. This clone with 1.5 kb insert was expected to be an authentic clone of either 3-hydroxyisobutyryl-CoA hydrolase or 2-enoyl-CoA hydratase and therefore completely sequenced from both directions.

AMC 4012 was 1,536 bp long with a longest open reading frame (ORF) of 1,032 bp from 23 bp to 1,054 bp position. This ORF was terminated by UAA at 1,055-1,057 bp position and the clone included a poly (A+) tail of 47 bp starting at 1,489 bp position. This ORF encodes a protein with 344 amino acid residues. The deduced protein of this ORF showed 65% identical and 79% positive aminoacids with the 2-enoyl-CoA hydratase of apricot, *Prunus armeniaca* (Ac. No. U93271). While U93271 was a truncated clone without the initiation codon ATG at the 5′ end coding for a partial polypeptide of only 281 amino acids, the present clone AMC 4012 (Acc. No. AF190450) from *A. marina* had the initiation codon and encoded a protein of 344 amino acids. This clone also has around 60 % positive amino acid with the full length cDNA clones encoding the 2-enoyl-CoA hydratase like proteins from *A. thaliana* and *C. elegans*. Therefore it is concluded that AMC 4012 is a full length cDNA clone that encodes for 2-enoyl-CoA hydratase in *Avicennia marina*. As the source of this clone was the leaf tissues of this species, it could be presumed that this enoyl-CoA hydratase could be a part of the beta-oxidation system of the peroxisomes. This is the first report of full length 2-enoyl-CoA hydratase gene from a tree species.

Table 2.15 : ***cDNA clones showing homology to the reported gene sequences analysed through the random sequencing of ESTs***

Clone No.	Size (kb)	Homologus to	Organism
Amc 4	1.2	AAO gene for ascorbate oxidase	*Cucurbita maxima*
Amc 5	1.6	Vacuolar H+-pumping ATPase	*A. thaliana*
Amc 6	1.0	Sulphate aldehyde transferase	*Rhizobium* sp
Amc 7	1.9	PEP carboxykinase	*Z. mays*
Amc 8	1.2	mRNA for ARG10	*B. napus*
Amc 11	1.1	rad15 gene	*yeast*
Amc 12	0.8	Beta-lactoglobulin gene	*Z. mays*
Amc 15	1.6	P480 reaction centre large chain	*Chlorobium*
Amc 17	1.0	G-protein coupled receptor	*A. thaliana*
Amc 18	1.2	Acryflavin resistant protein (acrB)	*Borrelia*
Amc 19	1.5	DNA binding protein	*Giradia tigrina*
Amc 20	1.8	Caffeic acid-O- methyltransferase	*Populus*
Amc 22	1.8	Homeobox-protein HOXC-9	*Fugu rubripes*
Amc 31	1.2	G-protein coupled receptor	*Arabidosis*
Amc 37	1.0	Acryflavin resistance protein	*Borrelia*
Amc 40	1.7	P5C reductase	*Arabidopsis*
Amc 44	1.1	Serine/protease inhibitor	*Populus*
Amc 45	1.5	Alcohol dehydrogenase	*Arabidopsis*

Sequencing of Expressed Sequence Tags: Apart from stress related genes, a number of randomly selected ESTs were partially sequenced at 5' ends. About 45 expressed sequence tags (ESTs) were sequenced (8965 bp in total). Through sequence analysis of these ESTs and homology search, 18 clones were found to have homology with reported functional genes from other organisms. The details of these clones are given in Table 2.15. The remaining 27 clones were unique ones.

Development of transformation system: In order to study the expression of genes isolated from the mangrove species in the genomic background of other plant species and to obtain information about the usefulness of these genes in conferring stress tolerance, an experimental transformation system was standardised in tobacco. For this purpose, a binary vector carrying the BADH gene cloned from the mangrove species, *A. marina* was constructed. The *A. marina* BADH was subcloned in *Bam*H I-*Eco*R I site of pBK-CMV (Stratagene). From

this, a *Xba* I fragment was subcloned into the same site of pGA643, a binary vector. The correct orientation of insert was confirmed by Southern hybridisation and the construct was named pPGA643. This vector has Tet^r as bacterial selection marker. It has the right and left border sequence of *Agrobacterium tumefaicens* T-DNA within which Kan^r as plant selection marker, CaMV 35S promoter followed by multiple cloning site and polyadenylation signal are present. *E coli* with pPGA643, *Agrobacterium* strain LBA4404 with virulence helper plasmid, pRK2013 with conjugation helper plasmid were grown on agar plates of appropriate media. A single colony from each was used for triparental mating on YEP agar plate. The cells after mating were serially diluted and plated on AB minimal medium with 10 μg/ml Rifampicin and 5 μg/ml Tertacyclin. Six transconjugants were selected and total DNA was isolated. The transconjugants nature of the colony was confirmed by Southern hybridisation using *A. marina* BADH as probe. One of the transconjugant LBA4404(pPGA643) was used for tobacco transformation (Fig. 2.2). Tobacco (Wisconsin 38) leaf discs were incubated for 48h on MS shooting medium without any antibiotics. LBA4404(pPGA643) culture grown to 1 OD_{600} was used to infect the preincubated leaf discs and co-cultivated in the same medium for 48h. The co-cultivated discs were transferred to MS shooting medium with 250 μg/ml Cefatoxime and 100 μg/ml Kanamycin. The Kanamycin resistant shoot buds were subcultured and then transferred for rooting in MS medium. This vector carried BADH gene under 35S CaMV constitutive promoter. *Agrobacterium*-mediated transformation of to-

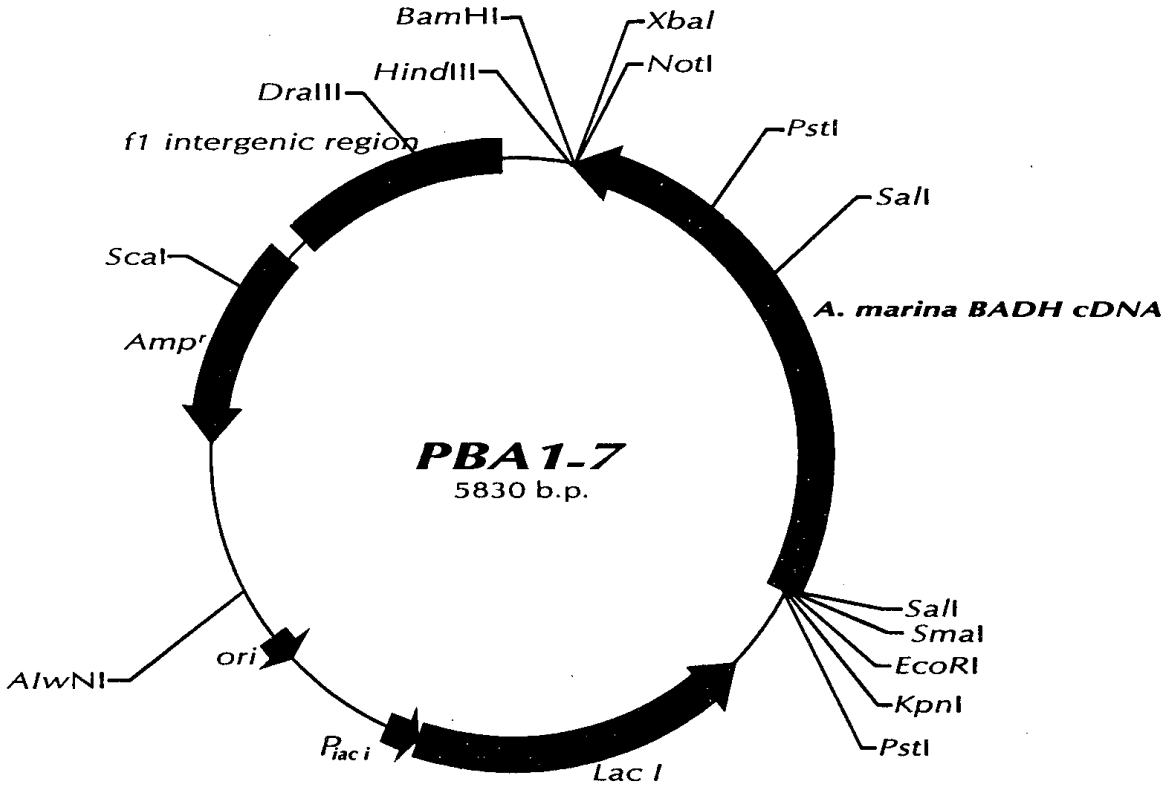


Fig. 2.2: ***Gene construct used for tobacco transformation***

bacco leaf discs was carried out to raise transgenic plants. These transformed plants were shown to have the BADH gene integrated into the tobacco genome. Assay for BADH revealed overexpression of this BADH gene in the transgenic plants, which indicated that the integration is stable and the gene is structurally and functionally intact.

Sub Programme Area 207

Monitoring Ecosystem Health Using Microbial Diversity

Significant headway has been made in assessing the natural populations of beneficial organisms with salinity tolerance while analysing the microbial diversity along the coastline of Tamil Nadu. Extensive progress on indexing and documenting with reference to the ecological preferences of lichen diversity of Siruvani Hills in Western Ghats has been made in the development of monitoring tools. This year an attempt was made to study the urban lichens. *The overall objectives inclusive of the basic research, databases and dissemination by training programmes and developing manuals falls in line with the Agenda 21 of the Convention on Biological Diversity with reference to the much less studied group of organisms - the microorganisms.*

207.1 Microbial Diversity in Coastal Agroecosystems

This part of the programme acts as a complementary activity to the ongoing activity on genetic enhancement for increase in crop productivity in the coastal agri-ecosystem. Despite their ecological and economic significance, efforts to characterise microbial diversity to exploit their potential for improvement of coastal biodiversity have been few. During the last few years our approach has been to monitor selected farm sites situated close to the coastline which undergo the normal stress of this region namely salinity, drought and excess pesticide usage due to varied farming practices. After initial sampling and monitoring, the emphasis in the last couple of years has been on analysing the diversity of these organisms using a polyphasic approach and assessing their performance under stress for better plant growth management.

To facilitate a more extensive use of biological nitrogen fixers, reliable information on their effective application must be made available. Work has been carried out to assess the diversity of the organisms occurring in this region along with their efficiency. Molecular marker assisted genetic diversity assessment study was also initiated with reference to these beneficial organisms. RAPD and DNA restriction fragment length polymorphism (RFLP) were used to study the diversity and applied successfully on the nodulating strains isolated from groundnut. Work was also initiated on the strains isolated from blackgram and cowpea. A complete analysis of the strains from the groundnut host reveals that all strains could grow in a wide range of pH from 4-10 and could tolerate salt upto 3%, especially in isolates from saline soils showing a natural selection. RFLP analysis of the total isolates from different populations along the coast revealed that they fall into two clusters, thereby establishing the genotypic differences among them. This was confirmed by PCR-RFLP analysis of the *nif*-region. Nodulation efficiency of isolates from the host

blackgram and cowpea have been tested. Preliminary results reveal that the strains isolated from blackgram performed better when compared with the ones got from cowpea. Further tests are underway before testing it at the field level. Analysis of the free-living nitrogen fixer populations *viz.*, *Azospirillum* isolated from the different sites along the coastline reveals that the majority of them are moderately halotolerant. However, their nitrogen fixing efficiency varied in the presence of salt. As for the phosphate solubilisers, although a good number of isolates were recovered, only about 35 isolates showed good activity. Initial broth assay for testing their solubilising capacity using tri-calcium phosphate showed that the isolates tested released 300-400 mg/ml from the initial 500 mg/ml inorganic phosphate supplied. Initial screening has also revealed the presence of moderately halotolerant strains, which are being tested at the laboratory level using pot studies with both sensitive and salt tolerant paddy as a test crop. Further studies to identify the best carrier material and its effect on the shelf life will have to be conducted before it is taken up for large-scale field level trials.

The high variability of the soil environment and its microbial components have worked as major impediments in successful introduction. Many questions in this area remain to be answered and it seems quite impossible to select a strain that is adapted to all environments. Moreover, using genetic exchange, the highly plastic 'native' populations may arise that are capable of rapidly dominating the field. The identification of these bacterial strains and in some cases host cultivers that are tolerant to these stresses opens the way for alternate, lower cost solutions to these problems. Although we will not be able to eliminate many of the stresses currently limiting crop production under low-input conditions, we would be able to throw some light on identifying better host-strain combinations as we use a polyphasic approach in characterising the various groups of our isolates.

207.2 Lichen Research

In a climatically uniform forest region, variations in the distribution patterns of the lichens caused by the microlevel changes in the mesohabitat conditions (*viz.*, light intensity, substrate pH, texture, moisture etc.) can be used to identify ecological continuity/disturbance. This study, carried out over the last few years, has been concentrating on site-specific lichen biomonitoring methodologies for unexplored sites in Siruvani Hills. To establish and place the results obtained through these studies on a scientific base, the ecosystem health is also being quantified through other ecological methodologies. The combination of both these data is being used in identifying indicator lichen communities.

So far fortyfour transects have been laid down at different elevations in Siruvani Hills and the data has been collected. With respect to forest quality, the lichen data was analysed to find the lichen diversity per unit area (diversity), its composition, their performance in terms of Cover Value and Colony Number, and the Important Value Index for each species recorded within the transect along with the performance of the various lichen growth forms and their photobiont, both separately and in combination. These parameters directly reflect the changing meso-and microhabitat conditions, which need to be monitored.

The methodology has highlighted the change in lichen diversity and its performance, with a change in tree density, canopy coverage, tree height and diameter. Over 70 lichen species have been recorded, accounting for nearly 50% of the total lichen diversity in the surveyed area.

Lichens in urban areas

Changes in the environment may be due to climatic changes, degradation of forest land, reduction of naturally vegetated areas, land use pattern changes, and increasing levels of air pollution (particularly SO_2, heavy metals and radionucleides) and their by-products, both local and transboundary. Urban areas witness these changes at a faster pace and Chennai (Madras) is not an exception. These adverse environmental conditions may also lead to lichen species loss from their current localities, gross distribution pattern changes, reduction in population size, reduction in reproductive potential of individual species etc., along with other organisms solely dependent on them for feeding or roosting. In such a chaotic situation, pockets of thick vegetation within cities act as refuge for a myriad species. Hence, unless inventory, monitoring and conservation are given top priority in and around urban areas, with special reference to thickly vegetated areas, it will be too late before we realise our irreversible loss.

The lichen diversity and distribution pattern within Chennai city (at the Indian Institute of Technology Campus and the Indira Gandhi Centre for Atomic Research, Kalpakkam) was surveyed on the lines of our previous experiences. These studies will serve as a base for future monitoring and conservation activities.

The following trends were observed: increase in lichen diversity with increase in tree density, demonstrating the usefulness of thickly vegetated areas within urban zones in maintaining high lichen diversity; mesohabitat conditions (specifically the presence or absence of water body and diversity of host species) determine the overall lichen diversity and its distribution within the study area and the lichen community structure is determined by the microhabitat conditions (*viz.*, bark moisture and light levels). That lichen diversity could be effectively used to monitor the health of such green pockets in urban areas has been clearly established by this study. Also, the fact that the effect of increasing air pollution could be related to the reduction of the reproductive potential of a few lichen 'species' occurring as sterile or with asexual reproductive means is an area of concern as in the long term it could threaten this diversity.

Sub Programme Area 208

Conservation and Bioprospecting of Endangered, Medicinal and Mangrove Plant Species

The major emphasis of this component is to :

- Screen various plant species from different environments and identify those species of potential importance in terms of antimicrobial, antipest, nutritional and other agronomic characteristics
- Subsequent fractionation, purification and identification of bioactive compounds
- Develop micropropagation protocols for

selected species and enhance the bio-efficacy using tissue culture.

208.1 Identification of Bioactive Compounds

Antifungal properties of essential oils from Syzygium travancoricum

Essential oils form the major constituents of the aroma of many plants. *Syzygium travancoricum* is a critically endangered plant occurring in the fresh water swamps of southern Western Ghats at an altitude of 1,200-1,500 mts. and belongs to the family Myrtaceae that has many genera containing economically important essential oils. From the studies conducted, it was found that solvent extracts, especially hexane extracts of *S. travancoricum* exhibited anti-fungal properties against human and plant pathogenic fungi. The major essential oils from the leaves were identified to be trans-Ocimene, trans-Caryophyllene and Copaene. In addition, a number of other essential oils are also present in this distillate, which will be analysed at a later stage. The efficacy of these oils in controlling pathogenic fungi will also be studied.

Anti-feedant properties of Lobelia nicotianaefolia on Spodoptera litura

Lobelia nicotianaefolia is a tall shrub occurring in the Western Ghats, growing at the elevation of 500–1,000 mts in open grasslands and edges. The leaves of this plant are similar in morphology to that of tobacco leaves and also have a pungent odour. Hence the species gets the name *L. nicotianaefolia*. Local people, especially in Wayanad region, use the leaves of this plant against storage pests because of the characteristic pungent odour. Studies have been initiated on the antifeedancy and repellence of the leaves of this plant against plant pests like *Spodoptera litura* and storage pests like *Tribolium castaneum*.

Solvent extracts of *Lobelia nicotianaefolia* were used to study the bioefficacy of this plant as an antipest agent. 10 and 15 % concentrations of the crude extracts of increasing polarity viz., Hexane< Chloroform<Methanol were used. The extracts were sprayed on the surface of the leaf disc of a known surface area. 3rd instar larvae of *Spodoptera litura* were introduced. 2% neem gold was kept as control. The experiment was performed with 10 replicates. Antifeedancy of 41% at 10% & 50% at 15% concentrations of chloroform extract of *L.nicotianaefoila* proved to be effective as a plant based pesticide. The low percentage of antifeedancy in the methanol extracts was due to the high mortality rate at the larval stages in comparison with the other extracts. A further study to purify the chloroform and methanol extracts is being done.

Storage pest repellant property

Solvent extracts of *L.nicotianaefolia* were used in this experiment to study the pest repellant activity. Concentrations of 10, 25, 50 and 75mg of the chloroform extract were applied to one half of filter paper disc and the other was kept as control. 30 g of Aluminium phosphide was kept as authentic control. This setup was kept in a petri-plate. Adult gram flour beetles *Tribolium castaneum* were introduced. The experiment was done with 10 replicates: maximum repellency was noted at 75 mg concentration. Further study is underway to purify the active fraction(s).

208.2 Tissue Culture Studies

Medicinal plants

Culture media and culture condition for Lobelia nicotianaefolia: MS (Murashige and Skoog, 1962) basal medium was used for shoot proliferation and adventitious shoot regeneration, whereas one-half and one-fourth MS medium was used for *in vitro* rooting. All media were supplemented with 30 g/l sucrose, 2 g/l phytagel (Sigma) and dispensed evenly into 25 x 150 mm culture tubes and 50 x 110 mm jam bottles. The pH was adjusted to 5.8 prior to autoclaving at 121°C for 20 min. The cultures were incubated in 16h light/8h dark photoperiods at 25 ± 2°C under a light intensity of 30 μ mol.m^{-2}s^{-1} provided by a cool white fluorescent lamp with 55% relative humidity.

Callus induction and proliferation : Callus induction was obtained in the first set, when 1.5ppm 2,4-D was incorporated into MS medium. The observations were recorded at the end of three weeks as number of initiated explants showing callus proliferation.

The callus was subcultured in MS medium with 0.5ppm 2,4-D after one month. Simultaneously 100mg pieces were placed in low concentrations of 0.5 ppm Benzyl Adenline (BA), 1 ppm BA + 0.1 ppm Napthalene Acetic Acid (NAA), and MS Basal medium for further organogenesis. Data recorded at the end of three weeks of incubation indicated number of shoots per callus.

Organogenesis: The fast growing, creamy white friable callus showed highest frequency of organogenesis in the MS basal medium and on lower concentrations of cytokinins. An average multiplication rate of more than 4 shoots was recorded at the end of every three week interval upon subsequent subculturing. An experiment is underway to achieve shoot elongation in the organogenic shoots and somatic embryo derived plants.

Mangroves and their associates

High efficiency indirect organogenesis protocols were standardised in various varieties (IR20, ADT 43, Vitilla) and salinity tolerant cultivars (pokkali, pateni) of rice using scutellar explant of mature seed. These protocols will be useful in developing protoplast fusion hybrids between intraspecific, interspecific (between *O. sativa* and *O. malampuzhensis*) and intergeneric (between *O. sativa* and *Porteresia coarctata*) hybrids.

Indirect organogenesis studies were carried out in *Porteresia coarctata* using nodal segments, leaf disc and mature seed. Callus was induced in N6 and MS media. The best response was obtained in N6 media supplemented with 2, 4 – D (2 ppm) + KN (0.1 ppm). Nodal explants from the mist chamber gave better response compared to the explants taken from the *in vitro* grown plants. Callus proliferation was high when the calli were subcultured in the same media with 1ppm 2, 4 – D.

Anther callus was obtained in *Porteresia coarctata* and *Oryza sativa* (IR 20). Uninucleate anthers responded well in N6 and Potato2 medium supplemented with 2,4 –D. A combination of carbohydrate sources (glucose + sucrose + maltose) gave better results compared to sucrose alone.

Shoot tips and young shoots were used for micropropagation in the case of *Salicornia brachiata*. LS media supplemented with 0.25

ppm IAA+0.1 ppm BA+0.1 ppm KN gave better multiple shoots.

In case of *Intsia bijuga* axillary bud break was obtained in WPM media supplemented with 2.0 ppm BA+0.5 ppm KN+1 g AC. Shoot elongation was also obtained in the same medium. Experiments are underway for getting an increased number of multiple shoots. Also cotyledons and young shoots explants produced callus in WPM media supplemented with 2 ppm 2,4-D+1.5 ppm NAA+0.5 ppm KN +1 g/l AC.

Oil estimation in Salicornia brachiata

Total oil content in *Salicornia brachiata* was estimated by solvent extraction method using petroleum ether. Seeds were ground to powder and extracted overnight in four volumes of petroleum ether. The supernatant was filtered and heated at 40°C to remove ether. Total fat was left out and weighed. There was a yield of 8–10% oil from the seed. However CFTRI is being approached for re-estimation of oil content using more refined methods. Experiments are also underway to measure the quality parameters *viz.* saponification value, iodine value and acid value.

208.3 Studies on Salt-induced Proteins

Porteresia coarctata

Six populations of *Porteresia coarctata* were selected for these studies. They were grown in the mist chamber in fresh water for 3 months. The plantlets which emerged from the rhizomes were selected for salt tolerance studies. Simultaneously *in vitro* propagated plants were also studied to compare the differences.

Salinity treatments were applied in both mist and *in vitro* propagated plants with five different concentrations of NaCl (0, 20, 30, 40 and 50 ppt). Leaf tissue was collected at 3 days, 5 days and 7 days interval. Five replicates were tried for each treatment and duration.

The salt induced denatured proteins were extracted as per Goday (1998) and protein concentrations were estimated by Bradford (1978) method and protein extracts were subjected to single dimensional SDS PAGE.

Two induced protein bands (35 kDa and 73 kDa) appeared consistently in mist propagated as well as *in vitro* propagated plants at 20, 30 and 40 ppt NaCl concentration up to one week.

Intsia bijuga

In the case of *Intsia bijuga*, a salt tolerant mangrove, total protein profiles at different pH (4.5, 5.8 and 7.5) and salinity regimes (0, 10, 20, 30, 40 and 50 ppt) were studied. Total leaf proteins were isolated after 7 days of the treatment and were run on the denaturing SDS polyacrylamide gels. At pH 4.5, all the major proteins were intact upto 20 ppt of salinity. At pH 5.8 all the major bands were observed upto 40 ppt and at pH 7.5 plants were able to tolerate salinity only up to 20 ppt. The above data was in agreement with morphological and physiological studies which showed that there was significant drop in photosynthetic rates followed by leaf curling and senescence above 20 ppt at pH levels of 4.5 and 7.5, and above 40 ppt at a pH level of 5.8.

These studies indicated that *Intsia* tolerates highest salinity (40 ppt) at pH 5.8. However it was not possible to identify any induced

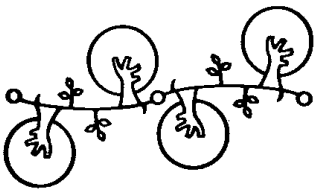
response to salinity in the present study. Experiments are underway to characterise some of the overexpressed (27 kDa, 22 kDa) and repressed (78 kDa, 86 kDa, 40 kDa) proteins by isoelectric focusing followed by reverse phase HPLC, amino acid analysis and sequencing studies.

Sub Programme Area 209

Golden Jubilee Biotechnology Park for Women

The first Biotechnology Park for women under the joint initiative of the Department of Biotechnology, Government of India, and the State Government of Tamil Nadu will become functional later this year. It is being set up to provide opportunities for professionally qualified women to take to a career of remunerative self-employment through the organisation of environment-friendly biotechnological enterprises. The contractor was chosen through a tender (as the lowest bidder), and all the architectural details have been finalized and given to him. Work at the site has begun and the financial closure is expected to be completed shortly. The logo has been approved. The Environmental Impact Assessment has been conducted and is pending with the Tamil Nadu Pollution Control Board for approval. The common facilities building will have all modern amenities to support the R&D requirements and the information section will serve as the hub for Business-to-Business and Business-to-Consumer facilities. This will be supported initially with the help of the Informatics division of the Foundation. The promotional activities have begun. Advertisements were placed in *The Hindu* and *Dina Thanthi* calling for women entrepreneurs interested in setting up their business at the park. The first orientation for the applicants was held. The initial screening of the applicants by the scientific committee will be held shortly to select the first batch of women entrepreneurs.

Programme Area 300



Ecotechnology and Sustainable Agriculture

The establishment of a Resource Centre for Precision Farming for Poverty Alleviation with support from NABARD triggered progress in the standardisation of techniques which can help to enhance crop productivity without associated ecological harm. Considerable progress was made in spreading the Biovillage concept of human-centred development to several areas in Tamil Nadu and Orissa. Work on low external input sustainable aquaculture and the establishment of an All-women Eco-aquaculture estate in Karaikal progressed well. The work of the JRD Tata Ecotechnology Centre has helped to launch an ecotechnology movement based on an optimum blend of traditional wisdom and frontier science.

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Sub Programme Area 301

JRD Tata Ecotechnology Centre

The JRD Tata Ecotechnology Centre was established in 1996-97 to develop models for operationalising sustainable rural development. Participatory research, capacity building and grassroot institution building are its three major dimensions. Till 1998, the Centre was focusing on testing specific technologies. In 1998-99, it adopted an area approach by introducing the concept of biovillage. The approach addresses the twin issues of natural resource management and livelihood security leading to an integrated management of the resources. Three areas in Tamil Nadu, reflecting different characteristics (Table 3.1) have been identified for implementing the biovillage model.

Integrated Intensive Farming Systems, ecoaquaculture, management of community ponds and backyard ornamental fish breeding are some of the options studied for the villages in Chidamabram. In Kolli Hills, the project has been making attempts to create an economic stake in conservation. Food fortification, market linkages and improving the productivity of minor millets are some of the important issues addressed by the project. In Kannivadi, the focus is on human resource development through skill empowerment of rural poor. These are attempts to facilitate the rural community to define its own path of development by integrating natural resource management with livelihood security.

In addition to the above, the NABARD Resource Centre for Precision Farming for Poverty Alleviation is developing methodologies for precision farming in these areas.

Table 3.1: ***Characteristics of the three areas***

Area	Characteristics	Focus
Chidambaram	Coastal region with low land irrigated paddy	Water use efficiency and soil conservation
Kolli Hills	Hill region	Agrobiodiversity and Food Security
Kannivadi	Semi-arid region	Value addition to the two assets of rural poor: time and labour, through skill enhance ment in agriculture and micro enterprises

The JRD Tata Ecotechnology Centre has been focusing on studying the relevance of various options in sustainable development. These options attempt to blend integrated natural resource management with livelihood security.

