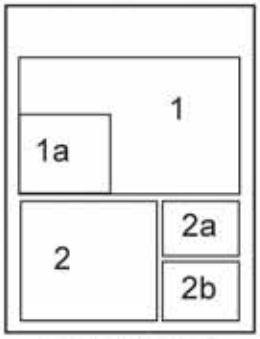
20 Years
LINKING SCIENCE AND SUSTAINABLE DEVELOPMENT
MSSRF

M. S. SWAMINATHAN RESEARCH FOUNDATION

2009-2010
TWENTIETH ANNUAL REPORT

CENTRE FOR RESEARCH ON SUSTAINABLE AGRICULTURAL AND RURAL DEVELOPMENT, CHENNAI



Front Cover

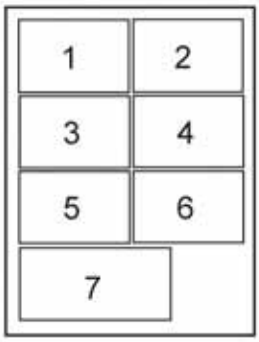
1 Human Resource Development Centre for Tribal Youth (supported by Mitsubishi Corporation) at Jeypore, inaugurated in March 2010

1a Mr. Senju, CSR Head, Mitsubishi Corporation; Dr. Surabhi Banerjee, VC, Central University, Odisha and Dr. M. S. Swaminathan at the event

2 Fish for All Research and Training Centre at Poompuhar, Tamil Nadu

2a Member of Parliament Smt. K. Kanimozhi visiting the Fish Processing Centre at Poompuhar

2b Minister of State for Human Resource Development (Higher Education) Smt. D. Purandeswari inaugurating the MSSRF-IGNOU College for Coastal Communities



Back Cover

1. Chief Minister of Kerala Shri V.S. Achuthanandan,

2 Minister of Agriculture and Food, Government of Norway, Mr. Lars Peder Brekk,

3 Minister of State for Environment & Forests Shri Jairam Ramesh and

4 Chief Minister of Odisha Shri Naveen Patnaik,

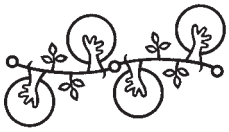
addressing the State-Level Consultations and International Conference organised by MSSRF as part of the International Year of Biodiversity, 2010

5 President, International Fund for Agriculture Development, Dr. Kanayo F. Nwanze delivering the Millennium Lecture

6 Ambassador of Switzerland Mr. Philippe Welti releasing the report on Climate Change

7 Minister for Communications and Information Technology Shri A. Raja interacting with students of Intel Learn Programme

Twentieth Annual Report
2009-2010



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Chairman's Introduction

Twenty-one years ago, MSSRF started its work in a rented building in Kotturpuram, Chennai, with the following major objectives:

- To promote **strategic research** involving genetic engineering technologies for meeting the challenges arising from potential adverse changes in temperature, precipitation and sea level caused by global climate change
- To commence **anticipatory research** to enhance the coping capacity of coastal communities to the problems arising from a rise in sea level
- To initiate **participatory research** with tribal and rural families and coastal communities in the conservation and sustainable and equitable use of biological diversity
- To link ecological and livelihood security in a mutually reinforcing manner in rural India
- To bridge the urban-rural technology divide, particularly in the area of information communication technology

This research agenda was based on a pro-nature, pro-poor and pro-women orientation to technology development and dissemination. Also, building on grass-root level experience, MSSRF initiated work on fostering science-based public policies in areas like integrated coastal system management, biodiversity conservation, mainstreaming gender considerations in research and development, use of the tools of biotechnology for creating novel genetic combinations, promoting sustainable food security and harnessing information communication technology for bridging the urban-rural digital divide as well as gender divide. It is a matter of satisfaction that during 2009-10 the work of the last twenty years has started making significant impact.

First, research on the breeding of salt- and drought-tolerant varieties of rice and other crops through recombinant DNA technology has identified valuable genes. Two international patents have been granted in 2010 — for Glutathione-S-transferase gene from *Prosopis juliflora* conferring abiotic stress tolerance in plants (United States Patent 7,655,837) and for Dehydrin gene from *Avicennia marina* responsible for conferring salt tolerance in plants (United States Patent 7,622,636) — based on novelty, non-obviousness and utility of the discoveries.

Second, the Coastal Systems Research programme initiated in 1991 has led to the adoption of Integrated Coastal Zone Management as a national policy. Mangrove forest conservation and restoration have also received attention from both government and local communities.

Third, the community biodiversity programme has encouraged the Tamil Nadu Government in taking a decision to establish five Genetic Heritage Gardens, as announced by Chief Minister Dr. M. Karunanidhi on 27 June 2010. Genetic heritage gardens will be set up in the five major agro-ecological regions of the State representing *Kurunchi*, *Mullai*, *Neithal*, *Paalai* and *Marudham* — the classification of land in Sangam literature. Dr Karunanidhi said plants and animals unique to these landscapes would be fostered in these gardens, and special emphasis will be placed on vanishing crops and dying wisdom both in agriculture as well as in Siddha systems of medicine. This will be Tamil

Nadu's contribution towards the celebration of the International Year of Biodiversity in 2010.

Fourth, the work on biovillages, which started in Puducherry in 1992 for promoting human-centred development, has now been adopted in Africa under the title, "Millennium Villages". The biovillage model of sustainable development has been based on the Rural System Research (RSR) methodology spearheaded by MSSRF. RSR, unlike FSR (Farming System Research), gives concurrent emphasis to raising farm productivity and profitability as well as non-farm employment, including small-scale industries.

Fifth, the work on watershed development has led to both the harvest of rainwater and the use of water for promoting market-driven microenterprises. Thus, every watershed is being developed as a bioindustrial watershed.

Sixth, the Information Technology programme is triggering a rural knowledge revolution through Village Knowledge Centres and ISRO-sponsored Village Resource Centres. This, in turn, has led to the initiation of a large national programme for starting 100,000 Common Service Centres under the Department of Information Technology of the Government of India. A National Alliance for Grameen Gyan Abhiyan has been formed for mobilising the power of partnership to take the benefits of ICT to rural areas. The Alliance has currently over 500 members.

Seventh, the human capacity-building programme led to the development of Training Centres for Tribal Families at Kalpetta in the Wayanad district of Kerala, and Jeypore in the Koraput District of Odisha. In addition, a "Fish for All and Forever" Training and Research Centre was inaugurated at Poompuhar in Tamil Nadu on 26 December 2009, the fifth anniversary of the tsunami which ravaged several coastal areas in India on 26 December 2004. This unique capacity-building centre imparts training in all aspects of fisheries, starting with capture and extending up to consumption. Fishermen going into the sea in small boats have been trained in using mobile phones containing GPS data on wave heights and locations of fish shoals, provided by the Indian National Centre for Ocean Information Services (INCOIS).

Eighth, research on food security at MSSRF initiated the Hunger-free India Programme in 2000. This programme titled, "Agenda 2007: A Hunger-free India" called for a Food Guarantee Act based on a rights approach to food entitlement. Though three years late in the making, the Government of India has now decided to enact legislation for conferring food security to the socially and economically under-privileged sections of society. The National Food Security Act, when adopted by Parliament, will be the most significant piece of legislation introduced in independent India, since it deals with the first among the hierarchical needs of a human being, namely, food. The goal is to ensure that the policy advocated by Mahatma Gandhi of ensuring food with human dignity becomes a reality.

Ninth, the aim of MSSRF to impart the power and economy of scale to farm families with smallholdings through a small farm management revolution made progress during this year through two major developments. First, the small farm families of Reddiyarchatram in the Dindigual district of Tamil Nadu organised themselves into a Reddiyarchatram Sustainable Agriculture Producers Company Ltd under Part IX A of the Companies Act 1956. Second, the Mahila Kisan Sashakthikaran Pariyojana started by MSSRF in Vidarbha three years ago for the

skill and management empowerment of women farmers, including the widows of farmers who had committed suicide, was elevated into a national programme in the Union Budget for 2010-11, with an initial allocation of Rs.100 crore.

Tenth, at the global level, MSSRF has been helping FAO in the following areas:

- Identification of Globally Important Agricultural Heritage Sites
- Development of a Global Soil Partnership
- Accelerating progress in achieving the UN Millennium Development Goal No.1, namely, reducing hunger and poverty by half by 2015

Also, the concept of "green agriculture" advocated by MSSRF as the pathway to launching an ever-green revolution leading to enhanced productivity in perpetuity without associated ecological harm has now been adopted by FAO.

Details of the work done under different programmes have been given in this Report. Hence, I do not want to repeat them. However, I would like to draw attention to a few significant findings and their implications.

The Coastal Systems Research (PA 100) programme initiated in 1990 to pay integrated attention to the landward and seaward sides of the coastline has now become a national strategy. The CSR programme attends to all aspects of the sustainable and equitable management of coastal resources. Thus, it involves forestry, agroforestry, and seawater farming on the landward side and sustainable fisheries and mariculture on the seaward side. Seawater constitutes nearly 97 per cent of the total water available on our planet. Mahatma Gandhi, through the Dandi March 80 years ago, emphasised that seawater is a social resource and should be utilised for the benefit of the people. The seawater farming techniques standardised by MSSRF involve the cultivation of halophytic plants and trees which possess salinity tolerance, such as mangroves, *Salicornia, Atriplex, Sesuvium, Casuarina*, cashewnut and coconut, as well as the culture of salt water-tolerant fish species. The MSSRF Sea Water Farming Centre in Chidambaram is now being developed as a national research and capacity-building centre for launching a seawater farming movement.

Another aspect of seawater farming is the below sea level farming techniques already in practice in the Kuttanad area of Kerala. Here, farmers had started cultivating rice below sea level (4 to 5 m below MSL) nearly 150 years ago. In an era where sea level rise is a distinct possibility because of climate change, there is need for anticipatory research in the area of standardising agronomic techniques for below sea level farming. MSSRF is developing the Kuttanad area as a Globally Important Agricultural Heritage Site and is planning to set up a Below Sea Level Farming Research and Training Centre in the Vembanad lake area.

Research on Biodiversity (PA200) gained momentum during this year, which has been declared by the United Nations as the International Year of Biodiversity. Policy Makers' Workshops have been held in Thiruvananthapuram, Bhubaneshwar and Chennai for sensitising policy makers on the implications of the community-managed agrobiodiversity programmes carried out by MSSRF during the last 16 years. The various suggestions that emerged at these workshops

have been compiled and published. Steps to collect and conserve rare, endangered and threatened (RET) species was intensified and a RET Conservation Garden was set up at Kalpetta. The 4C model of biodiversity management – conservation, cultivation, consumption and commerce – developed by MSSRF is gaining popularity. It is clear from the work done so far that sustainable efforts in the field of agro-biodiversity conservation will succeed only if there is an economic stake in conservation. The work of MSSRF has led to the development of the concept of biovalleys along watersheds, which will help to integrate biodiversity, biotechnology and business in a mutually reinforcing manner. The Genome Saviour Award instituted by the Plant Variety Protection and Farmers' Rights Authority on the suggestions of MSSRF is proving to be an important method of recognising and rewarding the invaluable contributions of tribal families to the conservation and enhancement of genetic resources.

Research in Biotechnology (PA-300), with particular reference to recombinant DNA technology, has resulted in the development of novel genetic combinations for tolerance to seawater and drought and for iron enrichment. As mentioned earlier, international patents now cover these findings. MSSRF has been helping the Department of Biotechnology in finalising the details of a Biotechnology Regulatory Authority Bill to be introduced in Parliament. The anticipatory research programme started in 1992 with the help of the Department of Biotechnology has now resulted in valuable genetic material that can enhance the coping capacity of coastal communities in meeting the challenge of sea level rise. As soon as the necessary clearances are received from the Regulatory Authority, rice varieties having high tolerance to salinity as well as those that are rich in iron can be introduced for assessment by farmers in their own fields. Bioprospecting of lichens and microorganisms have made excellent progress.

The science of Ecotechnology (PA 400) is now increasingly assuming importance since it helps to impart the dimension of environmental sustainability to technology development and dissemination and marry traditional ecological prudence with frontier science. The JRD Tata Ecotechnology Centre is spearheading a movement for converting every village into a biovillage and every watershed into a bioindustrial watershed. In this manner, concurrent attention can be paid to both on farm and non-farm employment. The Ecotechnology Centre has also standardised precision farming techniques in order to ensure that factor productivity is enhanced. At the same time, the Centre has been working on climate-resilient farming techniques that can enhance the coping capacity of rural families to meet the challenges of temperature rise and adverse alterations in precipitation. It is proposed to train one woman and one male member of every panchayat as Climate Risk Managers, well versed in the science and art of climate risk management.

The work on Food Security (PA 500) helped to update the MSSRF-WFP atlases on rural and urban food insecurity. A significant development during this period was the finalisation of an action plan titled Operation 2015 designed to help the rural and tribal families of the Koraput-Bolangir-Kalahandi region of Odisha to achieve freedom from hunger and poverty. This effort is a collaborative programme involving CFTRI, Mysore; NIN, Hyderabad; OUAT, Bhubaneshwar and the State Government of Odisha. As a first step, a

database has been developed on all the nutrition safety net and support programmes available to the people of this region. A Nutrition Security Passbook enables local communities to become aware of their entitlements and on procedures to access them. A benchmark survey has been carried out in order to measure the impact of this programme and its success in achieving freedom from hunger by 2015. Reducing hunger and poverty by half by 2015 is the aim of the UN Millennium Development Goal No.1.

The Information, Communication Technology programme (PA 600) has started to promote sustainable rural development. Village Knowledge Centres and Village Resource Centres are providing dynamic and demand-driven information in local languages. Steps were taken to achieve convergence and synergy among various government programmes in the field of education, employment, health care, sanitation, drinking water, rural industries and small-scale enterprises. Entitlements Passbooks are being issued to every household in the areas surrounding the VKCs and VRCs. Last mile and last person connectivity is being achieved through synergy between the internet and the mobile phone. ICT has opened up uncommon opportunities for bridging not only the digital divide between urban and rural areas, but also the gender divide in villages.

These programmes have accorded high priority to training and capacity building. To cite an example, Panchayat Raj leaders have been trained in the provisions contained in both the Biodiversity Act and the Plant Variety Protection and Farmers' Rights Act. The training has empowered local communities in the conservation and sustainable and equitable use of biodiversity. Numerous training programmes have been organised in empowering rural communities to master digital technologies. The Jamsetji Tata National Virtual Academy for Rural Prosperity has selected 1223 national and 31 internatioal Fellows this year. Steps are underway to establish Village Knowledge Centres in the aboriginal areas of Australia through partnership with Australian organisations and FOSA (Friends of Swaminathan, Australia). Already, such a partnership exists with Chile under a Memorandum of Agreement signed during the visit of the former President Dr Michelle Bachelet to MSSRF in 2009. Opportunities have also been provided to young scholars to get Ph.D degrees at the University of Madras based on work done at MSSRF, and during the year, three of them have given in their thesis submissions.

All this could not have been achieved but for the generous support of State and Central Government institutions, ICAR and State Agricultural Universities, national and international as well as individual donors, other sister scientific organisations both in the public and NGO sectors, and, above all, rural and tribal families. We wish to extend our gratitude to all of them. Our thanks are also due to the scientists and scholars as well as the administrative staff of MSSRF who carried out their tasks with great dedication and distinction under the visionary leadership of Dr Ajay Parida. Our thanks go to the Trustees of MSSRF who gave their time generously to assist the institution to grow to greater heights of scientific excellence and social relevance. During the year, most of the recommendations contained in the External Review Report of Dr. Uma Lele and Dr. Kavita Gandhi have been implemented. Steps have been taken to "right size" the staff strength in order to ensure that there was a proper match between programme needs and staff strength.

I wish to thank Dr. Sudha Nair, Dr. Rajalakshmi Swaminathan and Dr. V.A. Nambi for their hard work in compiling the Annual Report and Dr. N. Parasuraman for the photographs. Thanks also go to Ms. Gita Gopalkrishnan for editing the Report with care and thoroughness. We are also grateful to AMM Screens for bringing out the Report in a reader-friendly manner.

M. S. Swaminathan
Chairman

Programme Area 100

COASTAL SYSTEMS RESEARCH

The Village Development and Management Councils established in 14 tsunami-affected villages were strengthened through organising cross-learning visits between project villages and linking these councils with PRI. The community-based plan for long-term management of the mangrove bioshield established in about 250 ha was prepared jointly with all the stakeholders, and pilot tested. The reclamation of agricultural land from about 50 ha of abandoned shrimp farms and the introduction of eco-friendly aquaculture in about 400 acres of these farms have been the major livelihood activities completed this year. A series of gender sensitisation workshops were conducted for project staff, partner NGOs, youth, women and men and PRI leaders of the project villages. Initiatives were taken to increase the effective utilisation of remote sensing and geographical information system across programme areas of MSSRF. Community-based disaster risk reduction planning was another initiative taken up during the year.

Glimpses of eco-restoration of mangroves, seawater farming and multi-species non-mangrove bioshields

Programme Area 100

Coastal Systems Research

During this year, the main focus on strengthening the resilience of tsunami-affected communities was on the preparation and pilot testing of community-based management plans for the mangrove bioshield. The plans were prepared jointly by the community, PRI, partner NGOs and MSSRF. This joint planning helped in assessing strengths, weaknesses, opportunities and threats to take corrective steps in the management of the bioshield. It also helped in mobilising substantial resource contributions from the community, which would increase community ownership of the bioshield programme. Last year, 480 acres of abandoned shrimp farms were reclaimed back to agriculture, and the performance of paddy cultivation in these lands has been monitored. It clearly showed the effectiveness of technological processes in reclaiming land from high saline abandoned shrimp farms. A participatory process was developed and followed for the assessment of disaster risks in selected project villages, which will be used in the coming year to prepare model community-based disaster risk reduction plans.

Sub Programme Area 101

Mangrove and Non-mangrove Coastal Bioshields

The India-Sri Lanka project on strengthening the resilience of the tsunami-affected communities, which was implemented in 14 villages in Tamil Nadu and Andhra Pradesh, came to an end in March 2009. The project processes, output, and outcomes were evaluated in March 2009 by an external evaluator. Details of this evaluation have already been reported. The evaluation recommended extension of the project for 15 months mainly to complete the following activities: i) strengthening community-based organisations, ii) preparing and testing of community-based management plans for mangrove and non-mangrove bioshields, iii) strengthening some of the livelihood activities, iv) training project staff and partner NGOs on community-based disaster risk reduction, v) preparing and pilot testing of sustainability plan for VRCs and VKCs and vi) documenting and disseminating processes and results of the project.

Community mobilisation and organisation

In all the 14 project villages, a village-based organisation called the Village Development and Management Council (VDMC) was formed with adequate representation of women, poor families, youth, Panchayati Raj institutions, partner NGOs and MSSRF. The important functions of VDMC are local-level planning, and the implementation and monitoring of project activities.

Cross-learning visits: During project evaluation, it was understood that the performance of some VDMCs was much better than the others and it was suggested that exchange visits could be organised among project villages for horizontal

transfer of knowledge and experiences. In Tamil Nadu, representatives of VDMCs of Muthuregunathapuram and Kattumavadi and Thangamalpuram and Kattumavadi visited each other's village, interacted with the community, visited bioshields and discussed the effectiveness and efficiency of VDMC as well as livelihood interventions and management of bioshields. As narrated by the participants, the key learning from such exchange visits included the need for active participation of youth — both male and female —- for effective functioning of village level institutions as also the need for sharing the cost of developmental interventions by the community to increase its ownership. Many of the participants were of the view that this kind of cross-learning exercises will strengthen social relationships and networking among villages.

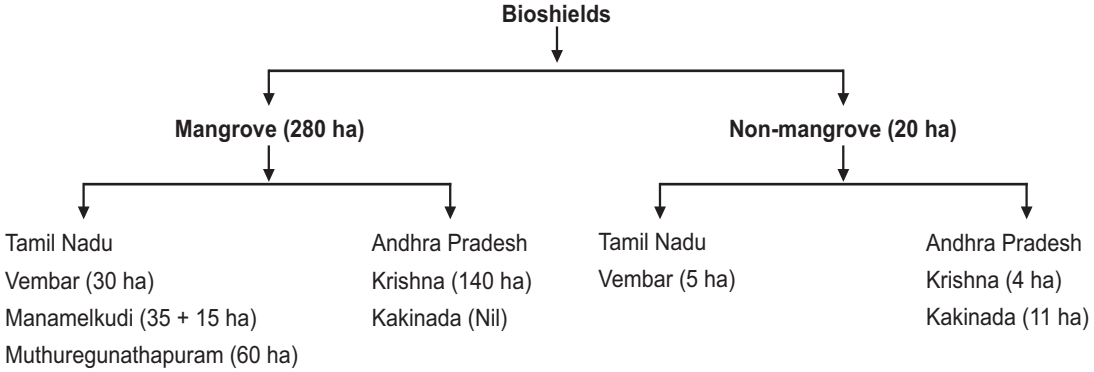
In the case of Andhra Pradesh, a cross-learning visit was organised between Danavaipeta and Sorlagondi village. In addition, a group from Nali, Sorlagondi and Edurumondi villages in the Krishna site visited Danavaipeta in the Kakinada site. In the former case, major discussions were held among the community of the two villages on the reclamation of agricultural land from abandoned shrimp farms and eco-friendly aquaculture since these activities had completely stopped out-migration and brought prosperity to the village. Community members were also taken to the field to observe the implemented activities and their impact. This visit helped Danavaipeta villagers to take initiative for the diversification of livelihood activities. In addition, Sorlagondi villagers shared their experience with conflict resolution mechanisms and achieving cohesiveness of the community in addressing developmental issues. In the second case, people from Nali, Sorlagondi and Edurumondi learned how to manage the revolving fund, including operational procedures and guidelines, from women members of Danavaipeta. In addition, they also understood the importance of both the ecological and economic value of the non-mangrove bioshields.

Linking with Panchayat Raj institutions: In both the Krishna and Kakinada sites in Andhra Pradesh, linkages between VDMC and Panchayat Raj institutions (PRI) were established in order to address some of the development issues identified during the participatory rural appraisal and also to sustain the project activities initiated in these villages. The village-level institution in Danavaipeta worked with PRI in getting community toilets as well as individual family toilets and also a school building. In Narsipeta village, such linkages helped in getting a community hall and in Edurumondi village, PRI laid irrigation pipes as per the request of VDMC.

Bioshield

As indicated in **Figure 1.1**, a community-based mangrove bioshield was raised in about 280 ha in different project villages. Similarly, a multi-species non-mangrove bioshield was raised in about 20 ha.

Figure 1.1 ***Mangrove and non-mangrove bioshields established in tsunami-affected villages in Tamil Nadu and Andhra Pradesh***



Community-based long- term management plans for mangrove bioshields

In spite of active participation by VDMCs in planning, planting, protecting and monitoring bioshields, it was realised during project evaluation that it was not advisable to leave the mangrove bioshield management with VDMCs at this early stage as it requires long-term strategies, technical guidance and funds. Therefore, it was decided to prepare a long-term community-based management plan for mangrove bioshields in Kattumavadi and Muthuregunathapuram villages in Tamil Nadu and Sorlagondi in Andhra Pradesh.

Process: In both the States, appropriate resource persons with fluency in the local language were identified to facilitate the process of preparing the plan. These facilitators were first oriented to the goals, purpose and participatory process of the project and activities undertaken, with detailed presentation on establishment of mangrove bioshields. Following this, a multi-stakeholder team comprising facilitators, members of VDMC and Panchayat Raj institutions, and staff from MSSRF and partner NGOs was formed. The team followed the following process in preparing the plan:

- Developing criteria jointly with the community to assess the current status of the bioshield
- Organising joint field visits to the bioshield
- Conducting Strength, Weakness, Opportunity and Threat (SWOT) analysis of the bioshield programme
- Collecting data by community members on the survival and growth rates of plants in a representative area
- Analysing information and learning by the team
- Holding discussions with the community, VDMC members and village leaders on their concerns, anticipated problems, activities to be carried out and the finance required in managing the mangroves

- Presenting a draft management plan to VDMC for its approval and feedback
- Obtaining formal concurrence and confirmation to commence the 6-month test run
- Reviewing the test run in the 6th month, incorporating the required changes into the management plan and putting up the final management plan for approval and funding
- Commencing the operation of the final management plan, from the 7th month

Kattumavadi mangrove bioshield

Joint field visit: As indicated above, a joint visit to the bioshield site was conducted by the multi-stakeholder team along with a considerable number of women and men. The assessment conducted by the team showed that involvement of, and ownership by, the local community was excellent and watch and watch was regular. The joint assessment also indicated that the survival rate of direct plantations of *Rhizospora* in the inter-tidal region was found to be more than 60 per cent, with the height of the plants reaching 54 to 74 cm. The survival rate of *Avicennia* planted in the canal areas was found to be 79 per cent, with an average height of 63 cm. During the visit, the team noted the presence of large numbers of migratory birds. The villagers said that this was the first time migratory birds were visiting the site.

SWOT analysis: Following the field visit, SWOT analysis of the bioshield programme was conducted in the village in which VDMC members including leaders, women and youth actively participated. The following are the results of this analysis.

Strengths

a. The target community has taken ownership of the programme over the past 2 years and both men and women of the village community are equally involved and committed to the programme.

b. The community not only lives contiguously and next to the mangrove forest area, their livelihoods depend on it.

c. The community is able to take decisions according to changing practical situations.

d. MSSRF has gained much credibility among the community for enabling the women and men to come together and work jointly.

Weaknesses

a. The community is unable to derive immediate economic benefits from mangrove plantations.

b. At present there is no local NGO who could provide the much needed facilitation and liaison support with MSSRF and government departments / agencies.

Opportunities

a. Three aqua culture ponds belonging to the Department of Fisheries within the village boundary and contiguous to the present bioshield area are lying unused. These ponds could be developed into an integrated mangrove fishery farming

system (IMFFS), which will enhance livelihood opportunities.

b. MSSRF has the technical know-how and financial capacity to develop this area as a model IMFFS.

Threats

a. Dead sea grass completely covers the young plants or pulls them down during tides.

b. Canals that have been dug may get silted or blocked.

c. Local cattle and goats graze the mangroves.

d. Clam shell and prawns are picked from the roots of the mangroves, thus endangering their growth.

Key issues and solutions: The key issues/ problems that would be faced in managing the bioshield in a sustainable manner were discussed threadbare with the community. Some issues were known, while some were unknown to them. **Tables 1.1** and **1.2** set out the issues discussed and classified as controllable and uncontrollable by the local community.

Table 1.1 ***Kattumavadi mangrove bioshield: issues under the control of the community***

No.	Issues	Possible solutions	
		Proactive/preventive	Reactive
1	Grazing by livestock	Ban on free grazing, continuous vigilance, fodder depot, live fencing with cacti	Penalty
2	Fishermen running nets over the plants (shore fishing with karavalai)	Continuous vigilance, buoys with fluorescent flags or LED lamps indicating area of cultivation (MAS) and designated corridors	Penalty
3	Cut for fuel wood	Strict enforcement of total ban on felling of mangroves, provision of alternate fuels (solar / bio-gas / LPG / power)	Penalty
4	Hand-picking of clams, crabs, prawns from under young plants	Strict enforcement of total ban on hand-picking, till the trees attain a particular height	Penalty
5	Natural death of plants through flooding during monsoon		Replant as and when dead

Key functions: At the end of the discussions on bioshield management, it was decided to take up the following functions over the next 3 year period: sea weed removal, regular watch and ward, desilting/deepening of trenches, re-planting of dead plants, overall supervision of management activities and managerial assistance. VDMC was made the agency responsible

Table 1.2 ***Kattumavadi mangrove bioshield: issues not under the control of the community***

No.	issues	Possible solutions	
		Pro active/ preventive	Reactive
1	Uprooted sea grass	Stop eco-insensitive fishing methods	Repetitive manual removal
2	Aqua culture	Bring in a local voluntary code in preventing new ones and stop older ones	Polluter pays
3	Salt production	Request formally / informally to move the salt pans	Polluter pays
5	Climate change	Enhance local population's appreciation of harmful effects of increase in sea level	None

for the implementation of all the activities except the last, which would be taken care of by the local NGO or MSSRF field staff.

Fund requirement: The cost estimates for the above activities over the next three years are shown in **Table 1.3.** Of the total cost of Rs.4,14,000/-, the community is ready to contribute 27 per cent (Rs.1,13,000/ -) by way of part-time labour and the remaining 73 per cent, will be met by the project.

Table 1.3 ***Detailed cost estimates for planned mangrove management activities***

Activity	Frequency	Per unit cost (Rs.)	No. / Year	Annual cost (Rs.)	Cost for 3 years (Rs.)	Community contribution
Sea grass removal	Quarterly	5,000	4	20,000	60,000	12000
Watch and ward	Daily	150	365	54,750	1,64,250	82125
Deepening of trenches	One time	50,000	-	50,000	50,000	0
Replantation of dead plants	One time	20,000	-	20,000	20,000	4000
Fencing Half-yearly	5,000	2	10,000	30,000	6,000	-
Overall supervision	-	-	-	-	-	-
M & E Monthly	250	12	3,000	9,000	9,000	-
Managerial Assistance	Weekly	500	54	27,000	81,000	0
Total			**1,84,750**	**4,14,250**	**1,13,125**	

As per the plan, funds are provided to VDMC and it is implementing the plan since January 2010.

Muthuregunathapuram mangrove bioshield

Joint field visit and SWOT analysis: As in the case of Kattumavadi village, the multi-stakeholder team visited the bioshield site along with the villagers and it was noticed that the survival rate was more than 90 per cent (based on measurements randomly over 10 sq.m plots). The growth rate of the plants was good, reaching about 35 to 95 cm over a period of 9 to 12 months. Following this, SWOT analysis of the mangrove bioshield programme was taken up. It revealed that effective functioning of VDMC, enabling environment for equal participation by women, cordial relations between VDMC and panchayat are some of the strengths of the village. High level of illiteracy, under- and unutilised natural resources such as land, palmyra, etc., and scanty rainfall were the weaknesses.

Key issues and solutions: Following this, group discussions were held with the community, including women and youth, to identify key issues affecting the bioshield and suggest possible solutions. Deposition of seaweed on plants during the monsoon season, grazing by livestock, fishermen running the nets over the plants during shore fishing, fuel wood collection and death of some plants during the monsoon season due to flooding were the major issues identified. Manual removal of seaweed, prevention of shore fishing in the bioshield area through negotiation, continuous vigilance through watch and ward, developing fodder bank and providing alternative sources of fuel were the proactive solutions suggested to tackle these issues. Development of prawn farms, discharge of effluents from nearby prawn farms and exploration for oil in the areas close to the mangrove bioshield showed up as areas over which the community had no control and it was decided to request the cooperation and assistance of the concerned authorities with active help from SPEED, the local partner NGO, and MSSRF at the appropriate forums to deal with them.

Key functions: It was decided to take up the following functions over the next 3-year period: watch and ward, sea grass removal, replantation of dead plants and overall supervision of management activities and managerial assistance. As in Kattumavadi, VDMC was made responsible for the implementation of all the activities except the last, which will fall to the local NGO or MSSRF field staff.

Fund requirement: The cost estimates for these activities to be carried out over the next three years has been calculated as Rs.3,92,000/-, of which Rs.2,19,000/- will go only for watch and ward. The community is willing to pay this amount (54 per cent of the total cost) by way of appointing a community watcher. The remaining 46 per cent will be provided to the VDMC to carry out the other activities.

Sorlagondi mangrove bioshield

Joint field visit: In Sorlagondi village, the mangrove plantation has been raised in

about 140 ha in two batches. The field visit by the multi-stakeholder team showed that the survival rate of *Avicennia marina* was about 75 per cent and that of *Rhizophora* was about 90 per cent. *Avicennia marina* reached an average height of about 50 cm, *Rhizophora* 45 cm and *Bruguiera* around 42 cm. The team also noticed naturally regenerated seedlings of *Avicennia marina* in large numbers. There were also a large number of juvenile prawn, fish and crabs in the mangrove plantation area.

SWOT analysis: The SWOT analysis in Sorlangondi village, in which a large number of women, men and youth participated, showed the following:

Key issues: Protection of mangrove bioshield in 140 ha from grazing, casualty replacement in the mangrove bioshield, desilting of canals, strengthening the skills of the community in sylviculture practices such as mangrove nursery, digging canals and linkages for livelihood and bioshield development have been identified as key issues in this mangrove bioshield programme.

Key functions: As per the decision of VDMC, the mangrove plantation will be protected by community members for 8 months while a paid watcher will be appointed during the peak agricultural season. During January 2010, dead plants were removed and new saplings were planted. Desiliting of feeder canals in 110 ha of the plantation area was taken up

Strengths

- Mangrove bioshield close to the village which is easy for monitoring
- Fishery resources and livelihood opportunities of the fishermen enhanced
- Opportunities for labour through mangrove restoration works in lean agriculture seasons
- Reduced wind erosion during summer
- Watch and ward by the community

Weaknesses

- Loss of common grazing land as cattle from nearby villages graze inside mangroves
- Ownership of the land with government, so less possibility of encroachment
- Side canals silted in a few places

Opportunities

- Increase in fishery resources due to growth of the mangroves
- Protection from natural disasters such as cyclones and tsunami
- Employment opportunities for men and women in mangrove restoration works
- Increased habitat and biodiversity in the restored area
- New areas for plantations available
- Mobilisation of funds through NREGS and forestry projects.