Major activities of the year:

- Market linkage was established between the tribals of Kolli Hills and TRIFED to market minor millets. This linkage is an

important step in creating an economic stake in conservation.

- Reddiyarchatiram Seed Growers Association (RSGA) took charge of the Seed Village programme at Kannivadi. *Poomani Magalir Sangam* took over the management of the rural biopesticide production centre. These events signify the initiation of grassroot institutionalisation of development programmes.

- A process of evaluation was initiated in all the project areas. Activities at Kannivadi were evaluated in terms of gender perspectives. Studies were conducted to understand the process of institutional changes in Kolli Hills. The socio-economic dimensions of agriculture were assessed in Chidambaram region. These perspectives helped to redefine the directions of the programmes.

- Self-Help Groups (SHGs) were linked with micro enterprises and a broad framework for community banking was evolved.

- NABARD Resource Centre for Precision-Farming for Poverty Alleviation began its programmes in all the three areas. Arava R&D of Israel is providing the technical support for the programme.

- A broad framework was initiated for launching the activities of the Centre in Orissa. A model biovillage is to be established in selected coastal villages of Orissa, providing a path of rehabilitation and sustainable development.

- Training programmes were conducted to the tune of 10,000 trainee days.

- Efforts to blend traditional wisdom with frontier science took place in Kolli Hills. Conventional green leaf manuring with *Dodonaea* species by the tribals was studied. Laboratory tests showed that this can help in controlling the population growth of pests like *Helicoverpa armeigera*.

- Little Millets was identified as an important feed for *Corcyra* in the production process of *Trichogramma*.

- It was demonstrated that the productivity of fish in the village ponds could be increased.

The period of 1999-2000, was a period of consolidation and indications of a self-replicating process have been observed in various project sites:

- The intensive training in and demonstration of the Integrated Intensive Farming System, with emphasis on more organic inputs, have helped in reducing the chemical fertiliser and pesticide consumption without any major decline in the productivity of paddy in Keelamanakudi village near Chidambaram. The impact has attracted the farmers from the various villages of the command area. The increase in the productivity of fish in the village pond demonstrated by a women's group with the support of the Foundation has generated interest among other women in the region and various women's groups are being formed to manage the ponds. Similarly many landless women labourers have formed Self-Help Groups (SHGs) to initiate ornamental fish breeding in the backyards of their houses.

- The linkage of minor millets cultivators with Tribal Co-operative Marketing Development Federation of India Ltd. (TRIFED) for marketing minor millets has helped in motivating more tribals in growing minor millets and would help in bringing an additional 300 acres of land under minor millets cultivation during 2000-2001(Details in SPA 205).
- Grassroot institutions have begun to play a major role in the process of sustainable development at Kannivadi.

301.1 Chidambaram

Models for sustainable development suitable for coastal regions are being studied in villages around Chidambaram. These models are being tested for their economic and social feasibility and environmental viability.

Ecoaquaculture

During the last decade aquaculture, in particular coastal aquaculture, has been facing opposition on environmental issues. Inland aquaculture has also been facing criticism in terms of water use efficiency and unsustainable practices.

Keeping these issues in view, the Centre has been studying the principles of environment friendly fresh water ecoaquacultre. In a research-cum-demonstration plot at Keelamanakudi near Chidambaram, the project has been attempting to develop a production model for *Macrobracheum rosenbergi* using harvested rainwater. The project follows the principle of Low External Input Sustainable Aquaculture (LEISA).

The productivity, which was around 1.024 tonnes per ha during 1999 dropped down to 0.403 tonnes during 2000. The main reason for the decline in productivity is the reduction in the growout period from 195 days to 144 days. The reduction occurred due to the decline in the quantum of rainfall and number of rainy days. The experiences during the last three years indicate that an optimal level of water for 180 days is crucial for maintaining the productivity.

An ecoaquaculture model for brackish water in the coastal region of Karaikal is also being contemplated. Preliminary studies are being carried out in collaboration with various government departments. This model would focus on empowering poor women in coastal villages on various aspects of aquaculture.

Sustainable management of village ponds

The village ponds have multi-purpose usage, mostly for non-irrigation purposes. The Centre has been attempting to improve the productivity of the fish in these ponds. During 1998-99, the studies of the Centre showed that the productivity of rain-fed tank and canal-fed tank was 210.5 kg per ha and 539.8 kg per ha, respectively. In order to demonstrate the scope of improving the productivity of the village ponds, the Centre formed a women's group consisting mostly of landless agricultural labourers and trained them in various aspects of pond management. The group leased a canal-fed pond from the village panchayat and managed the pond with proper stocking and feeding. The productivity during this year was 1.05 tonnes per ha. The increase in the productivity has attracted women from the neighbouring villages and the Centre is in the process of forming Self-Help Groups for managing more ponds in the coming year.

Integrated intensive farming system

Integrated Intensive Farming System (IIFS) is being implemented to demonstrate an alternative form of agriculture in a region dominated by mono-cropping and application of large doses of chemical fertilisers and pesticides.

The model of IIFS introduced at Keelamanakudi, one of the villages of the Cauveri delta region, stresses the inter-linkages within a farm with less off-farm inputs. Primarily, this is to show that conservation of biodiversity and biological intensification could also be profitable.

A model plot was established at Keelamankudi during 1996-97. During 1997-98 and 1998-99, the productivity of paddy in the demonstration field was around 2.5 tonnes per ha. Between 1997 and 1999, long duration *Ponni* variety was being planted in the plot whereas the entire village was planting short duration varieties. During 1999-2000, the model also planted the short duration variety and the productivity was 2.4 tonnes per ha. The cost-benifit analysis for the entire farm is being worked out.

The project has been monitoring the soil characteristics in the farm as well as in the village. Soil samples are being collected before and after harvest every year and various characteristics of the soil are being studied. Three farms including the model plot are the units of observation. In addition, cross-sectional studies are also being carried out. During December 1999, samples from 30 randomly selected farms were studied. The organic carbon level at the IIFS farm was 0.75% whereas the average organic carbon in the farms with mono-cropping was 0.41% (SD = 0.1). The project will continue to collect data in the model farm as well as in other farms to assess the impact of interventions on soil quality.

The project has been monitoring 32 randomly selected farm households with 88.8 acres of paddy field for understanding the determinants of agriculture. Farm level data is being collected every year during the month of April. The survey reveals that the intensive training and demonstration of the project have been able to create an impact in terms of fertiliser consumption. The chemical fertiliser consumption has been on the decline since 1997-98 (Table 3.2).

Table 3.2 : ***Chemical fertiliser used for paddy cultivation in the farms at Keelamanakudi***

Year	Number of sample farm households	Total area under the sample farm households in acres	Average consumption of chemical fertiliser (kg/acre)	Average productivity of paddy in (kg/acre)
1997-98	32	88.8	175.5	1,554.4
1998-99	32	88.8	155.9	1,522.9

The reduction in the consumption of fertiliser has taken place without a major decline in productivity. The Participatory Rural Appraisal (PRA) conducted during 1999-2000 has revealed that the consumption of fertilisers has reduced further. Similarly, there has been a decline in the use of chemical pesticides and the usage of neem-based biopesticides is increasing.

During 1999-2000, the Centre studied the various socio-economic dimensions of agriculture in the region. The study was conducted to assess the extrapolation domain for IIFS perspective in the region. This region suffers from problems which are faced by every other region with large-scale irrigation. Sustainable management of soil and water are the two major issues which need to be addressed. The reduction in the water flow in canal irrigation since the latter part of the 70s has created an impact on the cropping pattern, influencing labour absorption, land tenure, production relations etc.

The changes in the land use pattern of the Cauveri delta region are reflected in the changes in Parangipettai Panchayat Union (Table 3.3).

A phenomenal rate of increase in the classifications under *land under non-agricultural use, miscellaneous tree crops, current fallow and other fallow land* are noticed. The decline in net area sown and total agricultural area indicates the impact of changes in the irrigation pattern on land use pattern.

An assessment of the cropping pattern between 1970-71 and 1997-98 (Table 3.4) shows further evidences of the changing agricultural pattern.

Table 3.3 : ***Land use classification of the Parangipettai block***

Type of Land	Area (ha) During 1970-71*	Area (ha) During 1997-98**
Forest, Barren and Uncultivated Land	667	991
Land under Non-Agricultural use	44	2,648
Miscellaneous tree crops & other tree crops and groves	0	462
Total Agriculture Area	18,431	16,105
Net Area Sown	18,083	13,996
Current Fallow	348	2,109
Other Fallow land	86	701

Source : * World Agricultural Census, South Arcot District and Government of Tamil Nadu 1970-71
** Department of Statistics (g-returns-Parangipettai) Government of Tamil Nadu 1997-98

Table 3.4 : ***Area under different crops in Parangipettai***

Crops	Area (ha) during 1970-71*	Area (ha) during 1997-98**
Food grains-Rice	20,987	9,230
Food grains-Maize	98	0
Food grains-Sorghum	223	8
Food grains-Millets	161	2
Food grains-Pulses	356	3,778
Total food Grains	21,825	13,018
Non Food Grains-Orchards & Fruits	205	269
Vegetables	96	19
Ground Nut	731	2,154
Gingelly	151	28
Other non-food crops such as Casuarina	498	1,667
Total Non-Food Grain Crops	1,920	4,251
Gross Cultivated Area	23,746	17,269
Intensity of Cropping	128.2#	102.75 #

Source : * World Agricultural Census, South Arcot District and Government of Tamil Nadu 1970-71
** *Department of Statistics (g-returns-Parangipettai) Government of Tamil Nadu 1997-98, # in %*

Drastic reduction in area under rice (less than half) and increase under crops such as pulses (by 9 times) groundnut (by 3 times) and other non-food grain crops such as *casuarina* (by 3 times) reflect the changes in the irrigation pattern. The area under food grains has come down from 21,825 ha to 13,018 ha whereas the area under non-food grain crops has increased from 1,921 ha to 4,251 ha. Gross cropped area has declined by nearly 6,476 ha. The cropping intensity has also declined from 128.2 to 102.75 %.

Keelamankudi village, which lies in the Parangipettai region, has more or less gone through such a change. The village lies in the tail end of the Cauveri irrigation system and the irrigation from Cauveri is fed through *Sethiathope Anaicut* - a reservoir controlling the surface irrigation in the Cauveri delta region of Tamil Nadu.

As may be seen from Table 3.5 the population of Keelamanakudi has been growing at a rate of 1 to 2 % per annum.

Table 3.5 : ***Population of Keelamanakudi***

	1961	1971	1981	1991
Total Population	1,021	1,121	1,322	1,441
Sex Ratio (Number of Females per 1000 male population)	1,034	998	997	957

Source : District Census Hand Book, South Arcot District and Cuddalore District, Government of India

According to village level data available with the Village Administrative Officer (VAO) there are 270 households in the village. One striking observation when comparing the profile of workers during 1981 and 1991, as may be seen from Table 3.6 is the reduction in the number of cultivators, increase in the number of male agricultural labourers and stagnation in the number of female agricultural labourers.

The increase in the number of male agricultural labourers by more than 100% and decrease in the number of cultivators, substantiate to some extent the fact that most of the cultivators have turned into agricultural labourers. Another important point is that the number of women agricultural labourers remains more or less the same and there is only a marginal change in the number of female cultivators. One important question, which remains to be answered, is the relationship between the increase in the agricultural labour population and decline in the cropping intensity.

The cropping pattern has also changed substantially during the last three decades. A comparison of land use pattern between the years 1963-64 and 1994-95 given in Table 3.7, shows that the cropping intensity has declined considerably.

Table 3.6 : ***Main workers in Keelamanakudi***

Year	Main Workers			Cultivators			Agricultural labourers		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
1981	376	132	508	186	8	194	158	120	278
1991	424	146	570	79	12	91	324	120	444

Source : District Census hand Book, Tamil Nadu Government of India 1981 and 1991

Table 3.7 : ***Cropping intensity at Keelamankudi***

Year	Gross cropped area in acres	Cropping intensity (%)
1963-64	1,665	179
1994-95	963	98

Source: Records of the Village Accounts Officer (obtained from the Taluka office for 1963-64) 1999

The village and its region are characterised by a tremendous amount of change in terms of demographic characteristics and agriculture. While the population is more or less increasing on a natural growth rate, the sex ratio has been declining over the last three decades. On the other hand the literates among females are also increasing. Land-use pattern has changed; area under agriculture has come down; cropping intensities have declined; new crops such as pulses have emerged; occupational pattern tends towards agricultural labourers. But the paradox is that while the role of agriculture is declining in the region, the number of agricultural labourers is increasing. Since the population growth rate is more or less uniform with natural growth rate, inmigration may not be the major reason for the rapid increase in the agricultural labour population. Hence there is a possibility that farmers (possibly small and marginal farmers) are becoming landless labourers over the years due to changes in the agricultural systems. Genealogical study using anthropological tools has confirmed this trend.

During 1999-2000, an intensive study of the diary of a farmer of Keelamanakudi revealed interesting features about the adaptation techniques of the farmers. The farmer who belongs to a higher caste has been meticulously maintaining a field diary for a six-acre plot. This diary contains information on inputs in terms of quantities and values, employment of various types of labour and production details since 1980-81. The study reflects a shift from the long duration traditional varieties to short duration high yielding varieties as one of the adaptive mechanisms of the farmer. Transplanting is practised whenever the water is available. Otherwise the farmer has resorted to direct sowing. The shift to short duration varieties has resulted in higher consumption of chemical fertilisers and higher productivity, particularly during the last five years.

A higher rate of labour absorption is also seen during the last five years (excluding 1996-97) when floods affected the produce. In spite of increasing usage of chemical fertilisers, the proportion of material cost to the total cost has not altered much and the farmer attributes increasing wages for labour over the last one decade as a reason.

The analysis of the socio-economic data has helped the project to identify the role of a model like IIFS in the region. Reduction in the cost of cultivation, higher productivity and better labour management are some of the priorities of the farmers. On the other hand, the landless labourers are looking forward to increasing employment opportunities. In this context, IIFS would focus on a job-led and productivity-led sustainable agriculture system.

Income generation models: backyard ornamental fish breeding

Job-led growth is an important dimension in sustainable development. Seasonal unemployment and disguised unemployment in the agricultural sector are the major issues which need to be tackled for improving the quality of life in rural areas. The Centre has been attempting to develop models in this direction. One such model is backyard ornamental fish breeding. This activity has been envisaged to understand the possibilities of enhancing the income potentials of landless women through backyard fish breeding enterprises. The programme includes breeding of major Indian carps, catfish and ornamental fishes.

During 1999-2000, the participating households were able to generate a minimum of Rs. 500 per month per household as income from the production and marketing of ornamental fish. Realising the income generating potentials of the activity, the other 104 households have formed into three SHGs for raising resources and marketing the product. The members of SHGs are being given training in various aspects of fish breeding and marketing.

Sacred grove as traditional in situ conservation

Sacred groves stand as a testimony to the traditional wisdom of the community. Many rare species of plants are still found in them. The species *Dimorphocalyx lawianus* var *glabellus,* which is normally found at high altitudes, has been found at the sacred grove at Suriampettai Ayyanar Koil.

The Indo-Malaysian genus *Dimorphocalyx* consists of 12 species. In the Indian subcontinent 6 species have been described so far. The species of *Dimorphocalyx* is distributed in Srilanka, South India, Andamans, South East Asia, Indo-China, Malaysia, and New Guinea. *Dimorphocalyx balakrishnanii and Dimorphocalyx dilipianus* have been distributed in the Andamans. *Dimorphocalyx balakrishnanii* has been noticed in the coastal forest and the dry regions in Srilanka. *Dimorphocalyx glabellus* var *glabellus* has been noticed in the watercourses and the road sides in Srilanka up to 1,100m altitude.

The Centre focused on collecting the samples from wet evergreen forest regions in order to compare them with samples collected at Suriampettai. Samples were collected from the Western Ghats near Rajapalayam and chemotaxonomy studies are being carried out for comparison. A similarity between the samples collected in the two different sites may indicate the potential of a sacred grove as an *in situ* conservation for relict species.

Ecotechnology in Chidambaram: an overview

During 1999-2000, the project focused on consolidating the experiences from these models. The project also introduced the concepts and practices of precision farming. Models for sustainable management of village ponds and efficient use of canal water in agriculture were initiated during this year. Grassroot level institutions in the form of SHGs were strengthened. Changes in the agricultural pattern and occupational pattern are crucial issues and IIFS needs to take cognizance of such social dynamics. Linkages with relevant government departments like the Public Works Department, Agriculture Departments and Fisheries Department were strengthened.

301.2 Kolli Hills

Efforts were continued in creating an economic stake in conservation and in incorporating minor millets in the daily diet of the people. Linking primary conservers with the market and enhancing the productivity of little millets through improved cultivation practices have been carried out using a multi-disciplinary perspective. The important activities during 1999-2000 are detailed below.

Productivity studies in little millets (Panicum sumatrense)

Studies on improving the productivity of little millets are being conducted in Kolli Hills,

Nammakkal and Chennai. The results of the trials are being checked in the spatial and temporal contexts. The on-farm trials generate the suitable practices to increase productivity and at the same time study the managerial problems in practising the technology at the farmers' level.

In 1998-99, the impact of various nutrients in the productivity of little millets was analysed. The trial was conducted in the foothills of Kolli Hills. This year the experiment was conducted in the higher altitudes of Kolli Hills. Field experiments were carried out at Neduvalampatti, Vazhavanthi Nadu during kharif '99 under rainfed conditions. The soil of the experimental site is red sandy loam. The topography of the field is flat and pH status is slightly acidic. The experiments were laid under randomised complete block design with five replications.

Method of sowing and plant geometry: With the objective of maintaining optimum population per unit area, the line sowing method, with different plant geometrical/density treatments, was tried along with farmers' practice of broadcasting as seen in Tables 3.8 and 3.9. The sowing treatments were broadcasting (T1) and line sowing with the spacing of 20 x10 (T2), 40 x10 (T3) and 60 x10cm (T4). The same treatments were tried in two varieties i.e., short and long duration landraces of Kolli Hills. The local name of the cultivar is *sadansamai* (short duration race) and *vella perumsamai* (long duration race).

Little millets showed poor response to plant density. The crop was able to compensate the yield in reduced densities mainly by producing a greater number of tillers per plant. It follows the asymptotic response curve. Based on the trial, a spacing of 20 x 10 cm and 40 x 10 cm were found to be ideal for achieving higher yield to the percent of 44 and 41.5 in short and long duration landraces respectively over broadcasting. In the broadcasting method, i.e., in the higher plant densities, due to the lean growth of the stem and self-shading efficiency of the foliage, grain formation is decreased.

Table 3.8 : ***Effect of sowing method and plant population on growth and yield parameters of Sadansamai (short duration landrace)***

Treatments	Plant height (cm)	No. of leaves	No. of nodes	Panicle length (cm)	Grain yield/plant (g)	HI(%)	Grain yield/acre (kg)
T1	85.60	8.64	6.28	25.60	4.25	10.04	1,063
T2	92.40	8.68	6.36	29.12	8.23	14.56	1,957
T3	108.40	10.10	6.84	33.12	11.92	16.01	1,490
T4	99.88	9.78	6.04	28.35	14.08	15.46	1,173
SED	2.20	0.39	0.38	2.16	0.83	-	-
CD (5%)	4.80	0.87	NS	4.70	1.82	-	-

NS – Non Significant; SED - Standard Error Deviation; CD - Co-efficient of Deviation

It was evident from the analysis, as well as farmers' evaluation, that the line sowing practice is superior to the existing practice of broadcasting. But it requires more time and labour for sowing as the person has to walk a longer distance to carry out sowing whereas the conventional practice does not require much time or labour.

millets under rainfed conditions. The treatments were Control (T1), Presoaking in water for 12 hours before sowing (T2), Presoaking in water for 6 hours before sowing (T3) and Presoaking in 2% KCl solution (T4).

Alternate sources of nutrients: The objective of this trial was to find the response of little millets to different sources of nutrients. The treatments

Table 3.9 : ***Effect of sowing method and plant population on growth and yield parameters of Vellaperumsamai (long duration landrace)***

Treatments	Plant height (cm)	No. of leaves	No. of nodes	Panicle length (cm)	Grain yield/plant (g)	HI(%)	Grain yield/acre (kg)
T1	106.60	8.62	7.94	31.24	5.18	11.00	1,445
T2	86.52	9.16	6.64	39.18	8.56	11.73	2,140
T3	88.60	10.78	6.44	37.16	15.22	15.19	1,903
T4	86.76	10.78	6.26	30.08	17.24	17.84	1,437
SED	4.11	4.17	0.52	1.89	1.50	-	-
CD (5%)	8.90	9.09	1.14	4.10	3.32	-	-

NS – Non Significant; SED - Standard Error Deviation; CD - Co-efficient of Deviation

Table 3.10 : ***Effect of seed treatment on growth and yield of Sadansamai (short duration landrace)***

Treatments	Plant height (cm)	No. of leaves	No. of nodes	Panicle length (cm)	Grain yield/plant (g)	HI(%)	Grain yield/acre (kg)
T1	97.28	8.32	6.90	36.50	6.16	16.94	1,026
T2	96.06	7.60	6.54	36.22	6.60	16.42	1,100
T3	95.96	9.06	7.74	36.72	9.30	22.58	1,533
T4	95.82	9.04	6.72	35.88	7.74	18.23	1,290
SED	4.32	0.67	0.52	2.84	0.94	-	-
CD (5%)	NS	1.46	1.13	NS	2.06	-	-

NS – Non Significant; SED - Standard Error Deviation; CD - Co-efficient of Deviation

Seed treatment methods: The objective of the experiment was to find the influence of seed treatment methods in the productivity of little

are Control (T1), *Azosprillum* (T2), Farmyard Manure (FYM) (T3), Poultry manure (T4) and Inorganic–urea (T5). The same set of treatments was

tried in short and long duration landraces (Tables 3.11 and 3.12). The field site is high in available phosphorus and low in nitrogen. The treatments focused on supply of nitrogen to the required amount of 20 kg/ha.

The results showed that the efficient source of nutrients for both the landraces was *Azosprillum*, resulting in higher grain yield. But when compared to short duration races the organic sources of nutrients such as FYM and poultry manure have also produced higher grain yield over control in long duration races because of the late release of nutrients from organic sources. The results confirm those of a study conducted during *kharif '98* at Namakkal.

Table 3.11 : ***Influence of alternate sources of nutrients on growth and yield parameters of Sadansamai (short duration landrace)***

Treatments	Plant height (cm)	No. of leaves	No. of nodes	Panicle length (cm)	Grain yield/plant (g)	HI(%)	Grain yield/acre (kg)
T1	85.88	6.52	6.26	29.06	5.26	14.33	1,052
T2	100.86	8.80	7.22	37.88	10.70	27.35	2,040
T3	86.04	7.04	5.96	30.30	6.04	15.71	1,208
T4	83.89	6.90	5.46	28.91	6.34	16.28	1,268
T5	90.47	6.80	5.66	31.34	6.38	15.45	1,276
SED	4.27	0.94	0.52	2.42	0.60	-	-
CD (5%)	9.36	2.05	1.14	5.28	1.31	-	-

NS – Non Significant; SED - Standard Error Deviation; CD - Co-efficient of Deviation

Table 3.12 : ***Influence of alternate sources of nutrients on growth and yield parameters of Vellaperumsamai (long duration landrace)***

Treatments	Plant height (cm)	No. of leaves	No. of nodes	Panicle length (cm)	Grain yield/plant (g)	HI(%)	Grain yield/acre (kg)
T1	91.20	4.00	5.90	31.04	7.22	8.62	1,444
T2	110.10	8.14	8.10	44.74	14.38	15.84	2,876
T3	98.20	5.34	7.80	29.06	11.62	9.35	2,324
T4	94.60	4.90	6.82	30.42	10.58	7.80	2,116
T5	86.60	5.70	6.58	31.12	10.94	7.74	2,188
SED	3.68	0.66	0.42	1.49	0.97	-	-
CD (5%)	8.01	1.44	0.91	3.24	2.11	-	-

NS – Non Significant; SED - Standard Error Deviation; CD - Co-efficient of Deviation

Investigations are underway with regard to the intercropping systems.

Potentials of food fortification

Food processing establishments have shown interest and commitment to introduce millets based foods and include them in their products.

One of the leading bakeries in Chennai recently produced various bakery products such as millets bread, honey bars, pizza, naans, raisin millets rolls and muffins on an experimental basis. These products were tasted and scored for palatability with characteristics such as taste, texture and appearance for further explorations in incorporating and substituting wheat flour with millets flour in various products.

A major food company has also experimented with bread preparation using millets. It was proposed to include millets high fibre breads, biscuits and cakes. This proposal is being discussed. This experiment would determine the suitability of millets fortification in the bakery industry.

Revitalising household food consumption

To revitalise the consumption of traditional food preparations, the project set up a food stall of traditional foodstuffs made essentially out of millets and millets flour in the month of August '99 at the festival of the Aripaleshwarar temple in Kolli Hills.

Documentation of folksongs

To explore the cultural and ecological history of Kolli Hills and its relevance to the landscape about 300 folk songs have been collected from eight revenue villages (Nadus). They reflect various dimensions of the peoples' social and cultural background. They also express the relationship between the power structure and the native people, developmental changes and their impact, traditional cultivars, landscape, changes in cultivation practices, inter-personal and family relationships within the clans, migration issues and problems, dilution of socio-cultural aspects, belief and religious faith, spiritual activities, poverty and economic aspects. The consolidation process in the form of a book is proposed and attempts have been initiated for recognising and rewarding the local communities for their intellectual contributions.

Strengthening rural livelihoods through agro-industries

MSSRF has been attempting to strengthen rural livelihoods through agro-industries, with particular reference to fruit processing. Kolli Hills is endowed with a suitable climate for vegetable and fruit cultivation. Central Food Technology and Research Institute (CFTRI) is providing the technical support to the project, to set up a fruit-processing unit at Kolli Hills. Several studies were conducted to assess the quality and quantity of water required for setting up of the fruit-processing unit. These studies showed that the quality of water would not be suitable for fruit processing, since the water sample reflected substantial amount of fluoride content. The quality of water has been further affected by the presence of *coliforms* in the open wells.

Negotiations with TRIFED (Tribal Co-operative Marketing Development Federation of India Limited) for mar' ting pineapple have resulted in TRIFED indicating that they would be interested in buying the pineapple under 'Organic Product Sector'. Discussions are taking place between MSSRF and TRIFED to develop a framework for marketing.

Ecotechnology in Kolli Hills: an overview

During 1999-2000 the project was involved in the following activities:

- Studies on the grassroot organisation structure were made. The problems in forming co-operative societies were identified and an alternative structure in the form of SHGs has been mooted.
- Negotiations have taken place with officials of the Department of Food, Government of India, in identifying the problems and prospects of establishing fruit-processing units in Kolli Hills.
- Members of the co-operative societies in the villages near Pondicherry are carrying out mushroom production under the co-operative setup successfully.

301.3 Kannivadi Biovillage

1999-2000 was a period of institutionalisation of on-going programmes at Kannivadi. During this year programmes such as Seed Village and Village-level Biopesticide Production were undertaken by the local institutions. Training and production activities were also carried out by them. The Foundation played an advisory role. New programmes were initiated. Participatory research on precision farming, low-cost green house in the backyards of landless women for hybrid seed production and mobilisation of SHGs were the main activities undertaken this year.

Seed village programme and RSGA

The Seed Village programme was initiated in 1996-97 at Kannivadi with the objective of providing value to the only assets of rural poor, *viz.*, time and labour. Skill enhancement in agriculture in the form of training in hybridisation and quality seed production for rural poor and linkage with the markets are the twin aims of the seed village project. After three years, the project has been handed over to a local institution. As a result of the dialogue between MSSRF and the seed-growing farmers of Reddiarchatiram, *Reddiarchatiram Seed Growers Association* (RSGA) was formed to take up the responsibility of training women and farmers in seed production and to interact with seed companies. The total area covered under seed production during the last one year is 85.5 acres. 14 different seed crops were cultivated. An intensive training programme for 50 men and women was conducted to the tune of 7,000 trainee days. RSGA is also conducting experiments in its demonstration plots on different cotton varieties. The Agriculture and the Rural Development departments of the Government of Tamil Nadu are actively interacting with RSGA to develop plans for sustainable development at Kannivadi. RSGA is emerging as an extension agency run by farmers and agricultural labourers to support sustainable agriculture in the region.

Seed village project evaluation study

The project launched an evaluation study to consolidate the learning experiences from the Seed Village project. The study focused on gender perspectives emerging out of the project. An external consultant conducted the study using several participatory techniques and the report was submitted with a summary of findings and recommendations. The study found that the project was a unique

experiment in increasing skill level, employment and income of the poor in general and poor women in particular. The study pointed out that better-off sections have accrued much less benefits from the project than the poor. While poor households have played a major role in the project, the poorest among the poor have not been adequately involved. Women labourers have benefited more than men labourers. The increase in income has led to improvement of the household. The study points out that with regard to women's empowerment, the project has to make more efforts. Based on the results of the study, subsequent projects focused on the poorest and the dalit women in the area.

Twenty women belonging to the poorest households have been identified for training in backyard low-cost greenhouse for hybrid seed production of high value crops. Out of the 20 women, 15 belong to dalit groups. Similarly, another dalit women's group has been trained for 30 days by the *Centre of Science for Villages*, Wardha, in making paper and partition board from banana waste (the block produces around 7,500 tons of banana waste every year). The women's group has developed a project proposal. Government agencies like District Rural Development Agency (DRDA) and Tamil Nadu Adi Dravidar Housing and Development Co-operation (THADCO) have been approached for financial support to instal a unit in the hamlet.

In addition to the external evaluation, an internal evaluation study was also conducted using conventional survey methods. The study covered 100% samples of seed growing farmers and seed labourers in Pudupatty hamlet of Reddiarchatiram block. The survey showed that increase in input cost and increasing family labour are some of the major issues which need attention.

Mobilisation of rural poor for savings and credit: micro credits and Self-Help Groups

As a part of grassroot institution building, the project introduced group based activities for income generation and livelihood strengthening. The process of mobilisation started during the month of January '99. The total number of groups reached 34 in January 2000. 20 of them are exclusively women's groups, 13 are men's groups, and one group has both men and women members. Each group has 15 to 20 members with a total savings of Rs. 2,17,675. 12 groups of six months' standing in December '99 were linked with local commercial banks to get financial support of Rs. 1,20,000 which would enhance the capacity of the groups for low interest internal crediting. Ground rules were evolved for the effective management of the SHGs. Self-replication of SHGs has started taking place and the existing SHGs are involved in mobilising and forming new groups.

Orientation workshops were organised at Kannivadi for SHG leaders and members on the concept and scope of self-help groups and micro credit. Government departments, local service banks, NABARD and faculty from Gandhigram Rural Institute were involved in these programmes as resource persons and facilitators. An orientation workshop for SHG leaders and representatives, organised in Chennai, focused on multiple livelihoods, micro finance and rural entrepreneurship. Officials from the Department of Rural Development (DRD) and THADCO participated in the

workshop. Twenty project proposals were developed for micro enterprises.

Self help groups and micro enterprises

A production centre has been established at Kannivadi to develop a farm level biopesticide model through mass production of *Trichogramma* using *Corcyra* without using any major instrument. Women members of *Poomani Self-Help Group* came forward to manage the production unit. They were trained in production, quality control and marketing of biopesticide. An MoU was signed between MSSRF and *Poomani Self-Help Group*. The production of the first cycle has been completed and the cards were sold to the farmers cultivating the following crops: sugarcane (55%), paddy (13%), vegetables (18%), cotton (9%), and groundnut (5%). Participatory evaluation was carried out, based on the design developed by the women's self help group and the Foundation. The evaluation shows that during the first cycle 757.17 cc of *Trichogramma* cards were produced from 125 trays, at the rate of 6.06 per tray. The cost involved for production per tray was Rs. 45.38. Income per tray was Rs. 75.75 (at the rate of Rs. 12.50 per unit). Net profit per tray was Rs. 30.37. Nearly 400 acres of land was covered with *Trichogramma* cards between August and December 1999. The report also highlighted the need to adopt new strategies in the area of marketing. A micro plan was prepared for the next production cycle.

Low cost greenhouse for hybrid seed production

The objective of the programme is to train women of marginal landholding/resource poor families in seed production of value crops through low cost greenhouse in the unused area available close to the house to make a profit and add to the family's annual income. Twenty women (among them 15 are dalits) belonging to poor families from Pudupatty, Reddiarpatty, Tharmathupatty and Sevenakrayanpatty have been trained in hybrid seed production. In all the places, Participatory Rural Appraisal (PRA) was conducted to find out the time available for the women to participate in the training programme and later to install their greenhouses for seed production. A daily routine chart was prepared for men and women belonging to resource-poor families for both the agricultural season and for the lean season. Base line details were collected from all participants and were used as reference points to find the impact of the intervention after evaluation.

The first extension experiment of hybrid Tomato seed production was over by May 2000. The results show an average of 35 kg of tomato fruits from each greenhouse in an area of 15 sq ft, but the seed production was very low due to the very low quantity of seed setting in each fruit. The participants have taken a decision to choose a variety with higher seed content for the next set of experiments.

Other micro enterprises

Plans are being prepared to adopt the participatory approach to introduce simple income generation activities such as backyard ornamental fish breeding, recycling the waste for biopesticides, mushroom production using banana and other horticultural wastes and production of biomanure from banana and cotton waste, to enhance the income of the poor families of the region. PRA was organised

involving the women SHGs of dalit communities before preparing the plan of operations for setting up the micro enterprises. Simultaneously market linkages have also been identified for the products.

Extension of neem village model

The neem village model developed by the Foundation for wasteland development was extended to the uncultivated land belonging to the temple of *Arulmigu Gopinatharswamy Thirukoil*, Reddiarchatram, in collaboration with a Non-Governmental Organisation (NGO) called Centre for Sustainable Agriculture and Rural Development Research and Action (CENSAR). Nearly 15 acres have been covered under the project with seedlings and tissue culture saplings. Neem seeds were also sown. Benchmark details of soil nature were gathered before planting. CENSAR is training the farmers and neem seed collectors in efficient seed collection practices.

Kannivadi-overview

Skill empowerment and micro enterprises are the main themes at Kannivadi. The integration of activities such as biopesticide production and neem planting with seed production activities is a step towards establishing linkages between integrated natural resource management and livelihood security. The initiatives of the grassroot institutions indicate the social sustainability of the development interventions.

301.4 Chennai

The Centre conducts many studies in its laboratories at Chennai as a support service to its activities in Chidambaram, Kolli Hills and Kannivadi. It has a prawn hatchery operating on the principles of resource recycling. Training programmes are conducted regularly for participants in various projects and government officials. Seminars and conferences at the national and international levels help to strengthen the policies towards ecotechnology.

Farm level biopesticide production: study of Helicoverpa armigera for NPV production and the efficiency of feed for Corcyra cephalonica

Helicoverpa armigera is considered to be the world's most cosmopolitan and polyphagous pest possessing high mobility, high fecundity and facultative diapause. It survives in a wide range of habitat. Since 1997, the project has been assessing host specific variations at the sub-species level. The morphological parameters have failed to offer any insight and therefore a detailed biochemical study on the pest was initiated in 1998-99 using cotton, bhendi and redgram as host plants. In 1999-2000, studies were intensified with a greater number of host plants *viz.*, cotton, bhendi, sunflower, bengalgram, redgram, rose, crossandra, groundnut and lab-lab. The larvae of lab-lab were reared in the laboratory for three generations (LG1-LG3), and the variation in their biochemical constituents, enzymatic activity and protein profile was studied to understand whether the host-specific variation in *Helicoverpa* may influence the efficacy of Nuclear Polyhedrosis Virus (NPV).

Of the different biochemical parameters (total protein, total sugar, reducing sugar and total phenol) and enzymatic activities (acid and alkaline phosphatase) tested, the variation in total protein content (57mg in crossandra and 130 in sunflower) and total phenol (10 mg in cotton and 110 in sunflower) was found to be

high. The study clearly indicated that the pests from different hosts possessed different biochemical characters.

Utilisation of millets as a source for Corcyra

Beneficial insects play an important role in Integrated Pest Management (IPM). One of the best known egg parasitoid, *Trichogramma* sp. has been used extensively at the farm level to control *Helicoverpa armigera*. The suitable host for mass multiplication of this parasitoid is rice moth (*Corcyra cephalonica)* that is usually cultured in the laboratory using pearl millets as the base medium. Taking into consideration the cost involved and other region-specific factors, experiments were carried out to find a suitable feed media for *Corcyra*.

Three feed media *viz.*, rice, pearl millets and little millets were tested of which, pearl millets favoured the production of a greater quantity of eggs (284.6cc), compared to little millets (209.3cc) and rice (123.2cc). The observations also indicated that little millets could be used as an alternative base medium for *Corcyra cephalonica*.

Biofertilisers and organic fertilisers

People of Kolli Hills use *Dodonaea angustifolia (Vilari* in Tamil) as green leaf manure and also as a biocontrol agent. A study of the biocontrol characteristics of *D. angustifolia* vis-à-vis *Helicoverpa armigera* was undertaken this year.

The mass culturing of *H. armigera* collected from lab-lab plants was carried out in the laboratory using semi-synthetic diet under controlled conditions (25° ± 1°C with 60-70% RH). Fresh leaves of *D. angustifolia* collected from Kolli Hills were shade dried and ground into a fine powder and sifted. Leaf extraction was carried out in a Soxhlet apparatus using a range of solvents (petroleum ether, chloroform, hexane, acetone and water). The extracts were concentrated using a rotary evaporator. Adequate amounts of extracts were taken and dissolved in respective solvents for 10 and 20 % concentrations.

Treatments were fixed on a day-to-day basis with addition to the normal diet (honey solution) at respective concentrations (10 and 20%) for 4 days consecutively, using a cotton swab placed on a petridish. A batch of control was maintained without the extract. Triplicates were maintained with 5 pairs of each. Every day the egg cloth was collected, and data on the number of eggs laid (Table 3.13) and hatchability (Table 3.14) were recorded. The resultant progeny from the treatments were reared on semi-synthetic diet and the third instar larvae from each treatment were selected and segregated into three batches (normal diet + extract, normal diet + solvent, normal diet). The larval mortality and pupation were recorded.

Different treatments exhibited significant variation in the fecundity status and hatchability. Induction of egg laying with hexane extract (970.6) compared to control (901.6) is highly significant and needs further study. However, the water and acetone extracts inhibited the fecundity of the moth to a great extent.

Though the control and hexane treated moths favoured a greater number of eggs, the hatchability was 36.4 and 38% respectively. However 50% hatchability was recorded in acetone extract. Further development stages, *i.e.*, pupation and moth emergence depicted in Table 3.14 reveal 80.49% pupation with 73% healthy moth emergence compared to hexane extract (43.33%) with only 10% moth emergence.

Table 3.13 : ***Fecundity status of H. armigera***

Treatment	No. of eggs laid/day after treatment*										Total
	1	2	3	4	5	6	7	8	9	10	
10% honey (C)	0.0	21.6	23.3	70.6	141.6	183.3	100.0	166.6	125.0	68.6	9001.6
C+ 10% water extract	0.0	0.0	25.0	109.0	90.0	61.6	103.3	6.6	0.0	0.0	395.5
C+ 10% hexane extract	7.3	77.3	196.6	233.3	166.6	203.3	71.6	12.0	2.3	0.0	970.5
C + 10% acetone extract	0.0	0.0	12.3	43.6	28.3	18.3	63.3	70.0	0.0	0.0	235.8

*Each value mean 3 replicates of 5 pairs each

Table 3.14 : ***Effect of D. angustifolia extracts on growth and development of H. armigera***

Treatment	Pupation%	Pupal weight (mg)	Healthy moth emergence%	Malformed / dead %
Control (N)	80.49±0.02	380±1.00	73.33±0.18	6.66±0.23
Water Extract (W)	50.33±0.20	258±1.00	13.33±0.33	39.99±0.38
W N	53.33±0.07	285±1.00	43.33±0.33	9.99±0.33
Hexane Extract (H)	43.33±0.64	260±1.50	10.00±1.00	33.33±0.18
Hexane + Solvent	43.33±0.13	287±0.00	23.33±0.33	19.99±0.38
H N	66.66±0.04	314±1.00	56.66±0.09	13.32±0.19
Acetone Extract (A)	46.66±0.10	266±1.10	10.00±0.47	36.66±0.19
Acetone + Solvent	73.34±0.05	327±1.15	20.00±0.28	29.99±1.18
A N	73.34±0.05	360±1.52	63.33±0.39	9.99±0.27

Low cost greenhouse

The Centre has been studying the possibilities of using low cost greenhouse techniques for hybrid vegetable/seed production among the rural landless poor households. The experiment has been carried out at Kattupakkam near Chennai. Hut-type casuarina-pole framed greenhouses of 5m x 3m, facing east to west, were constructed. The study is being conducted since 1997-98 and during 1999-2000 the data for the third year crop was collected.

The study was conducted with randomised block design with three replications. The hybrid variety of tomato Vaishali was grown in rows parallel to the length of the greenhouse. Regular practice of cultivation (organic farming) followed. Chemical fertilisers/pesticides were not used. Plant extracts namely neem oil 3% was used to manage the pest incidence. Parameters *viz.*, crop growth, plant height, number of leaves, number of nodes and yield per plant were observed and statistical anlaysis was carried out (Table 3.15).

Significant increase in the yield (2145 gm/plant) was observed in T2 followed by T3 (2054.96 gm). This may be due to warm and humid weather prevailing inside the greenhouse. The plant height, number of nodes and yield per plant showed significant increase in T2, followed by T3.

The results of this experiment have helped in the participation of landless women labourers in studying the efficiency of low cost greenhouse in producing hybrid seeds in their backyard.

Ecoaquaculture: fresh water prawn hatchery

In 1998-99, a fresh water prawn hatchery was established at the Foundation, with a capacity for 3,00,000 fingerlings of fresh water prawn (*Macrobrachium rosenbergii*).

Table 3.15 : ***Growth and yield of tomato in different types of low cost greenhouses***

Treatments	Height (cm)	Leaves (no.)	Nodes (no.)	Yield (gm) / plant
T1	97.6	299	27	1,348.5
T2	105.9	325	28	2,145.0
T3	105.9	306	27	2,055.0
T4	108.8	322	27	1,415.4
T5	75.5	221	24	981.0
SED	3.8	27	0.6	131.8
CD (5%)	8.8	NS	1.5	303.9

T1- fully covered by UV plastic sheet (door opened during day), T2-side walls covered by nylon net (25% shade) and roof covered by UV plastic sheet, T3-side wall and rectangular roof covered by nylon net and remaining roof covered by UV plastic sheet, T4-half portion of side wall covered by nylon net and remaining portion covered by UV plastic sheet, T5-open-field (control).

The objectives of the freshwater prawn hatchery are:

- To demonstrate the appropriate breeding techniques for *M. rosenbergii* with indigenous inputs
- Precisioning of energy and other resource utilisation in fresh water prawn culture and introducing biological remedies of water treatment and recycling.

During 1999-2000, nearly 25,000 fingerlings (PL20) were produced and sold. 90 women were trained in various aspects of production. This encompasses various inputs such as broodstock, feed, water and energy (particularly electrical energy), followed by the cost involved and financial gains. Therefore, pilot studies have been designed and carried out in the hatchery premises, which in turn would facilitate the formulation of the production model.

Studies on the production efficiency of giant fresh water prawn seeds from broodstock collected from different farming systems: Although India has vast fresh water resources, prawn farming is yet to attract commercial interest, compared to the rapid progress in South East Asian Countries. *M. rosenbergii* has several desirable traits, such as its ability to grow both in fresh water and low saline waters, compatibility with major carps, hardy nature, fast growth, resistance to diseases, high consumer preference and market value. Development of feeds with high conversion rates, standardisation of effective management practices, development of suitable prophylactic and disease control measures etc., are some of the means to achieve high production. Comparison of the quality and quantity of giant fresh water prawn (scampi) seeds produced from the broodstock collected from the different culture conditions were made and the broodstock collected from a semi-intensive culture system was observed to be most appropriate for breeding purposes.

Impact of un-ionised Ammonia in the culture media of the post larvae of M. rosenbergii: The production of fresh water prawn larvae in a recirculatory system is limited primarily by the oxygen consumption factor and secondarily by the un-ionised ammonical factor. Ammonia originates through excretion of the larvae or as a product of microbial decomposition. This study was an attempt to find the tolerance limit of un-ionised ammonia in the culture medium by varying the pH and temperature. Synthetic medium using ammonium chloride was used throughout the study. It was observed that the post larvae survived at a higher range of un-ionised ammonia at neutral pH and at room temperature conditions.

Salinity tolerance levels of the post larvae of fresh water prawn, M. rosenbergii: The distribution of *M. rosenbergii* in any particular eco-system is determined by the degree of tolerance to the abiotic parameters such as salinity, temperature, pH and dissolved oxygen. Although the adult prawns live in a fresh water habitat, their larval cycle is completed in saline water conditions. Hence this study is designed to analyse the tolerance limit of the *M. rosenbergii* post larvae to different salinity ranges in relation to the dissolved oxygen content of the culture medium. Abiotic factors were also recorded throughout the study. The results reveal that the survival of the post larvae of *M. rosenbergii* is significantly higher in fresh water and low saline waters, at temperatures

between 28 and 30°C and pH level at 8 to 8.5. The dissolved oxygen level showed a negative impact at higher salinity concentrations.

Effluent treatment: The efficiency of the effluent treatment plant of the hatchery unit is being studied by analysing the physical and chemical characteristics of waste water before and after treatment. Determination of biological characteristics involves the cultivation of microorganisms. The sample was inoculated in different growth media. The microbes grown in Nutrient agar, were of Gram-positive and Gram-negative bacilli type. Most probable number (MPN) count confirmed the presence of *coliforms* 12/100ml of the sample. The organisms in Robertmon's cooked meat medium were of anaerobic, motile, Gram-positive type. The fungi identified were *Aspergillus* sp. and *Rhizopus* sp. The efficiency of the Effluent Treatment Plant (ETP) was compared by setting up an Experiment Study Tank (EST) and converting it to a biofilter by inoculating and cultivating mixed species of microorganisms.

Nutrients (inorganic enrichment media) were added directly to the EST while maintaining the pH and temperature. The layer of shell, sand, gravel, pebbles and charcoal provided a suitable environment for the luxurious growth of nitrifying bacteria which require a natural environment and substratum for their growth, attachment and slime formation.

The addition of 25 litres of filtered water in the same tank and inoculation of already cultivated microbes showed sufficient growth. Thus, the EST was enriched with mixed culture of microbes which is now a biofilter. The tank was filled with wastewater and left undisturbed for 2-3 days. Conditions like pH, temperature, time factor and nutrients were controlled throughout the experiment. Finally, the physical and chemical characteristics of treated water were determined.

The differences in values of turbidity, hardness (TH), conductivity (EC), nitrite, ammonia and nitrate were highly significant ($P < 0.01$). But there were no significant differences in pH and temperature. The experimental study tank was significantly more efficient than ETP in reducing the content of nitrite, ammonia and BOD and increasing the nitrate content, which are all important factors in the reuse of aquaculture waste water.

Thus, proper maintenance and conditions like pH, temperature, time period and nutrient addition may increase the efficiency of an aquaculture bio-filter in converting ammonia, nitrite, nitrate and BOD below the toxic level of aquatic animals.

Chennai-overview

The activities at Chennai are aimed at finding solutions to technical problems faced by the field centre while establishing production centres and micro enterprises. The study on *H. armigera* focuses on improving biopesticide production of *Trichogramma* and Nuclear Polyhedrosis Virus (NPV). The experiment on low cost greenhouse is emerging as an income-generating tool for rural poor. The hatchery is involved in research and training in ecoaquaculture.

Table 3.16 : *Physico chemical analysis+ of effluent water*

Parameters	Before treatment	After treatment	
		ETP	EST
pH	8.43	7.90	8.13
TH	311.00	150.00	296.00
EC	12.00	7.30	6.80
BOD	7.20	3.70	2.80
Nitrite*	0.75	0.59	0.02
Ammonia*	8.13	3.46	0.003
Nitrate*	2.13	15.70	17.60

+ Each value mean of triplicate, * ppm

The statistical analysis revealed a significant variation between treatments (ETP and EST) at 1% level.

301.5 NABARD Resource Centre for Precision Farming for Poverty Alleviation

The term "precision farming" involves several technologies that optimise the application of inputs to increase the efficiency, minimise waste of resources and limit the adverse environmental impact that is associated with modern agricultural practices. Precision farming as currently practised is highly mechanised, technology-driven and applied on large landholdings. A process is being evolved at MSSRF with the help of participating farmers, SHGs and NGOs, to blend precision farming with the existing traditional knowledge and make it applicable to the local condition.

This programme takes forward the concept of precision farming among the farmers who were previously trained under the CAPART Technology Resource Centre Programme. Five major modules have been adopted in this project: Integrated Intensive Farming System Module at Keelamanakudi, Pulse Village, Seed Village and Information Village Modules at Kannivadi and Minor Millets Village Module at Kolli Hills.

One of the approaches adopted is to determine the acceptability of collective/group approach towards farming activities, starting with the planning to the marketing stage. It is hoped that this approach would help to create employment opportunities for the poor and landless labourers, especially women. To achieve this objective the existing SHGs were sensitised to the approach and were involved in the project activities.

Through this project, it is envisaged to achieve a substantial reduction in farm-input cost and better returns for the farmers. It will also reduce the adverse effects of inorganic fertilisers and pesticides. Through participatory involvement it is hoped that this technique could be adapted/ replicated among the farming communities in general, and marginal farmers in particular.

During the year 1999-2000 the following processes have been initiated:

- Selection of farmer trainees for the programme (average of 30 trainees per module, Seed, Pulse and Information)
- Collection of baseline data
- On-farm hands-on training at the demonstration site
- Taking forward the concept to the farmers' field through participatory research and development

Integrated intensive farming system module, Keelamanakudi

204 trainee days have been completed during this period. Courses covered during this period were on biofertliser, Integrated Pest Management and incorporation of Precision Farming concepts into Integrated Intensive Farming System (IIFS). Among the 30 participants, 6 were women. They represented the farming community (18), NGOs (5), associations (2) and SHGs (5). The participants were drawn from 7 villages around the IIFS demonstration site at Keelamanakudi. A training programme on biointensive gardening was conducted for 59 women, and an exposure tour (to Tamil Nadu Oil Seeds Federation at Neyveli) and training in goat rearing (Telicherry goats) was conducted for 20 women. These women would play a dominant role in linking the components of biointensive cultivation and goat rearing in the farmers' fields where the IIFS concept is being practised. Through the participatory mode, six different combinations were evolved with IIFS concepts and six farmers among the trainees were chosen to demonstrate them in field conditions.

The combinations evolved for development and trials are:

- Paddy – Blackgram – Fish – Banana – Livestock – Mushroom
- Mango orchards – Fodder crops – Blackgram – Bee keeping – Livestock
- Paddy – Blackgram – Livestock – Coconut
- Floriculture – Annual *Murangai* – Fodder crops – Livestock – Bee keeping
- Banana – Bee keeping - Coconut – Mushroom
- Paddy – Blackgram – Japanese squail – Bee keeping – Mushroom

Pulse village module, Kannivadi

The Pulse Village focuses on precision farming activities for production of pulse crops under limited water supply conditions in dry land. During this period 325 trainee days have been completed. 12 courses, relating to the concept of precision farming in pulse production, were conducted. A participatory curriculum was designed by the participating farmers and the Foundation staff. The course structure provided an opportunity for the trainees to participate in every aspect of farm operation, from land preparation to harvest. Resource persons were invited to share their knowledge and give practical hands-on experience. The subjects covered were: soil sample collection methodology; water conservation; integrated pest management; compost preparation; plant nutrient management and recording plant growth development. During this period, two crops (blackgram and greengram) were harvested in the demonstration plots. Two farmers have adopted the techniques of precision farming (variable rate application technology) in their fields. The progress made

at the farmers' field is being monitored by the MSSRF staff along with the trainees. Enriched banana compost was used. Fig. 3.1 shows the results of the experiment in the demo plot.

On-farm trials were conducted for blackgram and greengram to evaluate the Phosphorus (P) use efficiency using different sources of Phosphorus. The trial was conducted in Oct-Nov '99 in the demonstration plot as well as in the farmer's field. The sources of P were super phosphate, rock phosphate and P enriched banana waste compost with phosphobacteria. The trial was laid out in Randomised Block Design with four replications and six treatments including control (without P). The treatments were control (T1), super phosphate (T2), rock phosphate phosphobacteria (T3), enriched banana waste (T4), 50% of T2 and 50% of T4 (T5) and 50 % of T4 and 50% of T3 (T6).

The results indicated that the highest grain yield and Phosphorous use efficiency were recorded in the enriched banana waste compost (nearly 40% over control) applied plot followed by rock phosphate with phosphobacteria treated plot. This could be due to the increased availability of P in the compost bacteria mobilisation in rock phosphate. In turn the available nutrients helped the plant to develop a good root system, nodules and grain formation that resulted in higher grain yield.

Handouts relating to the training programme are being compiled in the form of a booklet. Completion of the training programme with redgram cultivation, review of the programme with the first batch of participants and planning of the next phase are among the activities to be undertaken next year.

Seed village module, Kannivadi

The Seed Village module aims at developing methods of precision farming for horticulture seed production. 317 trainee days have been

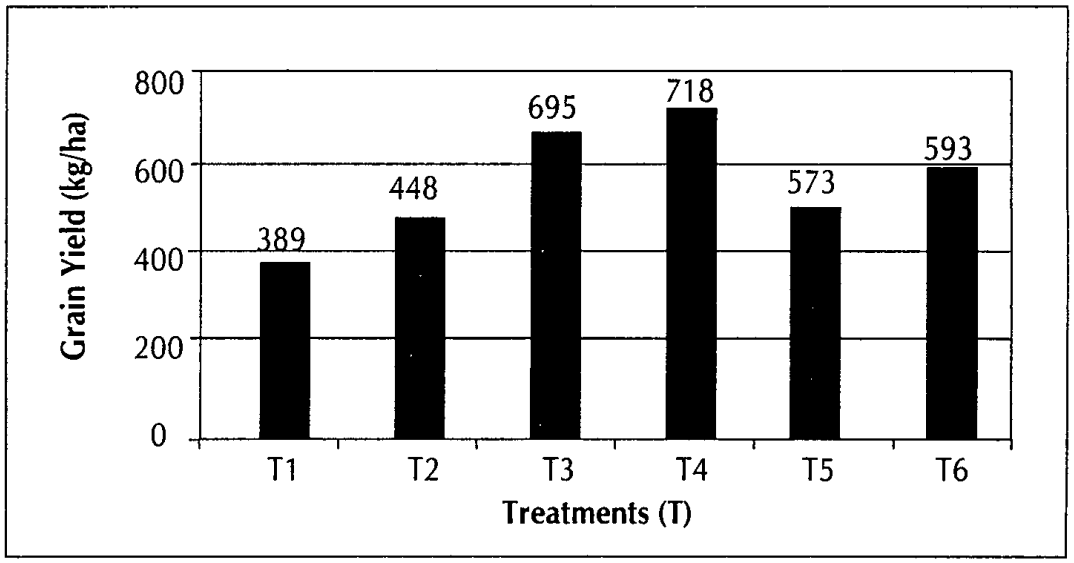


Fig. 3.1 : ***Effect of different sources of Phosphorous on pod and grain yield of blackgram***

completed during this period. 11 courses covering subjects such as designing plans for cultivating crops, soil mulching, irrigation, water management, variable rate application techniques, integrated weed management, box nursery, fertilisation calculation, seedling transplanting, integrated nutrient management, integrated pest and disease management, pro-tray nursery and biofertiliser utilisation were conducted. At present tomato and radish are being cultivated for seed production (in the demo field). Four farmers (who are cultivating tomato for seed production) are also trying out the concept of precision farming in their own fields. A women's SHG consisting of women farmers and farm workers and MSSRF are involved in the method of drip irrigation and fertigation of drip irrigation system in one acre of agricultural plot for seed production.