Threats

- Siltation of natural creeks preventing tidal water flow into the restored area
- Change in land use in future, with land rights given to others by the government

during March 2010 to facilitate optimum tidal flow during summer.

Fund requirement: The total cost involved in activities at Sorlagondi has been calculated to be Rs.4,56,000/-, of which Rs.72,000/- (about 15 per cent) is the community's contribution in kind by employing a community watcher; the remaining amount has already been provided by the project and VDMC is carrying out the management activities.

Livelihood activities in Tamil Nadu

During last year, Rs.3,00,000/- was provided as a revolving fund to a group of Women SHGs in Kattumavadi village through VDMC, which divided this amount equally and handed Rs.2,500 to each of the 120 women members. The women have availed this as a soft loan from VDMC and are repaying it over 13 months (Rs.200 per month with 4 per cent interest per annum). The money so returned is now being ploughed back into the community fund, whereby loans are given at 12 per cent interest per annum for livelihood purposes as well as for personal reasons such as marriage and higher studies. Analysis of the current status of the revolving fund was carried out with the women members with the help of HANDS, a local NGO. This organization also takes care of implementation of the bioshield management plan. **Table 1.4** sets out the major issues identified in operating the revolving fund, the reasons for such problems and possible solutions.

Table 1.4 ***Major issues and solutions in the management of the revolving fund***

Issues / Problems	Reason(s)	Solution(s)
Delay in repayment by about 40 women, over the last two months	Lack of clarity as to why money should be repaid and lack of responsibility on the part of the women and the VDMC members	A neutral agency such as a local NGO, to monitor, record and inform the status quo of the finance of VDMC on monthly basis and report the same to MSSRF
Under utilisation of money repaid (corpus)	Information on the corpus money available and its utilisation only with a few in VDMC	Sensitisation of VDMC members on rotation of money
Minute book, cashbook of VDMC and other record maintenance to be improved and kept up-to-date	Responsibility to minute, write the cash-book, etc. not fixed on anyone	Responsibility to be given to an individual, if necessary by paying a small monthly honorarium
Meeting of VDMC not held over last two months	No proper follow-up by NGO	A new local NGO to be enlisted to ensure that VDMC carries out its scheduled activity, in a regular manner and benefit a large target population among the community

Ten girls from women-headed families were trained in nursing and all of them are now employed in private nursing homes. With technical knowledge and skill upgradation, their productive ability has been increased and this has helped in combating the disadvantages of being girl children in women-headed families. Since there has been an increase in the number of outboard motors used for fishing it was felt that interested youth could be trained in outboard engine servicing. Ten young men were given three months training. Some of the trainees have taken up outboard engine servicing as a part time income-generating activity besides fishing. One of the trainees has started a servicing unit with the help of funds provided by VDMC.

Livelihood activities in Andhra Pradesh

Reclaiming agricultural land from abandoned prawn farms: As mentioned in last year's report, about 480 acres of abandoned prawn farms with high soil salinity were reclaimed for agriculture in Sorlagondi and Nali villages during 2008-2009. In these lands, farmers have successfully harvested four crops of paddy till April 2010. On an average 2.25 tons of paddy were harvested. Revival of agriculture enhanced employment opportunities in the villages, which has completely stopped temporary out-migration of farmers. Other income-generating activities have also increased, such as the rearing of milch animals due to increase in availability of paddy straw. This successful intervention made many owners reclaim agricultural land from their abandoned shrimp farms. For example, about 50 acres of abandoned shrimp farms, owned by 32 farmers of Venugopalapuram, were reclaimed during December 2009 and cultivation of paddy will be started here in July 2010.

Eco-friendly aquaculture: Last year, sustainable shrimp farming with eco-friendly practices started in about 360 acres of abandoned shrimp farms. This year another 400 acres of abandoned shrimp farms were brought back to shrimp farming by the farmers of Sorlagondi through linkages with National Centre for Sustainable Aquaculture (NaCSA) and partner NGO, Praja Pragathi Seva Sangham (PPSS). PPSS mobilised funds for 18 electrical motors, which are being used by 270 farmers collectively. The community and the government equally shared the cost of bringing electricity to the shrimp farms. Apart from the above, the NaCSA has provided revolving funds for five societies of shrimp farm owners. NaCSA is giving farmers technical support for good management practices like usage of disease-free seeds, maintenance of better water quality through regular water exchange processes, and usage of optimum quantity feed. The cost of farming has been reduced drastically due to electrification of ponds and the government is also initiating the process of electrification through National Fisheries Development Board (NFDB). Now the shrimp farmers are getting a profit of about Rs. 20,000/- per acre per year by practising sustainable aquaculture practices.

Training on post-harvest technology: Fishery-related post-harvest technology training was identified as one of the needs

during the preparation of the fund management plan in Danavaipeta village. The main aim of the training was to reduce post-harvest losses and also provide good quality products to the users. Hygienic handling techniques in fish cutting, removing gut, skin, gills and other wastes, salting and drying were demonstrated and hands-on training was given to 70 SHG members. The villagers actively participated in the training programme and were encouraged to use the techniques in fish processing. Different value-added products such as fish noodles, fish powder and tinned fish as well as the instruments used for preparation of boneless fish meat were exhibited in the training programme. Team of experts from Central Institute of Fisheries Technology (CIFT), Visakhapatnam, imparted the training.

Community-based disaster risk reduction

Community-based disaster risk reduction (CBDRR) is one of the components of the project on strengthening the resilience of the tsunami-affected communities of India and Sri Lanka. An important expected outcome of increasing the resilience of coastal communities is to reduce or avoid disasters by reducing hazards and vulnerability. Therefore, understanding and assessing risk is essential for enhancing the resilience of coastal communities. However, activities related to CBDRR could not be implemented earlier due to limited in-house human resources to take the work forward. There was also delay in identifying and developing partnerships with resource institutions. Recently, RedR (Registered *Engineers for Disaster Relief*) India was identified as a resource institute to collaboratively implement activities related to CBDRR. The purpose of collaboration was twofold: first, to enhance staff and project partner's capacity on community-based disaster risk assessment and disaster risk reduction planning and second, to ascertain and understand the project contribution towards strengthening community resilience. The project was implemented in all the 14 selected villages, and 4 of the villages (2 each in Tamil Nadu and Andhra Pradesh) were selected for conducting vulnerability and risk assessment. Further, one village from both the States is being identified for developing the disaster risk reduction plan. A well defined step-by-step process was followed to realise these objectives.

Process: The following is the process developed by MSSRF staff and RedR.

- Training on vulnerability and risk assessment to the staff of MSSRF and its partner organisation
- Conducting participatory disaster risk assessment in the selected villages with handholding by RedR
- Developing disaster risk reduction plans for selected villages through workshops

Resource persons from RedR India agreed to facilitate the whole process through workshops and handholding in field exercises.

Training: RedR India conducted a workshop on CBDRR in April 2010, which was attended by 17 participants. There were 4 representatives from partner NGOs, namely, HANDS, SPEED

and PPSS. Apart from project staff of PA 100 Coastal Systems Research, staff from PA 400 Ecotechnolgy and PA 600 Information, Education and Communication participated in the training.. By the end of the workshop, participants were able to (i) describe the basic concepts underlying CBDRR, (ii) describe the context and significance of disaster risk reduction, (iii) explain hazards, vulnerabilities, capacities and guidelines for assessing risks, (iv) explain the participatory facilitation of hazard, vulnerability, capacity and risk assessment of individuals, families and communities and (v) explain the process of participatory risk management planning.

Participatory disaster risk assessment in Tamil Nadu

In order to provide practical exposure, participatory disaster risk assessment (PDRA) was conducted in Kattumavadi and Muthuregunathapuram villages of Tamil Nadu with the facilitation by a consultant from RedR. The team, consisting of staff of MSSRF and partner NGOs who were trained in CBDRR and RedR facilitators, discussed and worked out plans and strategies for executing PDRA in both the villages using participatory learning and action techniques as per the operational guidelines of risk assessment.

On day one, the community was oriented on the proposed process of PDRA and the concepts of hazard, vulnerability, risk and disaster were demonstrated. The tools to be used for assessing the hazards, vulnerability, risk and existing capacities were decided and volunteers were selected from the community. This was followed by a 'transect walk' around the village. Finally, the team members met for a review meeting. Upon receiving feedback from all the team members, the exercise was conducted in three groups (participatory mapping, seasonal calendar / timeline, and Venn diagram).

On day two, one group prepared participatory mapping which comprises social mapping, resource mapping and hazard mapping with active community participation. The participatory map created was later discussed with a group of children, and their views were also incorporated. The second group completed timeline, Venn diagram and seasonality mapping exercises with a good representation of elderly members, youth and women. One of the major observations from Venn diagram was that most of the lifeline service providers made it to the outermost circle. Finally, community members themselves created the seasonality calendar wherein their traditional knowledge of different seasons in a year, weather conditions during these periods and possible impact on their life and livelihood was represented creatively. These exercises enabled the group to identify hazards (both in the past and present), their time of occurrence, vulnerability and risk exposures and the prevailing coping capacities of the communities.

Participatory disaster risk assessment in Andhra Pradesh

Similar to the Tamil Nadu exercise, PDRA was undertaken in Danavaipeta and Nali villages in the East Godavari and Krishna districts of

Andhra Pradesh in May 2010 with facilitation by RedR consultants. Participatory learning and action techniques such as participatory mapping (social, resource and hazard), transect walk, timeline, Venn diagram and seasonality mapping were prioritised and executed to ascertain the types of hazards, vulnerabilities, risks and existing capacities in the community.

On day one, the community was given orientation in the concepts of disaster, hazard, vulnerability, risk and capacity. Further, the activities related to the participatory disaster risk and capacity assessment were discussed with the community and a momentum was set by ascertaining the history of the villages through interaction. Gradually the team along with a few key informants undertook transect walk in the villages and documented the observations and information shared by the informants. The transect walk towards the sea helped to understand the topography of the area, view of the surrounding environment and ecological systems.

On day two, before leaving for the field, facilitators prepared a checklist of different aspects to be covered in the participatory mapping. Women initiated the participatory mapping and gradually men and the children took part. Active community participation demonstrated the villagers' awareness and ability to confront the vulnerable and risk situations in their lives. As the gathering was large, they were split into two groups to conduct exercises like timeline, seasonality mapping and Venn diagram. Through these exercises, the seasonal dimensions and trends in activities, problems, and occurrence of disasters as well as the perceptions of the community and their relationships with other stakeholders were elicited.

It was noticed in all the four villages in Tamil Nadu and Andhra Pradesh that the heightened awareness among the community members on hazards was able to provoke thinking among them about the ill effects of such hazards on their lives and livelihoods. With inputs on planning for the same, community resilience can be enhanced. Therefore, it is planned that the data collected through the PDRA process will be fed into the reporting formats as given in the guidelines for risk assessment and later the RedR team will visit for consolidation of these reports and to evolve disaster risk reduction plans with the participation of the multiple stakeholders.

Gender

A series of training on gender was organised to enhance the capacity of the community, project staff and partner NGOs. As a first step, a trainers' training programme on gender was conducted for selected staff of MSSRF and partner NGOs. Following this, an in-house Gender Training Team was formed to conduct gender sensitisation workshops to the community. Separate sensitisation programmes were conducted, with the assistance of a resource person, for men, women, youth, traditional and elected leaders of the community and other groups in the project villages.

Trainers' training

A three-day training programme on gender was organised for project staff of MSSRF and partner NGOs. In total, 24 staff including 6 women and 18 men participated in the training. The purpose of the training was to enhance the capacity of the project staff at different levels on gender concepts and gender analysis in order to promote gender inclusive project interventions. Various participatory methods like interactive sessions, group work, panel discussions, role play, etc., were used. The participants were exposed to the following aspects:i) gender definition, ii) difference between sex and gender, iii) gender dimensions of social relationships, iv) gender constructions, v) gender ideology, vi) patriarchy and stereotypes, vii) triple role of women, viii) practical and strategic gender needs, and ix) different approaches to women's development and empowerment. The in-house training team that was formed comprised 5 staff members from MSSRF and 6 from the partner NGO. A framework on conducting gender sensitisation workshops was designed.

Gender sensitisation workshop for women groups: Women leaders from 3 project villages of the Vembar site participated in a gender training programme. Similar training was organised in Manamelkudi for women leaders of 3 project villages of the Manamelkudi site. It was the first time that these women leaders were attending a workshop on gender and they requested that more such should be organised in their villages so that other women can participate. They also wanted such workshops to be conducted for men.

Gender sensitisation workshop for youth groups: A gender training workshop organised for youth groups of the project villages at the Manamelkudi site had 22 women and 11 men participants. While the introductory and valedictory sessions were common to all, the participants were split into groups for other sessions.

Acting on the suggestion that the VDMC leaders and members be sensitised too, because they were the ones who participated in group meetings and prepared, implemented and monitored village level plans, it is proposed to organise one-day training for the PRI leaders and traditional leaders at panchayat level and representatives from the panchayat unions at a common venue. For the other men leaders of local community-based organisations such gender training will be organised in the respective villages for one day.

Gender training in Andhra Pradesh: Gender sensitisation training was organised during this year in all the six project villages of both sites in Andhra Pradesh. Different target groups such as village and panchayat leaders, women, men and youth participated in the programmes. A major outcome has been that women are now participating actively in the project activities and expressing their views in the common forums. They also perform better in SHG activities. Apart from this, men in many villages have understood the importance of women's participation in decision making in developmental activities and are coming forward to provide space for them to participate in development interventions.

Sub-Programme Area 102

Integrated Mangrove Fishery Farming System

IMFF model system

A coastal farming system — the Integrated Mangrove Fishery Farming System (IMFFS) — which takes care of the ecological security of the coastal areas and the livelihood security of coastal communities has been developed in about 1 ha in a village called Pulianthurai, south Pichavaram. About 1700 *Rhizophora* seedlings and 320 *Avicennia marina* seedlings are being grown in this system since February 2006. *Rhizophora* has now grown to a height of about 2.3 m and *Avicennia marina* 1.9 m, indicating that mangroves can be successfully grown in this type of semi-enclosed farming system. Regarding fish culture, sea bass is being reared in the farm. It is planned to take up crab culture next year since the root systems of mangrove plants, which provide shelter to crabs and where crabs also find large amounts of organic matter for feeding, have developed well.

Replication of IMFFS in Andhra Pradesh

In Andhra Pradesh, two IMF farms were developed in 4 ha near Sorlagondi village. About 4000 propagules of *Rhizophora* and 5000 propagules of *Avicennia marina* are being grown along the inner and peripheral bunds of these farms. They were planted in October 2008 and their growth performance is monitored regularly. *Rhizophora* has now grown to a height of 84 cm and *Avicennia marina* has reached a height of about 62 cm. During the current year, an experiment on fish culture with sea bass (*Lates calcarifer*) was conducted. About 3000 fingerlings of *Lates calcarifer*, collected from the wild at a cost of Rs. 12,000/-, were released into the farming system. It was expected that about 60 per cent would survive, which would yield 1800 kg of sea bass after a period of 8 months, which in turn would fetch Rs.3,60,000/- as gross profit. However, only 460 kg of sea bass were harvested and sold for Rs.92, 000/-. The main reason for the poor performance was poaching. Since these farms are given to the poorest families of the village, they could not control the poaching by some of the village youth. This was brought to the notice of VDMC, which has now taken strong measures to avoid poaching. In the coming year, an experiment on shrimp culture will be taken up with no external feed. The fishing community has realised that IMFFS is environment friendly and remunerative with less input. Some of the fishermen are interested in converting their abandoned shrimp farms into IMFFS and have approached the National Council for Sustainable Aquaculture and banks for support.

Replication of IMFFS in Tamil Nadu

In the Pichavaram region of Tamil Nadu, two models of IMFFS are being demonstrated with the participation of the fishing communities of Muzhukkuthurai, MGR Thittu, MGR Nagar and Mudasalodai villages. As a first step in this participatory demonstration, community

representatives of the villages were given orientation on the current status of aquaculture, the conceptual framework of IMFFS and its advantages — particularly its sustainability — and the model developed earlier in Pulianthurai village. An exposure visit was organised to the model IMFFS. A suitable site was identified near Mudasalodai, one of the project villages, for the development and demonstration of IMFFS. Early in the 1990s shrimp farms were developed with permission in the lands owned by the Tamil Nadu Revenue Department on the southern side of this village. Due to reasons explained earlier, all these farms were abandoned. One of the fishers of the village, who owns more than 5 ha of farm, provided two farms of about 4.5 acres for the demonstration of IMFFS.

Design and layout of IMFFS: The design and layout of the IMFFS farm was developed in consultation with the local community, representatives of Fisheries Department and Revenue Department and local engineers**.** The present IMFFS farm has two models. In Model 1, physical space for the mangrove plantation has been created in the form of inner bunds. These inner bunds are nothing but extensions of peripheral (outer) bunds. In this farm, which is about 3 acres in size, the water-spread area in which fish is cultivated is about 1.85 acre whereas about 1.15 acre of land is available for mangrove plantation in the form of inner and peripheral bunds. In Model 2, inner bunds have been replaced by mud mounds. The water-spread area occupies about 0.6 acre and area available for mangrove plantation is about 0.9 acre. On the eastern side of the farm, there is a large brackish water canal, which is connected to the Vellar estuary in the north and Pichavaram mangroves in the south. Through these canals, tidal water reaches the farm during high tide and drains out during low tide. Each pond system has one sluice gate, which acts as inlet during high tide and outlet during low tide.

Mangrove plantation: The mangrove species selected for plantation are *Rhizophora mucronata* and *Rhizophora apiculata*. These are suitable because of their stilt root system, which provides space for fish, crabs and prawns to grow and also strengthens the bunds. In Pond 1, about 339 *Rhizophora* propagules and in Pond 2, about 251 propagules were planted during November 2009. Above these, *Avicennia sp* will be planted at intervals of about 15 m at a later stage. In the previous model, *Rhizophora* propagules were planted at 1m interval, which seems to be very close. It is predicted that canopy from such close plantation will shadow the entire water-spread area, which may affect water quality. Hence, in the present model, *Rhizophora* propagules were planted at 2 m interval. Survival and growth performance are being monitored once in three months. Till June 2010, survival has been about 60 per cent and plants had reached an average height of about 18 cm.

Halophyte plantation: A succulent halophyte, *Sesuvium portulacastrum,* which has commercial potential as a component of vegetable salads and as sea food, is also being grown on the top and sides of the bunds. Stem cuttings of about 15 cm in length collected from

nearby mud flats were planted at an interval of 1m in October 2009. The fresh weight of the plantation is measured at monthly intervals.

Fish culture: Three different types of experiments — composite culture of fish and prawn, high stocking of sea bass with live feed and low stocking with no feed — have been initiated during this year and results will be given in the next report.

Sub Programme Area 103

Nuclear and Biotechnological Tools for Coastal Systems Research

103.1 Activities at Kudankulam

BARC seed multiplication

Last year BARC oil seed (TAG 24) was grown in 14 acres under dry land conditions. Eleven farmers multiplied the seeds. Seven farmers harvested groundnut with yields ranging from 260 to 390 kg/ acre and crop duration 105 to 110 days. Greengram (TARM 1) was adopted by12 farmers and yields were obtained at 200 to 380 kg/ acre under pure culture. Another method of cultivation of greengram recorded yields of 130 to 240 kg per acre with inter-cropping under rain-fed conditions.

Fodder bank and cultivation

The cultivation of fodder grass KKM1 was extensively adopted in and around Radhapuram taluk in 72 acres due to its short duration and adaptation to dry land conditions. 62 farmers cultivated the grass and more farmers are showing interest due to its fast growth and better biomass yield. This year fodder crop has been demonstrated in a farmer's field. At present, the fodder plants are 10 months old and available for use and distribution. Fodder slips provided by MSSRF to farmers in nearby villages have created interest in other farmers. This programme has received good response from the local people.

In addition, based on their soil and water potential, the following options were taken by different farmers:

A) Fruit crops + short duration crops (90 days)

   Nelli + oil seeds + pulses

   Mango + oil seeds + pulses

   Cashew + pulses

   Fruit crops + vegetables

B) Short duration crops + fodder crops + green manure crops

Under a direct MSSRF programme, farmers with less than 1 ha land holding have been identified to receive free saplings of fruit crops.

Biodiesel crop (Jatropha)

The effect of different growth regulators on the rooting and sprouting behaviour of *Jatropha curcas* were studied in 25 uniform cuttings, with 36 different treatments set and data recorded (25 cuttings × 36 experiments = total 900cuttings + 100 control = 1000 cuttings). Propagated plants were grown and are ready for plantation.

Different management descriptors and environment descriptors were recorded in the prescribed format from March 2009 and July 2009. Neem oil mixed with *Pongamia* oil was applied to control the pest and diseases in *Jatropha curcas*.

This year, 5920 plants were planted under the agronomic and multi-location programme at MBDL site for evaluation of national *Jatropha* accessions in dry land conditions. Totally, 50 ha land is under utilisation for various trials.

Village Knowledge Centre (VKC)

The VKC at Kudankulam provides free computer education to needy girls under the computer literacy campaign. This year 30 girls successfully completed the TALLY course. Certificates were distributed by the Project Director (KKNPP) in the presence of DGM (HR). MSSRF has decided to handover all the VKCs to the concerned panchayats from January 2010.

Impact of our work

- NGOs and government officials are adopting the ATMA methodology to help farmers grow horticulture and floriculture crops. Big farmers have also started accepting the model and are playing catalyst roles in bringing more farmers to adopt the model. A few industries are also going in for fruit crops but there is a huge demand for land by real estate promoters.
- With the active participation of NGOs, government-sponsored programmes are visible and reaching the people.
- The computer literacy programme has been found to be a very effective tool in helping poor women in the village to get employment.

103.2 Sustainable ecological and economic rehabilitation

Ecological rehabilitation: Maintenance of bioshield plantations in the coastal areas

After the withdrawal of the bioshield project from the coastal areas, the people themselves are maintaining the bioshields under the village committees. These processes ensure the long-term sustainability and sustainable uses of bioshields in the coastal ecosystem. Five-year-old bioshields (mangrove and non-mangrove) are under maintenance at Sadras (mangrove in 2 ha and non-mangrove in 3 ha), Karaikal (mangrove in 8 ha), Chandrapadi (non-mangrove in 5 ha), Pudukuppam (sand dune vegetation 2.2 ha and non-mangrove in 3 ha) and Pazhayar (sand dune vegetation in 3 ha).

Economic rehabilitation: Micro-enterprises

This year 35000 saplings of non-mangrove and 15000 of mangrove saplings were raised at bioshield nurseries run by WSHGs at Chandrapadi and Keelavanjore villages. They supplied saplings to NGOs and government departments for coastal afforestation programmes. WSHGs utilised mangrove and non-mangrove saplings for replacement at field-level bioshields in Karaikal and Tamil Nadu.

Seventeen mushroom productions units have been working only from July to September in

four villages because of the non-availability of materials for mushroom culture. About 15 members have been involved in crab fattening practices in Chandrapadi, and the one-acre crab culture pond is in active use even after the withdrawal of the project. An integrated freshwater farm pond at Tenpathi has been culturing freshwater fishes integrated with a nutritional garden, coconut, and fodder grown on its bund.

Coastal Village Knowledge Centres

All VKCs have been handed over to the respective villages (Sadras, Pazhayar, Chandrapadi and Pattinamcherry) after withdrawal from the project sites but we conduct frequent monitoring of the activities. It was found that all sites have good maintenance practices and villagers have imported new ideas themselves and incorporated them from various sources for effective function of VKC resources. The village committees in the respective villages are closely monitoring the VKCs and generating financial resources from panchayats and private companies for maintenance.

Sub Programme Area 104

Remote Sensing and Geographical Information System

104.1 Coastal Systems Research (PA 100)

Coastal zone studies

The project on coastal zone studies was implemented from March 2005 to December 2009. The main activities of this project were (i) mapping the mangrove community zone of coastal districts in Tamil Nadu and Puducherry , (ii) mapping marine-protected areas and (iii) assessing mangrove health models using remote sensing and GIS. Results relating to the last two components were given in detail in last year's report.

Mangrove community zone mapping

Mangroves in 10 coastal districts of Tamil Nadu and the Karaikal and Puducherry region of Puducherry Union Territory were mapped using IRS Liss 3 and LISS IV of 2005, 2006 and 2007. A total number of 32 maps covering the 10 districts were prepared in the scale of 1:25,000. Each map shows the extent of area and density of different mangrove species which is classified as dense, moderately dense and sparse. The accuracy of mapping was verified in three stages. The first classification of the mangrove zones was verified by mangrove experts of MSSRF. External quality checking was done in two phases by scientists of the Space Application Centre (SAC). In the first phase, the mapping of mangrove zones was verified by experts of SAC through remote sensing applications on coastal wetlands, and, based on the inputs given, modifications were carried out. In second phase, the spatial database of the digital classification was verified.

According to this estimate, the total area of mangrove forests in Tamil Nadu (except Muthupet mangroves) is 2111 ha and in Puducherry it is about 19.95. The largest extent of mangrove (540 ha) in Tamil Nadu is present in Cuddalore district, followed by

Ramanathapuram (378 ha) and Nagapattinam (374 ha) districts. In the case of Cuddalore district, mangrove vegetation is mostly confined around Pichavaram whereas in Nagapattinam district most of the mangrove vegetation is in the northern part of the coast where the Coleroon estuary is located. In Ramanathapuram, mangrove vegetation is present in small patches. In all other districts, distribution of mangroves is scattered and confined to the mouths of small estuaries and backwaters. The major mangrove species found in the entire coast of Tamil Nadu is *Avicennia marina*. Other species such as *Rhizophora, Excoecaria* and *Acanthus ilicifolius* are found occupying large areas.

According to the present estimate, dense mangrove in Tamil Nadu is present only in about 509 ha (area of Muthupet is not included) and remaining areas are occupied by poorly managed mangroves. Steps are required to rehabilitate and manage these mangroves with the participation of the community and other stakeholders, including Panchayat Raj institutions. Secondly, of the 13 true mangrove species present along the Tamil Nadu coast, one species namely, *Avicennia marina* is found to be dominating in all the areas. Wherever possible, steps may be taken to enhance species diversity. The mangrove community zone map presented in the atlas in 1:25000 scale can be used as a tool for planning and monitoring the rehabilitation and conservation programmes of these mangrove wetlands. However, it will be useful if detailed studies are undertaken on land use around these mangrove wetlands.

Assessment of mangrove wetlands of the Godavari delta

The Godavari mangrove wetland spatially extends between the latitudes 82° 15'E to 82° 25'E longitudes and 16° 30'N to 17° 0'N latitudes, where MSSRF implemented a joint mangrove management project from 1998 to 2003 and restored about 175 ha of degraded mangroves. A base map of the Godavari mangroves was prepared using Survey of India topography sheets and changes in different land uses including increase or decrease in mangrove forest cover were assessed using remote sensing satellite data of 1986, 2008 and 2009. Remote sensing satellite data of IRS LISS III (Indian Remote Sensing Satellite Linear Imaging Self-Scanning System 3) of 2008 and 2009 were procured from National Remote Sensing Agency, Hyderabad and that of 1986 was already available with MSSRF. The remote sensing data of 1986, 2008 and 2009 were mapped for wetland features such as dense mangroves, degraded mangroves, restored mangroves, mudflats, beaches, lagoons and water bodies, and the changes were analysed. The classification was verified with intense ground truth survey. After rectification process using data gathered during ground truthing, the standard False Color Composite (FCC) image was generated with green, red and near infrared bands and enhanced through the histogram equalisation method to clearly distinguish the land use and land cover features. Onscreen digitisation procedure on ERDAS Imagine was carried out to delineate mangrove and associated land cover categories. The results of the

study showed that the mangrove cover has increased by about 2299 ha from 1986 to 2009 in the reserve forest areas, which included restored area of about 1859 ha (**Table 1.5**). Similarly, the other land uses in the areas outside the reserve forests (RF) showed that the space covered by shrimp farms/salt pans has drastically increased from 1986 to 2008. Changes in land cover and land use outside the reserve forest area are being analysed.

Strengthening resilience of tsunami-affected communities

GIS is used extensively in CDRR activities. The non-spatial information collected through PRDA and household surveys using participatory methods as well as GPS are stored in the GIS database. GIS in conjunction with field data manipulates, analyses and graphically presents the vulnerability, risk and existing coping capacities of the villages. Various thematic layers are generated by overlaying high risk and risk zones and related vulnerability to land, water and other physical infrastructures of the villages. Similarly, vulnerable groups such as children, the elderly, pregnant women and the differentially challenged across different segments of people are the other GIS layers projected. The existing community capacities such as the presence of natural barriers, information and communication systems, critical facilities including safer zone are also projected as a thematic layer. These thematic maps display geographic distribution of vulnerability and risk to different hazard scenarios and the major purpose of these maps is to quickly identify the lives and livelihoods that are exposed to vulnerability and are likely to get affected by different hazards. Thus, these maps are very useful for the community, PRI leaders, NGOs, development practitioners, administrative agencies and policy makers involved in disaster management.

Table 1.5 ***Changes in land cover and land use inside the reserve forests boundary of Coringa mangroves***

Land use classes inside RF	Area in ha 1986	Area in ha 2008	Area in ha 2009
Dense mangroves	13612.84	14031.99	14052.26
Mangroves in restored areas	-	1704.99	1859.97
Degraded mangroves	2923.33	818.86	695.68
Sand / Beach	983.94	1186.54	1134.78
Water bodies	13417.48	13148.64	13139.93
Casuarina plantations	1060.26	714.65	716.44
Mud flats	508.55	901.90	907.63
Total	**32506.40**	**32506.57**	**32506.69**

Strengthening research and organisational capacity of MSSRF

To increase the effective utilisation of RS and GIS applications across programme areas of MSSRF, geo-informatics has been incorporated as one of the components of the IDRC Research Grant Project. The geo-informatics component is conceived to facilitate micro and meso level planning, implementing and monitoring in operational areas of MSSRF in PAN mode. Specific thrust will be given to integrate GIS and remote sensing tools in the research and development programmes of MSSRF. This component is being accomplished in a participatory process. As a first step, discussions were held with the Programme Directors and a core group formed with members drawn from different programme areas. The core group was provided orientation to concepts and applications of RS & GIS and the use of GPS. Following this, one village from each Proramme area was identified for hands-on training for the core group. In these villages, areas of application of RS and GIS will be identified and accordingly data will be collected and different thematic maps will be prepared. These maps will be used for decision making.

The orientation workshop on Application of RS and GIS at Micro Level was conducted for the core group of 18 staff members (Male: 10, Female: 8). Resource persons were from the Indian Institute of Space Technology, (ISRO) Thiruvananthapuram, Department of Geography, University of Madras and Sathyabama University.. By the end of the workshop, participants were able to understand the basic concepts of RS and GIS and gain an idea about the micro level applications of GIS and RS. Villages where application of RS and GIS will be demonstrated have been identified for PA 100, PA 500 and PA 600, while the region has been identified for PA 200, PA 300 and PA 400. Preliminary visits to the villages of PA 100 and PA 600 have been completed and the major areas of RS and GIS applications identified. DRR planning and mitigation measures will be the area of application for PA 100 while livestock, soil, water resource and crop mapping will the key areas of application for PA 600.

The key area of RS and GIS application in PA 500 is mapping vulnerability to drought in Wardha district, Vidarbha region. For model building Lonsawali village has been identified. Cadastral map of the village has been collected and digitised. Field visits were also undertaken to collect primary data such as critical facilities, soil samples, and water resource points. GPS was used to locate points.

WebGIS

It was decided to demonstrate the application of WebGIS for the visibility of MSSRF and its activities. Unlike web mapping which is static in nature, WebGIS is dynamic and interactive by its features that enable analysis and processing of project specific geo data. WebGIS can be developed using open source software that can be downloaded from websites. So far MSSRF has not harnessed the advantage of such sophisticated open source software for its visibility and dissemination. Therefore,

it was decided to pilot test and demonstrate a model on WebGIS applications for Tamil Nadu and Andhra Pradesh under the Indo-Sri Lanka project to strengthen the resilience of tsunami-affected communities. Thus this WebGIS model will demonstrate the potential of Intra and Internet for overcoming spatial data in accessing problems and facilitating information sharing within MSSRF and external users distributed across the world. Linking the WebGIS with Knowledge Management Systems will add value.

To accomplish the task, a project staff member was trained on WebGIS model development in the Open Source Technology Centre (OTC), Chennai, from 26 February to 3 March 2009.. Based on the training, open source software, namely, MS4W and FIST were downloaded and installed on the Windows platform. The shape file layers such as World, India, location of MSSRF, location of CSR head office, Kakinada Site office, project districts and villages, location of VKCs and mangrove / non-mangrove bioshields and other interventions were added into the open source. It is proposed to add the IDRC-CIDA office and the location of boundary partners on the WebGIS. Different layers including point and shapes of the WebGIS are differentiated using various colours and symbols.

104.2 Ecotechnology (PA 400)

In continuation of the activities over the years on the use of GIS in land use mapping and planning in Kannivadi and Poompuhar, it is also being used as a M&E tool.

Remote Sensing and GIS-based spatial databases are being used in planning and monitoring of bio-industrial watershed project activities. During the year, household information for Ennai and Thalinji villages at the Pudukottai project site was linked with the *adangal* records and geo-referenced farmers' plots as derived from field measurement books (FMB). Maps were prepared to show the land use and land cover for Ennai village, and soil nutrient maps showed the variation across seasons in Meyakavundanpatti and Ennai villages. Elevation maps along with the site suitability maps for farm ponds were developed for Ennai and Thalinji villages. Maps on technology and livelihood-related interventions, socio-economic profile of the farmers and crop diversification at Pudukottai were also prepared to show changes over time and spatial distribution. At the Karsanur project site, GIS support was given in the preparation of soil nutrients, water resources, crop suitability map and land use / land cover maps. Remote sensing and GIS-based spatial database has been developed for 4 panchayats at the Kaveripoompattinam project site. Maps showing the village boundary, survey details (cadastral) and location of infrastructure have been prepared.