Information village module, Kannivadi

The Information Village module is meant to facilitate information empowerment that would help in minimising the transaction cost and post-harvest losses. 36 participants have been selected for undergoing this course. The training programme covers the overall concept of information and how it helps in decision making. In this module, the role of computers in information storage, retrieval and dissemination is being discussed. It is hoped that the trainees will assist in gathering information that is relevant, set up knowledge/information centres and also take care of their maintenance. 145 trainee days have been completed under this module.

Supply of information on available credit facilities, market price of various crops, especially vegetables and new innovations are very important for farmers. This could be achieved through empowering the villagers with information by starting 'village information centres' in the hamlet to facilitate sustainable development. Participatory Rural Appraisal (PRA) was conducted. It focused on the aspects of need driven information, information variation during the different seasons of the year, daily activities and the availability of time to spend on information gathering from the village knowledge centres' (see also SPA 303).

Minor millets village module, Kolli Hills

At Kolli Hills 26 individuals were selected to form the initial core group. 73 trainee days have been completed. The activities for which training was imparted are: summer ploughing, soil and water conservation, seed treatment, farm yard manure preparation, biofertliser, biopesticide, spacing methods, sowing methods, nutrients, inter cropping, harvesting, seed selection and storage, and millets based food preparation and processing. The thrust area at Kolli Hills was on developing models for improving the productivity of the traditional landraces of minor millets. These millets are tolerant to various biotic and abiotic stresses and cultivated with least care.

Unlike other areas, where input management needs precision concepts in soil, water, nutrient and pest management, in millets, evolving the site-specific management/cultural practices is the first step. The potential areas for enhancing productivity were identified by the farmers and experiments were designed for both short duration and long duration landraces traditionally grown in Kolli Hills.

The productivity aspects of little millets were studied, based on the participatory adaptive research cum monitoring method. Based on the growth rhythm of the crop, different experiments were monitored and evaluated by the farmers.

Lysimeter and drip irrigation

MSSRF is collaborating with Arava R&D, Israel, to promote a precision farming movement for poverty alleviation in India and to develop a methodology that will make precision farming suitable to the Indian conditions, especially semi-dry land and low land agriculture.

This will involve identification of the crop water and nutrient requirements based on crops and soil, suitable to the needs of Indian small farm conditions. To find out the exact need of the crop, lysimeters would be a viable tool, particularly in irrigation, nutrients and pesticides related studies. In this study lysimeters will be used to find the water and nutrient requirement of vegetable crops for the purpose of seed production. Usually seed crops need more inputs compared to the normal crop. The Foundation staff at present are undergoing hands-on experience in running the lysimeter and in designing experimental procedures for the lysimeter.

Sub Programme Area 302

Biovillages

Biovillage is a dynamic programme with a holistic pro-poor, pro-nature and pro-women approach that harmonises the need of the present with the future generation. The twin problems of natural resource degradation and rural poverty have been central to this project which was started in January, 1995. The Biovillage model of rural development has been acknowledged as one of the viable approaches to narrow the gap between the rich and the poor in an ecologically sustainable way. Various interventions on natural resource management and livelihood enhancements have been tried in the past and 1999-2000 was the consolidation phase of this project.

A Tripartite meeting was held by MSSRF, UNDP and the Government of Pondicherry on 29 November 1999 to review the progress of the project and the following recommendations were made for the extended period till December 2000:

- Continuation and selective intensification of on-going activities
- Micro credit facility for the Self Help Groups (SHGs)
- Biocentre and Biovillage Council formation
- Documenting and spreading the message of the Biovillage movement
- Establishing Biovillage and Community Banking Network
- Development and investment plan for bringing other villages under Biovillage programme

The Biocentre started at Pillyarkuppam in April 1999 will be the hub around which all the biovillages revolve and serve as a single

window system for activities such as training, demonstration, production and information. It will be a link between credit institutions and entrepreneur groups and will become fully functional during the third quarter of this year. The Biovillage Council, constituted from the elected members of 100 SHGs, will be trained in the functioning and management of the Biocentre, enabling the withdrawal of the Foundation's role by the end of 2000. Some of the enterprises will be linked to the departments of the Government. About 38 role models, identified from various enterprise groups, could help in the replication of biovillages by creating an impact on the adjoining villages. The sustainability of the Biocentre and its activities will be managed from the interest money generated through the corpus investment of ten lakh rupees, being equal contributions of UNDP and the Government of Pondicherry. A development plan to bring the other 266 villages under the biovillage model is being prepared by MSSRF jointly with the Government of Pondicherry.

302.1 On-farm Research and Demonstration

Integrated resource management

Sustainable management of natural resources such as soil, water and energy have been demonstrated under this sub-programme.

Demonstration of farm equipments: Demonstrations on various aspects of agricultural engineering were held for farmers in the villages. Agri-equipments such as drum seeders, rise husk stoves, treadle pump and groundnut strippers were demonstrated to various villagers mainly to highlight the sustainable use of water and soil resources, conservation of energy and drudgery reduction. It has been learnt that there is enough potential for introducing new simple machinery, as also taking up non-farm jobs displaced by the labour force in the villages. The coincidence of Sornavari crop and the monsoon rain creates an opportunity to propagate the electrical drying technology at a massive level. Household fuel energy saving devices are of utmost necessity to rural women confronted with indoor pollution. There is scope for improvement of access to information on modern farming technologies at the village level.

Soil health card : As a continuous monitoring and management tool for soil fertility, soil health card was introduced during the inauguration of the Biocentre on April '99. Soil health card ensures economy through required fertiliser inputs while maintaining the optimal yield. Soil samples were collected and soil test-based fertiliser application was carried out in the biovillages on paddy (48 trials), sugarcane (13 trials), cotton (5 trials), groundnut (4 trials) and tapioca (3 trials). Nitrification inhibitor *viz.*, neem cake and U-coat @ 200 g/kg and 50 ml/kg respectively were mixed with urea to reduce the fertiliser losses mainly to paddy and sugarcane. To break monocropping of paddy, which causes increased incidence of pest, depletion of ground water and soil nutrients, green manure was introduced in the cropping pattern to enhance soil fertility and productivity and arrest ground water depletion in Sorapet and Thondamanatham villages (10 trials). Crop and Resource Management Network (CREMNET) trials were conducted in collaboration with IRRI, Philippines to evaluate nitrogen management practices in paddy (20

trials) in the biovillages. Chlorophyll meter and Leaf Color Chart are effective in timing nitrogen application to paddy. Due to lack of facilities for soil testing in the Union Territory of Pondicherry, it has been decided to establish a Soil Testing Laboratory at the Biocentre.

Integrated crop management : In the Integrated crop management trials of paddy, the following packages and practices like application of biofertilisers - *Azospirillum* and *Phosphobacterium* in the nursery and main field were carried out. Installation of bird perches @ 25/ha, Neem oil 3% and Malathion 500 ml/ha were practised to manage leaf folder and ear head bug and soil test based fertiliser recommendation was practised. In the Sornavari season the short duration high yielding variety was grown. The yield increase was 15 per cent and the maximum yield recorded was 5.6 tons/ha. During Samba season the long duration variety white ponni was grown and the maximum yield recorded was 4.9 tons/ha.

Genetic interventions : In an attempt to increase the productivity of crops in the biovillage area, confirmatory yield testing trials of new varieties were taken up. Twenty-five trials to test the yield of 3 paddy and 2 groundnut varieties were conducted during the Sornavari (May – August) and Samba (September–January) seasons of last year. ADT 43 for Sornavari, CO 47 for Samba and ALR 2 groundnut variety for Thai pattam (December – March) having a 15 percent yield advantage, were recommended to farmers of the project area. To meet the demand for quality paddy seeds, seed production in an area of 20 acres was monitored and the seeds were sold locally.

Evaluation of Polythene Mulch Groundnut against 2 sowing systems (Flat bed and ridges and furrow) and three varieties (Pollachi red, ALR 2 and ALR 3) and Quantitative Evaluation of Fertility in Tropical Soils (QUEFTS) by taking up 15 trials in five villages were initiated during the Navarai 2000 season.

A survey of 100 farmers was conducted to evaluate the potential of hybrid rice in the biovillages. The farmers' expectations of a good hybrid included a minimal yield advantage of 20 per cent, good cooking quality, seed availability at a reduced rate and an ecofriendly package of practices. The suggested target group was small and marginal farmers for hybrid rice cultivation and women's groups for seed production. A poster on the above subject was presented at the International Rice Research Conference at International Rice Research Institute, Philippines.

To meet the demand for quality paddy seeds of the wet lowland cluster, a paddy seed processing group of 12 women members was organised at Poraiyur village which will be taking up the activity as a source of livelihood.

Integrated pest management (IPM)

Polythene mulch groundnut (PMG) : About 4 PMG trials were conducted in Sorapet village. Trials for setting up of pheromone traps *Spodoptera* and *Helicoverpa* and need based neem oil application were carried out. Castor was raised as a trap crop along the bunds for monitoring the *Spodoptera* population. A lower incidence of *Spodoptera* and aphid population was noticed.

IPM block approach in Paddy: The block approach was practised in Sorapet village with

15 farmers. A Farmers' Field School (FFS) was conducted at regular weekly intervals to inculcate the principle of IPM and INM. In the IPM block, farmers have reduced the pesticide cost to 25 per cent and maximum yield recorded was 4.8 tons/ha. Interestingly, after the FFS, both the botanical and chemical pesticide sprays have increased. In the non-IPM block area farmers applied more than four rounds of pesticides. This increased the cost of cultivation and the net income was low compared to the block area.

Farmer's field school (FFS)

During the Sornavari '99 season FFS was conducted in Kizhsathamangalam village and during Samba '99 season in Sorapet village. The important topics discussed in the FFS were: identification of pest defender role in the paddy ecosystem, demonstration of biofertilisers, demonstration of neem oil, installation of bird perches for control of grass hoppers, integrated weed management, fertiliser and soil management practises.

Biopesticide production

During a Participatory Rural Appraisal (PRA) conducted in the biovillages the potentials of biopesticide usage in the villages was also explored. As an outcome of this study, neem seed kernel extract will be established in the Biocentre to cater to the needs of the farmers. Since sugarcane and paddy occupy more than 60 per cent of the land in the Pondicherry region, *Trichogramma* production will also be taken up.

Integrated nutrient management (INM)

This is focused on the indiscriminate use of synthetic fertiliser inputs by the farmers and is aimed at demonstrating the use of biofertilisers and organic farm products in combination with synthetic fertilisers. As a part of the Department of Biotechnology programme on Integrated Nutrient Management a project entitled *Field Level Methodology for Feeding the Rice Plant Without Associated Ecological Harm* is underway in the biovillage project area. This study also analyses the constraints faced by farmers in adopting such technologies, in addition to creating awareness among farmers on the use of biofertilisers.

INM trials focus on the long-term benefits of locally available proven biofertilisers. Testing cum demonstration trials were initiated in two cropping systems *viz.* Rice-Rice-Rice and Rice-Rice-Pulse with four treatments reducing the percentage of synthetic fertilisers and substituting with biofertilisers, in 7 villages. Experimental trials in Latin Square Design were conducted at Krishi Vigyan Kendra (KVK) serving the purpose of institutional linkage. Trials were carried out in Samba '99 season in which biometric and yield observations were recorded. Yield values show that T4 (25% reduction in N + *Azospirillum* + 25% reduction in P + Phosphobacterium + Recommended dose of K through chemical fertilisers) performed better (with an average increase of 392 kg/ac than the farmers practice) than other treatments. Four Field Schools were conducted to propagate the beneficial results of biofertilisers with respect to improving soil health and reducing the fertiliser cost. Regarding raising rice-fallow blackgram in the month of February, crop loss was suffered due to rain and seepage of irrigation water from surrounding paddy fields. Farmers identified certain issues like lack of awareness, non-availability of quality products and labour

problem as constraints in large-scale adoption of biofertilisers.

Biofertiliser production

During the PRA exercises conducted in selected villages, an assessment of the availability of biofertilisers to the farmers and their usage was made. The findings indicate that farmers get biofertilisers from PASIC even at subsidised rates and also in required quantity. No shortage has been experienced by the farmer regarding the availability of biofertilisers. It is also inferred that no agency is selling *Azolla* and BGA in Pondicherry (In KVK, *Azolla* multiplication is done on a small scale mainly for their own use). Hence it has been decided to go for mass multiplication of *Azolla* and BGA in the Biocentre. As a preliminary step, *Azolla pinnata* var. *pinnata* is being multiplied in cement tanks in the Biocentre. A few farmers were also selected for *Azolla* multiplication in their fields.

302.2 Livelihood Projects : Micro Enterprises for Additional Income Generation

Animal husbandry programmes

Dairy – Fodder : The dairy project has covered 55 participants in 5 villages. The participants are linked with banks for financial assistance and with milk co-operatives for marketing of milk. An awareness campaign was conducted in collaboration with PONLAIT. The programme was replicated in 48 non-biovillages.

About 20 individual fodder plots were raised in 4 villages. A commercial fodder plot of 4000 sq.m was established in Poraiyur village. The fodder harvested is being used by the farmers. In Ramanathapuram village, a self-help group consisting of 10 farmers has been formed for commercial fodder production in an area of 3 acres.

Goat rearing : This project involves the upgradation of local goats by introducing purebred Tellicherry male goats for weight gain of offspring. In addition to covering all the 18 biovillages, this programme has spread to 4 non-biovillages of the neighbouring Tamil Nadu state.

Poultry : The project has created livelihood opportunities for 39 resource poor women of five villages through the introduction of the backyard poultry scheme as an income generating activity. The breed Giriraja was identified as a suitable breed for the Pondicherry climate and was distributed to the participants.

Aquaculture : In the past year, 2 new ponds (Vambupet and Poraiyur villages) were taken on lease for five years and renovated with assistance from DRDA. Two women's groups (out of which one is a dalit group) comprising 15 members have been organised to take up community aquaculture in these ponds. The new groups were trained in technical and social aspects of community aquaculture by the existing role models at Kizhur village.

There was a 40 per cent yield reduction in Kizhur pond due to heavy Tilapia contamination as a result of improper control over the inlet and outlet of the pond, which was taken care of in the new ponds. Ornamental fish rearing in cement tubs was

established for demonstration at the Biocentre for the management of which a women's group (7 members) has been organised.

Flower and vegetable production

About twenty flower gardens have been established. On critical appraisal of flower (jasmine and crossandra) trials of different unit size conducted in different biovillages in the last few years, the unit consisting of 150 plants and 500 plants of jasmine and crossandra respectively was found to be economically viable and technically feasible, generating a net income of Rs. 5,000-6,500 and employment of 125-130 mandays for jasmine and Rs. 5,000-5,500 and 160-180 mandays for crossandra. A Self-help group for flower production was organised in Ramanathapuram village. It is proposed to initiate the activity in the coming planting season.

Four vegetable trials have been conducted. From the critical analysis of the vegetable trials conducted in the past, it is revealed that among the different vegetables bhendi, brinjal and chillies which have the cost benefit ratio of 3.5, 3.75 and 2.5 respectively are suitable considering the soil and climatic suitability and market demand in the area. The trial conducted to find the effect of vermicompost on bhendi indicated that there is no significant difference in yield except consumers' preference by virtue of its good taste. About one hundred nutritional gardens (kitchen gardens) have been established in the biovillages through the Government of Pondicherry.

Vegetable minikit programme

A Self-help group for vegetable production was organised in Ramanathapuram village. It is proposed to initiate the production in the coming season after linking the group to the farmers' shandy established recently in Pondicherry. Flower nursery (low cost mist chamber) was established in Kizhur village for the production of crossandra cuttings.

302.3 Social Mobilisation

Savings and credit are an integral part of group action for rural development. During the year, 22 women's groups (15 credit and savings, 7 activity based) were organised in 9 project and 3 non-project villages.

To enhance holistic development of the village, Village Development Councils have been formed in three villages and linked to NABARD. Through linkages with government agencies (DRDA, FFDA, WDC) and financial institutions 25 toilets have been constructed in 3 villages as a part of the environmental sanitation programme. Financial support of 3.5 lakhs has been mobilised for the 5 women's groups from 4 villages through government linkages for taking up income generating programmes.

Training has been imparted to 400 women from 27 villages on aspects such as book keeping, entrepreneurship and various livelihood enterprises. 120 group leaders from 80 groups were given orientation on Biovillage Council formation. A workshop on Biovillages for women's group leaders was also conducted in which representatives from 80 SHGs of Pondicherry and Tamil Nadu participated.

Most of the biovillage SHGs are of mixed type (consisting of members both below and above the poverty line). Government subsidy programmes are however allocated only for

members who are below the poverty line in the group. This has created conflicts among group members and in some cases disintegration of the group itself.

302.4 Support Services

The Biocentre is the hub of the Biovillage movement and since it will be managed by the stakeholders themselves through the Biovillage Council, Biovillage Families will develop a sense of ownership of the Biocentre, thereby creating a social and economic stake in its sustainability and effective functioning.

Activities

The following activities have been introduced through the Biocentre:

- Animal health centre
- Group mushroom production
- Vermicompost
- Fodder
- Horticulture
- Biofertilisers
- Farm machinery
- Technical training in animal health care for village youth and members of the milk co-operatives
- Biopesticide plant
- Soil testing laboratory
- CREMNET trials
- Integrated aquaculture
- Formation of Biovillage Council
- Formation of Village Development Council
- Formation of Self-Help Groups for micro credit and community banking

Demonstrations

The Biocentre will be the focal point of technology generation, testing and demonstration of new crop varieties and hybrids and micro enterprises. The technologies that are introduced by the Biocentre are ecofriendly, economically viable, socially acceptable and employment generating.

Fodder demonstrations: A demonstration fodder plot of size 600 m^2 (15 cents) has been established with 13 different varieties of grass and leguminous fodder to create an awareness about the importance of fodder in milk production and to train the farmers in fodder cultivation. The varieties planted in the plot are Co 1, Co 2, Co 3, Cumbu napier hybrid grass, guinea grass (Co 1 Hawmill), para grass, hamil grass, sunnhemp, cowpea (Co 5), desmanthes, sorghum (Co 27), mulberry, sesbania and glyricidia.

Vermicompost trials: Vermicompost production is done with 6 locally available wastes in the villages namely leaf debris, vegetable waste, pressmud, sugarcane trash, paddy straw and coirpith. These vermicompost pits will serve the purposes of demonstration and training of rural people who wish to start the enterprise as a livelihood opportunity.

Azolla demonstration pits : The *azolla* species *viz., Azolla pinnata, A. microphylla, A. phillicuioides* and *Azolla* hybrid are grown for demonstration cum sale to farmers.

Integrated Aquaculture pond: The aquaculture demonstration pond has 10 cents (400sq.m) area and has been integrated with duck rearing. The fish feed on the droppings and the ducks roost and lay eggs on a thatched shed constructed near the pond.

Mushroom demonstration centre: The mushroom demonstration unit has about 150 mushroom beds which are hung in 3tier "uri" system. The production unit for spawn is being developed.

Horticultural Demonstrations: The demonstration plot for flowers has an area of 5 cents where jasmine (mullai CO2 and malligai) and crossandra (Delhi variety) are grown. The spacing for jasmine is 1.5x1.5m and crossandra is 75x75 cms.

The nutritional (kitchen) garden has 8 plots for seasonal vegetables and one plot for perennial vegetables in a total area of 5 cents.

In the mist chamber (flower nursery) crossandra cuttings are prepared and kept for rooting. In addition jasmine cuttings are in the process of hardening.

In the vegetable nursery raised beds are prepared and sown with vegetables (tomato, brinjal, chillies) for nutritional garden as well as for sale to the farmers of Ramanathapuram Village.

Training

Training on various micro enterprises, micro credit and crop management for the villagers are being imparted. On demand, NGOs and institutions are also being trained in micro credit and community banking and micro enterprises.

Centralised services

Various service facilities such as animal health care centre, biocontrol agents and mushroom spawn production have been provided.

Animal Health care Centre: This centre renders the following services to the villages around the Biocentre: insemination services and treatment, training on animal health care and insemination for rural educated unemployed youth and personnel of milk societies and orientation training for women dairy groups. It is self-sustainable through the charges collected from the owners.

Spawn Production and Biocontrol Agents: It is proposed to establish a spawn laboratory to provide spawn culture to the mushroom producers in the biovillages and a biopesticide laboratory to provide biopesticides like *Trichogramma*, etc., at the Biocentre.

The Biovillage Council

A Biovillage Council is currently being formed from the SHGs, which will provide guidance to the Biovillage Project. It will identify the needs and generate new innovative ideas and develop appropriate services and delivery systems, including training. The main focus of the council will be on the resource poor. All the women's groups, Village Development Councils and farmers' groups in the biovillages will collectively form the Biovillage Council. At the Village level, the Village Development Council will be the nodal structure for dealing with village level problems.

The Biovillage Council will act as a bridge between the rural poor, the Government and the other Institutions. Several meetings have been conducted with the SHGs of the concerned villages and members for the Biovillage Council have been identified and elected.

The Pondicherry Government has proposed to bring all the villages numbering over 250 under the Biovillage Programme. A development plan is being prepared for this jointly by MSSRF and the Government.

Sub Programme Area 303

B V Rao Centre for Sustainable Food Security

The Centre has undertaken various activities in collaboration with other organisations, to achieve the objective of sustainable food security.

303.1 Ramakrishna Bajaj Fellowship and the Tamil Nadu Council for Sustainable Livelihoods

In 1998 the Bajaj family instituted at MSSRF a Distinguished Fellowship known as the "Ramakrishna Bajaj Fellowship for Industry Community Partnership for Sustainable End of Hunger" in memory of Shri Ramakrishna Bajaj, a disciple of Mahatma Gandhi, committed to the end of hunger, and a member of the Global Board of the Hunger Project. The objective of the programme is "to promote symbiotic partnerships between the private and public sector industry and resource poor, tribal and rural families, in the areas of increased food production and improved economic access to food".

Realising that all programmes that address poverty, hunger, food and nutritional activity should be implemented in an integrated manner, the fellowship has been primarily focusing on:

- Designing and implementing projects for rural prosperity, especially those that provide multiple livelihood opportunities with focus on rural women.
- Development of Hunger-Free Area
- Implementation of nutrition based programmes, especially elimination of hidden hunger
- Research on policy imperatives concerning them.

Towards the fulfillment of these objectives and action plans, the Fellowship provides technical help, support and backup services to all programmes, projects and activities of the Hunger Project.

The Tamil Nadu Council for Sustainable Livelihood met on 17 July '99 and discussed the following subjects:

- Hunger Free Area Programme – in Vedasandur by Gandhigram Rural Institute, Deemed University
- Project to eliminate or make a dent on the incidence of silent hunger (micronutrient deficiency)
- Children for happiness – Reduction in nutrition related low birth weight
- Gender issues like declining sex ratio, female infanticide and feoticide
- Getting sex-wise data by suitably modifying the schedules for 2001 population census.

The Vice Chancellor of Gandhigram Rural Institute apprised the Council on the progress

made under the Hunger-Free Area Programme. The Vice Chancellor also said that he plans to cover all the panchayats of Vedasandur Block. He also observed that the panchayat presidents and the gram sabhas have accepted Hunger-Free Area Programme as their own project and participated in all the activities in collaboration with the Gandhigram Rural Institute. The Council reviewed the progress made under the Pilot Project on Silent Hunger funded by FAO. The Council also recommenced a need to study gender issues like declining sex ratios, female infanticide and feoticide and recommended getting sex-wise data for the year 2001 population census. The Foundation agreed to take steps to study the issue critically.

303.2 Hunger Free Area Programme (HFAP)

Operationalising of the Seven Point Action Plan for the Hunger Free Area Programme in Vedasandur Block by Gandhigram Rural University, started last year, was continued. The overall aim of the project is to improve the nutritional status of the ultra poor population with special focus on elimination and prevention of micronutrient deficiency. The strategies include:

- *Identification of the poor*: Identification of rural poor using participatory methods has been completed in 12 hamlets. PRA based baseline survey is available for all the 24 hamlets in Kovilur Panchayat.

- *Information empowerment*: The activities organised under the programme include orientation on the schemes of the government, banks and NGOs; awareness programmes on health, sanitation and environment; orientation to youth and women on various income generation programmes; establishment of rural libraries; AIDS awareness programme; awareness programme on agriculture and allied activities and distribution of booklets containing various government schemes.

- *Elimination of protein calorie malnutrition*: Nutrition education was imparted in all the 24 hamlets. 35 programmes covering 450 women were conducted.

- *Elimination of micronutrient deficiency induced hunger* : Four school gardens have been established with the support of the faculty of agriculture, KVK and the local people. These gardens supply vegetables to the noon meal centres in the schools. Intake of vegetables by the children in the centres has helped in improving the health status of the children. A quick study on the status of the children in HFAP villages (3 villages) revealed that the percentage of children suffering from vitamin 'B' deficiency has come down to 6.67 from the previous level of 20%. Similarly iron deficiency, which was 17.78% earlier, has come down to 4.67%.

  Seeds were distributed to 250 households to raise kitchen gardens. The personnel of KVK and Faculty of Agriculture and Animal Husbandry extended technical consultation.

- *Improvement of biological absorption and retention of food*: Protected water supply is ensured in almost all the project

villages. Smokeless chullahs have been installed in two villages. One village, namely Poosaripatti, has been declared a 'smoke free' village. Medical check-ups have been completed in all the 10 primary schools and a health card is maintained for each child. Awareness programmes on environmental sanitation were organised at periodic intervals.

- *Strengthen the rural livelihood opportunities through SHGs*: Twenty-five self-help groups have been organised. Thirteen of them are women's groups. The total value of the transactions of these groups works out to Rs. 2.25 lakhs. The members of these groups have been given intensive training in different income generation programmes. Important among them are:
  - Training in tailoring and wire-bag making for 120 women
  - Training in sericulture, horticulture and mushroom cultivation
  - Training in pottery
  - Training in cultivation of oil seeds and herbal plants
  - Training in nursery raising and kitchen gardening

Many of the men and women members of the group are gainfully employed. Community nurseries have been established in 5 villages. A study of the feasibility of desilting and reclamation of a chain of 13 ponds has been completed. A proposal has been submitted for reclamation of the tanks.

- *Special attention to women and children*: Women and children are given prime place in the activities. The majority of the participants in the training programme are women. The children get attention through the school health programme.

Other activities

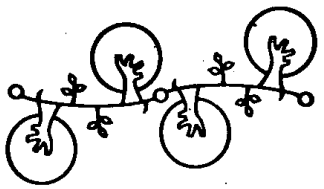
- Three batches of women from the project villages were taken to 20 different types of income generation projects at Gandhigram Trust.
- All the 10 schools in the Kovilur Panchayat were provided with a water drum for storing drinking water through the Rotary Club.
- One school in the project village was provided with furniture worth Rs.10,000 through the Rotary Club.
- One school was provided with a synthetic water tank, the cost of which is Rs. 5,000
- Oil seeds were distributed free of cost to 55 farmers.
- Animal health camps were conducted at periodic intervals.

303.3 Pilot Project for Elimination of Micronutrient Malnutrition in Tamil Nadu

The overall aim of the project is a practical, community-based contribution to the policy of the Government of Tamil Nadu to improve the nutritional status of the ultra poor population,

with special focus on the elimination and prevention of micronutrient malnutrition. This pilot project will cover 15 of the panchayats in the Pennagaram Block of Dharmapuri District. The Government of India's approval of the FAO funded project was received in late January 2000. The Government of Tamil Nadu undertook the preliminary work connected with the project. The National Project Co-ordinator took charge in February 2000. As a TRC for this project the Foundation had developed the framework for the conduct of the baseline survey. The fieldwork was entrusted to the Gandhigram Rural University. The fieldwork consisted of developing two different types of schedules, one on background information, income expenditure pattern, General Health Status, immunisation, health and sanitation, household food consumption etc., and the second schedule on particulars of family members, clinical examination and blood test reports of the population in the selected households. The work was in progress during the year under report.

Programme Area 400



Reaching the Unreached

Significant progress was made in efforts to engender the under graduate curriculum of Agricultural Universities and to mainstream gender considerations in biodiversity management. Also, a gender-sensitive Community Food and Water Security system was developed. A study was made on the relationship between the various components of Early Childhood Education programmes run by government and non-government agencies and the learning competencies of four-year old children. The role of Panchayat leaders in improving the quality of child care services was highlighted, thus paving the way for decentralisation of child care services at the grassroot level. Skills development in street theatre made further progress.

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Sub Programme Area 401

Project ACCESS

Research, capacity building and compilation of information on selected issues concerning the girl child were the areas of focus under the project Operation Resource Support, sponsored by the Bernard Van Leer Foundation.

401.1 Research

Of the three research studies, one was completed and two are nearing completion, details of which are summarised in Table 4.1.

by infants were also recorded. The first draft of the report was critiqued by the Advisory Committee (for the research study) in December '99. Based on the suggestions of the Committee, further consultations have been held with a nutritionist and statistician to finalise the plan of analysis. The report is expected to be ready by August 2000.

Impact of ECE on children

The second study analysed the relationship between the various components of Early Childhood Education (ECE) programmes run by the Government, NGOs and private nursery schools in Tamil Nadu and the learning competencies of four-year-old children. Two

Table 4.1 : ***Research Activities from June 1999 to May 2000***

Theme	Activity	Outcome
Child care practices of mothers and the growth and development of infants in urban slums	Preliminary presentation of results to Advisory Committee	First draft of report
Impact of ECE environment on children's learning competencies	Report completed and presented for critique. Final report being prepared	Research report
Analysis of costs and benefits of ECCD programmes	Workshop on methodology. Study ongoing	Workshop Report Study of costs of ICDS undertaken

The first study concentrated on analysing the results of a survey of 350 infant-mother dyads in thirteen slums of Chennai. Child care practices of mothers with regard to breastfeeding, supplementary feeding, management of illnesses etc. were elicited with the help of a prevalidated questionnaire. Anthropometrical measurements included the height and weight of infants. Developmental milestones achieved

tools, one for assessment of centres and another to assess children's competencies, were developed. The former, known as the Early Childhood Environment Rating Scale (ECERS) developed by Harms and Clifford was modified suitably for the Tamil Nadu situation. The tool, now named TECERS (Tamil Nadu Early Childhood Environment Rating Scale) has been validated by experts, as well as

through the study, and will be published later. Other tools were used to elicit information from teachers and parents. Two teams of trained investigators, for rural and urban areas respectively, were involved in data collection from August to October in Chennai and Dindigul. A five-day review meeting was convened in January 2000 to discuss the preliminary findings and test the data with in-depth statistical analysis. Experts from National Institute of Public Cooperation and Child Development (NIPCCD), Oxford University, U.K. and Gandhigram Rural University attended this meeting and enriched the analysis process. The report entitled *"Quality Matters!"* was prepared in April and a first meeting for critiquing and dissemination of results was held on 28 April. The study found a significant positive relationship between the quality of ECE centres and children's learning competencies.

Costs and benefits of ECCD

The study on developing a costing framework for Early Childhood Care and Development (ECCD) programmes started with the preparation of a discussion paper. Resource materials available within and outside the country were compiled as references. A brainstorming on "Developing indicators for analysing costs and benefits of Early Childhood Care and Development programmes" served as a platform to fine-tune many of the concepts and methodologies to be adopted for developing a costing framework. Around 25 delegates representing the Government, national and international donor agencies, NGOs and academic institutions attended this workshop. Inputs were also received from national and international experts in the field. Sessions on child-related indicators, women, family, community and other stakeholder-related indicators, monetising costs and benefits and an open forum on implications for policy deliberated on the various qualitative and quantitative, direct, indirect and hidden costs and benefits of ECCD programmes.

One of the main outcomes of this brainstorming was the decision to undertake the development of a framework for cost analysis of ECCD programme using Integrated Child Development Services (ICDS) as a model in Tamil Nadu. As a first step, permission was obtained from the Government of Tamil Nadu to make the cost data available. Data collection and analysis are ongoing and the report is expected to be ready by August 2000.

401.2 Capacity Building

The major activities, as presented in Table 4.2 have been training and skills development. As a result it has been possible to develop training courses, theatre productions and videos.

Training methodology

Since January '98, a small group of ECE professionals have been meeting twice a year to develop training programmes. With their support, the in-service summer refresher courses for teachers started in 1997 by the TN–FORCES network have gradually evolved into extended in-service training courses.

Table 4.2 : ***Activities in capacity building***

Activities	Target group	Content	Period	Outcome
Training methodology in ECE	ECE trainers	Review, problem solving and future planning	September 1999 and February 2000	Summer course and a full year schedule planned. New methodologies of working identified
Skills development in communication	NGOs	Theatre skills to address the issue of female infanticide	June 1999	A theme song, three plays and video documentation of the workshop

At the first meeting, the group reviewed the achievements and drawbacks of the 1999 courses and worked on a SWOT exercise. It was found that the main problems were lack of follow-up action and implementation in schools. The need to gain skills in supervision and handling external factors was discussed. During the meeting, the participants devised supervisory strategies with the help of video simulations and role play. They also had the opportunity to study, try out and refine the Early Childhood Environment Rating Scale, which can be used as a tool for advocacy, training, supervision, research, evaluation and accreditation.

The second meeting, which also started with a review, led to further insights about the need for simultaneous efforts at the two levels of institutions and advocacy. The need to deal with the problems of individual trainees and make a breakthrough in successful ECE training was stressed. A series of strategies at both levels was planned. At the same time, it was decided that the coming year's extended course would be developed as a package containing some of these elements, and used to convince the managements of the participating institutions even before launching the course. Three institutions will participate in the extended in-service course this summer, while a fourth is planning to work on another innovative approach, namely, 'tutoring' or 'mentoring' individual schools on a one-to-one basis.

Skills development in street theatre

A week-long skill development workshop was organised in Chennai in July '99 for NGOs addressing the issue of female infanticide in Salem and Dharmapuri districts of Tamil Nadu as an exercise in capacity building. Analysing and documenting the experiences of 70 NGOs who participated in a similar exercise earlier, it was observed that only changes in attitudes and perceptions about the girl child would bring about a permanent change in the situation of women. Therefore ACCESS took up the task of helping the NGOs to move towards this goal by strengthening their capabilities.

Street theatre being a communication strategy used by NGOs in dealing with the practice of female infanticide, the objective of the workshop was to concentrate on various elements of theatre. Music, movement and voice training were explored as different means of communi-

cating powerfully with the audience and evolving newer ways of touching the audience in such a way as to stimulate their participation.

The two distinct features of the workshop were the process and the product. The former enabled participants to develop ideas by drawing upon their own knowledge and experiences and to gain skills in technical areas such as body and voice culture, folk music, movement in space, the link between emotions and movements and transformation of the issues into visuals. As regards the product, the workshop helped the participants to compose a song collectively. They also made three short thematic presentations in three groups, working on three different approaches. The presentations were made before an invited audience who critiqued the performances for both content and skill. The participants plan to put this experience to use in their organisational work. The proceedings of the workshop were video documented and distributed to the participating organisations who might be able to use them as a training device in improving communication skills.

401.3 Action Research - People's Participation in Child Care Services

The role of Panchayat leaders in improving the quality of child care services is of great significance in moving towards decentralisation of child care services at the grassroot level. In this context an action research was undertaken jointly by MSSRF and Gandhigram Trust to orient, motivate and support Panchayat leaders in improving the quality of child care services in Athoor Block. The processes are summarised in Fig. 4.1.

A preliminary workshop was held for Panchayat leaders and women ward members in March '99 in which the importance of the period of early childhood was stressed. A review of available services helped to identify the lacunae. Participants drew up an action plan for improving services.

Over the next few months, after a couple of monitoring visits to gain feedback on activities carried out by the leaders, it was found that while leaders could improve infrastructure to some extent by activities such as whitewashing, installation of electrical connections and providing water supply, mats etc., very little was done to improve the quality of services and obtain community participation, as it involved recurring expenditure for which there was no direct allotment to the Panchayats. The leaders could not perceive their role in improving the government-run centres in the absence of specific directives or funding from the government.

A second workshop was held in December '99 to discuss these observations and to provide orientation with respect to their powers in improving child care services, methods of mobilizing financial resources and raising child care issues in Gram Sabha meetings. A link between the leaders and the District Project Nutrition Officer (DPNO) was also established to help them to work together to attract community participation.

It was found that even with all the inputs received, the leaders were unable to mobilise funds or to liase with the DPNO to initiate welfare projects. Further, the issue of child care was not raised in any of the Gram Sabha meetings. It was very clear at this stage that advocacy for decentralisation of child care services through Panchayat leaders may not be a realistic goal unless there are specific instructions

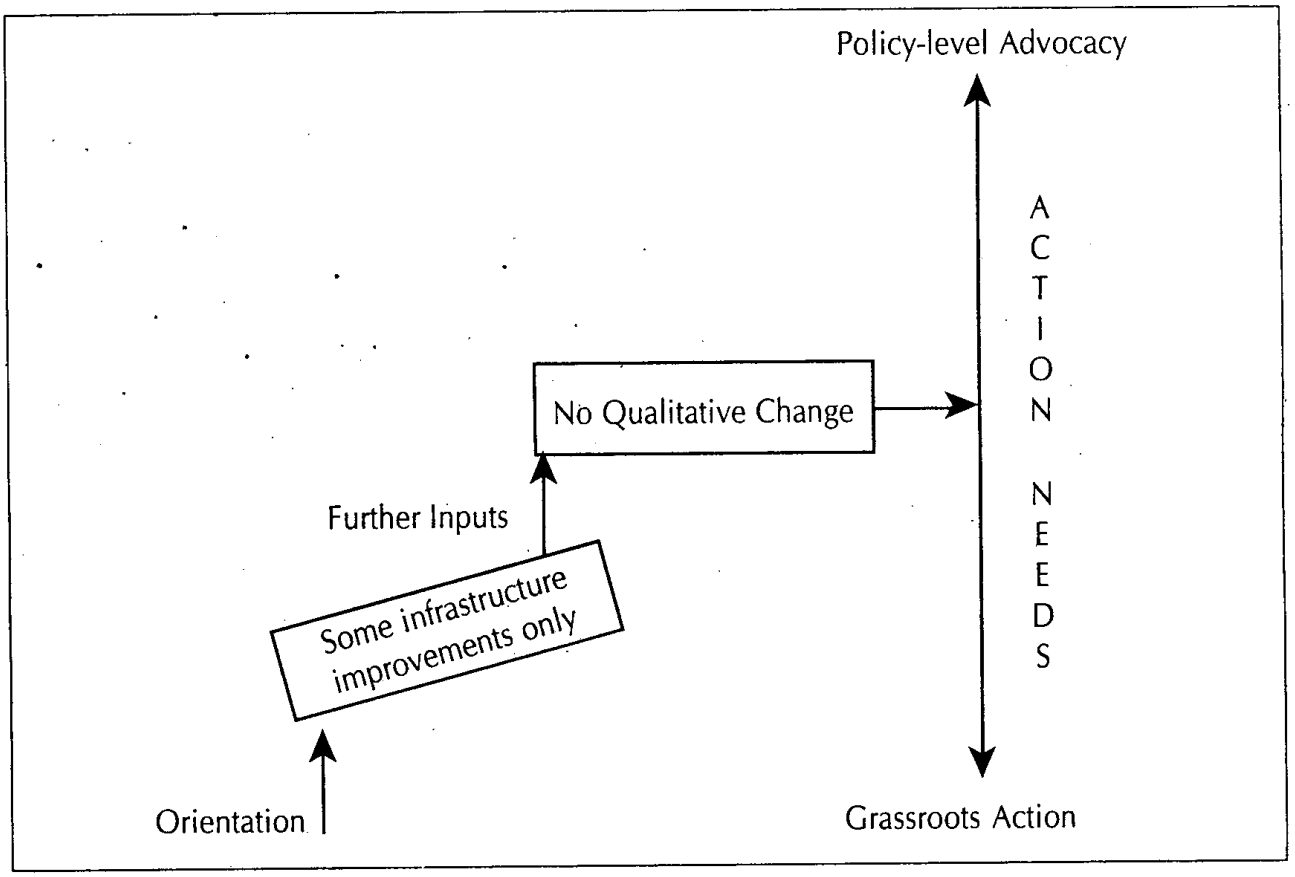


Fig. 4.1 : ***Intervention with panchayat leaders and outcome***

or GOs from the Government, making the involvement of the leaders mandatory and providing funds clearly earmarked for the purpose.

The final strategy arrived at by the end of this exercise was to motivate people's groups such as women's self-help groups and youth clubs to raise the issue of improving delivery of child care services at the Gram Sabha meetings.

401.4 Information Base on Young Children

Developing a photo archive on children below three years of age and compilation of information on the issue of the girl child were undertaken. As a first step in this direction a photo competition was planned and announced in *Dinamani*, a popular Tamil daily. Entries were solicited on three themes, namely, the role of family members in child care, spontaneous activities of young children and the expression of diverse socio-cultural-economic settings in child care. One hundred and forty nine (149) photos were received from thirty-six participants from all over Tamil Nadu. Twenty five photos were short-listed, and a team of three judges comprising a senior photographer, a media representative and an ECCD expert selected the five best photographs on the basis of relevance to the theme and degree of excellence. The selected entries were published in *Dinamani Kathir*, a popular Tamil weekly.

An information base on gender-desegregated data for 0-3 year old children is being developed on the following issues:

- Sex ratio at birth, and at different age levels
- Infant Mortality Rates by gender at different ages
- Health and nutritional status of children by gender
- Gender socialisation

Information on district-wise sex ratio at birth, as also the health and nutritional status has already been collected. Abstracting and indexing of available material within ACCESS has also been completed. The abstract gives details about the title, author, format in which the information is available, length and issues addressed in the material, along with key words, for easy electronic retrieval. A similar exercise is in progress for Tamil materials.

401.5 Other Activities / Events / Participation

Details about participation in other activities are presented in Table 4.3

Collaboration with TN - FORCES

As a member of the Tamil Nadu Forum for Creche and Child Care Services (TN-FORCES) network it was possible to play a major role in the development of an alternative ECE curriculum, described as "activity-based developmentally appropriate and child centred", through a group process led by IAPE (Indian Association for Preschool Education) last year. The Tamil version, formally released in January 2000, was submitted to the Government of Tamil Nadu as a resource for developing preschool curriculum in Government, voluntary and private institutions. The English version was released at the Regional Conference of the IAPE in April 2000, targeting an all-India audience. An effective tool for advocacy has thus been provided in two languages, which the TN–FORCES network is now ex-

Table 4.3 : ***Participation in other events***

Events	Partner	Activity / Theme	Time frame
Faculty Development Seminar	M.S. University of Baroda, Dept. of Human Development and Family Studies (HDFS)	Resource support to staff members on the theme "Theory, research, practice: the feedback loop"	September 1999
Regional Seminar	UNICEF	Paper on Innovations in ECCD	November 1999
Policy Committee Meeting	National Forum for Crèche and Child Care Services (FORCES)	Development of model legislation on Maternity Entitlements, Child Care Fund and Early Childhood Education	May 2000

pected to disseminate actively in the private and voluntary sectors, as part of its campaign for regulation of ECE in all sectors to strengthen the rights of the young child.

Action strategies

Based on the study of the situation of child care workers in Tamil Nadu, an advocacy workshop was held in April '99, following which a Task Force consisting of network members of the TN-FORCES, trade unions, donors and NGOs was constituted. An action plan was developed by a group of 10 institutional members of TN-FORCES in July '99, on the following issues:

- Crèche fund - sources of funding, structure and criteria for funding
- Alternative scheme for crèches and non-institutional alternatives for child care
- Wages and working conditions of child care workers
- Consultation for child care workers

This brief record of activities in sharing and collaboration points to the rich storehouse of experiences and materials now available at ACCESS, and its growing role as a resource centre on issues related to the young child.

Demand for resource materials

There continues to be a regular demand from various sectors for products and resource materials developed by ACCESS. In addition, this year the following materials (Table 4.4) were reproduced by UNICEF and supplied to the Director of Social Welfare at their request for use by the Tamil Nadu Integrated Nutrition Project (TINP).

In June 2000, UNICEF communicated the request of the Director of Rural Development for 15,000 copies of the Tamil booklet *Rights of the mother and child in Tamil Nadu - an overview* for distribution to Panchayat leaders. UNICEF will be responsible for reprinting and supplying the booklet.

Table 4.4 : ***Materials supplied by ACCESS***

Materials	No. of copies
Aadippaadi (Tamil Manual)	12,200
Empowering women to breastfeed (Tamil manual)	2,000
First three years (Tamil Manual)	1,500
Can the girl child survive ? (brochure)	1,500
Thayum seyam (audio cassette)	450
Messages that move (video cassette)	150

Sub Programme Area 402

Uttara Devi Resource Centre in Gender and Development

In its third year, the Resource Centre continued to develop along the two linked lines of Core Activities and Internalisation, according to its mandate. The activities are described in two separate sections.

402.1 Core Activities

Three major policy workshops (Table 4.5) were conducted this year.

Table 4.5 : ***Workshops***

Date	Theme	Target group	Outcome
November 1999	Gender Dimensions in Biodiversity and Food Security: Policy & Programme Strategies for Asia	FAO, Govts. and specialists from nine countries of South and South East Asia	Programmes, policies and strategies to integrate gender concerns in biodiversity management
December 1999	Engendering Undergraduate Agricultural Curriculum	Agricultural Universities and ICAR Institutes	Steps to gender-sensitise the Faculty and engender field work component
February 2000	Targeting Women: Implications for Food Security	UN World Food Programme, State Govts. and NGOs	Gender strategy for WFP and gender-sensitive development models

Biodiversity management

A Regional Technical Consultation on *Gender Dimensions in Biodiversity Management and Food Security: Policy and Programme Strategies for Asia* was held from 2 - 5 November 1999 jointly with the FAO Regional Office for Asia and the Pacific, Bangkok.

The purpose was to explore the linkages between household food security and biodiversity, mediated through gender roles, in a few selected countries in the region. The rationale is that small holding farmer households in this region are the trustees of agro-biodiversity, and the knowledge and strategies adopted to achieve sustainable gains in household food security and conservation of biodiversity are gender-differentiated.

The objectives of the technical consultation were:

- to share case studies and country papers for identification of a common framework and inter-disciplinary approach
- to examine the central concerns and innovative approaches for integration of gender dimensions in bio diversity management
- to identify the policy and programme gaps which act as barriers to the integration of women's concerns in biodiversity management

- to identify strategies and recommendations for national policymakers, programme specialists and researchers and suggest future courses of action
- to evolve recommendations for FAO programming in the area of gender and biodiversity management

The nine countries from the Asia-Pacific region, which participated in the meeting, are Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Philippines, Sri Lanka and Vietnam. Experts, nominees from scientific research institutions and donor agencies were also present.

Recommendations were made at the global and national levels. Global action was to be taken up by the FAO, at the WTO-TRIPS, the World Intellectual Property Rights Organization (WIPO), Conference of Parties to CBD (COP) for setting of an Asian Network on Gender, Biodiversity and Food Security and compilation of country-specific case studies.

At the national level, the following recommendations were made:

- development of national Gender Codes
- gender-sensitive legislation relating to Plant Variety Protection and Farmers' Rights and National Biodiversity Act
- adequate representation to women professionals in Government Departments of Forestry and Environment
- gendered data in the national Census
- gender-sensitive Participatory Forest Management and Community Biodiversity Registers
- mapping gender dimensions of biodiversity management through a survey of published literature
- recasting of passport data maintained by Gene Banks to bring out gender roles

Agricultural curriculum

Last year, the first steps were taken to promote the integration of gender concerns in the curriculum of Agriculture (and related disciplines) at the undergraduate level. This year, the next step forward was taken at a two-day Brainstorming Workshop on *Engendering the Agricultural Curriculum* on 16 and 17 December '99 in collaboration with the Indian Council of Agricultural Research (ICAR) and supported by the Royal Netherlands Embassy, New Delhi and UNIFEM, New Delhi. Senior teaching Faculty from different Agricultural Universities of India and resource persons, including gender specialists, social scientists and pedagogues took part, including Dr. Lisa Price, Associate Professor, Gender Studies in Agriculture, Wageningen Agricultural University, The Netherlands. Dr. R.S. Paroda, Director General, Indian Council of Agricultural Research (ICAR) and Secretary, Department of Agricultural Research and Education (DARE) inaugurated the workshop.

The purpose of the workshop was to develop a methodology for introducing gender into the existing undergraduate curriculum, both in terms of content (the WHAT) and strategies for teaching these topics (the HOW). As far as content goes, some of the topics suggested were: gender concepts, gender roles in agriculture, agrarian structure, trends in development, alternative development paradigms, contemporary problems and varying

needs of different social segments such as agricultural labour, now heavily feminised. As for process, alternative pedagogic strategies of various kinds, more emphasis on fieldwork, gender sensitisation, use of activity-based learner-oriented methods and computer-aided instruction were suggested. Feedback from present and former students of Agriculture was presented informally as a skit and formally in a paper.

Some important recommendations of the workshop were:

- recognition of the need for a fundamental course on gender
- orientation of teachers to the process of engendering
- a national-level Faculty Development Seminar for all Agricultural Universities
- development of a national-level Resource Group in Gender and Agriculture, and a data-base of Resource Persons
- recognition of Rural Agricultural Work Experience (RAWE) as the most effective method of gender sensitisation of students

A Resource Guide comprising the workshop report and suggested resource materials is now available and is being widely distributed.

Food security

A workshop was organised jointly with United Nations World Food Programme (WFP) from 10 to 12 February 2000 entitled *Targeting Women - Implications for Food Security* with the objective of identifying priority areas for formulation of relevant gender-based strategies for the World Food Programme for the period 2003-2005. The workshop, attended by development practitioners, academics, senior government officials, social activists and donor agencies, was spread over six technical sessions dealing with the three important components of food security, food availability, access and absorption. After intensive discussion on key issues, recommendations were made relating to:

- policy
- programme inputs
- capacity building and
- approach to interventions

The workshop emphasised that though India does not require food aid in the conventional sense of the term, steps have to be taken to improve economic access to food. Hence the strategy paper focused on models of development, which address the need. Two of them, the Hunger Free Area Programme and the Biovillage model have already been tested at MSSRF. Other strategic options included improvement of grain storage mechanisms at the village level, development of grain and gene banks at the community level and use of micro-credit to provide external economic support for micro-enterprises. Studies on nutrition programmes and the Public Distribution System were cited, and the paper stressed the need for training at all levels as a key component in ensuring gender-sensitive implementation of programmes.

Research studies

Last year, it was decided to initiate a programme of inviting Visiting Fellows to the Resource Centre every year to work in an area of their choice, related to the mandate of the

Centre. This would provide an opportunity to collaborate with distinguished scholars in various disciplines and at the same time enrich the Foundation's research base. It was decided to restrict the choice of themes to one of the following: Gender and Biodiversity, Gender and Agriculture, Gender and Livelihoods / Environment.

The first Visiting Fellow under this scheme is Dr. Shubh Kumar-Range, a distinguished scholar specialising in the areas of nutrition, economics and gender, and with a long record as a researcher, development consultant and gender analyst. Intrigued by some of the findings and insights arising out of MSSRF's several interventions in the Kolli Hills region of Tamil Nadu, Dr. Shubh Kumar-Range has taken up a research study entitled *Development and Change in Local Institutions and Gender Roles: A case study of Kolli Hills,* the purpose of which is to study the process of change in local institutions (formal and informal) as they interface with policies, programmes and organisations. Changes in institutions related to gendered participation in economic processes and transactions involved with resource use and human capital formation form the focus of the study. A comparison of alternative approaches for promoting the status and effective role of women in development is expected to help in the design of MSSRF's community-based interventions.

The field work for the study, which is being undertaken in collaboration with the JRD Tata Ecotechnology Centre, was carried out during February-April 2000. The draft report is ready by June 2000 and the final report will be submitted by August 2000.

402.2 Internalisation of Gender Dimensions

This parallel activity of the Resource Centre received as much attention as the Core Activities. The process of internalisation, which is already in action, was reviewed and strengthened.

Gender advisory committee

In October '99, the Gender Advisory Committee was set up to advise the Executive Director and management on gender issues. The Committee, of which the Hon. Director of GENDEAVOUR is the Chair, functions in the consultative mode and has no administrative responsibilities.

At its first meeting, the Committee prepared a note on two aspects of policy - internalisation of the gender dimension in all projects and gender-sensitive personnel policies. Regarding the former, it recommended that internalisation should be implemented at four stages in every project :

- proposal writing, planning and budgeting
- recruitment, exposure, orientation, training and sensitisation of staff
- implementation and monitoring, and
- impact assessment, evaluation and audit

As for the latter issue, as a personnel policy already exists at the Foundation, it was felt that more thought need be given and suggestions offered to make the personnel policy and work culture norms more gender-sensitive. The recommendations of the Gender Advisory Committee are being institutionalised.

Gender concerns forum

A need was felt for a regular Forum for sharing of concerns, queries, information and experiences relating to gender in all programmes, and for expressing needs for training, resources and information. With this objective, a Gender Concerns Forum has been set up. The first meeting was held on 21 April, during the Annual Review. The basis for discussion of gender concerns was a set of five questions which participants discussed in project-based groups. Several suggestions and plans emerged, including

- the need for separate brainstorming on topics like the gendered nature of indigenous knowledge, Human Resource Development (HRD) and problems associated with Women's Biotechnology Park
- specific plans for training camps or 'retreats' for different groups where gender and related issues could be taken up.

Capacity building

Several training programmes were held to assist capacity building as part of the internalising process.

Staff training : A series of workshops on gender aspects of fieldwork have been held for the staff from all the three field sites of the project CONESUB (Conservation, Enhancement, Sustainable and Equitable Use of Natural Resources) since September 1998. The third in the series was held in January 2000 at Jeypore in Orissa. In keeping with the themes of orientation to gender concepts in the first workshop and field skills in gendered data collection in the second, this one focused on gendered analysis and interpretation of data, resolution of conflicts arising from implementing gender concerns and enhancement of qualitative research skills. The next one, the last in the present series, which is to be held towards the end of the year, will concentrate on impact evaluation and gender audit.