Remote sensing and GIS-based applications were also carried out for the Policy Innovation System for Clean Energy Security (PISCES) run by the Climate Change unit of PA 400 that focuses on linkages between livelihood and adaptation to climate change. Land use and land cover map of Muktsar district, the Punjab, was prepared using remote sensing data of LISS IV.

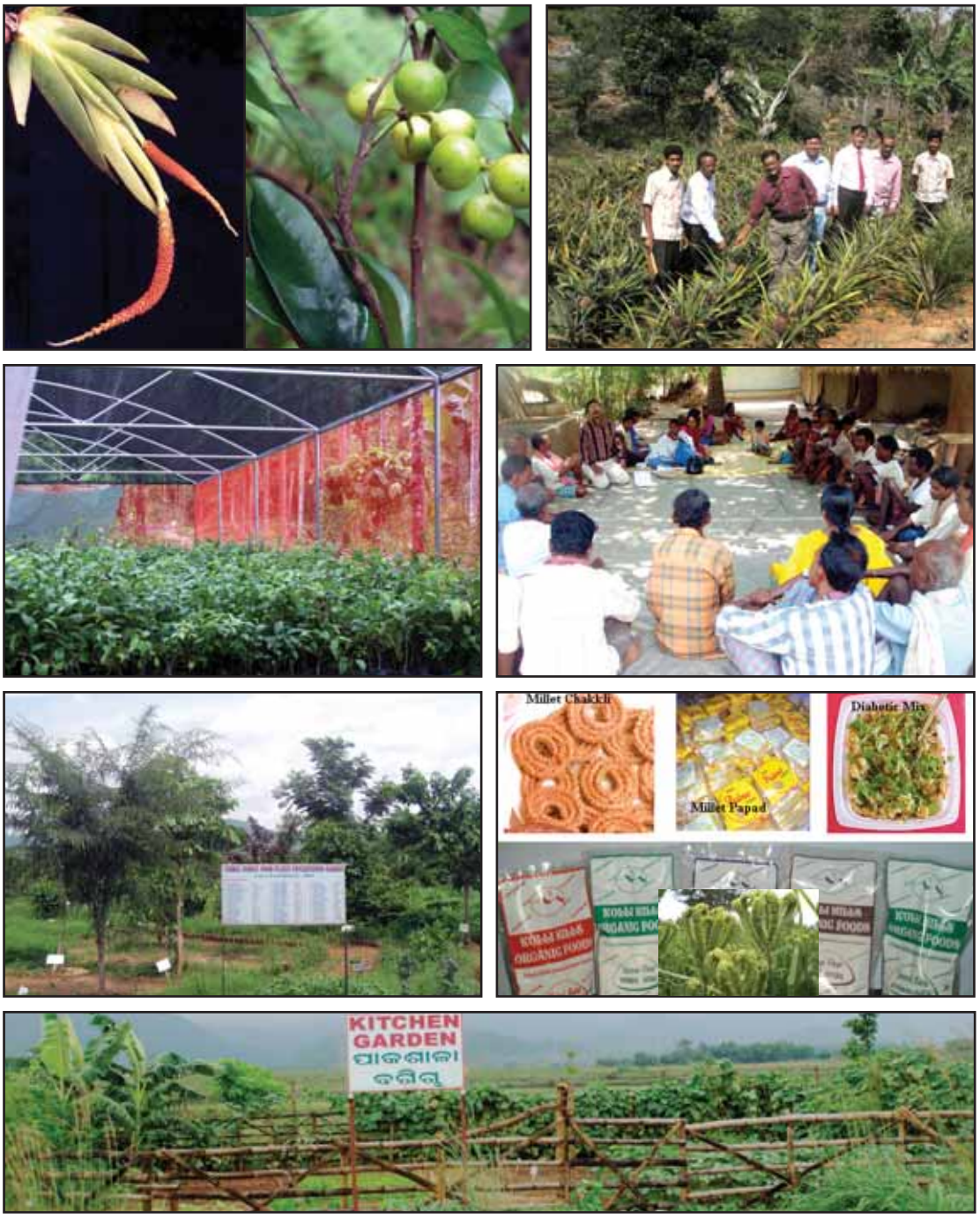
104.3 Food Security (PA 500)

GIS has been used in the preparation of maps relating to the state of food insecurity in urban India, which examines the status and the challenge of urban food security in the contemporary context across the major States of India. Eleven indicators have been used to obtain the composite index of food insecurity at two different time periods, namely, 1998-2000 and 2004-06. Maps obtained for each indicator have been overlaid to obtain the final composite index for the two time intervals. This has helped in assessing the relative changes in the position of the States with regard to the indicators.

Programme Area 200

BIODIVERSITY

The Programme Area works concurrently with local communities and policy makers as well as academicians and natural resource managers in the conservation and sustainable use of biodiversity. The significant highlight this year was the organisation of the international conference on Biodiversity in Relation to Food and Human Security in a Warming Planet (in memory of Dr. Norman E. Borlaug), three State-level consultations on Community-based Management of Agrobiodiversity in an Era of Climate Change and five field-level consultations on Neglected and Underutilised Species of Millets and Food Security.



Conservation to commercialisation approach for value addition of bioresources to enhance economic stake

Programme Area 200

Biodiversity

An international conference on *Biodiversity in Relation to Food and Human Security in a Warming Planet* was organised in Chennai in memory of Dr. Norman E. Borlaug. Three State-level consultations on *Community-based Management of Agrobiodiversity in an Era of Climate Change* were held at Thiruvananthapuram, Bhubaneshwar and Chennai. Five field-level workshops on *Neglected and Underutilized Species (NUS) and Food Security* with a focus on millets were organised in various millet-cultivating locations across Tamil Nadu to elicit the views of stakeholders on the status of millets with regard to conservation, cultivation, consumption and commerce.

A major highlight in Wayanad has been the support extended by the Department of Science and Technology, Government of India, for five core areas of activities in strengthening food and nutritional security. The Dorabji Tata Trust extended a second phase of financial support for the conservation of a fresh set of 80 rare, endangered and threatened species. Two micro-watersheds are being developed as part of a project supported by NABARD.

A project on large-scale cultivation and value-addition of market-driven prominent rice landraces funded by the ICAR National Agricultural Innovation Project (NAIP), with three consortium partners, was initiated in Jeypore during the year. An Eastern Ghats rare, endangered and threatened (RET) medicinal plants garden was established in the BPMPGRC campus to conserve 14 RET medicinal plants collected from forests. The Mitsubishi Corporation extended support for the establishment of the Human Resource Development Centre in Koraput district, which was inaugurated in March 2010. This centre will be used for training and capacity building of rural and tribal youth.

The programme area facilitated farmers' communities in Wayanad and Jeypore to apply for registration of farmers' varieties under the provisions of the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA).

In the Kolli Hills, an agreement was facilitated between the communities and a private company for exporting certified organically grown pineapples. An Internal Control System for organic pineapples was put in place which was selected by APEDA as a national model and placed in their website Tracenet. NABARD has sanctioned the implementation of the Integrated Tribal Development Programme for the Thiruppuli, Alathur, Gundani and Gundur (TAGG) clusters in Kolli Hills for the period 2010 to 2017, covering 1000 tribal families, under the Tribal Development Fund (TDF).

Sub Programme Area 201

Community Conservation Efforts in Kolli Hills

201.1 Biodiversity conservation, utilisation and enhancement

Selection of farmers and seed distribution for kharif 2009

Village-level farmers' meetings were conducted to identify millet farmers for *kharif* 2009 and 944 kg of seeds were distributed to 283 farmers from 18 villages: Periyakovilur, Adukkampatti, Pinnam, Sulavanthipatti, Vendalappadi, Arippalapatty, Padasolai, Semputhuvalavu, Puliyampatti, Thuvarappallam, Navakkadu, Palappadi, Aleripatti, Chinnamangalam, Velikkadu, Sundakkadu, Nathukkulipatti and Seekkuparaipatti.

Distribution of seeds of millet landraces

A seed viability test was conducted for 22 landraces of millets (7 landraces of little millet, 8 of finger millet, 5 of Italian millet, 1 each of Kodo millet and Proso millet) and a total of 944 kg of millet seeds were distributed to 283 millet farmers across Kolli Hills through the Village Millet Resource Centres (VMRCs).

Strengthening VMRCs

Flex sheets were prepared on the 4Cs (conservation, cultivation, consumption and commerce), processing units, methods of organic farming, sacred forests, SHGs, Farmers' Club and community seed bank for display and outreach. Fifteen seed storage bins were distributed to all VMRCs.

Impact survey of precision farming project

In 1999-2000, MSSRF was supported by NABARD for undertaking a project on precision farming. NABARD was keen on a revisit and impact study of the project and provided MSSRF with a format for conducting a survey in Semputhuvalavu, Periyamangalam and Aleripatti in June 2009. Data from 87 respondents were collected and submitted to NABARD, Namakkal.

Participation in video conference

MSSRF facilitated tribal farmers engaged in millet and organic farming to participate in video conferences to share their views on the role of women in the conservation of agro-biodiversity, notably in millet conservation, cultivation, consumption and commerce as well as on organic pineapple farming practices. These video conferences were held during the first Indian Youth Congress in June 2009 and during the visit of the IFAD President to Chennai in November 2009.

201. 2 Biovillage

Initiatives taken towards value addition

- Coordination of printing and processing work of carton package for ragi malt –in April 2009
- Registration of trademark **Kolli Hills Natural Foods** in the IP India Office, Chennai in April 2009.

- Inauguration of the Kolli Hills Natural Foods shop at Semmedu by State government officials and members of KHAbCOFED on 9 September 2009
- Discussion initiated with the Head of the Department of Home Science, Avinashilingam University, for training on value-added millet food for the SHGs at Kolli Hills
- Coordination of value-added training on millets conducted at Semmedu in November 2009
- Organisation value-added training on millets, TOT selection and interview at Kolli Hills in December 2009
- Organisation of the visit of Dr. Balasasirekha and her team of the Avinashilingam Women's University to Kolli Hills millet cultivation area, and people and TOT selection in February 2010
- Organisation of the participation of 12 women SHG members in the institutional training programme on value-addition in millets at Avinashilingam Women's University in March 2010

Establishment and institutionalisation of millet mill in Arippalapatty tribal hamlet

MSSRF assisted in the assembling of the machinery for the Arippalapatty millet mill with the support of local mechanics, which was completed during April-May 2009. The Kaliamman SHG mill was inaugurated and dedicated to the villagers on 8 June 2009 at a function presided over by Dr. Sudha Nair. Mr.Sundararajan, BDO, Kolli Hills, Mr.Periyasamy, Indian Bank Manager, Semmedu, Kolli Hills, Mr.Kuttiandi Duraisamy, President, Devanur Nadu, Kolli Hills, farmers, members of the SHG and public participated in the function.

Processes for institutionalisation

Small-Scale Industry Certificate: The Kaliamman Sutru Sulal Pathukapoor Sangam (KSSPS) members received the Small-Scale Industry certificate (SSI) from the Department of Industries and Commerce (DIC), Namakkal, on 20 February 2009.

Building Management Certificate: KSSPS members received the building management certificate from the BDO, Kolli Hills, a necessary requirement for receiving electricity connection from the EB.

Electrification: KSSPS received an estimate from the Electricity Board during July 2009. On 27 August 2009, the group paid the required registration fees and Earned Money Deposit (EMD) amount. On 9 October 2009, the group paid the caution deposit for the meter, service charges and development charges to the EB. During December 2009, street line cement posts and wiring materials were transferred from Namakkal to the KSSPS Mill and electrification work is presently under progress.

TIN number: KSSPS received the TIN number (33213163728) and certificate from the Commercial Tax Office, Rasipuram, in the month of May 2009, which will be used for marketing.

Strengthening existing mills

Rate schedules have been placed in the premises of the mills and processing charges written on their walls for the public to view. Periodical service arrangements have been made to monitor the performance of the machinery in the mills promoted by MSSRF. The de-husking mill and oil engine in the Nanbargal SHG mill were fully serviced and new de-stoner sieves and paddy hullers were purchased from Victor Machine, Salem. The electricity bill problem of the Vendalappadi mill was resolved by receiving the SSI certificate. The work of the Nanbargal SHG mill with regard to EB remains to be completed, since the transformer line to the mill is located far away and there are several other obstacles. MSSRF has advised the SHG to request the President of Valavandhi Nadu for a street lamp closer to the mill, which is likely to help in receiving electrical connectivity to the mill.

Strengthening millet marketing

Establishment of Kolli Hills Natural Food shop: MSSRF explored the opportunity to establish a nodal point for distribution of products prepared by the member groups of KHABCoFED. Accordingly, a feasibility study was conducted with KHABCoFED groups, and the Valvil Ori Men SHG, Semmedu, was identified for setting up the Kolli Hills Natural Foods shop at Semmedu. KAHBCoFED helped the group to get the premises in the Semmedu bus stand under the SGSY scheme. The shop was inaugurated by Mr. Gunasekaran, BDO (Regular), and Mr.Radhakrishnan, BDO (Scheme), Kolli Hills at Semmedu on 9 September 2009. This effort has helped in effective management of the supply chain and in monitoring the products flow and accounts through a single window.

Trademark: MSSRF helped KHABCoFED receive registration of the Kolli Hills Natural Foods trademark and logo. These symbols will be used in all the products produced under the umbrella of KHABCoFED.

New packaging for value-added millet products: Quotations for designing and printing carton packs for Ragimalt were collected from various printers in Tamil Nadu. After finalising the design, printing work was carried out at Sivakasi during April 2009 and Ragimalt launched in a new packaging format by Professor M. S. Swaminathan on 5 May 2009 at MSSRF, Chennai. Mr. Mooligai Selvaraj, President, KHABCoFED and KHABCoFED members Ms. Latha, Ms. Jayalakshmi and Ms. Malliga participated in the event.

Millet procurement

Millet procurement processes were regulated from the following production zones: Alathur, Keeriakadu, Keelmathiyadi, Melmathiyadi, Arippalapatty, Sulavanthipatti, Vendalappadi, Thegavai, Sundakkadu, Nathukulipatti, Periyakovilur, Nedunkapulipatti, Settur, Puliyampatti, Valukuli, Padasolai, Thirupuli and Kulivalavu.

Participation in state-level and district-level exhibitions

Several millet exhibitions were organised in various places and on various occasions to

showcase the works of KHABCoFed. These include:

- Biodiversity Conservation Awareness camp during *Adi* festival at Kolli Hills during July-August 2009
- National seminar on Impact of Research on Medicinal Plants at Arignar Anna Government Arts College, Namakkal, in September 2009
- Traditional food festival organised by the district administration in September 2009
- Youth Science Congress, Chennai, June 2009
- Mahalir Thittam stall in Thiruchengodu and Namakkal
- International Conference on Biodiversity and Climate Change in February 2010
- Policy Consultation on Effective Community Management of Agrobiodiversity in an Era of Climate Change at Thiruvananthapuram on 5 January 2010 and at Bhubhaneswar on 30 January 2010
- Exhibitions during workshops organised in different parts of Tamil Nadu for millets-based stakeholders in T.Kallupatti, Theni, Thalli, and Javadi Hills

Adi festival

KHABCoFED took the initiative to organise a stall at the Arappaleeswarar temple during the *patinettam perukku* festival during the Tamil month of *Adi* (August) 2009. SHGs like Arappaleeswar SHG, Periyakovillur SHG, Nanbargal SHG, and Kuchakiraipatti SHG actively participated in the event. Value-added millet products such as *samai* rice, *samai* flour, *thinai* rice and *thinai* flour, ready-mix millet products such as *thinai payasam* mix, *samai bajji* mix, *samai uppuma* mix, *samai rava dosa* mix and *ragi* malt as also ready-to-eat products like *thinai laddu* were sold in the stall along with recipe books for such millet preparations. The stall included displays on the 4C concept, pamphlets on organic farming and seeds of all millet landraces. As part of the event, training in value addition and marketing were imparted to members of SHGs. KHABCoFED members belonging to Kaliamman Sutru Sulal Pathukapoor Sangam, Arippalapatty; Pidariamman Self-Help Group, Sulavanthipatti; Sri Thayammal Iyyarkai Valam Pathukapoor Sangam, Periyakovilur; Ayyanar Pattan Self-Help Group, Padasolai; Padasolai Farmers' Club, Padasolai; and Elanch Situ Gents SHG, Chinnamangalam participated in the programme. Value-added products worth Rs.4,663 were sold during the festival.

Networking with Avinashilingam University, Coimbatore

As part of the capacity building on value addition in millets, an MOU was signed between MSSRF and Avinashilingam University (AU) to study and develop new recipes out of small millets and to provide institutional training for members of SHGs from the Kolli Hills. The staff of Avinashilingam University conducted a meeting with SHGs involved in value-added millet products during February 2010 to asses the knowledge of the SHGs with regard to value addition, quality production

Table 2.1 ***Details of sales of millet products in the* Adi *festival***

S.No	Particulars	Sold in Kg	Amount in Rs
1	Samai Rava	10.50	399
2	Thinai Rava	22.50	855
3	Samai Flour	5.00	200
4	Thinai Flour	7.00	280
5	Thinai Payasam Mix	0.75	240
6	Samai Rava Dosa Mix	0.50	36
7	Samai Uppuma Mix	2.00	144
8	Ragi Malt	9.25	925
9	Thinai Laddu	12.00	1584
	Total		**4663**

Table 2.2 ***Details of sales of millets, April 2009 to March 2010***

Month	Samai Rava		Thinai Rava		Samai Flour		Thinai Flour		V. Added Products	
	Kg	Rs	Kg	Rs	Kg	Rs	Kg	Rs	Kg	Rs
April	82.5	2640	24.0	768	56.5	1921	24.0	816	95.50	6301.0
May	61.5	1968	70.0	2240	26.0	884	39.5	1343	123.85	8079.0
June	14.0	448	4.5	144	4.0	136	6.0	170	76.60	5301.0
July	101.0	3636	123.5	4446	51.0	1938	76.0	2888	191.60	8528.0
Aug	93.5	3366	38.0	1368	42.0	1596	39.0	1482	141.75	8138.0
Sep	178.5	6426	29.5	1062	67.5	2565	7.5	285	115.45	9579.0
Oct	10.0	360	52.5	1890	0.0	0	22.5	855	58.00	4515.0
Nov	89.5	3222	124.5	4482	8.5	323	20.5	779	101.60	8103.0
Dec	188.5	6786	183.0	6588	28.0	1064	20.0	760	209.45	17189.0
Jan	20.0	640	5.0	170	5.0	170	0.0	0	34.50	2655.0
Feb	40.0	1280	40.0	1280	10.0	340	17.5	595	78.75	5742.5
March	30.0	960	37.5	1200	27.5	935	32.5	1105	111.50	7715.0
Total	**909.0**	**31732**	**732.0**	**25638**	**326.0**	**11872**	**305.0**	**11078**	**1338.55**	**91845.5**

Table 2.3 ***Financial details of 1 kg of value-added millet products (in Rs.)***

Item	Production cost	Selling cost	Profit	Percentage
Samai Rava	31.50	36.00	04.50	12.50
Thinai Rava	31.50	36.00	04.50	12.50
Samai Flour	33.50	38.00	04.50	11.84
Thinai Flour	33.50	38.00	04.50	11.84
Ragi Flour	20.30	30.00	09.70	32.33
Ragi Malt	54.60	84.00	29.40	35.00
Thinai Payasam Mix	67.25	72.00	04.75	06.59
Samai Uppuma Mix	54.87	68.00	13.13	19.30
Samai Bajji Mix	60.45	72.00	11.55	16.04
Samai Rava Dosa Mix	52.97	72.00	19.03	26.43
Thinai Laddu	93.00	118.00	25.00	21.18

and enterprise management. A programme was designed based on the insights gained from the discussion. AU conducted research on the preparation of recipes using small millets. AU and MSSRF jointly organised an institutional training programme for Kolli Hills SHGs in March 2010.

The training programme was inaugurated by Dr.Saroja Prabhakaran, Vice Chancellor, AU, Dr. Premakumari, Head of the Food and Nutrition Department, Dr.Booma Iyengar, Professor, Food and Nutrition Department, Dr.Thilagavathy, Professor, Food and Nutrition Department, and Dr.Balasasireka. The first technical session commenced with a motivation class conducted by Manoshakthi Masilamani to boost the self-confidence of the participants. Participants were divided into groups and provided with hands-on training to prepare ready-mixes and ready-to-eat products. They were also exposed to types of packaging and methods of handling gas stoves. Four groups prepared *ragi kheer*, *ragi pakoda*, *samai dosai*, *samai parupu*, *thinai pongal*, *thinai pudina muruku*, *varagu rava idli*, and *varagu bajji* and put the products on display.

Dr.Jerina, Professor, Food and Nutrition Department, AU, spoke about SHG management and formation of a new enterprise and its business economics. Dr.Shiviya, Professor, Food and Nutrition Department, AU, discussed the nutritional details of millet and Gandhian foods like peanuts, goat milk, sprouted millets and fruits. Mr. Senthil, Residency Hotel, Coimbatore, provided a detailed explanation of health and hygiene. Mr.Thangarasu, Deputy Director, DIC Office, Coimbatore, explained the provisions of the available schemes and subsidies. A valedictory function was held and, Dr.T.K.Shanmuganandam, Chancellor, AU handed over the certificates and course material to the trainees. As part of the training, members visited ACE Pack Machines, manufactures of complete solutions to food processing and packaging industries, and

J.P.Masala to gain first- hand knowledge about the industry.

Traditional foods stall

MSSRF had a discussion in August 2009 with the District Collector and the Joint Registrar, LAMPS, Namakkal, about setting up a traditional foods stall in Kolli Hills. A feasibility study was conducted in Kolli Hills and Senthorapoo SHG, Seekuparaipatti, was identified as a suitable group to prepare traditional foods, and the accounts of the group were shifted from the Indian Bank to LAMP Society. A proposal was prepared and submitted to the Joint Registrar's Office, Namakkal. The SHG is waiting for a suitable building and an appropriate location to start the food stall.

201.3 Organic certification processes

MOU with Lin Foodz Pvt Ltd.

In May 2009, MSSRF facilitated the signing of a three-year (2010-2012) Memorandum of Understanding between Lin Foodz Pvt Ltd. and Kolli Hills Organic Pineapple Growers. Members belong to four SHGs, farmers' groups, and representatives of Lin Foodz and MSSRF participated in the event held at the Thuvarapallam Organic Procurement Centre.

ICS management

Field inspection of 198 farms in Kolli Hills (mapping, crop details, ICS, farmers' diary) was carried out by Indocert in September 2009 and the Indocert certificate awarded. MSSRF organised the monitoring of the organic certification inspection work. APEDA's tracenet data base has incorporated the data of these farms.

Orientation training was organised in June 2009 at Kolli Hills to the millet and pineapple farmers of the Lin FoodZ signatories.

Conversion to Kew variety of pineapple

With the support of the Department of Horticulture, MSSRF took steps for the varietal conversion of pineapples in Kolli Hills. Applications were made on behalf of the farmers' group to receive Kew variety suckers under a scheme supported by the Department of Horticulture. A proposal for conversion of 100 acres was drafted in September 2009, and submitted to the Deputy Director of Horticulture for onward transmission to the Director of Horticulture, Chennai,. Follow-up discussions were held on 30 December 2009 and 12 January 2010, and it was planned to check the availability of suckers in Kerala. Farmers of Kerala cultivate Mauritius hybrid variety having more TSS (Total Sugar Soilds) ranging from 16 to 22. Therefore, to begin with, Mauritius Hybrid variety was opted for conversion of 20 acres. The Department of Horticulture has received permission for expansion of 100 acres under pineapple using the existing variety — Red Spanish. A representation has been made to allocate 20 acres under the Mauritius hybrid variety, since it suits processing and will enable better prices for farmers through the Lin Foodz agreement.

Technology improvement training for farmers in horticulture and spice crops

- MSSRF along with the Spice Board organised a series of training programmes

for members of KHABCoFED — on 10 September 2009, 22 farmers were trained at Vellisolai; on 28 October 2009, 32 farmers were trained at Ellkiraipatti; on 29 October 2009, 32 farmers were trained at Thuvarapallam.

- About 127 farmers of Kolli Hills — 54 from Ellakiraipatty and 73 from Nathukuli — were divided into three clusters and trained in collaboration with Lin Foodz Pvt Ltd. on 14-15 and 17 December 2009, respectively.
- In collaboration with the Horticulture Department, a training programme on improved cultivation methods of pineapple and other horticulture crops was organised at Semmedu in November 2009, in which about 100 farmers took part.
- In December 2009, 140 farmers at Nathukuli were trained in organic pepper and improved methods of pepper cultivation.
- The Coffee Board sponsored a training programme on improved methods of coffee cultivation for 30 women members of KHABCoFed in January 2010 at Ariyur Solakadu.
- TNAU and HRS Yercaud sponsored a training programme on improved methods of pepper cultivation on in March 2010 at Semmedu.

Training and capacity building events

Coordinated training and capacity building for SHGs and Farmers' Clubs (for 396 men and 323 women over 719 trainee days) were undertaken in

- modified methods of cultivation (land preparation, line sowing, weeding, harvesting, morphomatric data collection), relay cropping
- advanced agriculture technology in raising spice crops
- millet processing and quality checking at procurement centres
- machinery management, millet processing, millet packing, entrepreneurship
- value-added millet food preparation, millet marketing
- advertising and conducting road shows, thematic street plays
- water harvesting
- SHG and Farmers' Club management and financial linkages, NVA Fellows' training

NVA Fellows: MSSRF coordinated with NGOs to identify 16 candidates belonging to traditional knowledge holders, traditional panchayat leaders, community activists, panchayat leaders, Farmers' Club and SHG leaders, who participated in the NVA Convocation held at Chennai in November 2009.

201.4 The way ahead

NABARD-TDF project in Kolli Hills

MSSRF developed a proposal for the benefit of 1000 families from Kolli Hills under the Tribal Development Fund (TDF) of NABARD. After a series of meetings with NABARD officials in the district and in Chennai, the MSSRF team spent some time collecting data from various line departments, conducted PRAs

with families, and consolidated the information into a detailed project report to NABARD. A team of officials from NABARD visited Kolli Hills to inspect the site, interact with tribal families planning to participate in the project and assess its technical and social feasibility. NABARD has now approved the project with a budget outlay of Rs.400 lakh to be implemented over a period of 7 years from 2010 to 2017.

Sub Programme Area 202

Community Agrobiodiversity Centre, Wayanad

The Community Agro-biodiversity Centre established in 1997 has gradually built itself up by working in carefully chosen areas of operations with teams of people. In 2010, CAbC entered the 13th year of its journey towards the mission of achieving sustainable livelihoods and food security of local communities in the hill area habitations of the Malabar eco-region. We are in the process of developing and disseminating management solutions for operationalising a 4C framework in the area of sustainable genetic resource management. (For more about this concept see the MSSRF publication, *Biodiversity Programme: Hindsight and Forethought* by Anil Kumar et al, 2010).

A major highlight of the year is the Department of Science and Technology, Government. of India, coming forward to support our core areas of activities. As part of the agreement CAbC will focus on 5 key areas of action in the district: food and nutritional security through wild and traditional tuberous and leguminous crops in two micro-watershed units (500 families); high value ethno-veterinary medicinal plants and primary health care development by way of documentation, validation, propagation, cultivation and processing, market development; seed villages for medicinal and aromatic rice varieties in 10 locations; production and marketing of farm bio-inputs; and pepper and ginger conservation through collection, conservation, characterisation and enhancement of promising varieties. The Centre is to have similar kind of support from the Botanical Survey of India for the management of the conservation garden. The support from BSI has been sought for the redesigning of the existing conservation garden; establishing an information centre on Western Ghats endemic plants, and a front-gate visitor centre. We also have entered into a project agreement with Leibzig University, Hanover, Germany to study land use changes with reference to rice production and management of the rice ecosystem in Wayanad district.

202.1 Biodiversity conservation and enhancement

Study and conservation of 80 RET forest plants

The conservation team has been involved in the sustainable management of rare, endemic and threatened plant genetic resources of socio-economic and ecological value found in the Western Ghats. The year 2010 started on a positive note by receiving financial support

from Sir Dorabji Tata Trust for conservation of fresh sets of 80 RET plant species. A total of 35,000 seedlings of the targeted RET species were raised during the period. The RET Conservation Garden at CAbC was further extended to 10 acres of land with the addition of 700 seedlings. A RET Display Zone with 126 species and a Climbing Plants Zone with 232 species were also set up in the campus. The team's efforts in this area helped CAbC get the Green Institution Award for 2009, instituted by the Kerala State Biodiversity Board.

As part of creating awareness about conservation of threatened woody climbers, a new programme entitled *Vallikkudil* (Vine Hut) was initiated in 10 selected schools in the district with the participation of the National Green Corps, Wayanad. The Centre's initiative of fostering tree groves that started in the district in 2007 has now resulted in establishing 15 tree groves comprising several RET plants. The tree groves established in coffee and cardamom plantations were strengthened during the period with an addition of 6,000 seedlings. A total of 13,500 seedlings were distributed to various stakeholders such as religious and educational institutions, government and non-government organisations, botanic gardens and other interested individuals.

The floristic diversity study of Wayanad district has been completed and the report submitted during the year. This study unravelled the angiosperm diversity and highlighted the biological significance of the region that provides habitat for about 25 per cent of the rare, endemic and/or threatened flowering plant species of the Western Ghats. A total of 1950 flowering plants were documented, with 32 Red Data species and 550 endemics of the Western Ghats. Besides, seven forest patches, viz., Banasuramala, Chembramala, Kurichiarmala, Vaduvanchal forest, Sugandhagiri, Thirunelly and Chanthanathodu of the district were prioritised for immediate conservation action.

Towards restoration of the natural population of endemic plant species in a joint venture with Kerala Forests and Wildlife Department, two re-introduction plots were established with a total of 10,000 seedlings in Kakkavayal of Kozhikode Forest Division (100 ha) and Kunnambatta of south Wayanad Forest Division (10 ha). The survival rates of the species are also being recorded through periodic monitoring by the team to understand the success rate of the re-introduction efforts.

Study and conservation of 7 RET medicinal plants

The exploration and collection of seven RET medicinal plants — *Aristolochia tagala* Cham., *Celastrus paniculatus* Willd., *Embelia ribes* Burm.f., *Embelia tsjeriam-cottam* (Roem.&Schult.) DC., *Gloriosa superba* L., *Rauvolfia serpentina* (L.) Benth ex Kurz., *Saraca asoca* (Roxb.) de Wilde — in north Kerala is being continued. Three hundred and sixteen sample collections from 4 districts were made and were maintained in the nursery keeping their identities. A total of 6000 seedlings were raised and 3100 seedlings are ready for FGB establishment. Field Gene Banks of these RET plants were established at two localities (CAbC and Meppadi Forest

Range Office) as part of *ex-situ* conservation. A total of 322 individual plants is well established in the *ex-situ* gene bank. Eighty-seven individual plants from other collaborative centres are also well established in the FGB. These will be subjected to characterisation study. A checklist of RET medicinal plants in Wayanad district has also been made available with CAbC, MSSRF.

Study and multiplication of traditional and specialty rice varieties

An Institutional Ethics Committee (IEC) has been constituted to initiate a clinical trial of Navara rice, with the technical support of the Institute of Applied Dermatology (IAD), Kasaragode. The team carried out a small study on paddy ecosystem with help of ATREE, Bangalore. Awareness programmes were conducted by taking up the issue of conversion of paddy fields and its counter effects. The popularisation of SRI methods for increasing rice yield is being continued. This method was followed in 5 acres in Meenangadi in collaboration with the panchayat authorities. The modified method of rice cultivation was also started in Thachambath village of Meenangadi.

An association of indigenous and traditional crop conservers of Malabar, named SEED CARE, was formed and facilitated to apply for registration of traditional rice varieties under the purview of the Protection of Plant Varieties and Farmers' Rights Act. Applications for the registration of 6 traditional rice varieties — *Veliyan, Thondi, Chennellu, Chomala, Gandhakasala* and *Jeerakasala* — has been forwarded through SEEDCARE. Advanced training and capacity building programmes were undertaken for 32 rice farmers in the panchayat and SRI initiated in demonstration plots in 3 major rice-producing locations. More farmers are interested in SRI and, if the present trend continues, we can expect 20 to 30 per cent increase in total rice production and productivity in these locations in the long run.

202.2 Biodiversity education, communication and training

Training and capacity building of farmers

Training support for more than 320 people (120 men and 200 women) on various skill enhancement programmes like SRI, modified method of rice cultivation, bio-intensive vegetable gardening, vermicomposting, nursery techniques, good livestock practices, etc. is being provided. More people have acquired skills in different farm-based activities. Farm income of the participants is expected to increase over a period of time. The team developed contents on 8 topics of relevannce to community, biodiversity trainers, farmers, and others, which are disseminated to various stakeholders in the form of booklets, information brochures, etc.

Twenty-six in-house programmes for the stakeholders (farmers, SHGs, students, developmental workers) were conducted. Out of the total 774 people trained, 356 were women. Forty-one programmes have been conducted for 104 training days during the last six months and more than 1690 people have benefited.