In July 1999 a workshop was held for the staff of Biovillages to review the progress made in setting up the Biovillage Society and provide practice in the skills needed to work with women's groups in the preparatory phase. Later a unique two-day gathering of SHGs (Self Help Groups) was held in Pondicherry in December 1999. It brought together SHGs formed by the Biovillages project with others launched by other NGOs from all over Tamil Nadu. The first day gave the visiting groups an opportunity to get acquainted with some of the bioresource-based activities of the local SHGs, and to share experiences. In the course of the structured group discussion on the second day, the women were able to compare and contrast their experiences and learn from each other. They found that the Biovillages SHGs were stronger with regard to the development of economic enterprises handled collectively, while many of the others were stronger on thrift and credit. This discovery by exploration, reported in the final session, was a mutually enriching process and provided new ideas and renewed motivation for all.

Training capacity : To strengthen in-house training capacity as well as to utilise existing capacity, a plan is being developed for staff training and orientation for the year. Towards this end, resource materials like case studies, inventory of resource persons and documentation already undertaken by the staff, are being

collated and field level training 'camps' or 'retreats' for two groups have already been planned. The Gender Concerns Forum, which is expected to be held two or three times a year, is itself part of the process of capacity building. It is expected that this internal capacity will also be drawn upon to assist GENDEAVOUR in the external demand for training and sensitisation, which is already evident.

Social and gender audit

Following up last year's efforts in developing a tool for gender and social audit through participatory techniques, the JRD Tata Ecotechnology Centre invited the same resource person to conduct an external audit of the Seed Village project in Kannivadi. This project is currently moving from its initial three-year phase to a withdrawal phase, where the local partners will be playing a predominant role with MSSRF playing only a supportive role. This is also the first project to go through such a formal gender audit. The report was shared at one of the weekly seminars and is available in print. It is expected to provide a useful model for other projects, several of which are planning to take up gender and social audit in the coming year.

Sub Programme Area 403

Voicing Silence

This year, the major activity of *Voicing Silence* was a project combining two of its basic aims, namely, to help give voice to different communities of women, and to produce a play on a gender theme. These two aims coalesced in working with professional women stage artists in popular traditional theatre forms of Tamil Nadu. A group of eleven women who had earlier taken part in an all-woman play in the *koothu* style, directed by P Rajagopal under the auspices of the *Kattai Koothu Kalai Vallarchi Munnetra Sangam* were, along with some others, identified as the focus for KULAVAI '97, which brought them together to share, document and exchange views on their performing styles and professional work as well as on their lives as women. The relationship with *Voicing Silence* which began then, culminated in this year's innovative play, in a style fusing contemporary gender and artistic concerns with traditional forms, by drawing on both the performers' professional skills as artists and their perceptions as women.

Play within a play

The play was developed in a collective process which began with a 2-day workshop in which a group of twelve women from Chengalpattu and adjacent districts, who work in the genre known colloquially as *Novels* participated. They spoke about their problems as women artists, the inextricable linking of their personal and stage lives, the representation of women on the stage, the evolution of their art form in the last three decades, and the now almost-forgotten rich tradition of which they are oral repositories.

Dr K A Gunasekaran, Professor, School of Drama, Pondicherry University, himself a folklorist, musician and dramaturge, was invited to develop and produce a play based on this material, interweaving it with one of the classic plays of Sankaradas Swamigal, *Pavazhakkodi* (based on a Mahabharata tale). The outcome was a script that works at two levels, moving

from a realistic portrayal of the behind-the-scenes life of the performers, seen from a contemporary gender perspective, to the actual text, lyrics and tunes of the original musical play. The off-stage story with its rough and ready colloquial usage and sharp comedy provides a contrast and an ironic commentary on the patriarchal values and social structure which dominate the lives of both the Mahabharata characters and the actors of today. Reversing the tradition of *penn vesham* (female impersonation) the all-woman group plays both male and female characters, with several quick costume changes, on a two-level stage. The play constantly shifts between two worlds, fusing lives, dreams, performances and values; while the performers, skilled in music, acting, comedy, farce and melodrama, are able to subvert the dominant ideology, stubbornly living out their lives and the 'tradition' through tongue-in-cheek acting and sharp satire.

Since the performance season for the various theatrical / repertory companies to which the twelve women belong runs from mid-January to October, the period for which they were available as a group for rehearsal and performance was very brief. Only four performances (Table 4.6) could be held before the start of the busy season in March, but more are planned for the next winter season.

The play which received very favourable notices in both the Tamil and English press, was appreciated by both small-town and metropolitan audiences and invitations to perform are still coming in. The performance has been fully documented on video and there are plans to publish the text to make it available to a wider community of performers. Most importantly for *Voicing Silence*, the project has been able to raise the self-esteem, self-confidence, professional reputation and off-season earnings of traditional women performing artists.

Documentation

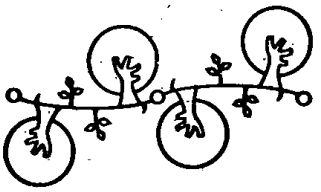
The video documentation of last year's play, *Avvai*, and the workshop, KULAVAI '99 were edited and made into appropriately shaped videos of 40 minutes and 59 minutes respectively. A complete 90 - minute video documentation of *Pavazhakkodi* as an innovative drama has also been made. With this, *Voicing Silence* now has a collection of seven videos documenting various aspects of work in gender, theatre and development. These are regularly in demand and used by students, activists and others. A brochure cataloguing them is available at the Foundation.

Table 4.6 : ***Performances of Pavazhakkodi***

Event	Place	Sponsor	Date
India Festival	Pondicherry	Department of Art and Culture, Government of Pondicherry	27 December 1999 *
Arangetram (Debut)	*Chennai*	*Voicing Silence*	*8 January 2000*
Tamil Theatre Festival	Thanjavur	Department of Drama, Tamil University	7 February 2000
South Indian Theatre Festival 2000	Kanchipuram	Tamil Nadu Kattaikkuttu Kalai Valarchi Munnetra Sangam	7 March 2000

* Cancelled at the last minute due to the death of the late President Dr S D Sharma

Programme Area 500



Education, Communication, Training and Capacity Building

The digital revolution initiated in Pondicherry villages through a computer and Internet aided and community controlled and driven Knowledge Centre programme began to attract national and international attention. This programme has shown the power of new information and communication technologies in accelerating the pace of progress in reaching the unreached and including the excluded in terms of information, knowledge and skill empowerment. Several seminars, workshops and training programmes were organised during this year. ***The Hindu*** *Media Resource Centre is developing into a powerful forum for interaction between scientists and media professionals.*

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Sub Programme Area 501

Workshops and Conferences

During this year, a number of workshops and conferences at the international and national levels were held on themes that are directly relevant to the activities of MSSRF. Over the years, the diversity of partners in organising workshops has been on the increase, while the quality of discussions and output has been maintained at a high level. Workshops/Conferences of national or international scope and participation are presented in Table 5.1. The recommendations of many of these are reported in various Sub-Programme Areas, while some are reported here.

Technical Consultation on Integrated Natural Resources Management in Coastal Areas (26 July 1999)

A technical consultation on "Integrated Natural Resources Management in Coastal Areas" was organised by the Foundation in collaboration with the Nuclear Power Corporation of India (NPCIL) on 26 July '99 at the MSSRF, Chennai. The purpose of the meeting was to evolve practical methodologies for effective use of the natural resource base and ways and means to link them with the livelihood security of the fishing and farming communities in the Kudankulam region. It was also intended to develop a technical consortium for effective eco-management in coastal areas in general, and in Kudankulam in particular. Forty-two participants with a wide range of expertise in natural resource management and community participation attended the meeting. The technical consultation was inaugurated by Dr R Chidambaram, Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, Govt. of India. Shri R M Lala, Director, Sir Dorabji Tata Trust presided over the inaugural session. Dr Y S R Prasad, Chairman and Managing Director, NPCIL also participated in the consultation.

Various technical presentations made by the experts representing soil survey, land use planning, social forestry, living aquatic resources, GIS and remote sensing applications and subsequent discussions described the enormous pressure on the natural resources supporting the livelihood security of the coastal population. It was clearly felt that technical and technological interventions are necessary in addressing the problems associated with natural resources management, crop productivity and livelihood security in these regions. Participatory management and conservation of natural resources are key factors in realising the sustainable development of these regions. Harmonisation of indigenous knowledge, local skill, utilisation of local resources and empowerment of the local community are essential factors in achieving a holistic development of the coastal region. Addressing the issue of common property resources is also vital for planning and implementation of developmental interventions. The presentations made during the discussions also described the technical capability of various research institutions in addressing and mitigating the problems in the coastal region. However, it was also realised that not enough has been done to transfer the technical know-how to implementable do-how. Also, we need to translate our data rich status to action rich implementation programmes.

Table 5.1 : ***Conferences / workshops held during 1999 – 2000***

Title	Associates/Sponsors	Dates	Details in
Technical Consultation on Integrated Natural Resources Management in Coastal Areas	DAE	26 July 1999	SPA 501
Launch of the National Association for Agribusiness Development	CFTRI, Mysore CIDA (Delhi office)	10-11 Sep 1999	SPA 301
Cost Benefits of Early Childhood Development in Tamil Nadu	—	30 Sep–1 Oct 1999	SPA 401
Gender Dimensions in Biodiversity Management	FAO	2-5 Nov 1999	SPA 402
Consultation on Priority Issues	World Food Programme	16-19 Nov 1999	SPA 303
National Workshop on Biovillages	UNDP	29 Nov–1 Dec 1999	SPA 302
Travelling Workshop on Ecotechnology in Tropical Monsoon Asia	Kyoto University	11-18 Dec 1999	SPA 501
Engendering the Agric. Curriculum	ICAR	16-17 Dec 1999	SPA 402
Knowledge Technologies for the Small Farmer in Asia	Kyoto University, SCOPE & Commonwealth of Learning	19-20 Dec 1999	SPA 501
Targetting Women : Implications for Food Security	World Food Programme	10-12 Feb 2000	SPA 402
Dialogue 2000: Biovillages and Community Banking	Union Min. of Rural Development; UNDP	17– 18 Feb 2000	SPA 501
Workshop on DNA-markers	Genetics Congress Trust	18 Feb 2000	SPA 501
DNA Technology & Management of Biodiversity	Centre for Cellular and Molecular Biology	20-21 Feb 2000	SPA 501
Environmental Mutagenesis - Challenges in the New Millennium	Environmental Mutagenesis Society of India	1– 3 Mar 2000	SPA 501
Project Design Workshop on Integrated Natural Resources Management for Food Security & Environment Quality	Sir Dorabji Tata Trust; Ohio State University	22 –24 June 2000	SPA 501
Project Design Workshop on Benefit Sharing under Provisions of the Convention on Biological Diversity	UNDP/Global Environment Facility	28-30 June 2000	SPA 501

Discussions with specific reference to the Kudankulam and adjoining areas indicated the severity of natural factors and their impact on the ecosystem. The landscape has the appearance of a desolate plain with low relief features and sparse vegetation. The slope is gentle and towards the east from the Western Ghats. In Kudankulam and adjoining regions, the observations are as follows:

- low rain fall and poor soil conditions are the major constraints for crop production
- though the average rainfall is around 750mm, it is very erratic and unpredictable, leading to frequent crop failures
- texture, depth, calciferousness and salinity/alkalinity are the major soil factors affecting the productivity of the soil
- salinity/alkalinity is moderate to severe in most parts of the low lying areas
- land suitability assessment showed the major constraints encountered for selected crops grown in the taluk
- most of the area is only marginally suitable for field crops

An action plan for integrated natural resource management for the Kudankulam region was evolved on the following lines :

- Documentation of resources status and changes in course of time
- Augmentation of physical resources inventory : soil, water, agriculture, socio-economic conditions

The approach in developing and implementing such an action plan should be based on participatory planning and management of community and natural resources. Specific importance should be given to demonstration programmes integrating various ecotechnology options through a biovillage approach. The demonstration programme should include growing mutant cultures of groundnut and pulses, especially short duration types. Available options for bioremediation of saline soil should also be undertaken in the demonstration models.

It was also pointed out that relevant expertise is available at various levels to implement the action plan. One of the highlights of the technical consultation was that the participants suggested the formation of a *National Consortium for Integrated Natural Resources Management in the Coastal Areas*. The collaboration in such a consortium is envisaged to be based on both cost free and cost sharing basis. Providing technical expertise through consultations and demonstrations would be given prime importance.

National Workshop on Biovillages
(29 Nov–1 Dec 1999)

National Workshop on Biovillages : a human centered pathway to sustainable agriculture and rural development, was organised from 29 November - 1 December '99 at Pondicherry. The UNDP, Government of India and Government of Pondicherry supported it.

Her Excellency Lt. Governor of Pondicherry in her inaugural address commended the work being done in the Biovillage programme and added that the Foundation can be a source of guidance to a number of NGOs and government departments. She called upon the NGOs to actively participate in the

governmental programmes that target the poor. Delivering the Keynote address Dr. Swaminathan called upon the NGOs to join hands in the alleviation of rural poverty instead of working in isolation. He proposed the conversion of over 250 villages into Biovillages by 2007 (the 60th year of Independence). The Government of Pondicherry could develop this plan in collaboration with the Foundation. Dr R Padmanabhan, the Development Commissioner of Pondicherry, detailed the achievements of the project and called for a more synergistic action of various organisations in the alleviation of poverty. Mr B Radhakrishnan, Programme Officer, UNDP and Ms. Rekha Kochar, Programme Officer, FAO also participated.

The workshop was attended by a number of NGOs, Government depts. of Pondicherry, research institutes, universities and financial institutions. The outcome of the workshop was :

- The initiation of a National network on Biovillages and Community banking
- Constitution of a team of experts to work in collaboration with the Government of Pondicherry in developing an integrated and holistic plan on the concept of the biovillage project, to be replicated in all the villages of the Union Territory of Pondicherry by the year 2007
- Developing and refining a Toolkit on Biovillages.

The workshop concluded with a field visit to the Biovillages and Information villages of the Foundation.

Travelling Workshop on Ecotechnology in Tropical Monsoon Asia : a Comparative Study of Mekong Delta (Vietnam) and the Kaveri Delta (India) (11-18 December 1999)

The MSSRF has used on-site workshops of multidisciplinary groups of experts to conduct comparative assessments of the state of natural resources. (Such workshops were organised in assessing the status of mangrove forests in Southeast Asia in 1992-93 and were found to be quite effective). The Centre for Southeast Asian Studies, Kyoto University, the Mekong Delta Institute, University of the Can Tho and the MSSRF came together to orgainse a travelling workshop to compare the potential for introduction of ecotechnologies in the Mekong and Kaveri delta regions. The programme was led by Prof Yoshihiro Kaida of Kyoto University, and had as members Prof Koji Tanaka (Kyoto, Japan), Prof Vo Tong Xuan (Can Tho, Vietnam) Prof Jitt (Chiangmai, Thailand) and Prof Salim (BAU, Bangladesh) with Dr K Balasubramanian serving as convenor of the Indian segment. The team spent 6 working days in and around Kilamanagudi village where the work on IIFS is taking place (SPA 301). There were visits to farmers' plots, irrigation works and to research institutes in the Kaveri delta region. There were also extensive consultations with the farmers in the area who have low-input methods in farming. The MSSRF group prepared and presented four working documents to this workshop covering different aspects of rural development in the area. The key recommendation of the group related to building up plot level soil taxonomy maps that combine traditional understanding with nutrient analysis data. The continuity in tradition was appreciated as a strong point.

Knowledge Technologies for the Small Farmer in South and Southeast Asia (19-20 December 1999)

The combination of developments, such as globalisation of trade, the World Trade Agreement and the unanticipated rate of the spread of information technology, present a confusing picture for the survival of the small and marginal farm families in South Asia. The MSSRF has always stressed the need to take advantage of these developments as opportunities to build a sustainable basis for agriculture. There is a need to interpret and build contemporary knowledge practices for rural poverty alleviation, as knowledge of every kind counts as capital. On this understanding, the MSSRF brought together a group of experts from India, Bangladesh, Sri Lanka, Malaysia, Thailand, Vietnam, Japan, Canada and France, with expertise spanning agronomy and irrigation to distance education. This meeting coincided with the end of the travelling workshop (referred to above), and had the participation of the Scientific Committee On Problems of the Environment (SCOPE), and the Commonwealth Of Learning (COL).

The workshop started with a set of overviews and case studies on the potential for the diffusion of knowledge-intensive ecotechnologies in Asia and the capacity of the IARCs under CGIAR to install or deliver requisite knowledge systems was discussed. The role of distance learning in such a process was considered in detail. Prof Y Kaida (Japan), Prof K Tanaka (Japan), Prof Vo Tong Xuan (Vietnam), Prof Francesco di Castri (France), Dr V P Fichelet (SCOPE/ICUS), and Prof Raj Dhanarajan (Commonwealth of Learning) conducted the sessions along with Prof M S Swaminathan. The recommendations and proceedings will be published in electronic form. As a result the Asian Ecotechnology Network has been redefined in its scope, and will function under the overall guidance of Prof Swaminathan and Prof. Kaida.

Dialogue on Biovillages and Community Banking (17-18 February 2000)

The biovillages project has been promoting a paradigm of development that is pro-poor, pro-nature and pro-woman. The orientation of this paradigm and its approach to technological choices has attracted wide notice. The changing phase of this project, with the biocentre becoming a hub in an overall sense, has been described in detail in SPA 302. One major outcome of a pre-terminal workshop (Nov. 99) of the biovillage project in its current phase of UNDP support related to strengthening the link between the micro credit and community banking paradigm and the biovillages programme. The deliberations on the Gulf of Mannar project (SPA 103) gave rise to a programme that seeks to use the biovillage methodology in the conservation and management of a biosphere reserve (BR) with strong linkages to micro credit and community banking approaches.

The Annual Dialogue 2000, therefore, focused on the broad topic of biovillages and community banking, with an orientation towards integrating these approaches for the sustainable management of BRs. A new paradigm of participatory management of BRs is expected to emerge, much as the paradigm of joint forest management emerged in the seventies by integrating social concerns and improved forest management practices.

Mr Ajit Banarjee, in whose forest division JFM was introduced for the first time in this country, delivered the inaugural address at the Dialogue. Hon. Mr Digvijay Singh, Chief Minister of Madhya Pradesh, participated in the Dialogue as a distinguished policy maker in whose State are located the largest number of BRs in the country. The other distinguished participants included Dr Guy Sorman (Adviser to the President of France), Prof Peter Raven (President-Elect, American Association for Advancement of Science), and Dr D P Rao (Director, National Remote Sensing Agency). Senior representatives from the DHAN Foundation, and BAIF, known for their excellence in generating micro credit paradigms, participated in the Dialogue.

A National Network on Community Banking and Biovillages has been launched, with the MSSRF serving as the co-ordinating agency for the network. (The guiding principles for the MSSRF Community Banking programme are given in the box).

National Consultation on Application of DNA Markers for Crop Improvement: Issues & Perspectives (18 February 2000).

Advances in the field of Molecular Biology and Biotechnology, over the last two decades, have provided new insights into the structure of the genome. The new science of "Genomics" provides direct information on the sequence, function, activity, position and grouping of genes on the chromosomes. The new developments in the field of molecular biology have given rise to systematic, high-throughput, whole-genome sequencing and associated activities, such as development of molecular markers for detecting the presence of genes or groups of genes directly by genetic linkage. The genomes of economically important plant species are being mapped through international collaborative efforts. Such information will help to improve the speed and accuracy of breeding new varieties of plants with improved performance traits. It will also support the production of

Guidelines for community banking

- Organise Self-Help Group (SHG), based on either a single enterprise (e.g. mushroom, aquaculture, vermiculture, seed production, etc.,) or a basket of enterprises based on both on–farm and non-farm activities.
- The single enterprise or enterprise-mix must be based on market demand and economic, ecological and social sustainability.
- Based on the enterprise chosen, the group may consist of either only women or a combination of women and men.
- The groups will consist essentially of women and men belonging to ultra-poor families (based on Gandhiji's *antyodaya* principle) but may also include, depending on the nature of the enterprise, marginal and small farm families. Social inclusiveness, rather than social exclusion, will be the motto for the asset building and community development activities.
- Credit limits will be set by each SHG based on the needs of the enterprise.
- Interest rates and recovery schedules will be fixed by members of the SHG.
- The SHG will maintain proper accounts and monitor recovery.

transgenic plants with improved performance characteristics not attainable by current breeding technology.

It is urgent to discuss the issues involved and take appropriate measures, particularly because biology is witnessing a rapidly expanding revolution. It was in this context that a National Consultation on "Application of DNA Markers for Crop Improvement : Issues and Perspectives" was organised at the M S Swaminathan Research Foundation in collaboration with XV Genetics Congress Trust. This consultation was inaugurated by Prof Peter Raven, Director, Missouri Botanical Gardens, St. Louis, USA and was attended by a number of leading experts in the field of DNA technology and crop improvement. The consultation addressed major issues such as:

- Defining a variety in the context of mating systems, genetic structure of varieties/ hybrids/ populations; emerging concepts of essentially derived varieties
- Requirements for valid application of DNA technology for varietal identification
- DNA chips and their application in variety characterisation, scanning the functional components of the genome; gene expression-based variety identification
- Relevance of developing appropriate statistical concepts and softwares for their elucidation and application
- Implications of emerging DNA technologies in the context of intellectual property protection and biosafety issues

As an outcome of the meeting, a broad consensus was evolved in relation to defining a strategy for application of DNA markers, sampling methods, DNA technology, statistical tools and ethical concerns.

Silver Jubilee Conference on Environmental Mutagenesis: Challenges for the Next Millennium (1-3 March 2000)

The Environmental Mutagenesis Society of India (EMSI) founded in 1975 has been in the forefront for the last 25 years in deliberating on issues related to environmental mutagenesis and carcinogenesis. On the completion of 25 years of its operation, EMSI chose "Environmental Mutagenesis : Challenges for the Next Millennium" as the theme for the Silver Jubilee Conference and this was organised at the M S Swaminathan Research Foundation, Chennai from 1-3 March 2000. The conference deliberated on topics ranging from fundamental mechanisms at cellular and molecular levels to socio-economic and ethical implications and consequences.

126 participants attended the conference. There were 53 oral presentations and 56 poster presentations. The conference was inaugurated by Prof P Rama Rao, Vice-Chancellor, University of Hyderabad and Chairman, Atomic Energy Regulatory Board. The invited speakers included A T Natarajan, Leiden; S Knasmuller, Vienna; T Nomura, Japan; A van Zeeland, Leiden; G Bronzotti, Italy.

Project Design Workshop on Integrated National Resource Management for Food Security and Enhancement of Environment Quality (22-24 June 2000)

This workshop was organised jointly with the Sir Dorabji Tata Trust and the Ohio State University. Workshop participants numbering

20, included leading experts from India and USA in agronomy, soil science, remote sensing, water management and ecotechnology. The purpose was to arrive at a collaborative, multi institutional project that would generate a set of natural resource management practices in dryland farming, both to enhance farm productivity and environment quality. The experts from the Ohio State University were led by Prof Bobby Moser, Vice President of the University. The Indian experts included Dr D P Rao, Director of National Remote Sensing Agency and from DHAN Foundation, working on community-based approaches to renovation of traditional sources of irrigation. Outlines of a project have been identified.

Project Design Workshop on Benefit Sharing under Provisions of the Convention on Biological Diversity (28-30 June 2000)

The Foundation has been active in promoting efforts to gain legal sanction for the concept of farmers' rights in relation to utilisation of plant genetic resources. The concept is gaining ground, and major enactments, such as the Bill in India (see *Chairman's Introduction*) are in the offing. There is a need to identify methods and standard procedures by which such legal sanction can be converted into incentives to the farmer-conservers. This workshop was an effort to formulate a project that will identify such procedures from ongoing local level practices all over the world. The workshop had participants from Latin America and Asia, UNDP and the CGIAR. It was supported by the Global Environment Facility.

* * *

As part of the conferencing and seminar activities, meetings were organised to celebrate important occasions. On 8 March 2000, a meeting was organised on the occasion of the International Women's Day where the issues of engendering agricultural curriculum, and women and food security were discussed. The discussions were based on the outcome of two workshops held earlier on these themes (SPA 402).

A function to celebrate Earth Day (22 April 2000) was organised, at which the Hon. Mr T R Baalu, Union Minister for Environment and Forests, was the Chief Guest. The Hon. Minister dedicated a Sacred Tree Park in the campus of the Foundation, which has been designed by Mr M A Parthasarathy, Chairman of the Wilderness Trust.

The National Technology Day celebration was organised on 11 May 2000. Biotechnology was the theme of the meeting, and fostering biotechnology-based enterprises was discussed, in the context of the Golden Jubilee Biotechnology Park for Women (SPA 209). Participants included both professional scientists and women entrepreneurs.

Sub Programme Area 502

Training Programmes

Over the last 10 years, the MSSRF training programmes have been tightly integrated with the research and development programmes, reflecting the emphasis given to capacity building and human resource development as components of participatory research. The nature and type of training varies: farmer-farmer; expert-farmer; expert-expert; expert-policymaker. These span the entire spectrum of programme areas. In Table 5.2, a digest of such programmes

is provided. An example of both the diversity and intensity of training is provided from the programmes of the J R D Tata Ecotechnology Centre (Table 5.3; also in SPA 301)

The MSSRF has been granted recognition by the University of Madras and Anna University as a post-graduate centre for conducting research leading to Ph D degree. As of June 2000, sixteen scholars are working full time towards their Ph D degrees, mainly in the programmes related to biodiversity, biotechnology and ecotechnology. Exchange of scholars took place between the University of Bologna, Italy and the Foundation, while research students have been at Cornell University and the International Rice Research Institute for carrying out advanced research on a collaborative basis. A number of young scholars were encouraged to participate in national and international conferences to promote their professional growth. Young researchers from the University of Southern California, Cornell University and the Princeton University have been accepted as visiting scholars. The World Food Prize interns are regularly placed in the Foundation for short periods of upto 12 weeks.

Table 5.2 : ***Major training programmes during 1999-2000***

Programme Area	Topic of Training	Site/Location	Participants	Details in
Coastal Wetlands	Micro credit	Project sites in 3 states	Rural families	SPA 101
	GIS	Andhra	Forest Staff	SPA 101
Biodiversity	Conservation methods for local area	3 sites	NGOs	SPA 201
	PPB	2 sites	Rural families	SPA 202
	Agro-biodiversity	3 sites	Rural youth	SPA 204
Ecotechnology	Precision Farming	1 site	Bank officials Rural families	SPA 301
	Biopesticide Prodn.	1 site	Rural families	SPA 301
	Aquaculture	1 site	Rural families	SPA 301
Biovillages	Biopesticide Prodn; Hybrid seeds prodn; Aquaculture	Biocentre, Pondicherry	Rural families	SPA 302
	Micro credit; Element of health diagnosis for cattle	Biocemtre, Pondicherry	Rural families	SPA 302
ACCESS	Impact of Early Childhood Learning Centres on Childhood Learning Outcomes	1 site	Field Investigators	SPA 401

Table 5.3 : ***Training programmes in the J R D Tata Ecotechnology Centre (1999-2000)***

Training	Trainee Days
Quality Seed Production Management and Wasteland Development	7,050
Integrated Intensive Farming System and Ecoaquaculture	650
Minor Millet Production and Marketing	850
Biopesticide Production	280
Self-Help Groups and Micro enterprises	126
Micro enterprise	300
Precision Farming	1,184
Training to the field officers of government departments	86
Intensive Training of B.Sc. Forestry Students from North Eastern Institute for Science and Technology	300
Total	**10,826**

Sub Programme Area 503

Knowledge System for Sustainable Food Security

This programme emerged from the series of discussions and dialogue (notably the Dialogue on Information Technology - 1992 and the World Science Academies Summit on Food Security – 1996) that focused on the need to use emerging communication technologies in advancing sustainable food security. A project was initiated in Pondicherry about 2 years ago, which showed that value addition to generic information is indeed a critical step in the use of contemporary networks for rural development. Based on this experience, the programme in Pondicherry has been consolidated, and is in the process of being expanded. In addition, a project has been launched in the Dindigul region (Tamil Nadu), while plans to launch a similar project in Orissa are in an advanced stage. This project will also be launched in the Gulf of Mannar region (see SPA 103) as part of the programme to promote alternative sources for livelihood security in the area.