NABARD has approved a project entitled *Capacity Building in Innovative Farming Skills and Methods for Small and Medium Farmers of Malabar Region of Kerala* to be undertaken over 18 months. This is meant for improving farmers' skills in accessing and using technologies. Another project proposal for financial support to establish knowledge centres for medicinal plants and provide quality training for farmers in the cultivation and processing of medicinal plants has been submitted to the State Horticulture Mission.

Training and capacity building for students, teachers, parents

Under the ECAS programme, a day's training was organised for teachers of each lower primary school, upper primary school and high school on various aspects of biodiversity and environment. More teachers became sensitised about biodiversity conservation and related issues. The ECAS curriculum has been revised by the addition of inputs from key stakeholders in the areas of child education. This year ECAS brought out training materials on means of identifying food adulteration, as well as fish and butterfly diversity. The butterfly garden of CAbC has been strengthened with planting butterfly host plants, and putting up information posters and nameboards of plant species hosting butterflies. As part of World Environment Day, ECAS students, volunteers and teachers planted RET species at the MSSRF campus. The ECAS team was also involved in the restoration of sacred groves in Chembothara and Rattakkolli, by planting tree species commonly found in such groves.

The team has conducted 2 awareness programmes for youth and mothers on health and hygeine and child care. Fifty-four classes on various aspects of biodiversity were conducted for 44 ECAS students at the hub centre. The ECAS programme was extended to 3 selected tribal hamlets and a total of 80 classes were conducted in them. ECAS programmes have thus reached out to more children and more tribal children have become part of ECAS activities. It is evident that tribal children have utilised this opportunity to improve their learning capacities: the number of ECAS students securing admissions at the model residential schools have increased.

A notable event of the year was a regional-level Environment Science Congress for children, organised under the DNA club project at CAbC, where a selected group of 16 students presented their findings of studies conducted in their respective regions on various environmental issues. They interacted with eminent experts, academicians, scientists and environmental activists. Students have learned the methodology for undertaking environmental studies and have acquired skills in preparing projects on environmental issues and presenting their inferences. Twenty lectures were organised, and quiz competitions, exhibitions, painting competitions conducted in each of the selected 4 schools from 3 districts. DNA clubs were active and the members took part in various programmes on biodiversity conservation and the scope and opportunities in biotechnology.

Policy advocacy

A State-level policy makers' workshop on the subject of *Effective Community Management of Agrobiodiversity in an Era of Climate Change* was organised at Thiruvananthapuram in January 2010. Thirty-five experts including heads of various government departments, activists and scientists attended the programme and discussed strategies to strengthen community conservation of biodiversity in the context of climate change. A paper setting out the way forward — in the form of a Declaration — has been issued, recording policy-level suggestions for the sustainable agricultural development of Kerala in an era of climate change.

202.3 Biodiversity-based sustainable livelihoods and food security

Watershed development initiative

With the support of NABARD, a watershed development programme has been initiated in two microwatershed areas — Pannikkal watershed in Pulpalli Grama Panchayat and Mundakkai in Meppady Grama Panchayat. Out of the total 380 ha geographic extent of the Pannikkal watershed, the initial intervention covers only 51.74 ha. The population of the project area is 2880. The soil is almost loamy and the texture is clay loam to silt clay, ranging in depth from 5 cm to more than 90 cm. The highest elevation of this area is 830 m, and the lowest is 780 m, from MSL. The average rainfall at Pannikkal is 2693 mm, and it is considered a rain-shadow area. It is also prone to drought, with consequent severe crop losses.

The Mundakkai watershed is located in the western part of the district and is 25 km away from the district headquarters. The total population of this area is 1280, spread over a geographical area of 639 ha. The first phase of the intervention will cover 55.64 ha. The soil of this locality also is loamy and the texture is clay loam to silt clay. Soil depth ranges from 0.5 m to more than 1.5 m. The highest elevation in the watershed is 2008 m and the lowest is 1284 m, from MSL. The highest intensity of rainfall is 42003 mm. The main crops are cardamom, coffee, pepper and tea. A sizable portion of the project area is reserve forest (60 per cent).

A detailed study on watershed areas has been conducted and an action plan prepared The Village Watershed Committees (VWC) has been constituted and capacity-building programmes organised for VWC members. Suitable soil and water conservation activities have been implemented. A number of training and capacity building programmes for other NGOs involved in watershed development in the district have also been hosted. Two training programmes on Project Planning and Management (PPM) and Feasibility Study Report Preparation (FSR) as well as two awareness programmes on global warming and climate change were conducted for the watershed development team (WDT). Seminars on sustainable agricultural practices were organised for the farmers of the watershed area. These were jointly organised with 9 other watersheds at Pannikkal and 3 other watersheds at Mundakkai. Forty farmers participated at Pannikkal and 39 at Mundakkai. Tuber crops were distributed among 170 tribal households for cultivation.

In the first phase,, 16600 m of earthen bund, 1700 water percolation pits, and 1040 agro-forestry activities were executed in the Pannikkal watershed area. In Mundakkai, 66 cubic m earthen bund, 547.89 cubic m stone-pitched graded bund, 145 cubic m water percolation pits and 475 cubic m inverted platforms were completed. Village watershed committees and Farmers' Clubs were constituted in both the areas.

Study and multiplication of medicinal plants of primary health care importance

During the year, training on primary health care and on addressing needs through sustainable utilisation of locally available herbal plants were provided to 375 SHG members in the district, and planting materials were distributed. Over 12000 seedlings of 101 species of medicinal plants were multiplied in the nursery for distribution. Three thousand medicinal plants were distributed to farmers and institutions. A demonstration plot for 32 popular and/or common medicinal plants was established and maintained at the CAbC campus, intended mainly to educate visitors and to make it a mother seed plot.

Study and multiplication of neglected and underutilised species

Strengthening of the germplasm collection of edible plants (both cultivated and wild) has been continued and 24 exploratory trips conducted to various parts of Wayanad district, including forest and agricultural villages. The team documented the field characters and peculiarities of each germplasm. Field gene banks of samples were maintained at CAbC. In order to address food insecurity among the tribes, the home garden initiative was replicated in 3 tribal hamlets (300 tribal households) viz., Pon*Koozh*y and *Koozh*imoola Kattunaikka tribal colonies of Noolpuzha Grama Panchayat. Home gardens were promoted in 71 Paniya tribal families spread over 15 acres at Mundery in the Kalpetta municipality during the year 2009-10. Seed materials and seedlings of 525 kg of yams 135 kg of taros 200 kg of elephant foot yam; 50 kg of arrowroot; 3 varieties of sweet potato and 7 varieties of banana were distributed. A community of traditional farm labourers cultivated and harvested 1527 kg of yam, 1140 kg of elephant foot yam and 1462 kg of taro from the minimal land area in their possession. Information on home garden diversity, consumption patterns, etc. has been gathered. Two training programmes were organised for a newly-formed farmers' group on vegetable cultivation and marketing. The group has marketed 330 kg of snake gourd, 210 kg of legumes and 40 kg of amaranth during the year. As an extension to the present effort, a diversification programme on tuber crops was also introduced in 170 tribal households (Paniya and Kuruma) at the Pannikkal watershed area.

Market outlet for organically grown produces

The market outlet run by the SHG named Greens, facilitated by CAbC, MSSRF, has

provided a platform for marketing both raw and value-added organic produces. Eighteen farmers supplied their products regularly to the outlet last year and got a premium price for them. Vegetables, fruit, spices, traditional rice, as also products from the wild, like honey and bamboo grain, and a few handicraft items were also marketed through the outlet.

The future

Our vision is to transform CAbC into a world-class institution in the area of community biodiversity management by the year 2020. As an important step towards this, we have now developed a business plan, which describes the do-how part of the strategy plan developed a year ago. Phase I (2010-2012) of the 2020 vision is consolidation and concentration of activities in the three key result areas (KRAs) ; conservation (biodiversity conservation and enhancement); education *(*biodiversity education, communication and training) and livelihoods (biodiversity- based sustainable livelihoods and food security). Phase II (2013-2015) will be the scaling up of the most successful initiatives in these KRAs such as Green Health programme, ECAS programme, Tribal Food Security programme (yams and tubers) and RET Plants programme. We plan to scale up the three KRAs in the 10 gram panchayats of Wayanad district dominated by tribal communities over the next five years (April 2010-March 2015), and eventually to the hilly habitations of the whole Malabar eco-region.

Sub Programme Area 203

Biju Patnaik Medicinal Plants Garden and Research Centre, Jeypore

203.1 *Ex situ* conservation of medicinal plants

The Biju Patnaik Medicinal Plants Garden and Research Centre (BPMPGRC) at Jeypore presently conserves 347 species of plants having different habits — trees (109), herbs (102), shrubs (91), climberss (39) and others (06) — which are being maintained in 9 gardens spread over 7 acres of land. This is an *ex situ* conservation centre of medicinal plants used in health care systems by the nine major tribes (Bhatra, Bhumia, Bonda, Gadaba, Koya, Kandha, Gond, Paroja, Saora) of the Koraput region.

The propagation of 20,000 seedlings of 14 species of commonly used medicinal plants was carried out under the Home Herbal Garden programme in two shade nethouses and three UV stabilised polyhouses. The planting materials were distributed to schools, home herbal gardens, community medicinal plants gardens, traditional healthcare practitioners, institutes, individuals and interested tribal families.

An Eastern Ghats RET medicinal plants garden was established inside the campus to conserve 14 RET medicinal plants collected from forests, as part of the Eastern Ghats

Mapping Project. Herbal gardens that were established in schools during the initial phase of the project were monitored and new seedlings provided to different schools to establish new herbal gardens.

Twenty-six medicinal plants prioritised by the National Medicinal Plant Board (NMPB) as suitable for climatic conditions in Odisha are cultivated in the garden in a plot of size 3m X 8 m, to demonstrate prospects for commercial cultivation. A checklist of 347 ethno-medicinal plants at BPMPGRC was published containing information on local names, botanical names, genetic family names as well as their use in treating various ailments.

National multi-location trials on Jatropha

Multi-location, agronomy and silviculture trials of *Jatropha* are to be carried out under the DBT *Jatropha* micromission in Odisha. It is proposed to carry out the trials in Asna, Dhola Jhiligaon and Kusumguda villages under 3 gram panchayats of Kundura in Koraput district. A total of 30 acres of uncultivated land has been selected in these three villages to carry out trials.

A total of 16,010 seedlings representing 90 accessions of *Jatropha* were received from four locations, viz.,Biotech Park, Lucknow; Ruchi Biofuels, Indore; TERI, New Delhi and Nandan Biomatrix, Hyderabad, in November 2009 and moved to the villages. Due to lack of rain in November, the seedlings were maintained in the nursery in the respective villages. Planting will be carried out at the onset of monsoon in June 2010.

203.2 Livelihood enhancement of the tribal poor

The project to enhance the livelihood of the tribal poor in the Jeypore region of Koraput district, through sustainable management of natural resources, has been implemented in 6 villages (Kaudiaguda, Kusumguda, Dhola-Jhiligaon, Chendia-Jhiligaon, Pokhanaguda and Uduluguda) under 3 gram panchayats of Kundura ommunity development block, addressing a total population of 3000, of which 82 per cent are tribals. The project is aimed at providing additional income through on-farm and off-farm activities, such as large-scale cultivation of vegetables, oil seeds, pulses, spices and fruit plants, vermicomposting, pisciculture, backyard poultry, land levelling, etc., with training and capacity building. During the reporting year, 600 farm families across 6 villages were involved in the programme, earning an average additional income of Rs. 2,250 per month per household through these activities. Linkages have been developed with government and PRI departments to mobilise different schemes entitled for tribal farm families related to agriculture, horticulture, soil conservation, etc.

Large-scale cultivation

During the year, an area of 125 acres was brought under the cultivation of vegetables, oil seeds, pulses and spices by involving 446 households across the 6 villages. Out of the total land area, 92 acres were under vegetables, 7 acres under oil seeds, 6 acres under watermelon and 20 acres under pulse crops.

Table 2.4 ***Overview of different activities***

Activities	HHs involved	No. of villages	Area (in acres)	Inputs by MSSRF	Additional income/ month (Rs.)
Vegetable, spice, oilseeds & pulse cultivation	446	6	125.0	Seeds	2900.00
Fish farming	59	6	9.9	21418 fish fingerlings	3400.00
Poultry	549	6	-	1200 chicks	Own consumption
Vermicomposting	87	6	-	earthworms	450.00
Land development	70	5	90.0	Construction materials, tractor with leveller	-
TOTAL	**600**	**6**	**224.9**		**2250.00**

Twelve different vegetable crops like pumpkin, bitter gourd, spinach, tomato, cucumber, bottle gourd, bean, brinjal, amaranthus, okra, ridge gourd radish, and onion and chilli, oilseeds like sunflower and mustard, pulse crops like greengram and Bengal gram and spices like, coriander, turmeric and ginger were raised with proper demonstrations. The produce was sold at the Kundura weekly market. An additional average income of Rs. 2900/- per month per farm family was earned, excluding their own consumption.

Five-plant campaign

An activity being carried out since 2008 is growing five plants — yam, drumstick, papaya, lemon and chilli — in each of the tribal households to ensure food and nutritional security round the year. Around 490 tribal households in the 6 project villages have adopted this model. Low cost polyhouses have been established in each village to raise seedlings of all these plants.

Land care movement

Ninety acres of medium lands and uplands were brought under land care activities by involving 70 farm families in 5 villages. In the uplands, farm bunds were prepared and levelling of the land carried out by tractors, to conserve rainwater for cultivating upland rice. Medium lands were levelled for uniform distribution of water, manure and fertilisers.

Backyard poultry

Over 1200 chicks of V*anaraja* variety of poultry were purchased from the Central Poultry Board and supplied to 549 farm families in 6 villages for rearing in their backyards. These activities promote the household consumption of eggs and poultry, thereby ensuring nutritional security.

Fish farming

Pisciculture was carried out during the rainy season in 26 small farm ponds, community ponds, and house ponds covering a total of area of 9.9 acres, involving 59 farm families in 6 villages. A total of 21,418 fingerlings of fresh water fish belonging to varieties like *rohu, mirgal* and *bhakur* were supplied, the community contributing 50 per cent of the total cost of the fingerlings. A sum of Rs. 3,55,270/- was accrued from the sale of harvested fish, generating an additional annual average income of Rs. 3,400/- per farm family.

Village Development Fund

A village development fund was initiated in all the 6 villages for providing credit for emergency needs of the villagers. The contribution per household per month is Rs. 10/-. A matching grant of Rs. 35,000 was provided to Kaudiuaguda village by Mitsubishi Corporation under its Corporate Social Responsibility (CSR) programme to strengthen livelihoods.

Vermicomposting

Out of the 101 vermicompost units established under this project, 87 are currently operational and have produced 8 qtl of vermicompost per pit within a span of four months. Three harvests were made to meet household needs as well for sale in the market. During the year a sum of Rs.38,400 was earned by selling 76 qtl of compost at Rs. 400.00 per ql. In addition, 40 kg of earthworm was sold at Rs.200 per kg, after meeting the needs of the 87 farm families for their own backyard cultivation, priority being given for the domestic utilisation of vermicompost.

Training and capacity building

Training programmes to build the capacities of tribal people on fish cultivation, vermicomposting, mushroom cultivation, vaccination of poultry, vegetable cultivation, spice cultivation, production of bio-fertilisers as well as setting up village development committees were conducted during the year over 73 trainee days. A total of 1268 members

Table 2.5 ***Training programmes at a glance***

S.No.	Training programmes	No. of villages	No. of days	Total participants	Men	Women
1	Fish cultivation	3	3	59	39	20
2	Vermicomposting	6	18	86	68	18
3	Mushroom cultivation	6	4	86	68	18
4	Poultry vaccination	6	6	402	234	168
5	Village development committee	6	12	92	64	28
6	Vegetable cultivation	6	22	446	446	446
7	Spice cultivation	3	6	73	47	26
8	Biofertiliser production	2	2	24	18	6
	Total	**6**	**73**	**1268**	**984**	**730**

consisting of 984 men and 730 women participated in such orientation.

Linkages with government and Panchayat Raj department

Linkages have been maintained with different government line departments like Agriculture, Rural Development, Irrigation, etc., to avail various government entitlement schemes for the benefit of tribal farm families in the demonstration areas.

18 seed kits of Bengal gram, greengram and mustard were mobilised from the Agriculture Department by 18 farm families of Kusumguda and Uduluguda villages to cultivate 24 acres of land. Similarly, 4 farm ponds and one big multipurpose pond worth Rs. 2.2 lakhs were sanctioned to the farm families from the Block office under the NREGS programme. Two 5 Hp diesel pump sets worth Rs. 46,000 were mobilised from the Irrigation Department for two SHGs in two villages to irrigate vegetables during winter and summer.

Renovation of farm ponds

The renovation of 16 farm ponds was taken up in 6 villages, involving 24 farm families. Deepening, cleaning of the pond and dressing of bunds were carried out with 50 per cent labour contribution from the concerned farm families. The bunds of the ponds were planted with vegetables, papaya, coconut and drumstick.

Village Knowledge Centres

Two Village Knowledge Centres were operationalised in two revenue villages of the gram panchayats of Asna and Kundura. The computer-aided learning programme (CALP) was conducted in Uduluguda VKC, for the benefit of school children. In Kaudiaguda VKC, the Microsoft Unlimited Potential Programme (MUPP), which was initiated in 2008, is still under operation.

203.3 Quantitative assessment and mapping of plant resources of the Eastern Ghats

The three-year project on the quantitative assessment and mapping of the plant resources of the Eastern Ghats was completed during the last quarter of 2009. A total of 444 grids in the Eastern Ghats covering 7 districts of Odisha were covered, in which 641 plant species (174 trees, 154 shrubs, 186 herbs, 52 climbers and 75 ferns, grasses, orchids and others) were recorded. Three RET species — *Gnetum ula*, *Albizia thompsonii* ,and *Stemona tuberosa* — and two endemic species — *Selaginella nairii* and *Stemona tuberosa* — were also recorded. The 3 RET species were conserved in BPMPGRC garden. Herbariums of 431 important taxa (128 trees, 118 shrubs, 84 herbs, 51 climbers and 50 others) are being maintained at BPMPGRC. Preparation of digital fliers of 200 species is under process by the coordinating institution, S. K. University, Anantpur.

203.4 DNA Clubs

Four additional schools from four districts of Odisha (Nabarangpur, Rayagada, Boudh and Kendrapara) were brought into the fold of DNA Clubs during the current year. On date, there

are 9 DNA Clubs spread over 9 districts of Odisha involving 478 student members and 18 teachers.

Exposure visits were organised for the DNA Club student members to different institutions such as the Central Rice Research Institute (CRRI), the Central Institute of Freshwater Aquaculture (CIFA), the Regional Museum of Natural History, the Institute of Minerals & Materials Technology, the Regional Plant Resource Centre, the Regional Science Centre, the Chandaka Elephant Sanctuary and the Nandankanan Zoological Park.

During the reporting year, a nature camp was conducted for two days at SAMBHAV (an NGO working on nature care) at Nayagarh district. 143 students along with 14 teachers from three schools in the Khurda district participated in the camp. Students were exposed to organic farming, regeneration of forests, community forest management, conservation of wild animals, SRI, plantation crops, soil and water conservation, nursery management of forest plants, etc. Other activities included celebration of Children's Day, Biodiversity Day, World Environment Day, Water Day, etc., in these schools. Competitions on essay writing, debates, poster preparation were conducted as a part of DNA Club activity. Exposure visits and lecture on various topics related to bio-resources and biotechnology were carried out as part of the activities of individual schools.

Orientation was conducted for four new DNA Club teachers about the activities that would be carried out in each school under the DNA Club programme.

203. 5 Biodiversity conservation, enhancement and utilisation

National Agricultural Innovation Project

A project on large-scale cultivation and value-addition of market-driven prominent rice landraces funded under ICAR's National Agricultural Innovation Project (NAIP), with the Central Rice Research Institute (CRRI), Cuttack, the Krishi Vigyan Kendra (KVK), Semiliguda, and the Orissa Rural Development and Marketing Society (ORMAS), Bhubaneswar, as consortium partners, was initiated during the year. The objectives of the project are:

- to enable enhanced income generation from the large-scale cultivation of 3 landraces — *Machhakanta*, *Kalajeera* and *Haladichudi,*
- to enhance productivity through ensuring procurement and primary processing, value addition and branding
- to enable the resource-poor communities to get rewards and recognition of their IPR and traditional knowledge systems

A baseline survey carried out involving 91 farmers from 15 villages in 5 gram panchayats of 2 community development blocks in Koraput district indicated that the total income of most of the farmers ranged from Rs 900/- to less than Rs.5000/- per month. The landholdings of more than 54 farmers fell under marginal to small groups, the area under rice cultivation varying from 1ha to 5 ha. There were 17 local varieties cultivated in these villages including *Kalajeera*, *Machhakanta* and *Haladichudi*.

Lack of knowledge on improved package of practices, especially IPM and INM, status of the soil and non-availability of labour in time are the major reasons for low yields. The villagers prepare puffed rice, pressed rice and popped rice during festivals and ceremonies.

Since 9 out of the 15 villages taken up under NAIP are those where MSSRF has not intervened so far, a PRA exercise was undertaken to gain understanding about the villages: their problems and possible solutions, and the political, social and biological resources. It was found that 72 per cent of the households are involved in agriculture and the major crops — rice and *ragi* — are cultivated only in the rainy season. From the problem tree analysis, it was identified that non-availability of seeds as well as lack of knowledge on pest and disease management have been the major constraints.

Large scale cultivation and market promotion of Kalajeera

The strategy adopted during the transit phase between the biodiversity project funded by SDC and the initiation of the new NAIP project was to strengthen the Kalinga Kalajeera Rice Growers' Cooperative Society (KKRGCS) by conducting a series of meetings, training and capacity-building programmes. With the help of a loan of Rs 6 lakh from the Orissa Rural Development and Marketing Society,.KKRGCS procured all the *Kalajeera* grains produced by 121 farmers from 29 villages, cultivated over an area of 98 acres, at Rs 1700 / ql. Farmers sold 339.64 ql of paddy to the society and kept the rest for their own consumption. It was for the first time that the society is looking after the activities covering 29 villages. The farm families were happy at receiving the higher price of Rs 1700 / ql. It was decided that the paddy will be processed in rice mills and sold as rice to marketing agencies by KKRGCS.

Quality seed production of Machhakanta and Haladichudi

This year 3 acres of land were cultivated under *Machhakanta* and 1.2 acres of *Haladichudi* for seed production. All improved agronomic practices were followed, from nursery raising to harvesting. Twenty-five ql *Machhakanta* seeds and 5 ql *Haladichudi* seeds were collected from mother panicles and stored in village seed banks. Blast disease in the field of a farmer was found to have considerably reduced the yield. The taste of popped rice from these varieties is different compared to other popped rice available in the market.

Introduction of appropriate agro techniques

Demonstrations were conducted in farmers' fields in different locations to compare traditional methods of rice cultivation, improved agronomic practices and SRI. For the first time, farmers were exposed to SRI in the operational villages. Six demonstrations of the three varieties were conducted in 6 villages at different locations. Farmers were trained to use planting markers and weeders. MSSRF facilitated their purchase from the block office at subsidised rates. Awareness was created through street plays and audio-visuals in the villages. Exposure visits of farmers to SRI

plots were organised at different stages of crop growth. Fifty per cent more yield was recorded in SRI compared to traditional methods of cultivation of *Kalajeera* and *Machhakanta*. Labour inputs were reduced during planting and weeding and high tillering density was observed.

Table 2.6 ***Cost of cultivation of* Kalajeera */ acre***

Activities	Cost of cultivation (in Rs)	
	Traditional	SRI
Seed cost	400	40
FYM cost	1500	1500
Labour for ploughing	960	960
Labour for raising nursery	50	250
Uprooting & transplanting	1400	600
Weeding	1200	400
Rouging	200	200
Water management, bunding & pesticide application	1000	1000
Harvesting & post-harvesting	1800	1900
Cost of gunny bags, winnowing fan,& others	500	700
Total	**9010**	**7550**

Table 2.7 ***Benefits per acre***

Particulars		Quantity	Rate (Rs/ ql)	Amount (Rs)
Grain -	Traditional	7 ql	1700	11900
SRI		15 ql	1700	25500
Straw -	Traditional	24 ql	50	1200
SRI		16 ql	50	800

Village Seed Banks

Fifteen villages were selected for the establishment of village seed and grain banks. Out of these, 5 villages have storage facilities. Construction of 10 new storage houses is in progress. The concept was explained to villagers by conducting a series of village meetings and focus group discussions and through audio-visuals. The initial contributions by members of VSBs were started in 7 villages, with 539 kg seeds of paddy and 50 kg seeds of finger millet as initial seed corpus. 650 kg of paddy and 265.8 kg of finger millet were repaid by 56 farm families (out of 71) to the village seed banks.

Local institutions

Panchabati Grama Unnayan Samiti (PGUS), Village Seed Bank (VSB) Committees, Central Village Committees (CVCs), Kalinga *Kalajeera* Rice Growers' Cooperative Society (KKRGCS) and Self-Help Groups (SHGs) were strengthened during the year.

Panchabati Grama Unnayan Samiti (PGUS) is a registered body — formed after receiving the Equator Initiative Award – 2002 at Johannesburg, South Africa — which covers 16 villages; 6 members represent each village and contribute Rs.25 monthly as membership fees. The interest from the Award will be used for village bioresource conservation activities as per the bye law. Two general body meetings and one executive body meeting were conducted this year in which 51 women and 73 men participated. Among the various proposals, those for pond renovation,

fish cultivation as well as construction and renovation of seed grain banks will be taken up immediately. An amount of Rs 3,00,000 is available to undertake these activities in the villages.

Village Seed Bank Committees take care of seed storage, transactions, record maintenance, monitoring, seed treatment and germination. Executive bodies have been constituted in all the villages. The initial contribution of seeds from the villagers is stored in a farmer's house pending completion of a store house.

Central Village Committees have been formed in all the villages, and members to executive bodies have been selected by villagers. The chief purpose of these committees is to look after village developmental works and conservation of bioresources, resolve village conflicts, monitor other committees like SHGs, identify key persons for training and exposure, and implement government facilities in their villages. In each village, village development funds (VDF) have been mobilised, with links to banks. Out of 15 villages, 4 already have VDF and in 8 villages new ones have been initiated this year. The total deposit in 8 villages is Rs

Table 2.8 ***Training, meetings and workshops conducted during the year***

Date	Particulars	Target groups	Participants		Total
			Male	Female	
27.04.09	Workshop on "Capitalisation of Prominent landraces of rice in Odisha through value chain approach" – supported by NAIP (ICAR)	Farmers, researchers, govt. officials	41	7	48
02.06.09	General body meeting of KKRGCS	Kalajeera farmers	46	21	67
18.08.09	Demonstration-cum-training on SRI	Farmers	53	17	70
08.09.09	Executive body meeting of PGUS	Members of PGUS	25	11	36
11.09.09	Training on IPM in rice	Farmers	47	27	74
14.10.09	CAC & CMU meetings at CRRI, Cuttack	Members of monitoring and advisory committees of NAIP project	20	0	20
01.12.09	Meeting with marketing agencies by the KKRGCS	Members of society & marketing agencies	25	6	31
05.12.09	Exposure visit to SRI fields and VSBs	Farmer representatives from 10 villages	14	5	19
19.12.09 & 20.12.09	Workshop on Community Social Mobilisation and Awareness	Farmers	46	14	60
03.03.10	Training on baseline survey	Farmers, staff members and volunteers	16	81	97
		Total	**333**	**189**	**522**

12,260/-, individual contribution of the villagers vary from Rs 2.00 to Rs 10.00 per month.

The Kalinga *Kalajeera* Rice Growers Cooperative Society was set up in 2007 by taking all *Kalajeera* growers into an umbrella organisation. It is a non-registered body, with each farmer contributing Rs 100/- as a lifetime membership fee. The main purpose of this society is to look after crop monitoring (in extension villages too), awareness, dissemination of improved method of packages of practice, links with financial institutions, storage and marketing. Two general body meetings and six executive body meetings were conducted during the year. The executive members have been exposed to different State and district level exhibitions for marketing their products.

Forty **Self-Help Groups** had earlier been formed for specific purposes by agencies of the government and NGOs. After withdrawal of these agencies, the SHGs were dormant. A series of meetings were conducted to activate and motivate them, mainly to prepare value-added products from rice after getting appropriate training from MSSRF. A deposit of Rs 4,14, 380/- has been made by 21 SHGs and the remaining SHGs are in the process of revival.

Sub Programme Area 204

Community Gene Bank

M. S. Swaminathan Research Foundation had commissioned a Community Gene Bank (CGB) in the early 1990s to preserve farmer-conserved varieties in order to revitalise the agrobiodiversity conservation tradition of tribal and rural farm families.

With support from the Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA), the Gene Bank has undertaken a project to characterise distinctiveness, uniformity and stability (DUS) of farmers' varieties of rice to facilitate their registration. During the second year of the project, a total of 200 varieties of traditional paddy collected from Wayanad and Jeypore have been taken up for characterisation. Based on the guidelines provided by the PPVFRA, trials were conducted on leased land in Jeypore and Wayanad. Sowing was taken up in three replications using random block design (RBD). Field observations were recorded based on different growth stages of plants to cover descriptors specified in the rice DUS guidelines of PPVFRA. Observation for the assessment of DUS was made on 10 plants per replication. To facilitate the assessment of distinctiveness, the following characters were used: basal leaf sheath colour, time of heading, stem length, decorticated grain length, decorticated grain shape, decorticated grain colour as well as decorticated grain aroma. For the purpose of grouping, analysis of two years' field data collected for the varieties is under process. As part of rejuvenation of accessions, the multiplication of 200 accessions was carried out.

With the support of the DUS descriptors, the Gene Bank has taken the initiative and facilitated registration of farmers' varieties

such as *Chennellu*, *Thondi*, *Gandhakasala*, *Chomala*, *Jeeragasala* and *Veliyan*, *Machkanta*, *Kalajeera*, *Haldichudi*, *Gathia* and *Umeriachudi* in coordination with the Jeypore and Wayanad centres. After verification by PPVFRA and notification in the Gazette, the applicant is entitled to rights specified under PPVFRA.

Two hundred accessions of paddy and millets have been added to the holdings at the Community Herbarium and as on date, total collections belonging to 95 families covering endangered, medicinal and traditional cultivars are housed in it.

Sub Programme Area 205

Supplementary Efforts in Community Agrobiodiversity Conservation and Sustainable Use, Chennai

The Swiss Agency for Development Cooperation (SDC), New Delhi has provided an extension to the project, *Integrated Management of Biodiversity Resources in Partnership with Communities* from 1 July 2009 until 31 March 2010, based on submission of an action plan and budget for completion of some work handled by the Chennai and Kolli Hills teams.

The Fourth Steering Committee Meeting of the concluding and consolidation (CC) phase of the project was organised on 31 July 2009 – 1 August 2009 in Jeypore. On 31 July 2009 a field visit to the CC phase villages — Gunthaguda and Nuaguda — was made, during which Professor M.S. Swaminathan and Mr.K.R.Vishwanath, representative of SDC, inaugurated the VKC and the wireless public address system.

205.1 Field-level Consultations on Mainstreaming Neglected and Underutilised Species (NUS) and Food Security

Five field-level workshops on neglected and underutilised species (NUS) and food security were organised as part of the CC phase. The objectives of the workshops were to understand the current status of NUS, notably millets, in various millet growing locations in Tamil Nadu and elicit and document current views of stakeholders using the 4C framework (conservation, cultivation, consumption and commerce). Farmers, members of SHGs, members of NGOs, millet processors and consumers participated in the workshops, fieldwork and discussions. Five workshops were organised over a period of 6 months, and the key highlights are summarised in this section.

Kolli Hills, Namakkal district

The workshop in Kolli Hills was organised in June 2009, in which 90 participants attended. The participants were divided into 4 groups to discuss the four themes of conservation, cultivation, consumption and commerce. Each group made a presentation at the plenary session and other members were invited to add and provide their views. This ensured that

the views of various participants were elicited and compiled.

Key learnings

- Farmers are not able to protect seeds properly since they are attacked by rats and pests.
- Some members in the family are interested in raising cash crops as against food crops like millets.
- Loans need to be extended for promoting cultivation of millets.
- There is a dearth of cattle which is making cultivation of millets difficult from the point of view of draught animal power and dung.
- Reduced area under millets increase pest attacks on small parcels placed under millets.
- Manual processing of millets for local consumption is difficult and a major problem faced by households.
- There is a low consumption preference for foodstuff made from crops like foxtail millet by children and young people.
- Cultivation of millets tie people to the land, while cultivation of tapioca releases them to undertake seasonal migration.
- The need for raising food crops is low in the light of subsidised food available through PDS.

T. Kallupatti

A workshop was organised in T.Kallupatti in July 2009 in collaboration with a local NGO, ADISIL from Thirumangalam. The workshop was preceded by a one-day field visit to various farm families involved in the cultivation of millets. A total of 60 participants attended the workshop. The participants were divided into four groups and discussed the 4 Cs. A plenary session was held during which a summary of the discussion of each group was made and enriched by members of other groups completing the information. The discussion provided a fair understanding of local issues related to millets and would help to further action in the area of millets.

Key learnings

- The region faces severe labour constraints with regard to cultivation of crops like millets.
- Commercialisation of agriculture and the consequent changed agrarian relations has relegated millets as a crop, which was used to pay labour in kind.
- Households face difficulties with regard to manual processing of millets.
- Farmers have alternative short duration crops for cultivation.
- The need for raising food crops is low in the light of subsidised food available through PDS.
- The cost of cultivation of millets is high and economic returns from the crop are low.
- There is lack of insurance for millet crops.
- Millet cultivation is tied to traders who advance money for its cultivation.

Theni, Theni district

A rapid reconnaissance study in Theni district was made in September 2009 to assess the present status of minor millets cultivation and use, and a report produced on the current status of conservation, cultivation, consumption and commerce. Based on preliminary work in Theni district, fieldwork was organised over two days to meet various farmers and their families to understand the current status of millets. This was followed by a one-day field-level workshop on 13 September 2009 in collaboration with a local NGO, HEAVEN based in Usilampatti. Over 45 farmers and other stakeholders (divided into four groups) participated in the workshop and shared their knowledge and experience. The workshop provided valuable information on the current status of minor millets in Theni district.

Key learnings

- Quality seeds of millets are not available, since the crops have been phased out from several locations.
- The cropping pattern has shifted with the advent of private wells, roads and vehicles relegating millets to the background.
- Reduction in the number of cattle is linked to the nutrient status of the soil.
- There is a severe wildlife-agriculture conflict in the region due to the presence of wild boars and birds.
- The economic returns from millets are low.
- Status consciousness and modern ideas hold that consuming *navadanya* is backward, leading to the relegation of millet consumption.
- There is a severe loss of knowledge among women about culinary preparations using millets.
- There is lack of financial support by the State.
- The need for raising food crops is low in the light of subsidised food available through PDS.

Thally, Krishnagiri District

Preliminary fieldwork was conducted in Thally block and its neighbouhood in Krishnagiri district to asses the present status of minor millets cultivation and use, prior to the one-day field-level workshop held on 28 October 2009 at Navadarshanam, an organic farm. Thirty-six farmers, in four groups, participated in the workshop and shared their knowledge and experience.

Key learnings

- Farmers felt the need for quality millet seeds.
- There has been a reduction of 30-40 per cent area under little millet in the Thally region, which has been replaced by finger millet.
- Millets are a non-remunerative crop and therefore farmers are under pressure to cultivate crops like groundnut, gingelly, horsegram and coriander.

- Financial assistance by the State for cultivation of millets is required.
- Animal component, notably livestock, is essential for cultivation of millets.
- There is a felt need for establishing processing units.

Javadi Hills, Tiruvannamalai district

Similar to the other locations, preliminary fieldwork in Javadi Hills was followed by a workshop on 11 December 2009, in collaboration with the Village Resource Centre (VRC) being operationalised jointly by the Vellore Institute of Technology (VIT) and the Tamil Nadu Forest Department. A total of 36 farmers and several stakeholders participated in the workshop and shared their knowledge and experiences.

Key learnings

- The region produces more quantities of little and other millets.
- Women face difficulties in processing millets during peak labour periods like harvest time and also in households with school-going children who need to attend school on time.
- The labour demand for millet cultivation is high.
- The State needs to extend loans for cultivation of millets.
- There is a need for establishing processing units to enable increased consumption.

205.2 State-level Policy Makers Consultations

205.2.1 State-level consultation in Thiruvananthapuram, January 2010

A State-level Policy Makers Consultation on *Effective Community Management of Agrobiodiversity in an Era of Climate Change* was held in Thiruvananthapuram on 5 January 2010. The Chief Minister of Kerala, Shri.V.S.. Achuthanandan, inaugurated the consultation. Following an in-depth discussion on all issues relating to the conservation, sustainable and equitable use, and enhancement of Kerala's rich agrobiodiversity, the following Thiruvananathapuram Declaration was adopted.

Agrobiodiversity Conservation and Enhancement for Climate Resilient Food and Livelihood Security Systems

Kerala and climate change

- Climate change presents mega-threats to Kerala's food and water security systems, as well as to the lives and livelihoods of coastal communities. Sea level rise will cause serious threats to coastal ecosystems as well as to the coastal mineral wealth, for example, the monozite and thorium deposits.
- A temperature rise of 2 degrees Celsius will affect the production and productivity of plantation crops like coffee, tea, spices and rubber, in addition to annual crops like rice.

- Change in precipitation may cause drought and floods as well as soil erosion and decrease in soil fertility. The forest biodiversity and medicinal plant wealth of Kerala will also be adversely affected. Ecosystem services will be disrupted. Vector-borne diseases will affect plant, animal and human health.

- Kerala may experience a large influx of 'climate refugees' from coastal to inland areas.

- To prepare for such threats both anticipatory research using advanced technologies as well as participatory research with local communities, including tribal families, will be needed so that coping mechanisms combining frontier science and traditional wisdom can be developed and put in place soon.

Kerala: An agrobiodiversity paradise

Kerala is rich in agrobiodiversity in crops like rice, banana, jackfruit, tubers, spices, medicinal plants, coconut, plantation crops, coastal halophytes, inland and marine fishes, large and small ruminants including the Vechur cow and Malabari and Attapadi goats. Its medicinal plant wealth has helped Kerala to perfect the science of ayurveda_and thereby become a preferred state for health tourism. The challenge now lies in both preserving and enriching this biological wealth and in converting bio-resources into jobs and income on a sustainable basis.

Community conservation

Kerala has a long tradition of *in situ* on-farm conservation in crops like rice, spices and tubers as well as *ex situ* preservation through sacred groves, botanical gardens, biosphere reserves and aquaria. Tribal communities have conserved lifesaving crops, particularly tubers and medicinal plants, and traditional healers have deep knowledge of the therapeutic value of local flora. Speciality rices like *Njavara* have been identified and conserved. Farmers have been serving as conservers, breeders and cultivators. Several important varieties like *Njallani* in cardamom have been developed by farmers like Sebastian Joseph and his son Reji Joseph in Idukki district. Kuttanad farmers have perfected the art and science of growing paddy below sea level. This knowledge will be of immense value in protecting coastal agriculture in the event of a rise in sea level.

Steps to strengthen Community Conservation

- There is need for promoting among the younger generation an awareness of the vital significance of agrobiodiversity for the well being of the future generations. Genome Clubs designed to promote genetic and biodiversity literacy may be organised in all schools and colleges.

- Infrastructure for strengthening community conservation resources like drying yards, seed storage and seed testing facilities needs to be supported in all agrobiodiversity hotspots.

- Community-managed Gene, Seed and Grain Banks should be promoted through

government support. This will help to enlarge the food basket and preserve intra-specific variability.

- Homestead gardens containing agro-biodiversity of the region need to be promoted as a movement for fulfilling the food security of households.
- The Government of India has instituted Genome Saviour Awards to recognise and reward the contributions of tribal and farm families to agro-biodiversity conservation and enhancement. The State Government may also institute **Community Conservation Awards** to provide social prestige and economic incentives to farmer-conservers, a majority of whom are women.
- A special programme should be launched for protecting rare, endangered and threatened species (RET) on the lines undertaken by the Community Agrobiodiversity Centre of MSSRF at Kalpetta, Wayanad.
- Pesticide-free policies should be promoted and water pollution should be controlled.
- A special programme for conserving climate-resilient species and varieties should be launched. Gene banks should have a special section for climate-resilient genotypes.
- Biodiversity management committees, as envisaged in the Biodiversity Act 2002, should be set up at the panchayat level. They should be enabled to maintain block-level biodiversity registers. Special training programmes should be organised to enable panchayat committees to become well versed with the provisions of the Biodiversity and Protection of Plant Varieties and Farmers' Rights Acts, particularly with those relating to prior informed consent, access and benefit sharing as well as the gene and biodiversity funds.

Preparing for sea level rise

Kerala has the unique advantage of becoming a world leader in managing the consequences of sea level rise. The Kuttanad area may be declared as a Special Agriculture Zone because

- It is the only region in India with experience of cultivating rice under below sea level conditions.
- It is a Ramsar site.
- It is a unique wetland promoting rice-fish rotation'
- It is an area of thriving water tourism'
- It is a biodiversity paradise in flora and fauna'
- It provides uncommon opportunities for learning how to manage the impact of sea level rise.

An International Research and Training Centre for Below Sea Level Farming may be established in Kuttanad.

Bio-valley

The area between the Silent Valley Biosphere Reserve and Wayanad may be developed as a

herbal bio-valley to promote the conservation and sustainable and equitable use of the genetic diversity occurring in medicinal plants. Micro-enterprises supported by micro-credit may be organised by WSHGs along the bio-valley. All RET species in the bio-valley should be protected and multiplied. The products of the bio-valley may be given a brand name. Conservation and commercialisation will then become mutually reinforcing, and there will be an economic stake in conservation. Today, there is an economic interest in the unsustainable exploitation of medicinal plant resources, and this needs to be halted and reversed through the medicinal plants bio-valley.

Kerala Consortium for Agrobiodiversity Conservation and Enhancement

In order to promote coordinated and concerted efforts in agrobiodiversity conservation and enhancement, it will be useful to constitute a Kerala Consortium for Agrobiodiversity Conservation and Enhancement with members drawn from the government, academia, civil society, media and private sectors. Such a consortium should promote the conservation of germplasm of crops, farm animals, fisheries and forest trees. The consortium should help in ushering in an 'Era of Bio-happiness' in Kerala, arising from the sustainable use of bio-resources by creating more jobs and income.

Kerala has to prepare itself for meeting the challenges arising from a 2^0 C rise in mean temperature and a 1 to 2 m rise in sea level during this century. The ability to convert agrobiodiversity 'hot spots' into 'happy spots' will greatly influence Kerala's agricultural destiny. Let 2010, designated by the United Nation as The International Year of Biodiversity, be the beginning of the unleashing of community participation and efforts in both saving and enriching Kerala's agricultural biodiversity.

205.2.2 State-level consultation in Bhubaneshwar, January 2010

A State-level Consultation on *Effective Community Management of Biodiversity in an Era of Climate Change* was conducted in Bhubaneshwar on 30 January 2010, which was inaugurated by the Chief Minister of Odisha, Shri Naveen Patnaik. The Bhubaneshwar Declaration developed out this consultation is set out here.

1. Mahatma Gandhi's plea that we should live in harmony with Nature and with each other should guide community efforts in the management of biodiversity. The declaration by the United Nations that 2010 be observed as the International Year of Biodiversity is to remind humankind that biodiversity is the foundation for global food security, and is the feedstock for both the biotechnology industry and climate-resilient agriculture.
2. Odisha is a genetic paradise with very rich genetic diversity in rice, mangroves and many other crops and farm animals. The challenge now lies in converting the rich bio-resources of Odisha into jobs

and income meaningful to the poor in an environmentally sustainable manner.

3. A Biodiversity Impact Analysis should be introduced in all development programmes, in order to ensure that economic advance is not linked to biodiversity loss.

4. To strengthen the linkages between biodiversity and food security, there is need to enlarge the food basket by including a wide range of millets, tubers and legumes in the diet. Local-level Gene (i.e., *in situ* on-farm conservation), Seed and Grain Banks should be promoted for this purpose.

5. Biodiversity in medicinal plants helps to strengthen health security. A herbal bio-valley may be established in Koraput along a watershed for ensuring sustained interest in conservation, by generating an economic stake in conservation. Also, the local communities should derive full benefit from the Gene Fund and other provisions of the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA). The Koraput area may be declared as a globally important agricultural heritage site (GIAHS) of FAO.

6. The role of biodiversity in sustaining livelihoods can be enhanced through crop-livestock-fish integrated farming systems. A movement may be launched for promoting the establishment of a water-harvesting pond and a biogas plant in every farm.

7. Recognising the key role played by women on the conservation and enhancement of biodiversity, gender considerations should be integrated in all biodiversity related programmes.

8. Coastal biodiversity, particularly the Bhitarakanika and Kendrapara mangroves, should be preserved. For this purpose, the Joint Mangrove Forest Management principles developed by MSSRF may be promoted.

9. Nutrition security can be strengthened by introducing horticultural remedies to nutritional maladies, like the deficiency of iron, iodine, zinc, vitamin A, vitamin B12 and other micronutrients in the diet. The nutritional dimension must be mainstreamed in the National Horticulture Mission.

10. Soil carbon banks may be built up by planting fertiliser trees, wherever possible. *Faidherbia Albida* is an efficient fertiliser tree. Mangroves are very efficient in carbon sequestration. Such steps will contribute to mitigation efforts in relation to climate change.

11. Every calamity provides an opportunity. The threats posed by climate change provide an opportunity for promoting conservation farming, climate-resilient farming systems and conservation of coastal and inland biodiversity. Gene banks for a warming India and rising oceans should be established. By taking steps to ensure the conservation and sustainable and equitable use of biodiversity, we can launch an era of biohappiness. This should be the goal of the International Year of Biodiversity.

205.3 Exhibition at International Conference on *Biodiversity in Relation to Food and Human Security in a Warming Planet*

A Window to Millet Heritage

With the purpose of highlighting millet culture, an exhibition representing the 4 Cs was set up at the International Conference on Biodiversity in Relation to Food and Human Security in a Warming Planet held in memory of Dr. Norman E. Borlaug at Chennai in February 2010. Articles of daily use related to conservation, cultivation, consumption and commerce were collected from Javadi Hills, Pacchamalai Hills and Kolli Hills in the Eastern Ghats of Tamil Nadu. Some of the small millets cultivated in the locations include little millet, foxtail millet, kodo millet, and barnyard millet. Being a subsistence crop, the exhibition team was able to collect a larger number related to cultivation and consumption. Farmers employ several cultivation and management practices to raise and use the crops. Women play an important role in seed selection, preservation, weeding, watching and protecting crops from pests, harvest and transport of produce to the village. They employ a range of millet processing techniques like hand-pounding, grinding, and cleaning, using different technologies. A booklet titled, "A Window to Millet Heritage – An Exhibition" was distributed as part of the exhibition.

205.4 Research studies

Koozh in Chennai

Ragi koozh, made from finger millet, is a popular street food sold in Chennai and other cities, towns and big villages in Tamil Nadu. A study on *koozh* in Chennai was undertaken to explore and highlight the consumption and commercial aspects of a popular variety of small millet – *ragi* or finger millet (*Eleusine coracana*) sold by street food vendors as *koozh* or cold porridge. The salient findings based on interviews with 35 *Koozh* sellers and 44 consumers are:

a) *Koozh* selling is an enterprise in the informal sector. Most of the *koozh* sellers are seasonal migrants from Tiruvannamalai or Krishnagiri districts from northern Tamil Nadu and a small section belong to those settled in Chennai.

b) The raw material *ragi* is purchased from local grocery shops, cleaned, ground into powder and used for preparing *koozh*. Fifty-five per cent of those interviewed reported purchase of 20 to 40 kg of *ragi* per week and 23 per cent bought more than 40 kg.

c) It was found that 46 per cent of *koozh* stalls had been established for 4 to 7 years and 37 per cent for less than 3 years, indicating this to be a new and growing phenomenon, at least in Chennai.

d) A sizeable percentage of *koozh* sellers (45 per cent) reported that 50-100 customers visited the stalls and 22 per cent served between 100-150 customers. The most number of consumers have been reported from three locations: Madhavaram, Tambaram and Koyambedu, mainly truck drivers and haulers (labourers loading and unloading goods).

e) Most consumers visited *koozh* stalls in the morning between 7 and 10 a.m. and 93 per cent of them being daily labourers. It is most likely that *koozh* is consumed as a breakfast dish and some consumers reported that it kept them going until afternoon. The bulk (45 per cent) of the consumers earned a maximum of Rs.5000 p.m. and 36 per cent earned a maximum of Rs.10,000 p.m. Forty-three per cent of the consumers reported having *koozh* every day of the week and 23 per cent, three days in a week.

f) A sizeable section of the consumers (43 per cent) reported that they consumed *koozh* as a health drink and another 31 per cent said it has the twin benefits of providing nutrition as well as cooling the body. Some of the consumers said that it helped sooth the stomach and reduce the impact of consumption of alcohol.

g) *Koozh* sellers reluctantly reported that they faced several difficulties in placing their shops in strategic locations due to problems with the police and local bodies.

A pathway for promoting use of millets, notably finger millet, in the urban context was developed as part of the study. The recommendations included provision of clean water to protect the health of consumers, formation of a *Koozh* Sellers Association for protecting the rights of sellers and promoting access to institutions, promoting awareness on food and nutritional security and developing best practices in food handling and consumer awareness.

Status of millets in Tamil Nadu

A study of small millets in important locations in Tamil Nadu was carried out during 2009-2010. The locations covered were T.Kallupatti, Theni, Dharmapuri, Yelagiri, Pacchamalai and Javadi Hills. A total of 36 samples were collected and sent for chemical analysis. The study is likely to throw light on millet landraces currently being cultivated by farmers in these locations, including their chemical composition.

Table 2.9 ***Samples of small millets collected from cultivating locations in Tamil Nadu***

S.No	Local Name of Millet	Location District	No. of Samples
1	Samai	Pacchamalai	7
		Javadi Hills	14
		Yelagiri	2
		Dharmapuri	4
		Theni	2
2	Thinai	Javadi Hills	3
3	Varagu	Javadi Hills	1
		Pacchamalai	1
4	Panivaragu	Javadi Hills	1
5	Kuthiraivali	Theni	2
		Total	**37**

205.5 Collaborations with other programmes

V&A Programme in Andhra Pradesh

A visit was made to Kottur and Narasingapur villages in Mehabubnagar district in Andhra Pradesh in July 2009 to suggest a possible course of action for establishing seed banks

as part of the V&A project activities. Group discussions held in both villages centered on the importance of maintaining records. A case study on Village Seed Banks in Jeypore, Odisha, prepared by MSSRF, was presented for the benefit of the participants. The process of seed selection through harvest of mother panicles, use of good quality seeds, and importance of good agronomic practices like use of farmyard manure, ploughing and tilling practices, and proper irrigation were highlighted.

ICT programme

The Biodiversity group in Chennai worked closely with the ICT group to extend assistance in the following programmes:

- Virtual Congress of Ecological Security at the National Youth Science Congress, RIYD, June 2009.
- National Workshop on Role of Gyan Choupals in Spreading Climate Literacy and in Building Sustainable Food and Water Security Systems, New Delhi, in September 2009.
- Facilitation and preparation of report of the Biodiversity and Micro-enterprises group of NVA Fellows in Asha Nivas during December 2009.

Consultative Group on Good Agricultural Practices (GAP)

In June 2009, MSSRF had constituted a Consultative Group on Good Agricultural Practices (GAP) to understand its current status and implications. Most members of the project team voluntarily joined the group and participated in a series of meetings to learn more about GAP. GAP implementation is voluntary and non-discriminatory to growers and certification bodies covering fruits and vegetables, food grains, plantation crops, spices and condiments, oilseeds.

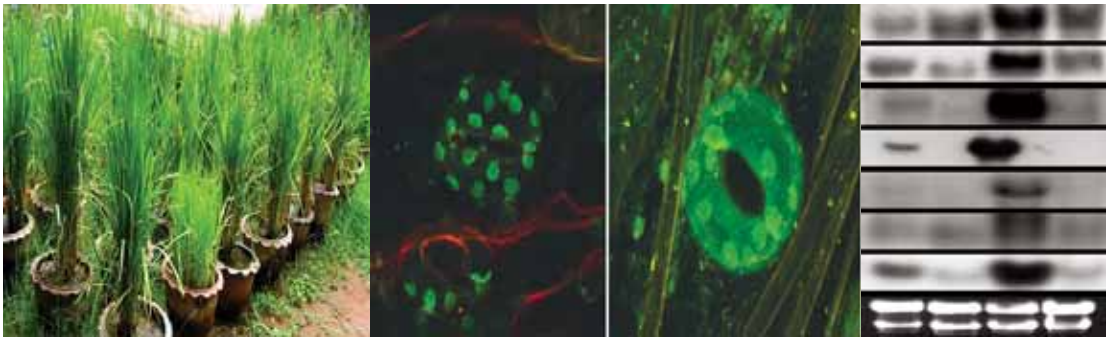
In August 2009 it was decided that the group would undertake a short study in 10 field sites across the various States where MSSRF works. A questionnaire has been developed based on IndiaGAP and is in the process of discussion. Kolli Hills is one of the sites and the study is likely to throw some light on millets and organic pineapple cultivation

Programme Area 300

BIOTECHNOLOGY

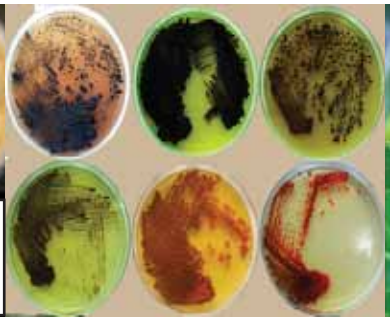
Two international patents have been granted this year. Two new transcription factors and two promoters involved in abiotic stress tolerance have been characterised and cloned. MSSRF is setting up National Jatropha Conservation Centres in Tamil Nadu and Odisha. MSSRF was invited to assess the Tamil Nadu Afforestation Project (TAP) in ten forest sites in six different agro-climatic zones. Two compounds from lichens Tryethelium eluteriae and Roccela montagnei and the extract of mangrove E. agallocha exhibit significant in vitro cytotoxicity against many cancer cell lines. Of the 25,000 bacterial cultures submitted, 1681 have shown promising leads in the bioprospecting work for potential biomolecules.

Collections, Conservation and Genetic Diversity Assessments



Transgenic rice: Understanding gene localisation and expression

Lichens – collections, culture and prospecting



Diversity of Micromonospora

Cotton stainer on the Morinda citrifolia

Programme Area 300

Biotechnology

Biotechnology and molecular genetics have opened up novel avenues of research that have enormous promise and implications for agriculture and food security and human nutrition. During the last few years, the development in molecular breeding and genomics tools has led to new prospects for building up abiotic stress-tolerant genetic material that will contribute significantly towards addressing problems in the context of potential adverse changes in temperature, precipitation, and sea level as well as water scarcity, increased salinisation in the agricultural sector, and increased contamination of groundwater and several other associated problems in waste management. In addition, the Programme Area focuses on bioprospecting for novel genes, compounds and microorganisms for therapeutic and agricultural applications. Organisms and biomolecules from medicinal plants and niche- specific microbes as well as little-known lichen species are being identified and studied for their potential. Tissue culture methodologies have significant implications for the production of low-cost quality planting material suitable for coastal and arid agriculture. The programme area looks in an integrated way understanding the basic scientific mechanisms, developing methodologies for identification and characterisation of novel combinations, furthering and refining the process for product development for societal benefits.

Sub Programme Area 301

Ecological Restoration and Ecosystem Monitoring

301.1 Production and demonstration of high quality planting material of *Jatropha curcas* and multilocation trials

Jatropha germplasm are being maintained and a total of 234 accessions were planted at the *Jatropha* genetic garden in Tirunelveli. Best practices are being followed in terms of irrigation, weeding, pruning and protection, and data collected for yield, growth, etc. Thirty-five farmers maintain this collection in about 28 ha. MSSRF maintains genetic gardens and plots in 12 ha at different field sites: Tamil Nadu (6 ha), Puducherry (2.5 ha) and Odisha (3.5 ha). Women SHGs are involved in vegetative propagation of elite *Jatropha* plants and their maintenance through their kitchen garden nurseries, and they supply saplings to farmers as well as for use in multi-location trials. A training programme was conducted for a group of dry land farmers and SHGs, for identification of elite germplasm, and propagation and cultivation of *Jatropha*. In the current year, 80 accession seeds (MSSRF 155 to MSSRF 234) were submitted to TERI for oil parameter analysis, of which we have received reports for 79 accessions. The oil parameter test reported that 7 accessions had oil content of more than 40 per cent and 18 accessions had more than 35 per cent. Data collection of all the 234 accessions at the genetic garden and also of the high seed-yielding plants is being

maintained and recorded at regular intervals in all the demonstration plots. Saplings of the micro-propagated select 7 MSSRF accessions under the DBT network have been supplied to the national network partners to conduct multi-location trials.

Selection of Jatropha curcas accessions for national network trials

DBT network trials

The main aim of the national *Jatropha* trials is to identify best performing, elite accessions from the respective regional trials for promotion of large-scale cultivation in dry lands and waste lands. In the first trial, 1205 saplings were received from the DBT *Jatropha* network partners (625-MSSRF, 125-NBRI, 125-Biotech Park, 225-PDKV, 105- HAP), of which 1087 saplings are surviving well and are undergoing trials in dry land areas in Tirunelveli district. Data collection at regular intervals is monitored for plant growth, flowering, seed yield per tree and this information is being shared between partners.

The 484 plants (139- MSSRF, 50-Biotech Park, 231-NBRI, 64-CST) received from DBT in the second national network trial are under maintenance in dry land conditions, and data collection is under progress. Phases I and II of the network trials are exhibiting similar positive results, both in terms of plant growth and yield, as compared to regional collections.

Half sib progeny trials

Evaluation of seed-raised selected accessions was done to analyse growth and yield in different locations in India for selection for large-scale multiplication. Half sib progeny seed materials received from five DBT network partners had 20 accessions of *Jatropha* (7-MSSRF, 4-NBRI, 3-Biotech Park, 3-CST, 3-HAP), which were raised as saplings at the *Jatropha* nursery. 600 plants are under these trials and data collection is under progress.

Multi-location trial of *Jatropha curcas* in different agroclimatic zones and study of agronomic practices

Totally 100 accessions were selected to conduct multi-location trials in various parts of India. MSSRF has received 32000 saplings from DBT bulking centres at Hyderabad, Ruchi and Lucknow to conduct multi-location trials in Tamil Nadu and Odisha. This will include monitoring of plants under irrigated and non-irrigated, fertilised and non-fertilised conditions, developing packages for best practices and also attempting to develop silviculture practice in *Jatropha* for crop improvement. This programme will start in June 2010.

Cultivation of elite *Jatropha* plants

For the initiation of cultivation trials of selected elite *Jatropha* accessions in dry/waste land areas, 24 progressive farmers working in 75 acres (windmill areas) have been identified through panchayats and local NGOs in Tirunelveli district.

Training of farmers and establishment of Jatropha seed production orchards

During the current year, a training programme was conducted for farmers on selection of

best seed-yield accessions from trials and from seed orchards, and for the establishment of seed production orchards. Three ha of *Jatropha* seed production orchards were established at 7 farmers' fields, in dry land conditions. Ten ha of seed production orchards are under maintenance at farmers' fields.

Jatropha nursery establishment and training

Three training programmes were conducted during the current year for Women SHGs and farmers. WSHGs were involved in preparation of nursery grounds for the development and production of saplings from cuttings of select elite *Jatropha* accessions. WSHGs produced 45000 saplings through cuttings, which were supplied to farmers and to national network trials for demonstration purposes.

National Jatropha Conservation Centres

As part of the micro mission project on *Jatropha*, DBT has identified four places in India as National *Jatropha* Conservation Centres. MSSRF is setting up two such centres, one in Tamil Nadu for south India and the other in Odisha for east India. The conservation centres will provide resources to conduct research programmes in crop improvement. A total of 1000 accessions have been selected for these conservation centres from national level germplasm collections, based on yield and oil parameters, of which MSSRF has provided 234 accessions as either cuttings or half sib progeny plants. Work is in progress to cultivate about 50 plants from cuttings and 50 plants from half sib progeny in each of these locations, The main objective of the conservation centres is to analyse each of the accessions in terms of performance and to select required characters for crop improvement. In addition, selection of clones for large-scale propagation and promotion of regional better performing accessions will also be carried out.

Micropropagation of Jatropha curcas

Direct organogenesis was achieved from uninodal explants in different hormone combinations with NAA and IBA, BAP and GA_3. Standardisation of surface sterilisation procedure for seed inoculation under controlled conditions has been established. *Jatropha* tissue culture generates a lot of contamination and we have used antibiotics to keep this under control. Among the various antibiotics, *ampicillin* has proven to be most effective.

From our observations, addition of adenine sulphate increases the shoot numbers but results in stunted growth. Among the various hormones that were used for indirect organogenesis, NAA and TDZ gave somatic embryos. Experiments were carried out to optimise callus formation from petioles from various parts of the plant. Petioles starting from the first to the tenth leaves were used for callus induction. The first and second petioles showed more callus formation and shoot proliferation when compared to other petiolar regions. Multiple shoot formation was observed in BAP and GA_3 combination. TDZ and IBA combination has shown a maximum of 32 shoots whereas a hormone combination of BAP, KN and IAA showed an average

of 14 shoots. While woody plant medium, modified MS medium, White Nitsch media showed only 2-4 shoots, maximum shoot formation was recorded in MS medium with different carbohydrate sources and hormone combinations. Further validation is under progress.

301.2 Demonstration of efficient energy plantations in the coastal regions of Puducherry with community participation

The establishment and maintenance of the coastal bioenergy programme in 10 ha of mangrove area is being carried out by Women SHGs under the integrated afforestation and eco-development project (Coastal Shelter Belt Development), supported by the Government of Puducherry. Women SHGs raise mangrove saplings at nurseries and during the current year 65000 saplings were supplied to the coastal NGOs and Forest Departments.

Ecological restoration

900 vegetative, 580 tissue culture and 3000 seed-raised plants of *Excoecaria agallocha* were hardened at field nurseries and supplied to Keelavanjore for replacement of saplings at bioshield and restoration sites in Puducherry. 15000 seeds of *Avicennia marina* were supplied to SHGs for establishment of mangrove nurseries and planting of saplings at Sadras Kuppam *(Buckingham Canal).*

301.3 Saving endangered plants

Conservation and sustainable utilisation of rare and endangered plants and development of *in vitro* protocols are being undertaken for mass propagation and rehabilitation. Some medicinal plants such as *Syzygium chavaran* and *Strychnos potatorum* were selected for *in vitro* protocol standardisation and cultivation. Certain important *Syzygium* species were selected for initiation of tissue culture studies, viz., *Syzygium caryophyllatum, Syzygium gardneri, Syzygium benthamianum, Syzygium grande and Syzygium balmesphorium*. The explants of *Syzygium* species for protocol development are from CAbC, Wayanad.

301.4 Lichen diversity and distribution pattern for monitoring ecosystem status in some selected forest sites under the Tamil Nadu TAP project

The impact of the Tamil Nadu Afforestation Project (TAP) implemented by the Tamil Nadu Forest Department at the treated forest sites was reviewed by measuring multidimensional field data. Some of the key data included: survival rate of the afforested species, density of general flowering plant species, lichen diversity and its distribution pattern. Lichen monitoring designed to identify ecological continuity/disturbance of forest sites, resulting from pollution, land use, climate change or ecological variables, is now an important part of the early warning environmental decision support system that is used in many countries. Surveying lichen diversity and distribution patterns and linking them with forest site characteristics such as physical setting, climate, forest management and anthropogenic factors assess the status of a forest site. Such lichen surveys were

carried out in 10 forest sites in 6 out of the 7 agroclimatic zones of Tamil Nadu, except the high altitude and hilly zone. The predominant vegetation type observed belonged to the southern tropical thorny forest.

The field staff of the Tamil Nadu Forest Department was briefed about lichens before ocular surveys were carried out on all possible lichen-occurring substrates such as tree bark, rocks, and soil within the selected TAP area. Data such as host species, substrate nature, and position of the thallus on the rock/tree, as well as the frequency and abundance of individual species were also noted. In addition, data on physical setting, climate, topography, dominant tree species, fauna, past forest management, and anthropogenic information were collected for each site from the respective Range Officers and were suitably coded and scored. The Non-Metric Multi-Dimensional Scaling (NMDS) tool was used on the coded data on lichens and forest sites to analyse multivariate ecological data and to visualise the differential ordination of forest sites in the space defined by the similarity and environmental parameters of the lichen species. All sites were analysed simultaneously to result in a consistent ordination pattern.

It was found that the richness of lichen ranges between 5 species and 25 species, the richest being in Odukatthur in Vellore district and the poorest being in Masakkalipatti in Namakkal district. Out of the 10 sites surveyed, 3583 lichen colonies were located, comprising 89 species belonging to 35 genera in 24 families of 9 fungal orders.

- The NMDS ordination represented 86 per cent of the variation in the data set, with 72 per cent loaded on axis 1 and 14 per cent on axis 2.
- Vegetation characteristics, forest management and climate conditions such as openness of the forest site, mean summer temperature, extent of dry season, reserve forest status of the forest site, etc., were loaded on axis 1 (lichens respond more to these characteristics followed by characters loaded on axis 2).
- Anthropogenic factors and physical settings like distance from human settlements and roads, altitude, etc., were strongly loaded on axis 2.

In addition, the study revealed the following:

- The surveyed forest sites showed high levels of degradation but also showed a resilient lichen community (lichens on bark, stone and soil colonising nitrogen fixing groups and capable of re-colonising if habitat conditions are reversed) within the forest sites under suitable microclimatic conditions.
- The lichen species indicated levels of forest degradation.
- Maintaining the structural complexity of habitat conditions is a key issue in maintaining lichen diversity within the target ecosystem.

The study provided an opportunity to devise lichen monitoring methods to assess the conditions of the forest sites of tropical

ecosystems and to provide measurable effects that can aid in developing site- and perturbance-specific conservation measures.