Programme in Pondicherry region

Village knowledge centres (earlier termed "information shops") have been set up in five places other than Villianur where it was first introduced. The locations are Kizhur (21 km west of Pondicherry), Embalam (19 km southwest), Veerampattinam (13 km south), Poornamkuppam (17 km south) and Pillayarkuppam Biocenter (9km north; see SPA 302). An MoU has been signed with the village communities and is renewed every year. Violation of MoU led to closure of two village centres other than the ones listed above. Gender sensitivity is built into all the operations. The gender composition of volunteers is as follows: Kizhur – 1M:1F; Embalam – 4F; Veerampattinam – 2F:1M; Poornamkuppam 2M: 1F; Pillayarkuppam –2F. The rural volunteers were given training in PC operations, as summarised in Table 5.4

Table 5.4 : ***Training of volunteers***

Average time for gaining familiarity with basic operations (Win 95)	2 weeks
Time taken to transact data on wireless	3 sittings
Time taken to gain preliminary knowledge of HTML	1 week
Word 97	2 days
PowerPoint 97	1 week
Use of Win 95 keyboard for Tamil Fonts	10 days

Content creation by value addition remains the key step. An example of this is the use of wave height predictions obtained from the web in Veerampattinam, a coastal village in which 98% of the families are involved in fishing. This information on wave heights in the next 24 hours, is downloaded from the web from a US Navy site and converted to suit the latitude and longitude of the village. This is used by the fishers in conjunction with their indigenous methods of assessment to decide whether to go in to the sea or not. Thermal mapping of fish aggregation near shore (25 km) produced by the National Remote Sensing Agency, Hyderabad, has also been provided to this hamlet whenever available.

Like last year, results and mark sheets of high school and higher secondary school examinations were made available through the Web to 1,219 students in June 2000.

An analysis of users' registers maintained in the village centres reveal that the proportion of women users is 16%. The proportion of users who are below the poverty line is 16% on the average (the average proportion of rural families living below the poverty line is about 21%) (Table 5.5). Just over 20% of the use is for voice telephony, indicating that voice is still an important medium for transactions in rural areas (Table 5.6).

Table 5.5 : ***Analysis of users' registers in 3 village knowledge centres****

Total Number of Users	10,656
Women	2,073
Dalits	188
Assetless Families	2,581
Illiterates	309
Persons below 14 yrs of age	2,682
One-time users	2,985

*Period: Jan 1999 – March 2000

Table 5.6 : *Analysis of users' registers / patterns (%)**

Voice	
Personal	17.80
Programme related	2.95
Data	
Agriculture and Fisheries	13.60
Education	20.15
Employment and Training	2.58
Health	9.57
Govt. Sector / Entitlements	32.72

*Period: Jan 1999 – March 2000

Each village knowledge centre was strengthened by the addition of 2 or more PCs. These PCs were provided by the Friends of MSSRF in Japan. Two of the PCs are used mainly for training by the school students in the village. They are also used by teachers to provide additional information on school subjects using CD-ROMs such as the *Encyclopaedia Brittannica*.

Continuous feedback is maintained through weekly meetings of project staff and the village centre operators, and monthly meetings of all operators and the project staff. This is the key to the identification of unmet information needs. Over a one year period, it has been noticed that a significant amount of content has been created at the village centres. Such content is highly specific to the locality and appears to fulfil some immediate need. Examples are the development of a detailed document on sugarcane cultivation, a guide book on application of biofertilisers in rice cultivation, a how-to style document on herbal remedies for minor disorders among children and one on local religious festivals. In one village centre list of voters in the local milk producers co-operative has been compiled and made public for the first time (against considerable opposition by the executives of the co-operative). Youth in these villages have come forward to gather news and information in the locality and have been given training in those aspects by professional reporters of the premier local daily. Through them a system for exchanging local information on availability of materials and labour has come into existence. A link between the village centres and the local credit and savings groups has also been established whereby groups maintain member profiles and financial data in the centres.

Impact evaluation

With the help of IDRC, Canada, which is the funding agency, an evaluation was conducted in November'99. The team of evaluators were Dr Bo Goransson of IDRC, Prof Roger Harris (University of Malaysia at Sarawak), Dr Merlita

Opena (Department of S&T, Government of the Philippines) and Ms. Narengeral Dander (from a private internet service provider in Mongolia). Besides being experts in the application of ICTs for sustainable development, the team members were also involved in operating similar projects with IDRC support. The team conducted detailed consultations with the field staff, village centre operators and the village community over a period of several days. The evaluation report discusses the difficulty in arriving at purely quantitative measures of impact and stresses the need to accept "stories" as outcome. This report concludes that the project should be viewed as "best practice" among such efforts in the world, and recommends wider dissemination of the results. Following this, the structure and results of this project have been presented and discussed in a number of international conferences. It emerges that content-creation through a combination of the bottom-up process of demand assessment, and the top-down approach of value-addition is the key to success.

The project will be extended to more villages in phases. Providing links to micro credit, micro enterprises and facilitating local level and intra-rural commerce will be the prime objectives of the project in the next phase. It is significant that the Government of Pondicherry has come forward to support such an extension.

Project in Dindigul region

The Ecotechnology projects of MSSRF have been active in this area, centering around Kannivadi village (SPA 301). Through frequent informal interactions with the rural families, it has been found appropriate to launch the rural knowledge centres project in this area. A survey of communication infrastructure in this area covering 108 hamlets was carried out during Feb-Apr 2000. From this survey, the following results emerged:

- In this area with about 2,20,000 population, there are only 38 public telephones
- There are 533 private telephones in the area, which are concentrated in 3 villages (380 of these telephones in a population of just over 10,000)
- There are about 3,890 TV sets in homes in this area

Participatory rural appraisal conducted during March / April 2000 revealed the keenness of members of rural families to gain some kind of access to information and communication infrastructure. Assessments of information needs show that men are interested in knowing more about new cultivation techniques while women tend to emphasise healthcare, and opportunities for higher education and training. Common needs relate to market prices for horticultural produce and entitlements from the government. Assessment of information needs of the assetless rural families is under way.

Based on topography, road links and communication facilities, the small town of Oddanchattiram has been chosen as the location of the project hub. This small town was also the choice of the local families as it emerged from PRA exercises. Oddanchattiram has facility to access the Internet with local number dial-up. The signals were found stable although the data transfer rates are low. It was found that dial-up access to the Internet could not be established from the hamlets where telephones are available. The reason is possibly

due to the relief line units employed by the Department of Telecom Services (DoTS). It is clear that the technology choice here will have to be a hybrid of wired and wireless access. Solar-mains hybrid will be essential here as a source of power, because the hamlets experience power disruption running to 170 min. per day on an average.

Sub Programme Area 504

The Hindu Media Resource Centre for Ecotechnology and Sustainable Development

This programme, established with the support of an endowment made by *The Hindu* group of publications, has completed two years of activities. The programme is premised on the understanding that the media is a critical channel in shaping policies for promoting sustainable development, which is becoming increasingly knowledge-intensive. All the activities are designed to build the capacity of media practitioners in absorbing knowledge inputs derived from frontier developments in science and technology, so that they can make meaningful interpretation of such inputs for the public as well as the policy makers. The activities this year included organisation of the Millennium Lectures, Public Fora and Media Workshops.

Millennium lectures

The Millennium Lectures are delivered by individuals of great eminence known for their lasting contributions to the conservation of natural resources and food security. The first two Millennium Lectures were by Hon. Mr. Maurice Strong and H.E. Dr. Jacques Diouf. This year, Millennium Lectures were delivered by Prof. Harlan Cleveland (USA), Dr. Norman Myers (UK) and Dr. Joseph Hulse (Canada).

Prof Harlan Cleveland, currently the President of the World Academy of Art and Science, is known for his contributions towards creating new technology systems for sustainable development. He spoke on the theme of *"Informatisation of Development"* (28 Sep 99), stressing that sharing of information results in its increase rather than depletion. New opportunities for socio-economic advancement of large numbers of the poor are opening up through "brain work", just as access to land, minerals and energy did in the past.

Dr Norman Myers is known for his outstanding theoretical contributions in elaborating the nexus between conservation and development. Based in Oxford, UK, where he works as an independent consultant, Dr. Myers has made authoritative analyses of global environmental issues, and is a prolific writer, in the popular as well as academic sense. In his lecture *"The New Millennium: the Ecology and Economy of Hope"* (16 Dec '99), Dr Myers pointed to the rapidly widening global inequality between the rich and poor: the top 20% of the global population owns 86% of the world's wealth, controls 82% of the global markets, 68% of foreign investment and 74% of telephone lines. The emergence of ecotechno-logies, such as improvements in energy-use efficiency, closed-loop systems of manufacture and zero-emission industrial production processes, offer unprecedented opportunities to reduce wasteful emission and correct such inequality. Dr. Myers, who is well known for coining the term "perverse subsidies" for the various policy measures that cause damage to the environment as

well as to economies, emphasised the need for rolling them back as a measure of hope.

Dr. Hulse, eminent nutritionist and food scientist based in Ottawa, Canada, is known for his advocacy of food processing at the primary level of production as a value-adding measure. He is the author of widely used books on underutilised crop species and their nutrition value, and has held important positions in the FAO and the IDRC, and in the corporate sector. In his lecture on *"Urban Food Security: a challenge with many opportunities"* (21 Feb 2000), Dr. Hulse pointed to the expansion of urban populations and the diversification in urban food habits, which throw a serious challenge to accepted notions of food security. When carefully planned and administered, the diverse demands of urban communities for processed and preserved foods can provide opportunities for stable employment for the rural poor, especially women. He outlined the process by which rural agro-industries which reduce loss between the farm gate and urban markets can be established.

Public fora

Taking advantage of the presence of eminent experts or policy makers in conferences organised by the Foundation, public fora are organised. These fora are designed as panel discussions for the public and the media. This year the Public Forum was on *"Fighting the Famine of Rural Livelihoods"* (18 Feb 2000). The panelists were the Hon. Mr. Digvijay Singh, Chief Minister of Madhya Pradesh; Dr. Guy Sorman, Foreign Policy Advisor to the President of France; Dr. Peter Raven, President-elect of the American Association for the Advancement of Science; Dr. Madhu Sarin, well known social scientist from Chandigarh; Dr D P Rao, Director of the National Remote Sensing Agency, Hyderabad. Mr N Ram, Editor, *The Frontline* served as the moderator.

The public forum discussed the possibilities of community banking based on social movement. To strengthen the case, the Chief Minister of Madhya Pradesh presented the successful case of his state's community banking based on the success of watershed management scheme. The public forum provided a case study, articulated international perspectives, proposed a new paradigm of development and debated the existing framework.

Media workshops

The approach here is to provide a background for media practitioners to find stories in relation to ecotechnology before they break and to report them meaningfully when they do. In this context, the following media workshops were organised.

Consultations on Gender (During the Technical Consultation on Gender Dimensions in Biodiversity Management and Food Security (November 5, '99)): Moderated by Ms Nirmala Lakshman, Editor, *The Sunday Hindu*, the workshop discussed linkages among such aspects as agrobiodiversity, forest-plant diversity and food security, and the gender roles associated with managing biodiversity. The intellectual property rights of tribal and rural women and men in relation to biodiversity were also covered. While the technical details were elaborated and exchanged by experts and media persons, there was a debate on how media should cover issues relating to gender and biodiversity management issues.

The Internet as a source of information on sustainable development (March 15, 2000): The role of Internet in the media is increasing. A new source called on-line journalism has emerged as a practice. On-line journalism offers sources to contact experts and databases and saves time for journalists who are forced to meet deadlines.

The workshop was informal and interactive. The entire workshop had less than 45 minutes of formal podium talk. Ms. Nora Paul, Library Director of Poynter Institute of Media Studies, (USA), The New Zealand Journalists Training Organisation and The United States Information Services, Chennai, contributed materials for this workshop. The fresh user of the Web, who was "information poor", suddenly becomes "information overloaded" once s/he is connected to the net. This workshop also addressed the ways to cope with such an overload.

Media on Water (May 20, 2000): Based on the earlier workshop on the water issue at the city level, the Centre conducted another workshop on water conservation and management at the city, state and national levels. The workshop threw new light on the water crisis i.e., conservation management, and discussed other successful models of conservation. The workshop enabled the media to access authentic data to cover issues relating to water security, in order to influence civic action. Mr N Ram, Editor of the *Frontline*, moderated the workshop, while Mr K Venu, Executive Editor of the *Business Line*, Mr Suriyanarayana Singh, Chief Engineer of the Metrowater and Mr P V Sahadevan, Director, Institute of Water Studies were among the panelists.

Sub Programme Area 505

Design and Development of Databases and Provision of CD-ROM Services

The Informatics Centre, which is one of the sub-distributed bioinformatics centres supported by the Department of Biotechnology, Government of India, continued its work on databases on mangroves and on agrobiodiversity and farmers' rights. The Informatics Centre is also responsible for the maintenance of the campus-wide network and its connection to the Internet.

Database on mangroves

The Mangrove Ecosystems Information Service (MEIS), in operation since 1994, has two components, namely the directory of experts and bibliography, which are merged now along with GLOMIS (Global Mangrove Data and Information Service), which is a project of the International Society for Mangrove Ecosystems (ISME). The Informatics Centre is now the designated center for GLOMIS for the Asia-Pacific and Northern Indian Ocean Regions, and covers data for over 40 countries. During this year, data on 492 experts has been compiled and 2,416 bibliographic entries prepared for the period 1990 – '99, covering this region.

Farmers' rights information service

No major additions were made to this database and it continues to be available on the Web at **www.mssrf.org.sg/webfris**

CD-ROM Services

The collection of CD-ROMs now provides access to about 3.8 million records in the areas of pure and life sciences and agricultural sciences. The collection includes the CAB-CD (agriculture), Biochemistry and Biophysics Citation Index and AGRIS (FAO) updated to March 2000. During the last year, 1,707 scholars from 17 institutions from Tamil Nadu made use of the CD-ROM services.

Through a recent evaluation, a recommendation has been made that the Informatics Centre should (a) construct a pilot virtual library for biosciences and (b) develop a software resource center for providing IPR guidance in bioinformatics applications. The centre will continue to provide assistance in training programmes for NGOs, media practitioners and policy makers involved in biosafety issues and in conservation of biological diversity.

Sub Programme Area 506

The Literature Analysis Group

The analysis of the implications of new information and communication technologies both for the scientific and scholarly community in the developing countries and for the rural poor has been extended. Our views were presented at a debate on information technology in the new millennium organised by the Volkswagen Foundation, Hanover, and subsequently published in *Journal of Information Science* as well as in the German language proceedings of the series of Millennium debates organised by the Volkswagen Foundation.

Analysis of mathematics research in India has been extended to cover eleven years, *viz.* 1988-1998. The study is nearing completion and the report would be finalised before September 2000. In this study, we have looked at international collaboration as reflected in papers written jointly by Indian and foreign mathematicians. Apart from the citation index databases of ISI, *Mathsci* is the only other English language secondary service providing addresses of all authors of papers.

As a precursor to a study of new biology research in India, funded by the Department of Biotechnology, we have looked at new biology research in Israel, using three years (1992, 1995 and 1998) of *Biochemistry and Biophysics Citation Index* (BBCI) as the source of data. The study covered distribution of papers by journal, journal country, journal impact factor, institution, institution type, etc., as well as the extents of domestic and international collaboration. The results were published in *Journal of Information Science*.

A study on new biology research in India and a few other countries has been initiated, using multiple databases as sources of data. As a precursor to this larger study, we are looking at mapping fisheries research in India, using *Aquatic Science and Fisheries Abstracts, CAB Abstracts, BIOSIS, Science Citation Index* (SCI), *BBCI* and *Biotechnology Citation Index* (BTCI) as sources of raw data. As different databases follow different ways of presenting bibliographic data, one

has to first standardise the structure. Also, as the same paper might have been indexed in more than one secondary service, one has to eliminate duplicates. This takes considerable time and effort.

Another study looks at international collaboration in 11 Asian countries, *viz.* India, China, Japan, Taiwan, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, Thailand and South Korea using SCI 1998 as the source of data. The results of this study are ready for submission to a journal.

With a view to studying highly cited Indian researchers, we have looked at more than 140 papers written by physicist-materials scientist Dr T Venkatesan of the University of Maryland, during the seven years 1987-1993. These papers have been cited more than 5,700 times up to 1999. The results were submitted by a trainee as a Masters' degree student project to the Birla Institute of Technology, Ranchi.

On an invitation from the editor of *British Medical Journal* (BMJ), our views on assessing and evaluating clinical information obtained from the Internet and on the status of tele-medicine and new information technologies on healthcare in developing countries have been given.

Sub Programme Area 507

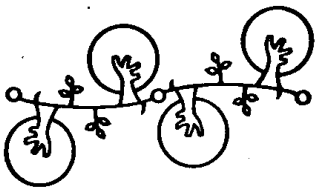
Library and Information Services

The print library now has a base collection of approximately 10,000 books and 125 professional journals. The library automation package called *Mathuram*, fully indigenously developed, has been upgraded and ported to MS-SQL Server and can be accessed online on the intranet. The library also provides digests of information downloaded from the Internet, and provides an alert service tailored to suit individual researchers in the MSSRF.

The CD-ROM collections have been updated. The CAB-CD collection of agricultural science CDs now stands updated till the end of 1999, along with *Biological and Biochemical Citation Index*. This collection is used extensively by researchers working on literature analysis (SPA 506).

The library provides assistance to research students working in the areas of pure and applied life sciences, agricultural sciences and environment policy issues. During the last year, about 1,800 students from 13 universities were provided information support.

Programme Area 600



Special Projects

The following are some of the major consultancies undertaken during the year:

- *Vision and Action paper for the Union Ministry of Agriculture, Agenda 2007 programme for the Union Territory of Pondicherry, designed to convert all the villages of the Union Territory into Biovillages by August 2007, which marks the 60th anniversary of India's independence*
- *Food Insecurity Map/Atlas of India for the World Food Programme, which is designed to facilitate action to end chromic hunger in the worst affected areas, will be released on October 16, 2000, designated as "World Food Day". This year's theme for the World Food Day is "A Hunger free Millennium".*

601 Preparation of "Perspective Plan and Vision 2020" and "Strategic Action Plan for Development" for the Ministry of Agriculture, Govenment of India 157

602 WFP-MSSRF Project on Food Insecurity Map of India 159

Sub Programme Area 601

Preparation of "Perspective Plan and Vision 2020" and "Strategic Action Plan for Development" for the Ministry of Agiculture, Government of India

The Ministry of Agriculture, Government of India, had commissioned the Foundation to develop a Vision 2020 document to outline the programmes and strategies that should be undertaken by the Department of Agriculture with the cooperation of the Government of India. The Study was conducted in two phases.

A perspective plan was developed with the primary purpose of ensuring food and nutritional security. The Document has been developed on the basis of four important national considerations: Food Security, Employment, Growth Stability and Sustainability. Based on realistic estimates of demand and changes in consumption patterns, economic empowerment and other socio-economic and socio-cultural factors, it was estimated that with accelerated growth rates, promoted by advances in technology, the country would be able to meet its food requirements in the coming decades, ensuring a marginal surplus of production over consumption. This optimistic plan will, however, require continued growth, dedication and commitment to provide overall food and nutritional security and policy support.

The Strategic action plan highlights

The subsequent document on the strategic action plan outlines the detailed steps that should be taken to achieve these objectives.

- *Growth* : The buzzwords for the new millennium will be sustainable development -not mere food security but also nutrient security and avoidance of profligacy in farm practices to avoid ecological imbalance. Through a proper mix of genomics and molecular breeding, information technology and ecotechnology, it will be possible to promote the agricultural production system that is rooted in the principle of *Integrated Natural Resource Management*. Specific steps would include spread and updating of technology together with a blending of traditional wisdom and adoption of a systems approach using optimisation models and creation of institutions for increased interface between the farmer and the market place.
- *Extension* : Broad based extension will be the key element in the new millennium. A cultural extension worker using information technology will play an increasingly important role in production and natural resource management. This will include steps to expand the universe of extension workers and ensure an era of gender awareness and gender equity with increasing participation of women in extension.

  The following initiatives and approaches would govern an integrated Action Plan in Extension:

  - Extension services should be responsive to the changing agricultural scenario
  - Public extension services should be restructured to address weaknesses

- The universe of extension workers should be enlarged taking into account the increasing role of the non governmental sector
- Financial sustainability of extension services should be ensured
- Participation of women in extension services should be increased
- Extensive use of mass media for communication and dissemination should be planned
- A "Knowledge System" based on the peoples' needs should be developed

- *Democratic decentralisation* : Self-mobilisation by the people will be the key principle for agricultural advance to link the ecological security of an area with livelihood security in a symbiotic manner. Hence responsibility will have to be delegated to the concerned local bodies, with a clear demarcation of their legal, consultative, discretionary, contractual and supervisory functions. The real strength of the local bodies lies in their financial independence and hence provision should be made for the devolution of funds. Integrating the watershed development programme with the village development plan will be an effective method to ensure peoples' participation as also sustainable and equitable use of water. These will have to be achieved through Action Plans spelling out the delineation of the decision-making process at each level.

- *Reduction of regional imbalances:* Equity will have to be the guiding consideration for sustainable agriculture and hence positive action to reduce imbalances will have to be taken. There will have to be area specific studies to concentrate on location/soil specific advantages with particular emphasis on rain-fed arid and semi-arid technology. A special fund allocation for improving infrastructure will be necessary.

- *Land use policy:* An institutional mechanism should be introduced to periodically review the land use plan and take into account ecological and habitat changes, which reflect the changing development paradigm. At the same time socio-political and socio-economic parameters that influence land use at the micro level should not be ignored. The following recommendations have been made:
  - Create institutional capacity to develop land use plans
  - Monitor progress of the policy implementation in a time format
  - Develop institutional mechanism for early approval of plans within national/regional overview
  - Create a mechanism for revision of land use plan

- *Globalisation and commercialisation* : Co-ordination of necessary activities and creation of new institutions to provide financial and other support for end-to-end technologies to ensure global competitiveness have to be planned to ensure export promotion without compromising the basic premise of self-reliance. This will cover market interface not only for agricultural primary produce but also products of re-

lated fields like horticulture, sericulture and floriculture.

- *Food quality and safety:* Institutions should be developed to ensure phyto-sanitary conditions, proper grading and standardisation and adherence to *Codex Alimentarius Standards*. Credible and public regulating agencies are necessary for the maintenance of quality standards for both international and domestic markets.

- *Management system:* The systems approach will be the guiding consideration in evolving a management structure during the new millennium. This will call for continuous review of the system to provide flexible management decision mechanisms to provide price and non-price incentives for utilising information technology. The system will have to be pluralistic in design to bring into force the diverse interests of producers and consumers. In particular an effective mechanism for biosafety, bioethics and biosurveillance will be needed in the next millennium, as advances in genetic technology will tend to be more precise and revolutionary as compared to traditional methods and approaches.

Sub Programme Area 602

WFP-MSSRF Project on Food Insecurity Map of India

World Food Program (WFP) approached the Foundation to prepare a Food Insecurity Map of India, to identify priority areas needing attention from Government, Non-Governmental Organisations and international aid agencies to launch hunger free area programmes. The action was initiated through a contract signed between the two organisations on 26 December '99. October 2000 is the agreed time of completion.

Food Insecurity Map of India aims at describing food insecurity in all its dimensions and identifying the hot spots of hunger–the most vulnerable states, the most vulnerable groups and the most vulnerable situations. The analysis of food insecurity situations and the maps of food insecurity are expected to serve as advocacy tools for policy changes and programme interventions. The focus of the study is not on just producing a map of India with different colours showing the concentration of hungry people, but to analyse the food insecurity situation, and spell out the policies and programmes needed to make India hunger-free.

Defining food insecurity

Food insecurity is defined as the "present or potential inability to consume and absorb adequate balanced diet, complete, in all its nutrients, essential for a healthy and productive existence, either temporarily or for long periods of time." A temporary situation is referred to as transitory food insecurity and a long-term situation is referred to as chronic food insecurity. We have adopted a comprehensive definition, covering several dimensions of food insecurity. Each dimension of food security necessitates a different approach, a different policy and a different programme. All dimensions of food insecurity can be captured in the three essential aspects of food: food availability, food access and food absorption.

Food availability depends primarily upon food production, growth in production, fluctuations in production and sustainability of production. Food consists of all food items needed for a healthy living from plant and animal sources. Availability further depends upon marketing of food, storage of food, imports and exports of food, movements of food and existing infrastructure, physical and institutional. Availability is further affected by natural disasters such as floods, droughts, cyclones and earthquakes. Man made problems such as wars and political, social and communal upheavals may also affect availability at times.

Food access depends upon access to livelihood. Education, skills and opportunities and food prices determine the household's earning capacity and its ability to purchase adequate balanced diet for all the members. Further, social and gender related factors might prevent an individual's access to a balanced diet.

Levels of food consumption depend mainly upon food availability and food access. Food consumption also depends upon habits, preferences, perceptions and the knowledge of basic nutrition. Intake of calories, proteins, fats and other basic nutrients are guided by the above considerations. Food absorption means being able to assimilate the food consumed for a healthy life. Food absorption in turn depends upon the state of health as also, pollution, sanitation and hygiene of the surroundings. These in turn depend upon health infrastructure available in a locality.

Dealing with it

Safety nets and 'coping mechanisms' help to overcome food insecurity. A food insecure population develops certain coping mechanisms over time. They may be at the community level or household level. Some of these can be captured and quantified. Others practised by the household may not have a record, but will be reflected in their food security. Loans from the landlords, self help groups, low interest rates in lean seasons, entitlements such as free housing, free food, vegetables, milk etc., on a regular basis by the employer are positive coping mechanisms of the community. Some of the coping mechanisms, such as indebtedness and sale of assets, may have an adverse impact on long-term livelihood and food insecurity.

Outside agencies such as the Government, local authorities, international organisations and non-governmental organisations help the population to overcome food insecurity. Providing food grains at subsidised prices, providing micro credit for self-employment, credit for consumption in times of crop failure, providing employment in off-peak seasons, care feeding programmes, supplementary school feeding, anganwadi feeding etc., come under this category. When the safety nets are successfully cast, food insecurity will be minimal. Further, the effectiveness of the safety nets depends upon the need, the suitability of the programme, the awareness and participation of the community and the competence of the executor.

Food insecurity indicators

An appropriate indicator of food insecurity is one which provides the measure of magnitude and intensity of inadequacy and deprivation experienced by an individual, community or a geographical area. Indicators are of various types.

Some are sensor indicators, which sense the intensity of the problem. They are the causes of the problem. The level of production, levels of income, drought prone location, lack of knowledge of nutrition, lack of health facilities, lack of basic infrastructure, etc., come under this category.