Sub Programme Area 302

Molecular Mapping

302.1 Generation of microsatellite markers in *P. fascicularis* L. genome

Microsatellites, or simple sequence repeats, are usually regarded as the markers of choice in many research programmes because of their co-dominant nature and high variability. The development cost of these markers is usually high, requiring significant investment as primer pairs specific to the microsatellite locus must be designed. In addition, microsatellite primers developed for one species often do not cross-amplify in related species, necessitating separate development for each species. However, microsatellites found in ESTs might better cross-amplify as they reside in or near conserved coding DNA. Microsatellite markers can be developed in several ways: through genomic libraries, enriched genomic libraries, BAC/ YAC libraries, and cDNA libraries. *P. fascicularis* is an important plant because of its economic viability and also its perceived physiological roles. The use of molecular markers as genetic tools can help in providing much needed information for its overall development, sustenance and use. However, reliable microsatellites are difficult to develop for *Pandanus* species due to their relatively large genome size and the extensive repetitive nature of their DNA.

A tandem repeat in DNA is two or more adjacent approximate copies of a pattern of nucleotides. All the ESTs generated from *P. fascicularis* were screened for presence of such microsatellites or tandem repeats using the tandem repeat finder software. Those positively containing repeats were subjected to further scrutiny using the Fast PCR algorithm. In all, 38 EST clones contained either simple repeat sequences such as mononucleotide, dinucleotide or trinucleotide repeats or complex repeats containing 12 bp to 34 bp long individual repeat units. The number of copies of these individual repeats ranged from 2 to 30. The most abundant or common repeat was AG/GA, which was found occurring in 11 clones out of the total 38. The ESTs containing this dinucleotide repeat were coding for Acireductone dioxygenase 1 and 2 (ARD 1 and ARD 2) and an unknown / hypothetical protein. Overall dinucleotides repeats like AG/GA, TC/CT, and TG/GT numbering 14 were most commonly found in the EST library followed by trinuclotides like TTA, AAG and CAG (numbering 3). Only one mononucleotide repeat (poly A) was observed, while the remaining clones contained different complex repeat sequences. One of the important criteria for these repeats to be used as possible markers is their copy number. Hence, only those EST-SSRs whose copy number exceeded 6 were selected for genotyping. This resulted in only 8 EST-SSRs containing either dinucleotide or trinucleotide repeat sequences while 2 EST-SSRs had a complex repeat. Once the putative EST-SSRs clones were identified,

the next step involved designing primers that enabled these repeats to be amplified from genomic DNA. Polymorphism within male and female plants was observed in 4 EST-SSRs while the remaining 6 EST-SSRs were monomorphic when resolved on PAGE gels after PCR amplification. Of the polymorphic EST-SSRs, two were trinucleotide repeats (TTA and CAG), coding for an unknown protein and a transcriptional regulator, while one dinucleotide repeat (TC) and one complex repeat were coding for an unknown protein and metal-ion binding protein, respectively. Metal-ion binding proteins play a vital role in biological processes as metals play a pivotal role in cellular metabolism. They function as the catalytic centres in many biochemical reactions and serve as structural elements for a large number of regulatory proteins. Transcriptional regulators are specialised proteins involved in regulating transcription by either binding to a promoter or enhancer DNA sequence or interacting with a DNA-binding transcription factor. Both these proteins are key components as any biological process and polymorphisms in the DNA regions coding for these proteins can have potential for far-reaching applications once their target genes have been identified. Sequence analyses revealed that the frequencies of insertions/deletions and base substitutions were lower in EST-SSRs than in other types of microsatellites, confirming that EST-SSRs are more conserved than traditional SSRs. Analysis of these microsatellites will provide an important new tool for addressing questions related to conservation and tree improvement programmes. Many parameters — such as genetic diversity in natural and breeding populations, gene flow, pollen and/or seed dispersal, and mating systems — are important for the conservation of genetic resources. In tree improvement programmes, microsatellites can be used for QTL mapping, clone identification, estimating pollen flow/contamination, and determining male parentage of seeds produced in seed orchards.

302.2 Analysis of nuclear DNA in *Cajaninae* and *C. cajan* landraces

C. scarabaeoides, C. cajanifolius and a cultivated variety of *C. cajan* (CO 6) comprising the subtribe *Cajaninae* along with the 50 landraces of *Cajanus cajan* sampled from five districts of Odisha formed the genetic material for an analytic study of their nuclear genome using DNA-based molecular markers like random amplification of polymorphic DNA (RAPD), simple sequence repeat (SSR) and inter-simple sequence repeat (ISSR) markers. Total genomic DNA from all the plants were isolated following the CTAB method and subjected to PCR analysis. The amplified products were resolved on 1 per cent agarose gels and stained with ethidium bromide. Overall, 164 markers were used, of which 83 were RAPDs, 46 were SSRs and 35 were ISSRs. Very little polymorphism was observed as only 21 markers differed in their banding profiles. Of these, 13 were RAPDs, 5 were ISSRs and

3 were SSRs. Most of the sampled landraces were amplifying a molecular profile similar to the cultivated variety of *C. cajan* (CO 6), while a few were amplifying a banding profile similar to *C. cajanifolius.* Around 1 to 2 landraces were similar to *C. scarabaeoides* in their profiles. This shows that although most of the landraces are similar to *C. cajan*, some of them seem to have outcrossed with *C. cajanifolius* and/or *C. scarabaeoides*. Only 4 markers (2 RAPDs and 1 SSRs) were found to be polymorphic within the landraces. One RAPD marker OPAO 14 was amplifying a polymorphic band at the 1000 bp region, while the other RAPD marker OPAK 18 amplified a polymorphic band at the 750-800 bp region. SSR 876 was amplifying a polymorphic fragment consistently at the 500 bp region, while SSR GA15GT8 was showing polymorphism at 650 bp region. A dendrogram generated for distance/similarity score matrix using UPGMA and Jaccard method and bootstrapping with 100 replicates resulted in most of the landraces being closely clustered in one group along with the *C. cajan* cultivated variety, while two tiny clusters with *C. cajanifolius* and *C. scarabaeoides* were also formed. This showed that genetic diversity among the sampled landraces was very narrow. Similar such results were also reported by other groups working in this area. Use of a larger population from much more geographically diverse regions along with use of AFLP and use of other specific marker systems like SSR or ISSRs would help unravel their narrow genetic diversity further.

Sub Programme Area 303

Genetic Enhancement

303.1 Introgression of transgenes to develop location-specific rice varieties for salinity stress tolerance and enhanced iron content

AmSod1 introgressed lines were assessed for their ability to withstand the NaCl stress at their seedling stage with their respective recurrent parent and donor line L12. In general, all the NaCl treated plants had reduced height when compared to the untreated plants. The leaves of most of the White Ponni control plants were rolled after 12 days of 150 mM NaCl stress, whereas the *AmSod1* introgressed line WS had expanded leaves. The leaves of the ADT43 parent line became rolled and started drying out after 11 days of 150 mM NaCl stress whereas the *AmSod1* transgenic line AS had all the leaves expanded at the same time and level of NaCl stress treatment. The control IR20 plants were dwarf, leaves were rolled and about to dry when compared to the *AmSod1* introgressed line IS after 12 days of 150 mM NaCl treatment. However, there was no significant difference between the IR64 and RS after 27 days of 150 mM NaCl treatment. The parent as well as transgenic line exhibited the same level of salinity injuries. The plants (both transgenic and control) were uprooted in all the populations when the respective parent lines were withered and about to die, and fresh weights were recorded. The introgressed lines

WS, AS, IS and its donor parent L12 had higher fresh weight (statistically significant) when compared to their non-transgenic background parent under 150 mM NaCl treatment. There was no significant difference in fresh weight between IR64 and RS under 150 mM NaCl treatment.

The grain iron content of the *GmFer1* introgressed lines were estimated along with their recurrent parent and donor parent in the brown as well as polished grains. In the brown grains, recurrent parent ADT43 had iron content of 14.9 µg/g, whereas *GmFer1* introgressed line AF had 24.4 µg/g. The IR20 had 14.1 µg/g of iron and introgressed line IF stored 23.5 µg/g of iron in brown grains. The *GmFer1* introgressed line RF under IR64 background had iron content of 23.3 µg/g, whereas its recurrent parent IR64 had 13.6 µg/g of iron in brown grains. The donor parent Fer had 27.4 µg/g of iron in brown grains against its background variety Pusa Basmati1 with 18.0 µg/g. In total the transgenic lines AF, IF, RF and Fer had 1.9, 1.66, 1.71 and 1.52 times increased iron content in brown grains against their respective parents. In the polished grains, the recurrent parents ADT43, IR20 and IR64 had 4.6, 4.9 and 3.4 µg/g of iron and *GmFer1* introgressed lines AF, IF and RF had 14.8, 15.4 and 12.3 µg/g of iron, respectively. The donor line Fer and its background parent Pusa Basmati1 had 14.3 and 3.3 µg/g of iron in the polished grains, respectively.

A F_1 hybrid plant was obtained from the seeds developed after conventional crossing of DC2 (transgenic for *AmApx* and *AmMdar*) and L12 (transgenic for *AmSod1*) using DC2 as male parent and L12 as female parent. The presence of three genes in the F_1 plant was determined by PCR analysis. The expressions of the transgenes were determined by the Northern Blot analysis. Seventy-three F_2 plants were raised and the segregation was studied using PCR analysis. Among the 73 plants, 34 were positive for all the three transgenes, 21 were positive for *AmSod1*, 14 were positive for *AmApx* and *AmMdar* and 4 plants were negative for all the three transgenes. This fits in with the expected double hybrid (as *AmApx* and *AmMdar* are cloned in a single construct) ratio of 9:3:3:1 with chi square value of 0.758 (lower than the table value i.e. 0.7815 at α^2 = 0.05, 3 df). Progenies were raised from 34 F_2 plants (PCR positive for all three genes) and 48 progenies from each line were screened through PCR analysis. Among the 34 lines, one line F_3-73 was homozygous for all the three genes, 9 lines were homozygous for *AmSod1* and heterozygous for *AmApx* and *AmMdar*, 7 lines were homozygous for *AmApx* and *AmMdar* and heterozygous for *AmSod1* and 17 lines were heterozygous for all the three genes, fitting in with the expected ratio with α^2 value of 2.595.

303.2 Isolation and characterisation of an iron deficiency inducible transcriptor factor from the wild rice *Porteresia coarctata*.

The IDEF transcription factor plays a key role in maintaining iron homeostasis in rice. A cDNA clone of 1.5 kb size was isolated from the wild relative of rice *Porteresia coarctata*. To

understand the molecular mechanisms involved in iron acquisition with respect to salinity, a time course analysis of gene expression during iron deficiency and salt stress was conducted for the IDEF transcription factor both in roots and leaves using semi-quantitative PCR. The result showed that the IDEF transcription factor is strongly induced under iron deficiency stress both in roots and leaves. Under the combined effect of salt stress and iron deficiency, PcIDEF was down-regulated at 100mM salt but showed up-regulation at 150 and 200mM salt concentration, indicating that the possible role of the IDEF transcription factor in maintaining the iron balance in plants under high saline conditions leads to iron deficiency stress. The isolated genomic clone of PcIDEF contained nine exons.

For *in vivo* localisation of the IDEF transcription factor, IDEF-GFP fusion protein was constructed under the control of double strength CaMV 35S promoter and mobilised to the tobacco plant by *Agrobacterium*-mediated transformation. Transgenic tobacco plants bearing IDEF-GFP fusion products are being maintained in selection medium using 40mg/L Hygromycin.

To characterise the *in planta* function of PcIDEF, the 5' upstream region of iron regulated transporter (IRT) which is reported to be up-regulated under iron deficiency stress was isolated by TAIL PCR. *In silco* analysis of the sequence revealed the presence of IDE-like elements in the promoter region, which acts as the binding site for the IDEF transcription factor. The IRT promoter was fused to a reporter gene GUS and introduced to the transgenic tobacco plant bearing IDEF under the control of CaMV 35S promoter. Analysing GUS expression of double transformed transgenic tobacco plant under iron deficiency stress will give an idea of the role of IDEF transcription factor in regulating the downstream genes which are up- regulated under iron deficiency conditions.

303.3 Characterisation and over expression of Dehydrin genes from a mangrove system, *Avicennia marina*

Dehydrins are LEA proteins (late embryogeneic proteins) with YSK segments. Dehydrins are induced under extreme conditions of drought and salinity. In a study taken up in the previous year, dehydrin was chosen for characterisation as an approach to developing an improved variety of rice that can withstand adverse environmental conditions. A contig of intron-less dehydrin was taken from the ESTs of *A. marina* for further study. The dehydrin fragment was excised from pSPORT and cloned into pBSSK in *Pst I* and *Hind III* sites and it was further cloned in pSF20 at the *BamHI* site. This construct was mobilised into the *Agrobacterium tumefaciens* strain (LBA 4404) for transformation in rice (Pusa Basmati). pCAMBIA-1301-DEHYDRIN construct was transformed in Pusa Basmati via *Agrobacterium*-mediated transformation.

When Southern analysis was done, three lines showed a single copy of the gene of interest. A Northern analysis was done to determine the gene expression at the transcript level. In T1 generation segregation, analysis

was done with UTR-specific primers. In T2 generation homozygous lines were screened and selected for stress studies. Conditions are being standardised. The dehydrin promoter (*Avicennia marina*) was cloned into pCAMBIA 1391Z and the construct was transformed into *Agrobacterium tumefaciens*. pCAMBIA-1391Z dehydrin promoter construct was transformed in tobacco (*cv. Petit Hava*na). The presence of dehydrin promoter in transformed tobacco lines was confirmed with promoter specific primers. The transformed tobacco lines were tested by the GUS histochemical assay to confirm the GUS gene expression driven by the dehydrin promoter.

303.4 Tissue-specific expression of the promoter of a novel gene, Am244, from *Avicennia marina* that is induced by salinity stress and its characterisation

A localisation study of PR244 aided by GFP by the PR244 promoter was initiated. The transgenic plants (lines) PPG-1, 2, 6, 15 exhibited fluorescence when visualised under the UV microscope. All the positive lines, which were confirmed after performing Northern and Western profiling for the expression of the gene *Am244*: GFP under the promoter PR244, were chosen and placed in the greenhouse for seed setting (under optimised conditions). T1 generation seeds were harvested from the positive plants after 3 months. Plants were sprayed with water every two days till the flowers set, then the buds were collected carefully at the correct time (53 days) prior to the seed dispersion time. T1 generation seeds were processed and plated for germination on MS medium supplemented with vitamins and Hygromycin (40mg/L) and Cefotaxime (250mg/L). GFP localisation studies are in progress. Screening for the promoter lines for single copy line is being continued.

The *PR244 myc* single copy lines (6, 8, and 17) were also taken for seed setting. The same conditions were followed for harvesting T1 generation seeds. Seeds were collected and plated for lines 6 and 17. Stress studies and Northern profiling have been initiated and are in progress. Rice transformation using PR244 *myc* via *Agrobacterium* was carried out with Pusa Basmati and IR64 and ADT43 (*Indica* variety). Callus regeneration was not observed. Transformation in the same variety is under progress with necessary modifications made on trial.

303.5 Assessment of stress tolerance in *Am*MYB1 transgenic tobacco plants:

Whole plant salt tolerance and chlorophyll leaching assay

Wild-type and transgenic tobacco seedlings germinated on MS medium were transplanted to soil. After one month, healthy plants of same size were cut and kept in water for rooting. The rooted plants were then subjected to salt stress. For stress tolerance assay, plants were kept in hydroponic half-strength MS basal medium supplemented with 100 mM NaCl. The salt concentration was increased from 100 mM to 300 mM at 100 mM increments every 3 days and monitored for signs of wilting. Stress tolerance assay of transgenic plants (whole plant level) was performed and compared to

wild type non-transformed lines grown under the same conditions.

For chlorophyll leaching experiments, leaf discs of 1.5 cm diameter were excised from healthy and fully expanded tobacco leaves of one-month-old *Am*MYB1-expressing and vector-control plants. The discs were floated in a solution of NaCl (100 mM, 200 mM and 300 mM) or water (experimental control) for 72 hours. The discs were then used for measuring chlorophyll spectrophotometrically after extraction in 80 per cent cold acetone. The salinity and water treatments were carried out in continuous white light at 25 ± 2°C. The experiments were done with three experimental replicates of each vector-control and transgenic lines.

In the presence of salt stress, chlorophyll loss was significantly reduced in *Am*MYB1 transgenic lines L1 and L4 as compared to wild type and L26 plants. Wild-type leaf discs however retained their green colour only in distilled water. The chlorophyll content of the leaf discs was also determined to assess the extent of salt stress induced cellular damage. Chlorophyll content in transgenic lines L1 and L4 was significantly higher than wild type and L26 leaf discs at 300 mM NaCl. Line 4 (L4) had higher chlorophyll content in all the salt treatments as compared to wild type and the other two transgenic lines (L1 and L26).

To examine the effect of constitutive *Am*MYB1 expression on conferring salt tolerance to tobacco at the whole plant level, two-month-old transgenic and wild type plants were kept in half strength MS nutrient medium supplemented with different concentrations of NaCl. Symptoms of salt stress like wilting and leaf rolling were observed only in wild type plants after two days in 200 mM and 300 mM NaCl treatments. Even though the leaves of wild type plants did not droop at 100 mM NaCl in the growth medium, only *Am*Myb1 tobacco plants had healthy leaves. Between transgenic lines, L1 and L4 showed better tolerance to salt stress up to 200 mM NaCl as compared to L26 at whole plant level.

Transformation of *Am*MYB1 transcription factor in rice is underway to assess the performance of transgenic rice plants in response to salt stress conditions.

303.6 Isolation and characterisation of zinc finger protein gene from *Avicennia marina*

RING (really interesting new genes) zinc finger domain containing proteins are widely found in different organisms but only few genes encoding the RING finger domains with visible effect on plant growth and development have been documented. As reported last year, *in planta* NaCl stress tolerance assays of transgenic tobacco plants were carried out. Transgenic tobacco plants showed better tolerance to NaCl stress (200, 250 and 300 mM) when compared to untransformed plants. Since zinc finger proteins are known to involve in protein–protein interactions, *in vitro* protein–protein interaction assay (Far Western Blotting) has to be carried out.

To analyse the function of zinc finger protein, full-length ORF sequence was cloned into

pET32a expression vector. This construct was then transformed into the expression host *E. coli* BL21(DE3).Cultures of *E. coli* cells carrying pET32a-*AmZFP* and vector controls were grown at 37°C in LB medium containing 100 mg/ml ampicillin to an O.D. of A600 = 0.6 and induced with 1 mM IPTG for 3 hours. The cells were then harvested by centrifugation and then re-suspended in lysis buffer and incubated at room temperature for 1 hour. After that, the recombinant Trx::ZFP fusion proteins were purified by using Ni-NTA column and analysed using SDS-PAGE. Polyclonal antibodies against Trx::ZFP fusion proteins have been raised *in vitro* protein–protein interaction assays. Interactions between plant RING and plant-specific NAC protein have already been reported. Based on the previous study, a cDNA clone coding for NAC protein was selected and the ORF was cloned into the pGEX vector and induced as above. Protein–protein interaction assay between NAC and ZFP has to be carried out using Far Western blotting.

The isolation of ZFP gene was done using UTR specific primers, and the product was cloned and sequenced. The sequence analysis of gene revealed that this is a single exon (intron-less) gene. Homologues of zinc finger gene in humans having single exon genes have some differences in their promoter region, so the upstream region of zinc finger gene was isolated using TAIL-PCR methodology and about 1.2 kb fragment was cloned and sequenced. The sequence analysis of the promoter region did not show any significant differences in *cis* acting elements as in their human counterparts.

303.7 Transformation of *Brassica juncea* through *Agrobacterium*-mediated transformation

Prosopis juliflora, a phreatophytic tree species, grows well in heavy metal-laden industrial sites and accumulates heavy metals. There is a wealth of information on the contribution of metallothionein proteins in heavy metal tolerance of a plant. Metallothioneins (MTs) constitute a superfamily of evolutionally conserved, low molecular weight (4-8 Kda) polypeptides rich in cysteine rich residues (25-33 per cent). They are thought to sequester excess amounts of certain metal ions.

The metallothionein gene was isolated from *Prosopis juliflora* (*Pj*MT1) and cloned in pCambia 1301. This was later introduced to *Agrobacterium tumefaciens* EHA 105.

The use of plants to remove toxic metals from soil (phytoremediation) is emerging as a cost-effective alternative to conventional methods. In recent years, researchers have discovered that the Indian mustard accumulates moderate levels of environmentally important metals, including Zn. The metal-accumulating ability of this plant, coupled with its potential to rapidly produce large quantities of shoot mass, make it ideal for phytoextraction.

Brassica juncea varuna was transformed with *Pj*MT1 (metallothionein gene from *Prosopis juliflora*) using *Agrobacterium tumefaciens* (EHA 105). Hygromycin (20mg/L) was used as the selected marker. The surface sterilised *Brassica* seeds were grown in 3 per cent MS medium for 8 to 10 days. Hypocotyls

were cut from the germinated seedlings and infected with the *Agrobacterium* with the vector containing metallothionein gene. The explants were co-cultivated on 3 per cent MSNB (N-NAA, B-BAP) for 2 days after which these were transferred to 3 per cent MSNB containing Cefotaxime, Hygromycin and silver nitrate. The explants were later transferred to 3 per cent MSCHA (minus hormones) after 15 days. Later on subcultures were done every 10 days until the plants were mature enough to be separated into individual plants (approximately 2 months).

GUS assay was carried out to confirm the expression of the reporter GUS gene in the putative transgenics. Transgenic plants developed blue colour whereas control did not. PCR analysis of the putative transgenic plants for the metallothionein gene were carried out and found positive for all the plants tested.

PjMT1 promoter cloning to 1391Z and transformation to GV3101

Promoter region of *Pj*1377 was cloned in the Hind III/Bam HI site of pCAMBIA 1391Z. This was then mobilised into *Agrobacterium* GV3101 strain. *Pj*1377 in pCAMBIA 1301 was also transformed to GV 3101. Standardisation of transformation of *Arabidopsis thaliana* is underway.

303.8 Isolation and characterisation of genes responsible for betaine accumulation from a mangrove plant, *Suaeda monoica*

Glycine betaine is a non-ionic solute that confers osmotic tolerance in most plant species, particularly members of the spinach family. It is known to increase the osmolarity of cells as well as protect the structure of proteins involved in photosynthesis (Papageorgiou and Murata 1995). The accumulation of glycine betaine is brought about by at least 3 enzymes: Phospho-ethanolamine N-methyl transferase (PEAMT) that converts ethanolamine to choline by successive N-methylation, Choline monooxygenase (CMO) that oxidises choline to betaine aldehyde and Betaine Aldehyde Dehydrogenase (BADH) that converts betaine aldehyde to Glycine betaine. Gene pyramiding of these enzymes in crop plants would help them tide over drought as well as soil salinity.

Full-length cDNAs of PEAMT, CMO and BADH have been isolated from *Suaeda monoica*, a halophyte growing in the Pichavaram mangroves. Experiments to study the protein profiles of the three genes are under way. Preparation of vector constructs for plant transformation is in progress. Future work is focused on complete characterisation of the three genes at the RNA and protein levels and transformation of rice by pyramiding the three genes.

303.9 *Agrobacterium*-mediated transformation of *Porteresia* antiporter into rice

NHX is an antiporter gene: it provides an efficient and straightforward way to avert the deleterious effects of Na^+ in the cytosol and maintains osmotic balance by using Na^+ accumulated in the vacuole to drive water into

the cell. *Porteresia* NHX gene was cloned under its promoter in pCambia 1301 and was introduced into *Agrobacterium* LBA4404 strain. The surface sterilised IR64 seeds were plated in callus induction medium. After 21 days calli were subcultured and infected with *Agrobacterium*. The infected calli were transferred to selection medium containing Hygromycin (50 mg/ml) and Cefotaxime (250 mg/ml). After 3 selections, calli were transferred into regeneration medium. Shoot induction was observed in the regeneration stage. Around 10,000 calli were infected. Further transformation events are under progress.

303.10 Prospecting novel genes from lichen species

In an effort to identify putative genes responsible for symbiosis, biotic and abiotic stress tolerance and secondary metabolite biosynthesis from lichens, a cDNA approach was used. The cDNA library of *R. montagnei* had a representation of about 50,000 clones of which 1,097 were randomly selected and sequenced in the first phase sequencing. Of which 914 readable sequences were selected, based upon the tblastx search. Putative functions were annotated and categorised manually, using results obtained from NCBI tBLASTx search. These EST sequences were assembled using CAP3 programme to reduce the redundancy. The analysis performed on the above data set grouped them into 92 contigs (encompassing 322 ESTs) and 592 singlets resulting in a 35 per cent redundancy.

Important genes like TOM complex component (Tom7), Major Facilitator Superfamily (MFS), Ubiquinol-cytochrome c reductase, 1, 3-beta-glucanosyltransferase, Exo-beta-1, 3-glucanase (Exg1), Initiation-specific alpha-1, 6-mannosyltransferase, Septin-8, Clavaminic acid synthetase (CAS), Dynein heavy chain, Protein phosphatase 2A, Serine incorporator (Serinc), PP-binding Super family, and Glycosyl transferases, related to UDP-glucuronosyltransferase have already been identified. The analysed EST pool also contained transcripts coding for enzymes involved in the oxidative stress such as Glutathaione S-transferase (GST), Thioredoxin (TRX), 1-pyrroline-5-carboxylate dehydrogenase (PRK), Thiolase, and Flavin reductases. In addition, genes reported to be involved in secondary metabolites biosynthesis, transport, and catabolism are 3-ketoacyl-(acyl-carrier-protein) reductase and Acyl-CoA synthetases; and those responsible for symbiosis and virulence factor are PB1 domain and Cas1p protein, which were also categorised, respectively.

Two contigs — *Rocm*0149 (accession no. GR209492) and *Rocm*0472 (accession no. GR209776) — encompassing 8 ESTs are reported to have known functions related to abiotic stress induced genes Glutathione-S-transferase (GST). The presence of EST for *Rocm*GST (accession no. GR209492), an enzyme that is reported to play multifunctional roles in fungi, showed 38 per cent identity to previously reported sequence of *Gibberella zeae* (accession no. XM_380938). The other *Rocm*GST (accession no. GR209776) showed

63 per cent identity to *Phaeosphaeria nodorum* SN15 hypothetical protein partial mRNA. These two *Rocm*GST ESTs were compared with other GSTs of various Ascomycetes group of fungi, *Avicennia marina* and *Prosopis juliflora* using CLUSTALW analysis. In the phylogenetic analysis carried out using treetop, phylip programme, the *Rocm*0149 GST showed maximum homology to the GST of fungus *Teleromycese* and GST (*Rocm*0472) and an out-group from all the other known GSTs. Hence these two ESTs were further selected for full length characterisation and molecular analysis under different stress conditions (salt, heavy metal-cadmium and drought). Thioredoxins (TRX) (accession nos. GR209746) also represents 63 per cent identity to *Ostreococcus lucimarinus* chromosome 5, complete sequence (accession no. CP000585). 682 additional ESTs were generated in the second phase of sequencing for micro assay analysis.

As mentioned in the 2008-09 annual report, lichens are well known for their synthesis of unique secondary metabolites including polyketides such as depsides, depsidones, depsones, dibenzofurans, and chromones. Polyketides are organic molecules that are formed from small carbon precursor acid molecules whose condensation is catalysed by a cluster of enzymes called Polyketide Synthases (PKS).

Complete sequence information for *Dn*PKS (8162 bp) from the lichen *Drinaria applanata* was obtained by walking in the 5′ and 3′ directions of the isolated KS domain using TAIL PCR. In another study, mycobiont cultures of lichen *Trypethelium eluteriae* Spreng. (*Trypetheliaceae, Pyrenulales*) — a species which is distributed along coastal Tamil Nadu — established using ascospores were used to examine the expression patterns of polyketides under modulated culture conditions. The mycobiont cultures were analysed for secondary compound production under modulated culture conditions specifically with different carbon sources and varying sucrose concentration. Degenerate primers designed on the basis of previously reported PKS sequences (Schmitt et al 2005) were used to amplify a fragment corresponding to the KS domain from genomic DNA isolated from established *T.eluteriae* (*Te*PKS) mycobiont cultures. Subsequently, this genomic information was used as a starting point for walking towards both the 5' ends by TAIL PCR to obtain the sequence information for the putative start codon and binding sites for fungal transcription factors such as AflR and AreA. Six per cent sucrose in the culture medium was found to up-regulate novel polyketide production along with maximum growth (4.23±0.3 cm /7 days) and biomass (9.45±0.1 mg) production. Keto Synthase (KS) domain of the Polyketide synthase (*Te*PKS) gene was isolated from the cultured mycobiont and natural thallus. Two KS sequences of size 750bp and 936bp from cultured mycobiont and one KS sequence (750bp) from the natural thallus were identified. Comparison of all the three *Te*PKS genes with other characterised PKSs shows conservation of typical active-site sequences for KS domain (TACSSSL-

acyl binding cysteine). In the phylogenetic analyses, the KS sequences of *T. eluteriae* were found to cluster along with the non-reducing PKS genes from both lichenised and non lichenised fungus. *Te*PKS genes did not cluster with *XePKS1*, a PKS gene involved in the biosynthesis of physcion in *X. elegans*, suggesting the presence of a distinct PKS paralog in *T. eluteriae*.

The effect of components of various mediums (sucrose and carbon source) on the expression of the *Te*PKS gene was assessed by subjecting the cultures to varying sucrose and additional carbon sources and the KS domain was used as probe. A single transcript, approximately 5.5 Kb in size, was detected in all cases.

In the Northern blot experiment, the genes *TePKSC* and *TePKSC1* showed differences in expression patterns under varying sucrose concentration and different carbon sources. *TePKSC1* was observed to be up-regulated under higher concentration of sucrose and in sorbitol than *TePKSC*. With increasing sucrose concentrations, *TePKSC1* expression was found to be up-regulated compared to control grown in MY0. *TePKSC1* showed maximum induction in mediums containing 8 per cent sucrose and marginally induced in mannitol and sorbitol added cultures. The gene *TePKSC* showed only marginal induction in mediums supplemented with 6 and 8 per cent sucrose compared to the expression of *TePKSC1.* The transcripts of both the genes could not be detected in control and in mediums with 2, 4 and 10 per cent sucrose, glucose, inositol and fructose.

303.11 Identification of genes that regulate oil biosynthesis in the biodiesel plant *Jatropha curcas*

Jatropha curcas is an oilseed plant that has gained a lot of attraction for its potential as a source of biodiesel. It is imperative to understand the regulation of oil biosynthesis in its seeds, in order to improve oil yield through different techniques. Oil yield is a quantitative and complex trait, controlled by various factors like the genotype of the plant, environment and proper agronomic practices. We concentrated on genes that regulate the synthesis of oil by carrying out large-scale expressed tag (EST) sequencing of seed-specific cDNA library that was specific for the mid-maturation stage of seed development. In addition, we carried out experiments to isolate seed-specific sucrose synthase (gene and cDNA) that is involved in the logical step of oil biosynthesis, where it diverts the carbohydrate pool towards oil synthesis by breaking down sucrose.

In 2009-2010, we sequenced about 1800 ESTs and annotated the sequence information for functions using different bioinformatics tools. Interestingly, a couple of the ESTs in the library represented sucrose synthase, indicating the importance of this gene in oil biosynthesis. We also used techniques like TAIL-PCR and RACE-PCR to isolate full-length sucrose synthase gene and cDNA. We were successful only in obtaining partial information of about 4.5 kb out of a probable 5.5 kb of the gene. Using a technique called 3' RACE, we were able to obtain the downstream, untranslated

information of the gene or cDNA. Obtaining full-length information of the seed specific sucrose synthase mRNA would facilitate studies on its differential expression during different stages of seed development and different plant tissues.

SubProgramme Area 304

Bioprospecting

304.1 Lichen bioprospecting and culture

Lichens are fungi that live in symbiotic association with one or more green algae or cyanobacteria. Lichens are considered potential sources of novel compounds and genes since they are the pioneering organisms colonising newly exposed substrates and extreme environments. Lichens synthesise a wide array of secondary compounds which protect them from excess light and UV radiation, desiccation, high temperature and flooding, and also serve as a defence against microbial activities and herbivory by micro invertebrates and insects. Currently there is an increasing interest globally in exploring the bioactive potentials of lichen secondary compounds as well as in mining novel genetic combinations to combat biotic and abiotic stresses. At MSSRF, the secondary compounds of selected lichen species are being isolated, characterised and prospected against cancer and tuberculosis in collaboration with the Cancer Institute, Chennai and the Tuberculosis Research Centre, Chennai.

Screening lichen compounds against cancer

Cancer and tuberculosis are the two most important diseases both in India as well as worldwide. Compounds extracted from lichen and plants were screened for anti-cancer properties in different cell lines last year. In the preliminary screening, 3 cell lines, viz. NCI H460, MCF-7and SNB-19, were used. All the cell lines were procured from NCCS, Pune, and NCI, Bethesda (USA) and maintained with appropriate medium supplemented with Fetal Bovine Serum. Cells were plated in each well of the 96 well plates to study the cytotoxicity of the compounds and were exposed to different concentrations of the test compounds starting from 10 nM to 100 µM for 48 hours. After the exposure, cells were taken for cytotoxicity assay using MTS [3-(4, 5-dimethylthiozol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulphonyl)-2H-tetrazolium] reagent.

In the current study, 5-methyl–4–acetyl resorcinol isolated *R. montagnei* and 6-hydroxy-7-methoxy-2,3,3,9-tetrametyl-2,3-dihyronaptha (1,2-5) furan-4,5-dione isolated from the lichen *Trypethelium eluteriae* were screened for its anti-cancer activity in three cell lines, namely, NCI H 460 (lung cancer), MCF 7 (breast cancer) and SNB 19 (human embryonic cells- normal cells), using the MTT assay. The anti-cancer assays exhibited significant *in vitro* cytotoxicity against all the cancer cell lines. 5-methyl–4–acetyl resorcinol isolated from *R. montagnei* showed that the survival rate of cancer cells varies between 93 per cent and 97 per cent against different

concentrations in comparison with untreated cells, whereas in the case of NCI-H460 cells it was 87 per cent to 100 per cent. Further anti-cancer assays using various other approaches to measure the potentiality of the target molecules are ongoing. 6-hydroxy-7-methoxy-2,3,3,9-tetrametyl-2,3-dihyronaptha (1,2-5)furan-4,5-dione isolated from the lichen *Trypethelium eluteriae* work is currently under screening.

Screening lichen compounds against tuberculosis

Anti-tuberculosis assays showed 100 per cent mortality of *Mycobacterium tuberculosis* by 5-methyl–4–acetyl resorcinol dissolved in DMSO at a concentration of 12.5 mg. Anti-tuberculosis assays on novel compound 6-hydroxy-7-methoxy-2,3,3,9-tetramethyl-2,3-dihydronaptho[1,2-*b*]furan-4,5-dione isolated from mycobiont cultures of *Trypethelium eluteriae* showed inhibition of *Mycobacterium tuberculosis* at a concentration of 0.625 mg. Further assays to measure the potentialities of the target molecules are ongoing.

Lichens grow extremely slowly and produce low biomass in nature and hence large-scale harvesting of naturally occurring lichen thalli is considered to jeopardise lichen conservation. Hence, in the lichen bioprospecting programme, establishing culture protocols for biomass (for molecular studies) and secondary compound production is a vital component.

The lichen culture protocols were standardised for optimum biomass production and secondary compound synthesis through lichen whole thallus, fungal (mycobiont) and photosynthetic partners of 28 lichen species. The lichen whole thallus cultures of these species produced secondary compounds similar to that of the natural thallus. The mycobiont cultures upon modulationg the carbon sources as well as under varying sucrose concentrations showed the production of unknown compounds. Nine unknown compounds have been isolated from *Glyphis scyphulifera*, *Trypethelium eluteriae, Graphis scripta, Pseudopyrenula subvelata* and *D. applanata* so far. One novel compound from the mycobiont cultures of *Trypethelium eluteriae* has been structurally characterised.

Large scale cultures in bioreactor

We reported last year that large-scale bioreactor cultures for target compound production have been standardised (mediums, time period and culture conditions) for *R. montagnei*, *P. praesorediosum* and *D. applanata*. The establishment of large scale suspension and bioreactor cultures for lichen species *R. montagnei* and *P. praesorediosum* has been achieved. The culture conditions such as pH, temperature, and light intensity were standardised in the bioreactor for compound production. The target compound has been isolated from the cultures for preliminary screening against cancer and tuberculosis.

In the current study, 5.0 gm of resorcinol from 2000 gm of *R. montagnei* and 1.2 gm of compound from 50 gm of *P. praesorediosum* have been isolated from bioreactor cultures. The lead fractions of *D.applanata* (2.0 gm) were isolated from 150 gm of *D.applanata*

established cultures. The mycobiont cultures of *T. eluteriae* are currently under bioreactor culture.

304.2 Screening of extract of *E. agallocha* for anti-cancer and anti-tuberculosis activities

The extract of *Exocoeria agallocha* was screened for its anti-cancer activity in three cell lines namely NCI H 460 (lung cancer), MCF 7 (breast cancer) and SNB 19 (human embryonic cells-normal cells) using the MTT assay. The anti-cancer assays exhibited significant *in vitro* cytotoxicity against all the cancer cell lines. In NCI H 460, MCF 7 and SNB 19 cell lines the percentage of survival varied from 50 per cent to 100 per cent with different concentrations ranging from 40µg to 140 µg. The Cell Proliferation Assay using 28 cancer cell lines using the extract of *E. agallocha* exhibited significant *in vitro* cytotoxicity against almost all the cancer cell lines, with IC 50 values less than 8µg/ml. However, activity was observed to be less against MDA-MB 231 (breast cancer cell line) cells and OVCAR 3 (ovarian cancer cell line) cells compared to other cell lines. Anti-tuberculosis activity of the leaf extracts of *E. agallocha* is currently being studied.

304.3 Bioprospecting of minor millets

A total of 100 clonal selections of minor millets *samai* and *panivaragu* collected from different hill agro-ecosystems in Tamil Nadu were analysed for their nutritional profile. Results show variation in the nutritional profiles among locations and clones. Among the unique characters that were observed was that *samai* has various types of nutrients among populations. Nutritional profile analysis of minor millets showed rich nutrients like macro and minor nutrients; magnesium, lead and potassium showed higher variability among millets even in the same location. Analysis of nutritional diversity in additional collections of minor millets is under progress.

Sub Programme Area 305

Microbial Diversity

305.1 Microbiology Laboratory: Bioprospecting for novel microorganisms from the mangrove ecosystem

Vibrio mangrovi sp. nov., a nitrogen fixing bacterium isolated from a mangrove-associated wild rice

The taxonomic status of a nitrogen-fixing bacterial strain MSSRF38T, isolated from the rhizosphere of a mangrove-associated wild rice, *Porteresia coarctata* Tateoka, in Pichavaram, was studied using a polyphasic approach. Phylogenetic analysis based on 16S rRNA gene sequences indicated that the novel strain MSSRF38T was most closely related to *Vibrio ruber* DSM 16370T (98.3 per cent gene sequence similarity), *Vibrio rhizosphaerae* DSM 18581T (98.2 per cent sequence similarity) and < 96 per cent to the remaining *Vibrio* species. Multilocus sequence analysis using *ftsZ*, *gapA*, *gyrB* and *mreB* genes showed low levels of gene sequence similarities (82 to 90 per cent) with all species of the genus *Vibrio* with validly published names, indicating

that strain MSSRF38T occupies a distinct phylogenetic position. DNA–DNA hybridisation experiments showed that strain MSSRF38T had <70 per cent DNA–DNA similarity to its closest neighbours *V. ruber* DSM 16370T (27.4 per cent) and *V. rhizosphaerae* DSM 18581T (12.1per cent). The strain MSSRF38T could be differentiated from its relatives on the basis of several phenotypic characteristics. The major fatty acids were feature 3 (including C16:1ω7c and/or C15:0 iso 2-OH), C16:0, C18:1ω7c, C14:0 and C12:0. The DNA G+C content was 45.4 mol per cent. Based on genotypic, phenotypic, chemotaxonomic and DNA–DNA analyses, the name *Vibrio mangrovi* sp. nov. (type strain MSSRF38T=LMG 24290T=DSM 19641T) is proposed for this novel taxon.

Diversity of actinomycetes from the mangrove ecosystem

Actinomycetes from extreme conditions including high and low temperatures, high and low pH, and high salt concentrations have attracted the attention of microbiologists world over. Totally 105 actinomycetes were isolated from rhizosphere of *Rhizophora* spp. of the Pichavaram mangroves using different pre-treatment methods such as dry/dilute/heat and phenol treatments. The nitrogen-fixing ability of these 105 free living actinomycetes was screened by using 19F and 407R primer specific for *nifH* gene. Only six strains (MSSRFA10, MSSRFA19, MSSRFA28, MSSRFA25, MSSRFA29, PA69) showed positive amplification, which was further confirmed by sequence analysis and compared with the gene sequence deposited in the NCBI database. Ninety percent of the isolated actinomycetes were found to belong to the genus *Micromonospora* based on the colony morphology and colony colour (which was initially orange but later turned brown or black) and microscopic observations revealed the presence of single spore. This was further confirmed by amplifying the 16S rDNA using *Micromonospora* specific primer M558F and C1028R, which produced an amplicon of 470 bp. The genetic diversity among 45 isolates with similar colony morphology was determined by rep PCR using $(GTG)_5$ primers, of which 32 isolates showed different genetic profiles. These isolates were screened for various other functional properties, viz., antagonistic activity, production of extracellular enzymes and phosphate solubilisation. Four isolates (MSSRFA1, MSSRFA19, MSSRFA29, MSSRFA36) exhibited high antagonist activity against the rice sheath blight pathogen, *Rhizoctonia solani* and 3 isolates (MSSRFA19, MSSRFA1 and MSSRFA29) inhibited the growth of rice sheath rot pathogen, *Sarocladium oryzae*. Further, two isolates (MSSRFA19 and MSSRFA28) produced lysing zone size of 0.3 cm and 0.2 cm in tricalcium phosphate amended Pikovskys agar, 14 isolates produced chitinase (MSSRFA2, MSSRFA 10, MSSRFA11, MSSRFA18, MSSRFA20, MSSRFA22, MSSRFA23, MSSRFA26, MSSRFA35, MSSRFA37, MSSRFA40, MSSRFA57, MSSRFA65, MSSRFA91) with the clear chitinolytic zone ranging from 01. to 0.8 cm in colloidal chitin agar, and 44 isolates produced clear cellulolytic zone ranging from 0.1 cm to

1.2 cm in cellulose agar. These enzymes would play an important role in the nutrient cycle of this ecological niche.

Diversity of denitrifying bacteria harboring nitrous oxide reductase (NosZ) gene from mangrove ecosystem

Soil is a rich source of organic nutrients, particularly those that support the growth of microbes and plants. The nutrient status of the soil is maintained by microbes that perform various bio-geochemical cycles. Major reactions include nitrification, denitrification and methanogenesis carried out by microorganisms and each cycle has its own impact on the environment, both beneficial and harmful. Though these microbes play a vital role in the bio-geochemical cycle, some of the reactions that are carried out have deleterious effects in the environment. Some of the major greenhouse gases like methane, nitric oxide, nitrous oxide and carbon dioxide lead to drastic climate change. Recent studies have shown that the emission of nitrous oxide from soil results in an increase in global temperature. Nitrous oxide reduction is the final step in the denitrification pathway and it is found to be regulated by the enzyme nitrous oxide reductase, which is encoded by the gene *NosZ*, one of the major gene components involved in the conversion of nitrous oxide into gaseous nitrogen. This *NosZ* gene is found to be unique to denitrifying bacteria. The study focused on investigating the diversity of denitrifying bacteria that harbours the *NosZ* gene for the conversion of nitrous oxide to nitrogen, which ultimately reduces the emission of nitrous oxide to the environment. A total of 73 denitrifying bacteria were isolated from the rhizosphere of the mangrove ecosystem using three different mediums such as bromothymol blue medium, screening medium and denitrifying medium. These isolates were further screened by using *NosZ* gene-specific primer *NOS Z 661f* and *NOS Z 1773R.* Of the 73 isolates screened, only 6 isolates showed the amplion of 1100 bp relevant to the *NosZ* gene, which were further grouped into two genetic groups based on rep-PCR banding pattern. Comparison of the 16S rRNA (partial) gene sequences to the NCBI data base by Blast search was carried and the phylogenetic tree was constructed using UPGMA. The representative genotypic strains, MSSRFN2 and MSSRFN 3, showed a higher 16s rRNA gene sequence similarity of 99 per cent to *Psuedomonas alcaligenes* strain LMG1224 T and strain k2945, respectively. Further studies are in progress to identify the bacterial diversity harbouring the *NosZ* gene.

Quorum sensing among gram-negative bacteria from the mangroves

Bacteria often possess a regulatory system known as quorum sensing (QS) to modulate gene expression as a function of their cell density. In gram-negative bacteria, the most common QS system is regulated by the N-acly homoserine lactone (AHLs) signalling molecules. The production of this has been suggested as a possible mechanism to protect plants from plant diseases and also to regulate phenotypes in plant growth promoting bacteria, bacterial growth and

root coloniation. In the present study, the diversity of the AHLs-producing gram negative bacteria from the mangrove ecosystem was investigated. Gram-negative bacteria were isolated using different selective mediumd to inhibit gram positive bacteria and further short-listed using the KOH string method. The selected strains were screened for AHLs production using *Chromobacterium violaceum CVO26* reporter strain. Among the 320 gram-negative isolates screened, only 40 showed positive reaction by the development of purple colour in the presence of the reporter strain. Among the 40 AHLs positive strains, 26 isolates showed positive amplification for *Pseudomonas* specific primers. Genetic profiles of the positive strains studied by rep PCR using GTG_5 grouped these isolates into 10 different groups. Representatives from the 10 genotypic groups were further analysed for PGPR functional activities such as phosphate solubilisation, IAA production, extracellular enzyme production, biocontrol activity and biofilm formation. Among the functional activities, 6 strains were positive for protease, 2 for biofilm, 3 for lipase, 1 for IAA and 35 for phosphate solubilisation. The positive strains were characterised using various biochemical tests such as IMVIC, urease, TSI, sugar utilisation test, oxidase, catalase and motility. All of them were found to be catalase and citrate positive, 38 were oxidase positive, 2 were methyl red positive and one was Voges Proskauer positive. Further tests are in progress to confirm the genus of the positive strains and also to characterise the AHL molecules.

305.2 Screening micro-organisms collected from different ecological niches for biomolcules

The demand for novel antibiotics to combat drug-resistant pathogenic microorganisms has been gaining momentum in recent years. Modern biodiversity prospecting integrates the systematic search for new sources of biomolecules, genes and other economically valuable natural products, especially from untapped microbial resources. The on-going project, which envisages mega-scale screening for microbes from different ecological niches distributed throughout the country, involves nine academic institutes and an industrial partner, the Piramal Life Sciences Limited India (PLS), Mumbai. The main objective has been the focus on screening for microbial metabolites with anti-cancer, anti-infectivity and anti-diabetic activity, and building up a Microbial Culture Collection (MCC) Centre located at Pune. In the present study, soil samples were collected from different ecological regions of the Eastern Ghats including Kolli Hills, Pachamalai Hills, Javadi Hills, and Yercaud well as from the mangrove ecosystems at Pichavaram, Muthupet, Pulicat lake, Ennore, Marakkanam, Coringa, Nellore, Kakinada, Karaikal, etc. Using 30 different media, large numbers of bacteria were isolated and 1000 bacterial isolates were supplied to PLS every month for high infectivity throughput screening (HITS) for anti-cancer, anti-inflammatory, anti-diabetic and anti-infectivity activity. Another set of cultures was also supplied to the Microbial Culture Collection (MCC) at Pune. In addition, two glycerol stocks of all the microbes isolated

from the different ecological niches were maintained in the Microbiology Laboratory at MSSRF. A total of 25,000 bacterial isolates have been isolated and their colony characteristics such as purity, colony size, configuration, margin, elevation, colour, mucilage, biofilm formation and pigment production have been recorded. Among around 15000 isolates screened by HITS, the following three star hits were observed: anti-cancer activity 132; anti-diabetic 553; anti-inflammatory 281; and 75 anti-infectivits. The bacterial strains from the mangroves proved to have highly potential with maximum HITS.

305.3 Biological control of diseases

Biological control of blast disease of finger millet using plant growth promoting bacteria

As reported earlier,blast disease caused by *Magnaporthe grisea* has been identified as the serious constraint in finger millet production. The yield loss caused by this pathogen has been estimated to reach 59 per cent in all the finger millet (*Elusine coracana*) cultivated regions. The aim of the present study was to control the disease using plant growth promoting pseudomonads isolated from the finger millet rhizosphere soils collected from different districts of Tamil Nadu. Among the 1500 rhizobacteria isolated, 120 pseudomonads were selected as *Pseudomonas* positive using 16s gene specific primers ([5'-GGTCTGAGAGGATGATCAGT-3'] and rev 18-mer [5'-TTAGCTCCACCTCGCGGC- 3'] and the functional and genetic characteristics of these strains were analysed. The diversity of the antibiotic coding genes 2, 4-diacetylphloroglucinol (DAPG), Pyoluteorin (PLT), Phenazine-1-carboxylic acid (PCA) and Pyrrolnitrin (PRN) was determined by PCR using gene specific primers. DAPG and HCN were screened using DAPG specific primers Phl2a 5'- GAGGACGTCGAAGACCACCA-3' and reverse primer Phl2b 5'-ACCGCAGCATCGTGTATGAG-3'and HCN specific primers PM2-31-mer 5'-GGCATGGGCGTGTGCCATTGCTGCCTGG-3' and the reverse primer PM7-26-mer 5'-CGCTCTTGATCTGCAATTGCAGGCC-3'. Among 120 pseudomonads screened, 24 strains showed positive amplification for DAPG antibiotic coding gene and 76 strains showed positive amplification for HCN coding genes and 17 strains showed amplification for both. Among the 24 DAPG positive and the 76 HCN positive strains, only 26 strains exhibited antagonistic activity against the blast disease pathogen, *P. grisea*. These pseudomonads were screened for various functional diversities and it was found that 57 of them produced extracellular chitinase and 7 produced acy homoserine lactones, 12 isolates produced tri-calcium phosphate clearing zones, 32 strains exhibited positive reaction for ACC deaminase and 32 showed biofilm formation, indicating their possible role in helping plants to grow under abiotic stresses. All these strains survived at 0.5 M salt concentration and 10 strains were able to grow even at 1 M NaCl concentration. Genetic diversity was analysed through BOX PCR and 16 different genotyping patterns were observed among these isolates. Further identification of the representative of each genotype by amplifying the 16s rRNA to identify the species is under progress.

Programme Area 400

ECOTECHNOLOGY

On 26 December 2009, the fifth anniversary of the tsunami, the Fish for All Centre was dedicated to the community and the nation. District-level advisory meetings and constant stakeholder discussions have helped in the enhanced convergence with government departments and other agencies in dovetailing various schemes. The JRD Tata Ecotechnology Centre has reached out to 16,000 households across its sites and has imparted 52,000 training days. A training manual on 'Climate Risk Management' has been developed for imparting capacity to the local communities to deal with climate risks.








On-farm and off-farm strengthening and diversification for improved livelihoods

Programme Area 400

Ecotechnology

The year started with a retreat, which focused on introspection, strategy and planning for the JRD Tata Ecotechnology Centre based on the feedback from the programme and management reviews conducted earlier. This gave the team an opportunity to examine the relevance, effectiveness, efficiency and impact of the work in the light of the recommendations given in the programme review. The vision and mission of the Centre was revisited as well as its links to the organisational vision and mission. The Biovillage framework and the strategies adopted were reconsidered based on the initiatives, outputs and outcomes from the various sites. Plans were reassessed and the need to work towards consolidation and scale up was discussed.

Based on the decisions taken, the activities focused on consolidating and working towards identifying areas that could be scaled up by enhancing the convergence mode with relevant agencies and community members. The major areas the Centre focuses on are natural resources management and livelihoods through the biovillage and the bioindustrial watershed approach, under which special attention is being given to promoting sustainable agricultural practices, promoting organic farming and integrated farming systems, land and water care, adding value to bioresources as part of the value-chain approach, thereby strengthening, diversifying and looking at alternative livelihood options. A considerable amount of time has been spent on capacity building through training and stakeholder engagements, which have helped in nurturing grass-root institutions and strengthening convergence with other organisations, agencies, PRIs and other partners. The district level advisory meetings being held in all the watershed sites help in enhancing these convergences to a large extent. This year a total of Rs.15,22,000 was distributed to support income-generating activities from the micro-credit support initiative and a sum of Rs.9,65,425 was recovered.

A pilot project on *Community Managed Decentralised Biomass Energy Systems to Provide Rural Energy* was initiated during the year at Pudukottai and Koraput in the watershed areas of these two sites. Project activities carried out during the year were to understand the availability of biomass inclusive of agri-residues, energy utilisation pattern in the community, and the livelihoods around this. Studies at Pudukottai have shown that there is potential for using *Prosopis juliflora* as this is available in plenty. The entire value chain has been assessed and the roles of the different stakeholders have been studied along with the volumes harvested, utilised internally, value added and traded. It is very clear from this that this value chain needs to be looked into more carefully to see how livelihoods around this can be strengthened as also the feasibility of setting up a gasifier. While the studies at Koraput show that the requirement of domestic energy is met from fuel wood collected from the forests, there is good potential for establishing

energy plantations which would reduce the dependency on the forest for fuel wood. In both places estimations of the standing biomass is under progress.

Sub Programme Area 401

Coastal Regions

On 26 December 2009, the fifth anniversary of the tsunami, the Fish for All Centre was dedicated to the community and the nation. A community college was launched with the support of IGNOU. Activities related to strengthening the IFS farmers in the three blocks have been initiated and consolidation efforts are on going to cluster the 406 farmers.

401.1 Chidambaram

Need-based support is being extended to the three grass-root institutions — the Thenkoodu clusters, the Athivaraganatham Farmers' Welfare Association and the Manikollai Lift Irrigation Farmers' Association — nurtured during the active phase of work at Chidambaram. They continue to work as collectives.

Thenkoodu SHG Federation

The Thenkoodu SHG Federation, established in 2002, has been functioning independently, with 506 women as members in 31 WSHGs and 61 men as members in 4 men SHGs. The total turnover of the Federation was Rs. 2,44,66,094. Dairy farming, goat rearing, floriculture, calf rearing, banana cultivation, grocery marketing and tailoring are being carried out as part of income-generating activities. In the brick-making enterprise, individual members earn an average monthly income of Rs. 1600 to Rs. 2150. Thirty-one women have taken 20.46 acres of land on lease to cultivate paddy and pulse crops. Totally 43.7 tonnes of paddy were harvested and sold for Rs. 1.77 lakh. Gross income of Rs 5.73 lakh and net income of Rs 3.95 lakh were realised at an average of Rs 28,000 / per acre and each member got Rs 12,767 for the paddy. Fifty-six women members of the Vekkaliamman SHG and Annai Lakshmi Bai SHG have started a community fodder bank, by taking up fodder cultivation with coconut and floriculture as inter crops. During the year, 21.56 metric tonnes of CO3 fodder were harvested.

Integrated Farming System Welfare Association

As part of giving power of scale to the farmers practising IFS and in continuation of the survey conducted late last year on strengthening the practice and adoption of IFS at the three block levels of Portnova, Keerapalayam and Mel Bhuvanagiri, meetings were held to support the three clusters towards developing an apex body. Associations have been formed at the Portnova block (93 farmers) and at the Mel Bhuvanagiri block (123 farmers). Of the 406 farmers, 24.9 per cent fell under the category of small farmers, 47.3 per cent were marginal farmers and 27.8 per cent were large farmers. The success of IFS depends upon a holistic approach with suitable forward

and backward linkages, which enable the farms to be efficient in resource utilisation. Currently they have to depend on the existing systems of extension support that is sectoral and this has limited their growth. Based on the feedback support for procuring improved breeds of livestock, timely availability of fish seed / feed, information and credit, the task of strengthening the links with the line departments, TNAU, KVK and Annamalai University is on. Once an apex body is formed, it would enable them to organise input support and mobilise other related services like access to credit, insurance and markets.

System of Rice Intensification

In the current year, SRI method of paddy cultivation was taken up in 81.40 acres in four villages. The Kuriyamangalam cluster and the Adhivaraganatham Farmers' Welfare Association have taken up SRI on a large scale.

Manikollai Small Farmers' Lift Irrigation Federation

Formed in 2003, the Federation still continues to be active with 108 members and has been facilitating the replication of lift irrigation in the surrounding villages. With early nursery preparation, utilisation of water and lift irrigation by farmers, agriculture labourers and village people are getting daily work in their own villages. Farmers are now regularly cultivating crops that had been introduced as alternative crops during the project phase, such as pulses (18 acres), *ragi* (3 acres), chilli (1 acre), cucumber (0.33 acre), watermelon (4 acres) and vegetables (2.40 acres). In total, 439 metric tonnes of paddy were harvested from 225 acres.

401.2 Kaveripoompattinam

The Fish for All Centre focuses on imparting need-based training and building the capacities of the coastal communities in strengthening the capture-to-consumption chain. As part of the integrated natural management approach, inland aquaculture and on-farm interventions are also being carried out. The project area comprises 24 villages in 4 panchayats (Kaveripoompattinam, Vanagiri, Thennampattinam and Perunthottam) of Sirkazhi block in Nagapattinam district. Of the 24 villages, 8 are fishing villages, while the other village communities undertake agricultural activities along with inland and fresh water fishery. Members from several agencies like MPEDA, NFDB, State Fisheries as well as some national leaders visited the facility and felt it was a good model for replication in major landing centres.

Infrastructure facilities

The Fish for All Research and Training Centre (FFARTC) at Kaveripoompattinam (Poompuhar) was dedicated to the coastal communities of the nation on 26 December 2009, which also marked the fifth anniversary of the tsunami hitting the Indian coast. The FFRTC complex consists of 3 buildings: the fish processing complex with a 10-tonne processing and holding capacity, the training centre and office, and a dormitory block to accommodate 50 beds along with kitchen

and dining facilities. The inauguration of these buildings was done in the presence of a large gathering of the community members and Professor M.S. Swaminathan presided over the function. Ministers of the Central and State governments, Dr. D. Purandeshwari and Mr. K.P.P. Sami, respectively, and Members of Parliament Ms. Kanimozhi and Mr. A.K.S. Vijayan were the chief guests. Dr. G.K. Pillai, Vice Chancellor, and Dr. Latha Pillai of the Indira Gandhi National Open University (IGNOU), and Dr T Ramasami, Secretary, Department of Science and Technology were also present on the occasion and for the inauguration of the community college in fisheries. The local traditional and elected panchayat leaders also attended.

Community mobilisation

In all the 8 fishing villages, marine fishing is the main activity of the community members. Mechanised vessels, motorised boats and catamarans are widely used, with gill nets, purse seine, hooks and lines being the commonly used gear. Fishermen actively take part in fishing as well as in allied activities like maintenance of the craft and gear. The fisherwomen are engaged in vending fresh and dry fish and allied activities. The post-harvest season is utilised for the preparation of dry fish, which sees a heavy demand, and this activity is carried out by fisherwomen.

Through a survey conducted in these fishing villages, nearly 1355 fisherwomen have been identified as vendors of fresh fish; mostly selling by headloads in the neighbouring villages and also commuting through the local public transport system to nearby towns like Mayiladuthurai, Sirkazhi and Kumbakonam. Dry fish preparation and vending is also a major activity of the fisherwomen in all the 8 fishing villages. About 1672 such fisherwomen are actively engaged in this venture. Non-availability of ice for preservation of fresh fish, lack of transport facilities to the neighbouring areas and the drudgery of carrying 15-25 kg of fish as headloads are some of the issues raised by the fish vendors. With the completion of the PRA exercise in five villages earlier, PRA was conducted in the remaining fishing villages of Savadikuppam, Melamoovarkarai and Puthukuppam.

Inland aquaculture

Inland aquaculture farming is practised in the villages of Vanagiri, Kaveripoompattinam, Melaiyur, Manikkiramam, Kelaiyur, Poompuhar, Neithavasal, Perunthottam and Thenampattinam. Marginal and small farmers with landholdings of 1 to 5 acres have inland fish ponds occupying 0.30 to 3 acres. Out of 75 such fish farmers identified, 45 have dug their ponds with the support of the government schemes. Three inland aqua farmer clusters have been formed. MPEDA officials visited fresh water fish farmers to explore the subsidy for scampi stocking. Advisories for inland practices are being given on the following parameters: renovation measures for the ponds, water filling and fertilisation, collection of quality fish seed, selection of species, species diversification, feed management and fish sampling. The ultimate aim of fish culture is to grow fish to a marketable size in the shortest

possible time. Under favourable conditions, fish of marketable size between 750 gm to 1.5 kg can be raised in 5 to 7 months, when the fish can be harvested. Multiple harvesting (2 to 4 times) was carried out, and the fish sold locally for around Rs.60 to 100/- a kg.

Livelihood activities

Crab fattening: As a post-tsunami rehabilitation activity, crab fattening was promoted in Madavamedu village for the Malligai WSHG. In continuance of the activity, the WSHG was loaned Rs.1 lakh from Friends of MSSRF Initiatives, Japan, in 2008 to be repaid in three instalments. They have successfully repaid the first two, amounting to Rs. 65,000. In the current year they have fattened 250 crabs worth Rs.75,000. The women members involved in this activity get Rs.1000 to 1100 per cycle.

Solar dry fish preparation: Solar tent fish dryers have been fabricated by the JRD Tata Centre to dry the fish in a hygienic manner, thereby adding commercial value to it. Ten units have been fabricated for demonstration purposes, and fisherwomen have been trained in the use of the solar tent dryers. The advantages of these dryers include no energy cost, very low equipment cost, ease of fabrication, shorter drying period, no contamination by dust and insects, more hygienic product with low moisture content.

Fish powder preparation: As part of value addition to the low-cost fish, and as a diversified livelihood activity, fish powder preparation was chosen by a group of women. They used small-sized prawns called *chinnakuni* to make the fish powder. The fish powder mixture is weighed and packed in small quantities (around 20 g) in plastic pouches and marketed in the local groceries at a cost of Re. 1 per packet. The cost of preparation of 1 kg of the powder is Rs. 125 and the women make 100 per cent profit. Seventeen women from Nila SHG at Poompuhar have been actively involved in this seasonal activity carried out for three months from April to June.

Non-farm activities: The members of the WSHGs in the project areas are by and large those who are at home with less livelihood options and opportunities. A survey was conducted to identify the sort of livelihood support services that would benefit them. The survey revealed that most of these women wanted non-fishery-based activities like candle making, *agarbati* production, gold-covering ornament making, setting up of petty shops, etc. Based on the interest, 12 women were given training in candle making and *agarbati* production, and 32 women were taught the process of gold-covering ornaments. Initially, marketing of these products were also arranged and subsequently, the women themselves have become involved in the marketing. A buy-back arrangement has been set up with vendors of the gold-covering ornaments by which the raw materials would be supplied by them and the finished goods would be taken back.

Grass-root institutions

The women and men of the different villages have been formed into SHGs based on their

activities. Six agricultural men farmers groups and 30 fisherwomen groups have been created in this region.

Tamil Nadu Fish Farmers Association: The fresh water fish farmers have been linked with the Tamil Nadu Fish Farmers Association. Farmers have received technical details and seed and feed from this association. Periodical meetings to discuss several issues have been conducted for all the fish farmers from all over Tamil Nadu. Further, information regarding welfare schemes like education and accident benefits has been provided to the registered members.

Agricultural Farmers Club: A NABARD Agricultural Farmers Club — The Kaveriamman Farmers Club — was inaugurated on 12 March.2010, where 20 farmers have been enrolled as members and identification cards given to them..

Exposure trip: Six inland farmers from Perunthottam were interested in an exposure trip to a fish hatchery at their own expense. So arrangements were made to take them to the Sarmasthu Fish Seed farm at Swamimalai on 7 November 2009. The hatchery proprietor oriented the team on the importance of stocking period, size of the fish for stocking, feeds and feeding, health, and harvesting and marketing. The farmers have purchased 10,000 fish seed for stocking after checking the seed quality.

Training and capacity building: A training programme was conducted along with the IFAD-assisted Post-Tsunami Livelihood Project, Government of Tamil Nadu, on fisheries resource management and conservation. The topics dealt with included fishing pressure leading to reduced catch per unit effort, destructive fishing methods and their impact on fishery resources, fish aggregating devices, tuna fishing, and marine pollution and its impact on fishery resources. The effect of industrial effluents and destruction of breeding grounds by human interaction in the coastal zone were highlighted.

As part of post-harvest loss reduction in marine capture fisheries, the fishermen have been given a series of training in hygienic handling of fish. As part of the value-addition process, the fisher women and other women from the SHGs were given training in the preparation of value-added fishery products. Training on accounts keeping was also organised for 74 women belonging to various WSHGs.

In coastal aquaculture, good aquacultural practices and the need for record keeping have been taught to the shrimp farmers. In fresh water aquaculture, the farmers have been taught and trained in a scientific manner on how to increase productivity, and in the selection and use of good seeds and feeds, including sourcing from dealers in the local area. In addition, the farmers have been provided with hand-holding support for linkages with the line departments for technical and financial support for farming activities.

Education and nutrition support to orphan children: Educational sponsorship and nutritional support to 45 orphan children are

continuing to be provided in the three villages of the project area through the partnership with the local NGO.

Integrated Farming System

Post-tsunami intervention in soil reclamation was carried out to an extent of 32.28 acres of land at Neithavasal, Anaikovil and Vellapallam villages. Four farmers' groups of small and marginal farmers comprising 63 members took part in the Farmers' Participatory Integrated Farming System demonstration in the coastal region of Nagapattinam district, conducted in one wetland and three dry land plots. The system besides being profitable in terms of net return of Rs.12,572 / acre / annum also generated 347 man days as compared to crop alone 342 man days / year. Not only this, all the farm wastes, crop residues, animal urine and dung, etc., were properly collected, composted and recycled. Twenty farmers have since adopted IFS.

Pedal pumps

Concrete pedal pumps with capacity to deliver 60-80 lt of water per minute were distributed to 100 farmers in Vettaikaranirruppu, Vellapallam, Anaikovil, Vanagiri, Neithavasal and Illupur villages in the Pudukottai site in the first phase. Pedal pumps are more efficient than conventional ones in lifting water and are also cost effective. Since farm ponds are very common features in the coastal region, there is good scope for the self-replication of the technology. In order to increase water use efficiency as well as to reduce waste in the highly sandy soil, a zero- energy drip system was integrated with the pedal pump technology. Of paramount significance is the affordability factor which makes this technology accessible for the smallholder. Water for Third World has also committed 100 more pumps in the second phase

Training and capacity building

Farmers were trained in soil sample collection, water management using pedal pump, IFS and SRI as well as in setting up animal health camps and maintaining kitchen gardens. The total number of trainee days covered was 254. The farmers' clubs established were supported by NABARD to the tune of Rs.10,000 per year.