Some are response indicators, which are a consequence of a problem. They are of two types: a) Indicators that show the adverse impact of food insecurity: low level of food consumption, migration of labour to other regions in times of drought, etc., come under this category; b) Indicators that reflect coping mechanisms : they may be in terms of government interventions by way of public distribution system, employment generation programmes, supplementary feeding programmes etc. Coping mechanism can also include indebtedness, sale of assets, use of seed as food etc.

Some others are outcome indicators, which are also exposure indicators such as chronic energy deficiency, malnourishment, underweight, stunting, wasting, disease, low life expectancy, high infant, child and maternal mortality, micronutrient deficiencies, incapacitation etc.

Data requirements to study all the aspects in full are enormous. The data also may not be available or reliable. Depending on the reliability and availability, a choice of the data that best describes the food insecurity situation must be made. Secondary data has been utilised for this purpose. The same reference year is not possible for all indicators, but all the indicators used refer to the decade ending in 2000. National sample survey data, '91 census data and data from the three nutritional surveys, (National Health Surveys, District Nutritional Profiles and National Nutrition Monitoring Bureau Survey), have been used extensively in this study.

This study is the first stage. It aims at indicating the road map to achieve the ultimate goal, in terms of policies and programmes. The district and village level studies constitute the second stage. The third stage is to design specific programmes to attack those problems.

Methodology

The method adopted is to group the various indicators into indices, reflecting a different dimension of food insecurity. Various indices, such as food production index, food consumption index, environmental sustainability index, livelihood index, adult and child nutrition index, health infrastructure index, safety nets index etc., have been computed to study the intensity of food insecurity experienced by the people in various States. The indicators and indices and their inter-relationships are being carefully analysed to get the full picture of the intensity of food insecurity. Explanations of inconsistencies and paradoxes from the point of view of food availability, access and absorption are provided as and when necessary. The safety nets available, problems left unattended and intensity of adverse impact are also studied. The groups which are most food insecure are identified. Existing policy lapses and ineffective approaches to the problems are analysed and the magnitude of the effort is assessed.

Analysis and findings

The final Report will have all the findings arranged and analysed in a systematic manner.

The following indices have been computed for the 16 states for which we have data: food production index, environmental sustainability index, disaster index, food consumption index, livelihood access index, adult nutrition index, child nutrition index, rural health infrastructure index, gender disparity index, and safety net index. Both parametric and non-parametric measures are used for analysis. The initial finding shows that states involved in higher levels of per capita food production also have high levels of crop land degradation as well as environmental degradation. The problem of deficient calorie consumption, particularly in the lower income groups, appears to be much larger than the problem of poverty. The problems of micro nutrient deficiency and growth disorders encompass even the non-poor. Rural health infrastructure is directly correlated to child health. Livelihood access is not very sound for many states with a high percentage of population dependent on casual labour.

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Nair, Sudha. 2000. *Global Knowledge Conference.* Kuala Lumpur. March 7-10.

Nair, Sudha. 2000. *Science Partnership Committee, Mid-term meeting of CGIAR.* Dresden, Germany. May 21-26.

Parani, M. 1999. *Visiting Fellow in the University of Bologna under Indo-Italian Scientific Co-operation.* Italy. December 15 - January 15.

Parani, M. 2000. *UNESCO Biotechnology Action Council Fellowship.* International Rice Research Institute, Los Banos, Philippines. April 1 - June 15.

Patel, Shilpa. 2000. *Training for Trainers Course on Food Quality and Safety based on Good Manufacturing Practices and Hazard Analysis and Critical Control Point Principles.* FAO of the United Nations and Export Inspection Council. Chennai. January 31 - February 11.

Ramakrishna, D. 2000. *DST-Sponsored Workshop on Fluvial Geomorphology with special reference to Flood Plains.* Indian Institute of Technology, Kanpur. April 3-7.

Rangarajan, Sunita, 1999. *Training on Contaminated Site Assessment and Remediation.* Confederation of Indian Industry, Chennai. Sep 21-22

Rao, C. S. 1999. *Visiting Fellow in the University of Bologna under Indo-Italian Scientific Co-operation.* Italy. November 15 - December 15.

Ravishankar, T. 2000. *Workshop on Biodiversity Conservation in Andhra Pradesh.* Andhra Pradesh Forest Department, Hyderabad. February 4-5.

Ravishankar, T. and M. M. Jeelani. 2000. *Workshop on National Environment Awareness Programme for Youth.* Nehru Youth Centre, Kakinada, Andhra Pradesh. February 29.

Ravishankar, T. 2000. *International Symposium on Participatory Plant Breeding and Participatory Plant Genetic Resources Enhancement: An Exchange of Experiences from South and South East Asia.* CGIAR, Pokhra, Nepal. May 1-5.

Senthilkumaran, S. 1999. *International Institute of Communications Annual Conference* Kuala Lumpur. September 4-9.

Shaleesha, A. 1999. *First National Conference on Aquatic Biotoxins.* Industrial Toxicology & Research Centre, Lucknow. November 25-26.

Swaminathan, Mina. 1999. *State Level Workshop for Ensuring the Survival and Protection of Girl Child in Tamil Nadu.* Alternative for India Development, Chennai. November 29-30.

Awards/Honours

Balaji, V. 2000. *Member, Editorial Committee for the Global Action Plan of Global Knowledge Partnerships.* Global Knowledge for Development (GK2) Conference, Kuala Lumpur, Malaysia.

Narayan, L. R. A. 2000. *Schwidefsky Medal* for Achievements in the Evolution of Spatial Information Sciences. International Society for Photogrammetry and Remote Sensing.

Parida, A. 2000. Prof. *Umakant Sinha Memorial Award* in the field of Biochemistry and Molecular Biology. Indian Science Congress Association.

Raman, K. V. 2000. *Prof. Sushil Kumar Mukherjee Commemoration Award* for Soil Science Research and Sustainable Agriculture. Indian Science Congress Association.

Shanmugavelan, Murali. 2000. *Member, Committee on Education and Environment & Communication (CEC).* The World Conservation Union (IUCN), Geneva.

Swaminathan, M. S. 1999. *The Volvo Environment Prize.*

Swaminathan, M. S. 1999. *UNESCO Gandhi Gold Medal* for Outstanding Work in Extending the Benefits of Biotechnology. UNESCO.

Swaminathan, M. S. 2000. *Asutosh Mookerjee Memorial Award.* Indian Science Congress Association.

Swaminathan, M. S. 2000. *Franklin D. Roosevelt Four Freedoms Medal.* Franklin and Eleanor Roosevelt Institute.

Swaminathan, M. S. 2000. *Planet and Humanity Medal.* International Geographical Union.

Videos

M. S. Swaminathan Research Foundation. *Avvai* - Video Documentation of a Play. 1999. 40 mins. (Tamil).

M. S. Swaminathan Research Foundation. *KULAVAI '99* - Video Documentation of the Workshop. 1999. 59 mins. (Multiple Languages with English Subtitles).

M. S. Swaminathan Research Foundation. *Pavazhakkodi* - Family Conflict. 1999. 40 mins. (Tamil).

M. S. Swaminathan Research Foundation. *Pen Kuzhandaiyin Vazhum Urimai* - Survival of the Girl Child. 1999. 90 mins. (Tamil).

M. S. Swaminathan Research Foundation. *Penungal Oor Pillaigalai* - Role of Panchayats in Child Care Services. 2000. 19 mins. (Tamil).

M. S. Swaminathan Research Foundation. *Reaching the Unreached: Village Knowledge Centres in Pondicherry for Sustainable Food Security.* 2000. 7.21 mins. (English)

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M.S. Swaminathan Research Foundation (MSSRF) was registered in 1988 as a non-profit Trust, recognised by the Government of India, Department of Scientific and Industrial Research, New Delhi, and by the Director General of Income Tax Exemptions, for the purpose of exemption of contributions from Income Tax under Section 80G and section 35 (1) (ii) of Income Tax Act, 1961, read with Rule 6 of Income Tax Rules, 1962. The Ministry of Home Affairs, Government of India, has recognised the Foundation for receiving funds from sources abroad under the provisions of Foreign Contribution (Regulation) Act, 1976.

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Sanjeev and Promoj Thomas

Subba and Kavitha Dukkipati

Thomas and Peggy Brennan

Tilak and Kiran Sikri

Vijay Harsha Raval

Sources of Project Support

Programme Area 100 : Coastal Systems Research

National	*International*
Department of Atomic Energy Government of India	India-Canada Environment Facility New Delhi

Programme Area 200 : Biodiversity and Biotechnology

National	*International*
Department of Biotechnology Government of India, New Delhi	Swiss Agency for Development and Cooperation (SDC)
Ministry of Environment & Forests Government of India, New Delhi	The Ministry of Foreign Affairs The Netherlands
Department of Agriculture Government of Tamilnadu	The Summit Foundation USA
Directorate of Horticulture Government of Mizoram	

Programme Area 300 : Ecotechnology and Sustainable Agriculture

National	*International*
Department of Biotechnology Government of India, New Delhi	The Hunger Project - India
Council for Advancement of People's Action and Rural Technology, New Delhi	United Nations Development Programme (UNDP), New Delhi
Hindustan Lever Limited Mumbai	International Development Research Centre (Food Links), Canada
National Bank of Agriculture and Rural Development, Mumbai	The Global Hunger Project

National Bureau of Plant Genetic Resources
(Indian Council of Agricultural Research)
New Delhi

Gopuri Charitable Trust, New Delhi

Sikkim Charitable Trust, Sikkim

Department of Science & Technology
Government of India, New Delhi

Volkart Stiftung
Winterthur

Programme Area 400 : Reaching the Unreached

National

National Commission for Women,
New Delhi

International

The Hunger Project, India

Humanistic Institute for Cooperation with
Developing Countries (HIVOS), Bangalore

Bernard van Leer Foundation,
The Netherlands

Programme Area 500 : Education, Training and Communication

National

Sir Dorabji Tata Trust, Mumbai

R.D. Tata Trust, Mumbai

Council for Advancement of People's Action
and Rural Technology, New Delhi

National Commission for Women
New Delhi

Department of Biotechnology
Government of India, New Delhi

International

United Nations Development Programme

Food and Agriculture Organisation (FAO)
Rome

International Development Research
Centre (IDRC), Canada

Royal Netherlands Embassy, New Delhi

British Council Division, Chennai

Dutch Trust Fund, c/o World Bank, USA

United Nations Development Fund for Women
New Delhi

Department of Science and Technology
Government of India, New Delhi

Indian Council for Agricultural Research
New Delhi

Indian Centre for Philanthropy, New Delhi

XV Genetics Congress Trust, New Delhi

Ministry of Rural Development
Government of India, New Delhi

Scientific Committee on Problems of the Environment, France

The World Food Prize Foundation
USA

International Society for Mangrove Ecosystems (ISME), Japan

World Food Programme
New Delhi

Volkart Stiftung
Winterthur

Programme Area 600 :Special Projects

National

Ministry of Agriculture,
Government of India, New Delhi

International

UNDP-Global Environment Facility

World Food Programme

M S Swaminathan Research Foundation

Programme Priorities, Principles and Outputs
2000 - 2005

Introduction

The fifth Annual Report of MSSRF contained information on the programme priorities for 1995-2000. We started planning programme priorities in 1989, in guest faculty rooms of the Indian Institute of Technology and the Anna University. 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. In 1998, the infrastructure for training and scholars' residence was strengthened through a building constructed for the JRD Tata Ecotechnology Centre, with funds provided by Tata Trusts. His Excellency The President of India, Shri K R Narayanan inaugurated this building on July 29, 1998, a day which marks the birth anniversary of Bharat Ratna JRD Tata.

From the beginning, we have been working on five major programme areas. The programmes in our Centre are generally not of a short duration, except for consultancy reports and seminars/dialogues. Achieving the goals of our work requires both sustained work and sustained support.

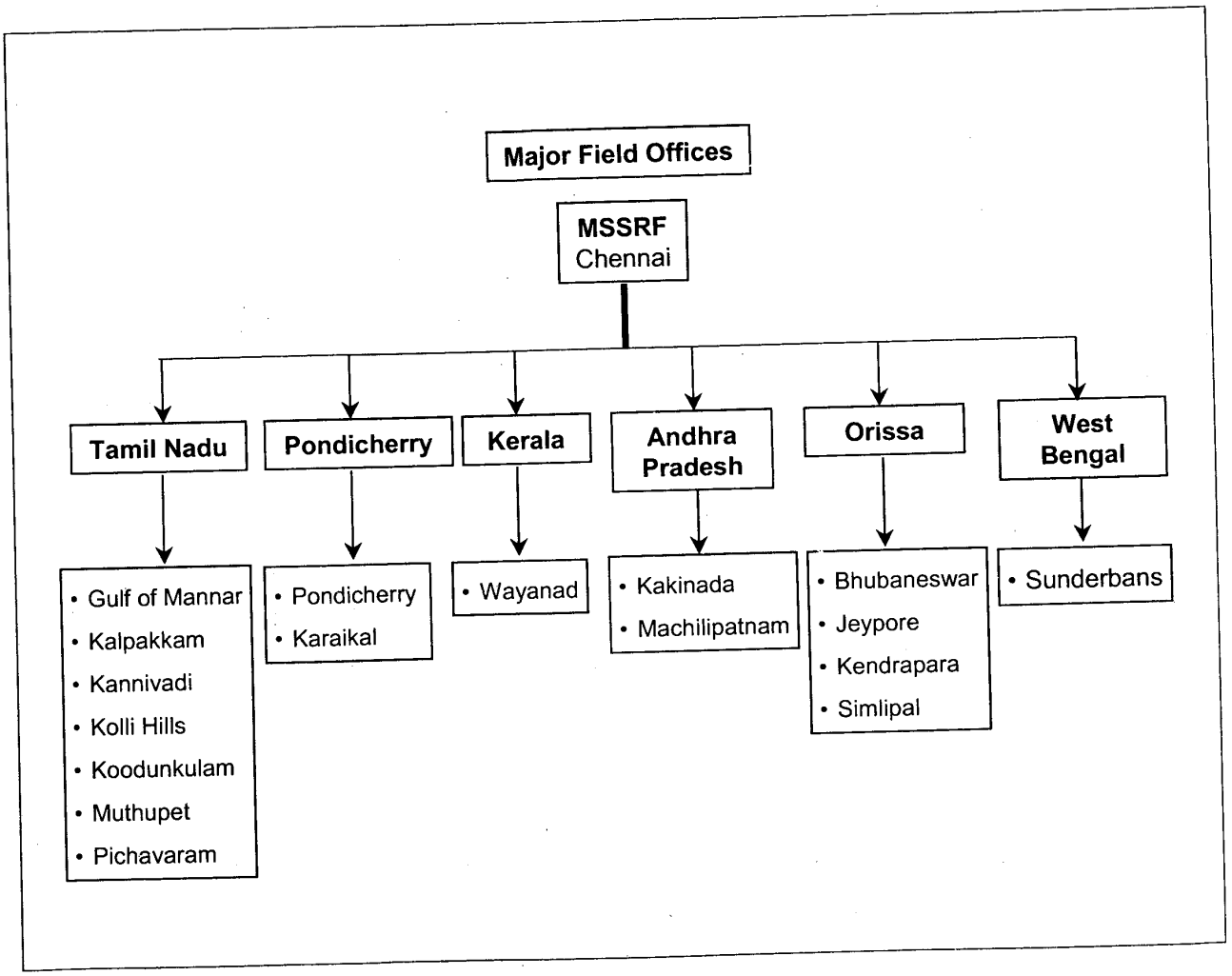
During 1999-2000, several staff discussions were held to review the work done since January, 1990 and to develop a road map for the next 5 years (2000-2005). This write-up lists the Programme priorities identified and also the principles which guided this exercise. It will be observed that throughout the last 10 years, MSSRF has kept to the original five Programme areas. Over the years, the Programme areas have acquired greater depth, though in some cases there has also been a widening of the programmes in terms of geographical coverage and range of problems handled. MSSRF programmes cover grass root level interactions and activities on the one hand, and policy makers', National and International, on the other. It is hoped that the five year Programme outlined here will help the scientists, scholars and staff of MSSRF to work with single minded devotion towards achieving the goal of ecologically, socially and economically sustainable livelihood and food security.

MSSRF Mission

- To foster sustained human well being by promoting the conservation and enhancement of natural resources and by mobilising frontier technologies and traditional wisdom
- To promote job-led economic growth in rural and tribal areas through a pro-nature, pro-poor and pro-women orientation to knowledge and skill empowerment

Programme Priorities: Guiding Principles

- Articulate vision in terms of inspiring goals
- Break down goals into time-bound "doable" propositions
- Select priorities and stick to them
- Demystify techniques and technologies


Major Field Offices
MSSRF
Chennai
Tamil Nadu
Pondicherry
Kerala
Andhra Pradesh
Orissa
West Bengal
• Gulf of Mannar
• Kalpakkam
• Kannivadi
• Kolli Hills
• Koodunkulam
• Muthupet
• Pichavaram
• Pondicherry
• Karaikal
• Wayanad
• Kakinada
• Machilipatnam
• Bhubaneswar
• Jeypore
• Kendrapara
• Simlipal
• Sunderbans

- Mobilise a symbiotic alliance of all stakeholders through strategic partnerships
- Pay attention to scale
- Emphasise on self and external monitoring and link authority and accountability at all levels
- Ensure relevance to human well being
- Unleash the full potential of women
- Generate and sustain political commitment and action
- Promote relevant international cooperation, dialogues and linkages

The Pathways

- Consolidation of programmes and concentration in areas where MSSRF has established a niche and has gained national and international reputation on the basis of the work done during the last 10 years
- Well-defined and quantifiable outputs in relation to the MSSRF mandate
- Promoting the development and spread of ecotoechnologies through a blend of traditional wisdom and frontier technologies, particularly biotechnology and information, communication, space, nuclear and renewable energy technologies and organising biovillages and virtual colleges for this purpose
- Promoting ethics and equity in benefit sharing with reference to the conservation and enhancement of biodiversity
- Serving as a Technical Resource Center in selected areas like gender, precision farming, biotechnology, ecorestoration, farmers' rights and media liaison, and as the coordinating center for national and regional networks
- Promoting the professional growth of MSSRF staff members through opportunities for training and re-training, and through emphasis on a work culture which stresses creativity and encourages self-targeting of achievements and competition with one's own past achievements
- Linking research, advocacy and policy studies with workshops and publications in the selected areas of strength

Highlights of Research, Training and Development Activities

PA 100 : Coastal Systems Research

- Foster sustainable systems of participatory management of coastal mangrove wetlands along the east coast of India (the term "management" is used to cover conservation, restoration, sustainable use and equitable sharing of benefits)
- Facilitate a multi-stakeholder management of the Gulf of Mannar Biosphere Reserve through a Biosphere Trust and promote participatory management systems for World Heritage sites and Biosphere Reserves in other States.
- Undertake restoration of degraded mangrove ecosystems and serve as a Resource Centre in Mangrove Restoration Ecology, with particular reference to areas prone to cyclones and natural disasters

- Strengthen the livelihood and ecological security of areas around Nuclear power plants
- Undertake anticipatory research to meet the potential adverse impact of sea level rise and climate change
- Promote space applications in agriculture based on GIS methodology for use in the conservation and sustainable management of mangrove wetlands as well as other biodiversity-rich areas

PA 200 : Biodiversity and Biotechnology

- Promote Community Centered Gene, Seed, Water and Grain Management Systems in Tamil Nadu, Kerala and Orissa
- Foster an integrated crop improvement system involving pre-breeding using recombinant DNA technology, and participatory breeding with rural families in selected crops in order to assist in the development of locale-specific varieties possessing resistance to abiotic stresses like salinity and drought, thereby combining genetic efficiency with genetic diversity at the field level
- Undertake research on functional genomics in rice, with a view to breeding varieties resistant to salinity
- Identification of beneficial microorganisms with reference to resistance/tolerance to abiotic stresses and demonstration of their value in farmers' fields
- Undertake Micropropagation of Red Data Book species and bioprospecting based on biopartnerships between commercial companies and rural and tribal families, thereby enlisting commercialisation as a tool in the revitalisation of the *in-situ* on farm conservation traditions of local communities
- Develop and disseminate biomonitoring tools to enable students and local communities to monitor the health of their ecosystems
- Serve as a Centre of Excellence for facilitating the filed level implementation of the provisions relating to Farmer's Rights and the prior informed consent and benefit sharing provisions of the Biodversity Act
- Organise policy research and policy makers' seminars on topics relating to biodiversity and biotechnology
- Organise and assist a NGO Community Biodiversity Conservation Network
- Serve as Technical Resource Centre for the Tamil Nadu Women's' Biotechnology Park

PA300 : Ecotechnology, Biovillage and Nutrition Security

- Serve as the co-ordinating centre for the UNESCO Asian Ecotechnology Network
- Promote the growth of integrated intensive farming systems, pulses and seed villages and rural self-help groups
- Promote inland and coastal ecoaquaculture (i.e., low external input sustainable aquaculture) including the establishment of a Women's Aquaculture estate in Karaikal
- Foster a Panchayati Raj-led Hunger-Free Area Programme and help to achieve total freedom from hunger in selected areas by August 2007

- Organise and service a National Network on Biovillages and Community Banking
- Develop the NABARD Resource Centre on Precision Farming for poverty eradication into a leading research and training centre in collaboration with the Arava R&D Centre in Israel and the Ohio State University, USA

PA400 : Reaching the Unreached

- Organise studies on Women's multiple roles and support for child care and early childhood education
- Serve as a Resource Centre for gender and Development, including research, advocacy, capacity building, communication and resource materials in the area of gender studies and women's empowerment
- Support internalisation of gender dimension in all activities and projects of MSSRF, including gender sensitisation, training, planning, audit and evaluation
- Undertake programmes gendered in cultural studies and action, and mobilise theatre and folk media as instruments of education and gender equity

PA 500 : Information, Communication, Training, Workshops, Dialogues and Publications

- Organise post graduate and non-degree educational programmes
- Organise a Network of community controlled and operated Knowledge Centres and Virtual Colleges based on modern information and communication technologies for assisting in the eradication of poverty and promotion of human wellbeing
- Develop *The Hindu* Media Resource Centre for Sustainable Development into an important forum for dialogues on policies and controversial scientific issues
- Undertake the development and dissemination of national and global databases in areas relevant to the mandate of MSSRF
- Serve as a Resource Centre for the knowledge and skill empowerment of the women and men members of Panchayats and other local bodies in areas such as the implementation of prior informed consent, benefit sharing and Farmers' Rights provisions of the Biodiversity Bill and Protection of Plant Varieties and Farmers' Rights Bill currently before the Parliament of India.
- Develop communication and dissemination strategies and materials, especially those involving mass media and popular communication forms, to build and interface between science and society
- Undertake training and capacity building including international training programmes
- Organise seminars, workshops and multi disciplinary dialogues involving national and international participation
- Undertake the preparation of publications, training modules and educational resource material (audio, video, electronic and printed products)
- Maintain library and documentation services (printed and electronic)

- Initiate a programme for interactive learning for children in the areas of environment protection and gene revolution

PA600 : Special Projects

- Undertake ad hoc Consultancies in areas where MSSRF has the requisite expertise

- During 2000, undertake the preparation of a food insecurity Atlas of India, indicating the "hot spots" with reference to the persistence of chronic hunger as well as the standardisation of indicators for measuring food security at the level of individuals within a household in selected districts of Orissa (both these Consultancies are on behalf of the World Food Programme)

- Chronicle Good Practices for operationalising the Benefit Sharing Provisions of the Convention on Biological Diversity at the Project Level (on behalf of the UNDP/GEF)

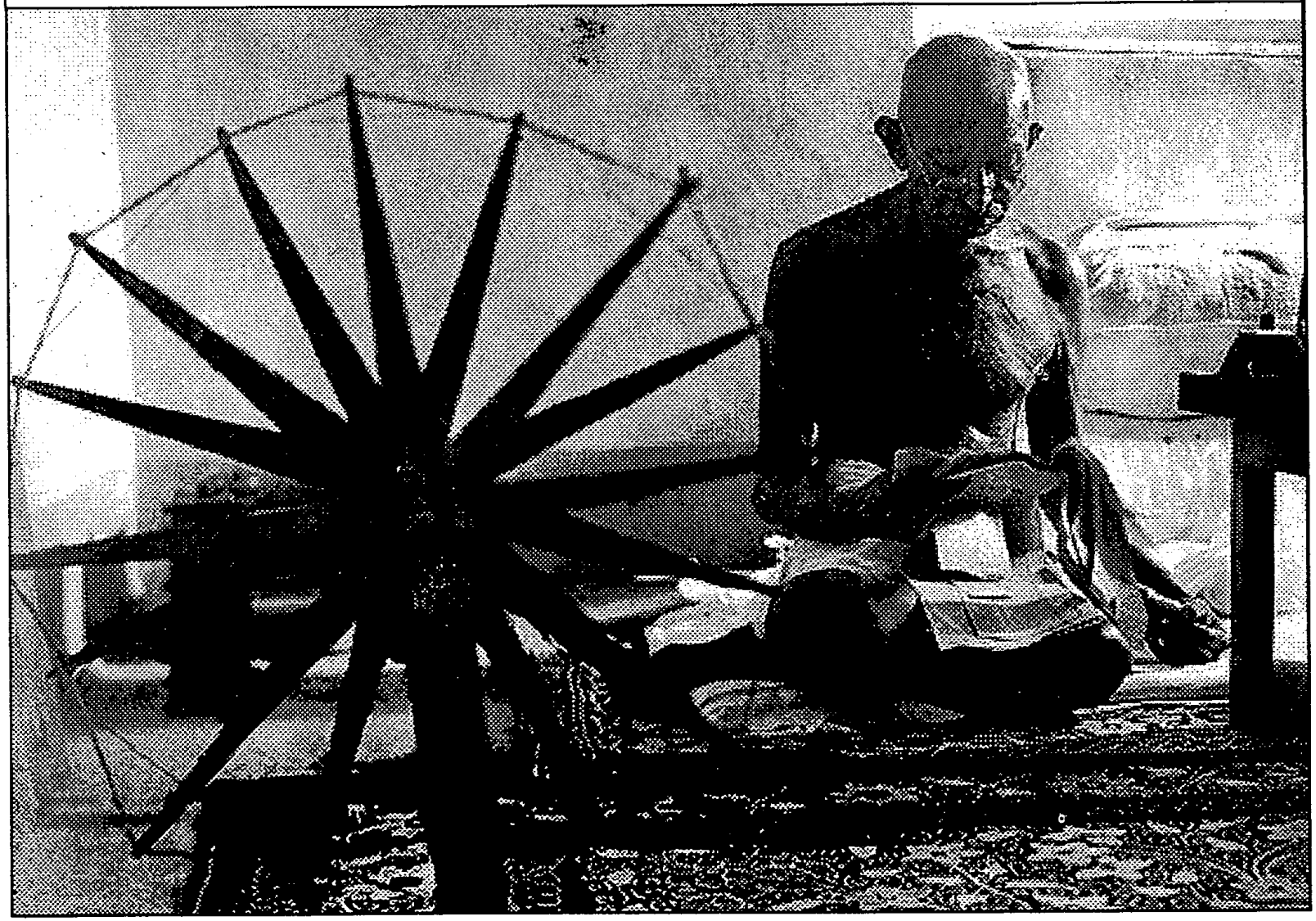
- Prepare a Vision and Action paper for the Ministry of Agriculture, Government of India

- Develop a strategy for converting all the villages of Pondicherry into Biovillages by August 2007

Conclusion

The above programmes involve a combination of strategic, applied and field level participatory research. MSSRF does not have an experimental farm of its own, as a matter of policy, since the research philosophy and methodology are based on working with farming families in their own fields. Such participatory research helps to enhance confidence in the economic, environmental and social sustainability of the technologies under development and testing and hastens diffusion of relevant research findings.

"Be the change you want to bring about"



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