Convergence with line departments, research institutions, marketing and finance institutions

Convergence with line departments like the State Fisheries Department, research institutions, marketing and finance institutions have been carried out successfully. Establishing contacts with Central Institute for Brackish Water Aquaculture (CIBA), Chennai, Central Marine Fisheries Research Institute (CMFRI), Kochi, Central Institute of Fisheries Technology (CIFT), Marine Products Development Authority (MPEDA), Kochi, Fisheries College and Research Institute (FC&RI), Thoothukudi and National Centre for Sustainable Aquaculture (NACSA) for various training and technical support is being done on a regular basis. Developing linkages with local banks like the Indian Overseas Bank and State Bank of India is also being done. Further, developing contacts and networking as well as establishing contacts with like-minded

NGOs and CBOs like Avvai, Sneha, Dhan Foundation, World Trust, Bedrock (formerly NGO Coordination and Resource Centre), Covenant Centre for Development, South Indian Federation of Fishermen Societies, Fishermen Cooperatives, etc., has been very fruitful for the implementation of the project activities in a smooth manner.

401.3 Kendrapara

During the year, the Kendrapara biovillage programme extended its area of operation to 8 villages at the project site. The team continues to work at improving livelihoods through capacity building, participatory research, strengthening grass-root institutions and networking with other agencies.

Aquaculture-based integrated farming system

In 2004, an aquaculture-based integrated farming system (AqIFS) model farm was established at Manitiri village. Over the years the model farm has expanded to cover 1 ha and functions as a Farm School. This AqIFS model farm is managed by the 3 Women SHGs of Manitiri village who train other SHG members and individuals from neighbouring villages on various components of integrated farming. The net profit from the farm operations of the AqIFS Farm School was Rs. 66,648 during the year. The following services were provided from the Farm School: distribution of 45 kg fish fingerlings to 8 farmers following AqIFS approach in their field and undertaking the raising of early paddy seedlings in 7.85 acres, transplanted in 130 acres. Raising early paddy seedlings have benefited farmers by 15 to 20 per cent increase in grain yield compared to the conventional practice in the region, which in monetary terms works out to Rs. 1,40,000 as additional gain. A total of 1,300 agro-forestry and fruit seedlings was raised and distributed to 110 farm families and 8 schools in the adopted villages. The AqIFS model is gaining popularity in the district with government departments such as Fisheries, Veterinary and Agriculture providing support to individuals willing to take up this model. A survey has identified 45 individuals practising AqIFS methods in the surrounding villages.

Sunflower cultivation

Area under sunflower cultivation during the period 2009-10 has increased over last year. During the *rabi* season, 117 farmers raised sunflower covering a total area of 36.25 ha. The average yield rate has been 15.75 qtl / ha. Similar increase in area under sunflower cultivation has been observed across the district, with the Agriculture Department extending full support for oil seed production through the compact area programme where irrigation facilities are available in the *rabi* season. The government has supplied seed and bio-fertilisers at 50 per cent subsidised rates to farmers. A survey in the district shows that 320 ha area has been covered by this crop during *rabi* 2009-10. Farmers in saline areas cultivated sunflower as their alternate crop after *kharif* rice.

System of Rice Intensification

In the project area, 126 farmers have adopted the SRI method of rice cultivation during the

kharif season and 21.6 ha area has been covered and up to 62 qtl / ha harvested. Farmers have realised that this system of rice cultivation saves seeds and cost of cultivation. SRI is now being promoted through ATMA and the Agriculture Department, which supports farmers in training, and in providing agriculture implements and quality seeds at subsidised rates along with biofertilisers and biopesticides. During 2009-10, SRI method of paddy cultivation has spread to 270 ha during *kharif* and 600 acres during *rabi* across the district.

Kitchen gardens

Vegetable production in the district is limited due to water scarcity in the summer season. MSSRF promoted vegetable cultivation, with the support of KVK and the Horticultural Department, as a backyard activity for women SHG members by providing training and quality seeds. This is a year-round activity which provides nutrition and income security at household level. During the year, 547 SHG members grew various vegetables covering 22.60 ha; the net income, including home consumption and sale, was Rs 4,87,878. In *rabi* 2009-10, the Horticulture Department distributed 1450 seed packets (mini kits) comprising different seeds at 90 per cent subsidised rates.

Poultry rearing

MSSRF imparted training and demonstration in poultry rearing to SHG members and farmers. The rearing of coloured birds like Banaraja, Giriraja and Black Rock was promoted in a semi-intensive method to meet the market demand for poultry meat. During 2009-10, 7,425 chicks of Banaraja, Asseli, Broiler and Black Rock were procured from KVK, Animal Husbandry Department, Kendrapara, and Central Poultry Research Centre, Bhubaneswar, and reared by 128 women in the 9 project villages. Poultry meat production has been estimated at 14,480 kg and net income at Rs. 6,04,628. MSSRF has also requested the Odisha Deptartment of Animal Husbandry as well as KVK for the steady supply of chicks at the doorstep of SHG members.

Mushroom cultivation

The coastal region of Odisha is suitable for cultivation of oyster and paddy straw mushroom. Since 2000, MSSRF has been promoting the cultivation of mushroom among SHG members in collaboration with the Horticulture Department and KVK. Awareness has steadily developed for mushroom cultivation among SHG members and farmers in the district and market linkages have also been developed with some shops selling mushroom at Kendrapara. During the year, 520 spawn bottles were utilised by 164 members and 968 kg of oyster mushroom was harvested and sold with a net profit of Rs. 25,168. There is ample scope for developing enterprises around mushroom cultivation as raw materials are available and market linkages are also being established.

Grass-root institutions

During the retreat, it was decided to extend biovillage activities to all the villages in Rajagarh and Kuhudi. Accordingly, surveys

of the new villages are being done and SHGs are formed and strengthened.

During 2009-10, 44 women SHGs were enrolled under MSSRF activities from the new villages. Currently 1305 individuals in 79 SHGs are functioning in the project area. These members from 3 clusters, namely, Nari Shakti Mahila Sangha, Nembara (12 SHGs), Jeevan Jyoti Sangha, Rajagarh (24 SHGs), and Jhansi Rani cluster, Balipal panchayat (5 SHGs), have strengthened their livelihood options in dairy farming, kitchen gardening, mushroom cultivation, poultry and duck rearing, and in non-farm activities like *agarbati* preparation and petty businesses. To create awareness among the people on village sanitation and health, a *Grama Kalyan Samiti* has been established with the help of Nari Shakti Mahila Sangha. The total financial transaction in the year was Rs. 17,23,250.

The Community Bank supported by Asia Initiatives provided interest-free loans of Rs. 4,44,000 for the development of different enterprises to Nari Shakti Mahila Sangha in November 2008 and Rs. 2,16,000 to Jeeban Jyoti Sangha in December 2008. Apart from that, the Bank of India has provided a loan of Rs. 3,50,000 at subsidised rates for dairy development to Om Bajarangwali SHG, Patana. SHG members have used these loans in dairy farming, poultry rearing, agricultural operations, rice trading, hiring out tents for functions and grocery business. Loans received from MSSRF by both the SHG clusters have been repaid and income has been generated in both the on-farm and non-farm sectors.

Community Learning Centre

A Community Learning Centre was established by MSSRF at Nembara village in 2005 to educate SHG members and others through computers. This centre is helping them in up-to-date record keeping, computer learning, weather forecasting, etc. MSSRF also facilitated 16 students including SHG members for one month to learn soft skills development in a government- sponsored project at the Orissa Computer Application Centre (OCAC) at Kendrapara, which would enable them in getting employment in panchayats through the Mission Shakti programme.

Training and capacity building

During the year 1,777 trainee days were conducted in the following areas: *agarbati* preparation, pest and disease management of crops, floriculture and kitchen gardening, INM, IPM, mushroom cultivation, AqIFS, sunflower cultivation, rodent control, post-harvest technology and fruit preservation. Activities initiated by MSSRF at the project site are being promoted for large-scale replication along with government line departments and other NGOs across the district. The areas in which convergence has been successful include that with the Agriculture Department for System of Rice Intensification and sunflower cultivation; Veterinary Department for extension of poultry and duck rearing and dairy development in rural areas; Horticulture Department for kitchen gardening and mushroom production; Fisheries Department for aqua-culture and development of AqIFS model. KVK, Kendrapara has asked for advice on overall agri-based development

and economic upgradation of the people and NGOs like SAMBANDH, CYSD, IPFP, APOWA, etc. want suggestions for the sustainable development of the farming sector of the State.

401.4 Puducherry

The focus of the Puducherry Biocentre is to implement the biovillage programme and the bioindustrial watershed programme at Karasanur. A stakeholder meeting was held which was presided over by the Chairman to take stock of work done and initiate discussion on the 'Every Village a Biovillage – 2015' project.

Biocentre-Biovillage Programme

The MSSRF Biovillage Programme was initiated in 1991 in 3 villages with the support of The United Nations Development Programme (UNDP) and in collaboration with the administration of the Union Territory of Puducherry. Presently the programme is replicated in 57 villages of Puducherry. The Biovillage Council facilitated by the Biocentre has accelerated the biovillage movement.

At present, the Biocentre is focussing on strengthening the existing SHGs federated as the Innuyir Grama Sangam, the grass-root institution, and also replicating the biovillage at Mannadipet Commune in 11 villages. Coordination mechanisms and a harmonising approach have been adopted to spread the movement. The project continues to work in partnership with the local line departments of the State government and other NGOs working in the area. While doing so, the multi-stakeholder approach has been adopted for effective execution of the programme through participatory planning, where the main implementers are the members of the Innuyir Grama Sangam.

Status of the grass-root institution

The strengthening process of the grass-root institution started with the vision building exercise. Strategic planning and a series of capacity building trainings were planned and implemented and the process is still on. Capacity building and mentoring have been undertaken for independent functioning and management as well as for long-term sustainability. The Federation has been trained in social and managerial skills, development of enterprises / technology adoption, business plan, market intelligence, micro insurance, micro financing, etc.

The SHGs / Federation operational guidelines have been developed and a perspective plan for the Federation is being evolved. Financial auditing of the Federation (external audit for the years 2007-08 and 2008-09) and individual SHGs (internal audit 2009-10) have been carried out and systems have been put in place. The management information system (MIS) has been streamlined through the Self-Help Enabler (SHE) software package. The General Body election was conducted for Innuyir Grama Sangam. New council members, executive members and office bearers were elected and the new body formed the apex structure. To manage the affairs of the Federation and to expand the biovillage movement, animators

were appointed to monitor the various services and activities of the Federation and the SHGs. Three fulltime animators, 10 part-time animators and 1 community accountant will look after the 250 SHGs.

For ensuring its financial sustainability, the various services of the grass-root institution and its scope for income generation were analysed and a comprehensive plan has been developed, with the details of the services to be executed and the system / procedures to be followed.

A sum of Rs. 233 lakh has been loaned to 2147 members, which has helped them enhance their income-generation activities and livelihoods. The participation of women in community activities and the active involvement of some of them in local self-governance (PRI) are ongoing processes.

Biovillage community banking

The Innuyir Grama Sangam Community Bank (micro credit institution) was established in 2007 with the SHGs members' contribution of Rs. 1.45 lakh, to promote livelihood options and support on-farm, off-farm and non-farm activities. About 250 SHGs were brought under the community bank fold. This bank mainly lends money for establishing, promoting and scaling up enterprise activities of the SHG members. Until now, Rs. 20.13 lakh has been given as loans to 182 beneficiaries.

Last year, the community bank provided loans to 79 members to the tune of Rs. 9.71 lakh for initiating and scaling up income-generation activities. This credit extension has been a means of empowerment by which the women are able to take up eco-enterprises or any other enterprise for upgrading their livelihoods in a successful manner. This has been possible by the contribution of the SHGs (at an annual membership of Rs. 500 per SHG) and the Community Bank supported by Asia Initiatives, to the tune of Rs.4.82 lakh and Rs.2.50 lakh, respectively.

Training

In the last one year, 6,437 trainee days (4,851 trainee days through the mentoring cell of which 2042 days were given by BVC) were organised by the Biocentre to benefit SHG members, SHG leaders, cluster-level leaders, farmers, officials of government departments, staff of other NGOs and other stakeholders. The experience of the Centre has shown that with proper access to technology, credit and marketing institutions, the SHGs can become a tool for achieving job-led growth in the rural areas. The Centre will continue to impart managerial skills; facilitate partnerships and networking and train grass-roots institutions in emerging areas such as market intelligence, micro insurance, micro financing, etc. For almost 200 days in a year guests and experts interact with BVC and visit the Biocentre to understand the concept of biovillages. This year the visitors included representatives of Practical Action, Bangladesh; Vilans Liebig, Germany; Nirupan Sen, Government of West Bengal; the AGM and DD of NABARD; Nandita Rai, SRDA (RM & DD), Government of Sikkim; Professor Pradip Kumar, Queensland, Brisbane; an eight-member team from NAARM, Hyderabad; Arbeif Libeu, Germany;

Dr. J.. Anantha, Regional Research Institute (Siddha), Puducherry; and research fellows from universities and NGO representatives from in and around India.

Partnerships and networking

Partnerships have been built up with small and marginal farmers, government Departments of Agriculture and Horticulture (for supply of certified seeds, seed kits, farm implements),. the Forest Department, Tamil Nadu Agricultural University (TNAU), Krishi Vigyan Kendra, PONLAIT, Hatsun Agro Products (for technical support for milch animals and seedlings of fodder), PASIC (for market tie-up of bio-organic inputs), nationalised banks (for credit support to SHG members), NABARD (for capacity building and skill trainings related to SHGs and mciroenterprises), DRDA, research institutions, educational institutions, medical colleges, veterinary college, Sankara Nethralaya, Fish Farmers' Development Agency, REAP, various NGOs and other government departments.

Funds obtained

In the year 2009-10, a sum of Rs. 8.09 lakh has been availed from government departments. In kind, horticulture seeds worth Rs. 8500, fodder from PONLAIT worth Rs. 3800, dairy subsidy of Rs.7,52,000, goat and poultry subsidy Rs. 26,500 and Rs. 18,500 through labour through the NREGA project have been received.

Bio-industrial Watershed Programme

The Bio-industrial watershed programme (BIWS) is being implemented by the bio centre at Karasanur village in the Vanur block of Villupuram district since 2007. The activities at the project site focused on extending and scaling up the biovillage work on a watershed scale. Activities such as dairy farming were strengthened and are being promoted as a livelihood option amongst the watershed community with marketing tie-up with the Government of Puducherry. Acreage under crop varieties like the *Muttlur* and *Perambulur* onions and maize is being increased to bring it under large-scale marketing. Improving the pond systems have helped recharge wells and has thereby extended the cultivation season. This site has been able to make effective use of the Community Learning Centre and the Mini Agro Weather Station to impart information and knowledge to the watershed community on general awareness, functional and computer literacy, weather conditions, etc. A District Advisory Committee (DAC) consisting of the district line departments, Community Based Organisations (CBOs) and the PRIs has been formed to guide and support the watershed activities. The first meeting of DAC was organised at Thiruchitrambalam, Vanur on 10 February 2010 in which the watershed project and its activities were highlighted in detail to various government departments and support in terms of schemes and technical guidance was requested.

The project has been able to obtain Rs. 4,72,510 for watershed activities from various government departments and schemes. This year the project has facilitated credit worth Rs. 1,43, 800 for livelihood enhancement activities.

Land and water management of the watershed area

Summer ploughing: Apart from soil management practices, awareness on summer ploughing was imparted to improve soil texture / structure and to increase infiltration. During the year, summer ploughing was extended to 39 acres by 28 farmers.

Green manure crops: To improve soil fertility, awareness on green manure crops, especially sun hemp and *Sesbania* sp, was imparted through the Farmers' Field School, in addition to exposure visits to the Government Seed Farm at Vanur. As a result, currently 22 farmers have adopted green manuring on 45 acres of farm land.

Soil samplings / soil health cards: During 2009, the second phase, 128 wet land soil samples and 68 soil samples were collected for soil microbial analysis (SRI and conventional methods in paddy). Soil health cards were prepared and distributed to 123 wet land farmers based on the results obtained from the Soil Lab at MSSRF, Chennai. Currently, 30 soil samples have been dispatched to the Soil Lab from the onion farmers' fields for both nutrient and soil microbial analysis. Testing of the third phase soil samples from wet / dry lands is under progress.

Perumalkulam renovation: As part of the renovation of water bodies**,** Perumalkulam pond (three-quarter acre) was renovated with the support of the BIWS Committee. Vegetation was cleared to an extent of 450 m along the supply channel adjacent to the pond. A check dam was constructed near the pond with inlet-cum-outlet channels. After renovation, the water-holding capacity has increased to 56,63,369 litres. As a result, 15 open wells around the pond have been recharged and the pumping hours has increased to two hours. Indirectly, 34 farmers owning 43 acres of land have benefited due to recharge of their open wells. The cropping pattern, intensity and additional second crop are being monitored.

Introduction of new varieties and crops

As part of introducing new varieties and strengthening the on-farm crop diversity, the focus has been on the following interventions:

Cluster cultivation of onion: To strengthen onion production, new varieties were proposed for introduction through the Farmers' Field School in addition to the traditional (*Muttlur*) variety already cultivated. A demonstration trial was raised on 40 cents wherein the yield was 1.8 tonnes. Knowledge regarding improved INM / IPM packages of practice was also imparted. Twenty-eight farmers in 30 acres have adopted *Muttlur* cultivation this year with the support of the BIWS Committee. Work is under progress to form an Onion Producer Company in the near future.

Vegetable cultivation: To increase the production of cultivation of vegetables, cluster cultivation of *bhendi* (lady's finger) (Mahyco10) has been facilitated on 8 acres through 50 per cent subsidised IHDS schemes in 2008, with the farmers having obtained a yield of 28 tonnes during 2008-09. The area

of cultivation has now been enhanced to 12 acres and a yield of 39.5 tonnes has been produced. Improved package of practice has been imparted for local varieties of brinjal on 9 acres in dry lands and a yield of 45 tonnes has been obtained.

Cultivation of *thenai* (Italian millet) and pulses: In June 2009, free *thenai* kits worth Rs.7000 were received from the Agriculture Department, and 6 farmers raised *thenai* on 10 acres in dry lands obtaining a yield of 18 tonnes. Similarly, a local variety of white sorghum was cultivated by leasing an acre of land by the BIWS Committee. With the success of harvesting nearly 300 kg, the BWIS Committee has decided to go in for redgram cultivation next season. Blackgram (VBN1) was introduced in 3 acres, getting a yield of two tonnes.

INM with use of enriched compost and biofertilisers

Through the Farmers' Field School (FFS) programme, crop-specific IPM / INM / ICM practices were imparted to SRI farmers and onion / vegetable farmers. As a result, bird perches and light traps have been installed in the groundnut demonstration plots and farmers have adopted this method in 15 acres of onion (*Muttlur*), 10 acres of chillies and 7 acres of brinjal. This has resulted in the reduction of pesticide usage. Over 80 men farmers and 50 women farmers have undergone training on IPM, INM, and organic farming, totalling 1,531 trainee days.

SRI cultivation

As part of the watershed programme, SRI was first introduced at Karasanur during the *samba* season of 2007-2008. Initially, 11 farmers underwent complete training on SRI package of practices at the Biocentre; in continuation, an exposure visit was arranged to Perambai village to impart practical knowledge on SRI cultivation aspects. Towards dovetailing government schemes into the programme, free SRI Kits (ADT37) were procured during 2007-08 and 9 farmers followed the principles of SRI on 7 acres of land, obtaining a yield of 12 tonnes. In 2009-10, 50 farmers were motivated to take up SRI through the Farmers' Field School. Exposure visits were arranged to the Government Seed Farm, Vanur. Free SRI kits (ADT 37), cono weeder, SRI marker, micronutrient mixtures, and biofertilisers worth Rs. 45,000 were mobilised from the Agriculture Department for 18 farmers for cultivation on 30 acres.

Bio-industrial initiatives as alternative livelihood sources

Integrated Dairy: A stakeholder's meet was organised to initiate dairy activity. The Karasanur Milk Producers Group comprising 30 members (11 men and 18 women) was formed with the group submitting a business proposal to the Indian Bank. The bank has disbursed Rs. 7,50,000 as loan to the group. Training was provided to build their capacity in integrated dairy farming along with exposure visits. CO4 variety of fodder was introduced in 3 acres; the existing CO3 variety was extended to 7 acres.

The milch animals were insured to the tune of Rs 27,000 for which government subsidy was dovetailed. Marketing tie-up was established with PONLAIT, the Pondicherry Co-operative Milk Producers Union. A milk collection centre has been established and is monitored by the BIWS Committee. Cattle feed is supplied by PONLAIT at a subsidised rate. Twenty-eight members are producing vermicompost in their backyards, while 12 have also initiated kitchen gardens in their backyards. A SHG comprising members from the SC community has received Rs.10.000 as government subsidy for goat rearing. Government subsidy of Rs.10, 000 was facilitated from the Agriculture Department for TANWABE women's group for paddy seed (ADT -37) production.

Technology diffusion: Community Learning Centre

Farmers and students, were exposed to functional literacy and computer literacy through the CLC. Computer literacy training programmes (MUPP-based programmes) were organised. At present, 8 women are appearing for the examination. Eighteen school students have been trained so far in four batches on the use of MS Office. A baseline survey on functional literacy has been made wherein 15 members have been identified.

Need-based, region-specific databases have been created and updated on dairy farming, goat rearing, cultivation of sorghum stem, piggery, uses of organic fertilisers, agriculture, quail rearing, calf rearing, poultry farming, biopesticides, causes and prevention of tuberculosis, etc. Some of the major training programmes were on SRI cultivation, cultivation practices of vegetables and fruit, marketing of agricultural produce, subsidies available, animal husbandry practices, reading and interpreting weather details for farming, health-related details, government schemes, etc. Totally, 110 men and 160 women have undergone such training. A weather station has been established at Karasanur village. An animator has been identified and trained to monitor the Mini Agro Weather Station. Farmers are showing keen interest in using the weather data for carrying out agricultural operations.

Capacity building of project stakeholders

Exposure visits: An exposure visit for 30 farmers was organised to Renganathapuram, Nainayarpalayam with support from the Agriculture Department to understand precision farming in onion / vegetables and to impart knowledge on drip irrigation.

Training: The community members were given training on technologies like SRI, INM, IPM, crops and vegetable cultivation practices, dairy farming, hybrid fodder production, SHG formation, etc. A total of 1586 training days have been utilised, of which women have undergone training for 680 days.

Convergence with line departments, research institutions, marketing and finance institutions

Rs. 1,43,800 has been obtained from the various government departments towards funds and schemes.. The BIWS Committee

has contributed Rs.65,100 in terms of wages for three years, the contribution in terms of land lease, building and electricity for three years has been Rs.1,80,500, while the contribution in terms of labour till date amounts to 556 days. Around Rs.45,000 was made available for SRI and *Muttlur* variety onion cultivation by farmers.

Sub Programme Area 402

Semi-Arid Regions

402.1 Kannivadi

Continued efforts in strengthening the two grass-root insitutions — Kulumai SHG Federation and Reddiyarchatram Sustainable Agriculture Producers Company Ltd (RSAPCOL) — focused on improving organisational management, especially internal control systems and management information systems. In both the institutions, business development services were promoted and streamlined. With regard to ecoenterprises, 3 new technologies were introduced and the activities and management of the enterprises were mainstreamed. Under community informatics, 4 new centres were started during the year. Annual planning and budgeting as well as management information systems for each of the activities have been designed and are regularly updated on a monthly basis by the respective groups.

Kulumai SHG Federation

Promotion of savings, credit and insurance products have become an integral part of the microfinance services provided by the Kulumai Federation. Here microfinance is seen as a means to mobilise and organise the community, and linkages are being established with other development institutions to impact livelihoods. Towards this, an integrated approach has been adopted to move forward from microfinance to livelihood promotion and strengthening by establishing the Kulumai Livelihood Promotion Cell as an independent arm of the Federation. It provides business development services for the enterprises / income generation initiatives taken up by the group members.

The current strength of the Federation is 180. During this period 32 new groups have been formed. The annual turnover of the Federation is Rs 3.46 crore with a repayment of around 95 per cent in functioning groups. Special efforts and strategies were planned to improve the repayment rate among 20 groups. The utilisation pattern of the credit to livelihood activities as seen last year has increased to 85 per cent, followed by education and health aspects. The six-month internal audit and controlling system and external audit for individual groups as well as for the Federation have been completed. During the current year, 1020 group members were linked to Jana Shree Bima Yojana cum Group Insurance Scheme as against 800 during the last year. Accounting systems have been streamlined and special software is regularly used for group level activities. It is planned to shift to digital records instead of registers which would help to save around 60 per cent of field staff time with the groups. The Annual General Body meeting was held in June 2009

and around 1250 members participated; the passing of annual accounts and the yearly plan was discussed. Apart from this, 12 executive committee meetings were held and 4 cluster meetings were organised.

Ecoenterprises for livelihood security: Kulumai has adopted ecoenterprise development as a means to ensure the move from microfinance to livelihoods, which is part of the pro-poor growth strategy. The experience of promoting ecoenterprises among the socially and economically disadvantaged sections of the community shows that it seems to be more effective when combining technology and finance with other business management services on a collective basis. With this in mind, the established ecoenterprises have been institutionalised within the Federation. Also, the newly formed Kulumai Livelihood Promotion Cell encourages more members to become entrepreneurs through providing services for business development apart from credit links. It has helped to streamline the enterprises and markets under the common brand of Kulumai. Guidelines and governance structures have been evolved collectively and implemented since June 2009. The accounts and management systems are internally audited on a quarterly basis and submitted to the Kulumai Federation.

As part of the diversification and upgrading process of existing ecoenterprises such as the production of biological products such as *Trichoderma viride*, *Pseudomonas fluorescens*, *Paecilomyces*, *Azosprillum* and *Phosphobacteria*, protocols for liquid culture is going on. Efforts to scale up the production in *Arbuscular mycorrhiza* (AM) and Trichogramma chilonis with improved technology were begun last year. During the year under review, production of uzifly parasitoid *Nesolynx thymus*, ladybird beetles (*Cryptolaemus* or *Scymnus*), a mealy bug predator and *Beaveria basiana*, a bio-pesticide, has been initiated and the production process has been refined. The Department of Sericulture has approved financial support to establish production of uzifly parasitoid and ladybird beetles. Two more women SHGs are being trained in the production of country chicken; the business plan has been prepared and they are in the process of establishing the unit.

Multiple marketing strategies have continued with a full-time staff and an intensive training and awareness programme among 1800 sericulture men and women farmers in Dindigul, Theni and Madurai district has been carried out with the support of the Department of Sericulture. During this reporting period, around 3800 farmers were directly reached and linkages were established with 28 input dealers in and around Dindigul district.

The production details of the various units are: 4200 kg of *T.viride* and 500 kg of *Paeciliomyces* (*Bionematicide)* by the Elayathendral group, 4000 kg of *Pseudomonas fluorescens* by the Durga group, 10000 kg of biofertilisers (5000 kg each of azosprillum and phosphobacteria) and 7000 kg of VAM produced by various groups using different strains. With reference to the handmade paper production unit, partnership with Kalangium Thozilagam Limited, Madurai

has been continued for marketing in addition to JK Cards, Madurai, for bulk purchase; last year's transaction was around Rs 5.2 lakh and 2010 labour days were generated. There were some problems with the silk reeling unit, with internal conflicts among members in managing the unit, but they have since been resolved and now the unit is functioning smoothly. Last year its turnover has been Rs 22 lakh and 2000 labour days were generated. The strengths and weaknesses of the commission agent-based kind of procurement on going in the current dairy enterprise was studied. Since dairy farming is a very common enterprise, the Kulumai group was requested to work with RSAPCOL members on a collective basis in order to reach a scale of performance. In this regard, discussions were held with a local dairy firm which has bulk cooling facilities. Seven training manuals have been developed in Tamil and it is planned to convert them into self-learning materials.

Reddiyarchatram Sustainable Agriculture Producers Company Limited

The Reddiyarchatram Seed Growers' Association has been strategically promoted as a farmers' producer company — the Reddiyarchatram Sustainable Agriculture Producers Company Limited (RSAPCOL). It was registered under Part IX A of the Companies' Act, 1956 (No 1 of 1956). The board of directors and a representative executive committee have been formed and so far 320 farmers comprising 22 farmer groups have joined as shareholders. The Company initiated input, financial and market services with an annual turnover of around Rs. 22 lakh. The systems for input and financial services are in place but there is need to strengthen the same for market and insurance services. Last year market services were initiated for maize, and based on the lessons learnt, it is planned to carry out such services for lemon, vegetables, coconut and milk this year. Group management and accounting systems were developed based on the common guidelines of the company. Efforts are underway to establish an input centre that will cater to the needs of the region by providing access to correct and quality inputs.

The learning materials with regard to 46 crops grown in this region, which had been developed earlier under the collaboration programme on lifelong learning with Arul Anandher College, have been looked at afresh. Ten of these have been converted into self-learning materials and the rest are being done. The market website has been redesigned as a web-based learning tool, which is under construction in the local language. The recently initiated newsletter based on selected themes of the open and distance learning course, including feedback from the readers, is being circulated to 2000 farmers; 200 farmers have been targeted to successfully complete the course. In addition, around 250 IKSL-Airtel Green SIM cards has been distributed for voice mail in partnership with Vidiyal, an NGO based in Theni district. In this regard, the company has developed 500 one-minute granules on agricultural themes for voice mail.

As for linkages to the government Agriculture Department and KVK, the RSAPCOL farmers play an active role in ATMA programmes

as president and members and so far they have mobilised around Rs 20 lakh worth of benefits.

Community informatics: RSGA manages the hub of the CLCs, which delivers locale-specific information on need basis. Regular need assessment among different sections of the community is now practised as a non-negotiable task. With the technical support of the Indian Meteorological Department, the Kannivadi Agromet is providing weather forecasts to six districts in Tamil Nadu. Self-reliability in terms of organisational and financial issues has been promoted as a core task among the CLCs. Village-specific income-generating strategies such as mobile-based services, electricity bill payment, etc., are coming up and efforts have been taken to improve the same. With regard to mobile phone top-ups and other services, a special tie up has been forged with Airtel. During the reporting period four new CLCs were started and now 11 centres function in this region. Base line survey and preliminary work has been done to establish four more centres in the region. Nearly 12488 members (around 54 per cent men and 46 per cent women) visited the CLCs during the year for various purposes, with the number of women slightly higher than last year. A total of 43,640 trainee days were organised during the year, covering 95 per cent women learners.

402.2 Pudukottai

The bio-industrial watershed programme is being implemented at Pudukottai since 2007 at Ennai and Thalinji panchayats of Illupur taluk. During the first two years of the programme, focus was on creating awareness and formation of activity- and need-based groups. Simultaneously, the programme also took up land-based activities like water harvesting structures, land and soil conservation through building check dams, undertaking summer ploughing, and creating recharge soft in rainfed areas, and promoting vegetation cover in the catchment areas. The dissemination of soil and water management techniques was also undertaken, which has helped in bringing additional area under cultivation. SRI drum seeder method was introduced in the project area. Since the inception of the project, the total water-spread area has increased by 32,000 m^2 and the corresponding increase in water harvesting capability is more than 32 million litres. The activities were carried out with the participation of the community, the engineering section of the government's Agriculture Department and Panchayat Raj institutions.

Land and water management

With some major interventions in terms of land and water management having been taken up in the last three years, **Table 4.1** captures the expansion of the water-spread area in that period.

The community-managed small-scale irrigation system (integrated percolation pond at Gounderkulam) was established in June 2008 with community participation and developed through the watershed development fund. An analysis of the impact of the intervention illustrates the improvement in various parameters, as seen in **Table 4.2**.

Table 4.1 ***Water-spread area of community-managed bio-industrial watershed***

Source	2007 – 2008 (m^2)	2008 – 2009 (m^2)	2009 – till date (m^2)
Community participation with MSSRF	-	5,000	8,400
Facilitated with Agricultural Department	4,050	9,450	2,450
NREGS	-	1,250	1,050
Water Users' Group	-	-	360
Total	**4,050**	**15,700**	**12,260**

Table 4.2 ***Water usage of integrated percolation pond***

Particulars	2007-08	2008-09
Net area cultivation (in acres)	29	29
Gross area cultivation (in acres)	29	33.75
Total labour absorption	1226	1476
Total production / acre (in Rs)	4,740	8,040
Net income for 29 acres (in Rs.)	1,21,225	1,82,466
Per acre net income (in Rs.)	4,180	5,406
Water-lifting detail (in hours)	1,408 / well	2,319 / well

Benchmark survey for water table: Geological survey was done at the three areas of intervention by the geologist from the engineering wing of the Agriculture Department. As a result of this survey, a community-managed open well could be dug. The Geological Department also identified the water point at Goundarkulam and an engineering plan has been prepared for well digging, masonry work, and installing a diesel engine, with budgets and measurement of land area for laying pipes and drip irrigation. A Dalit Women Farmers' Association was formed which was linked to banks for support.

Community participatory rehabilitation of rainfed tank: Based on the need assessment by the community, rehabilitation of Pommakulam was given top priority. The rehabilitation of the rainfed tank is to help improve livelihoods of marginal and small farmers and the landless. It is expected to have an overall positive impact on the immediate environment by augmented supply of irrigation water, better recharge of groundwater, increased production and productivity and enhanced employment opportunities. For rehabilitation, 4 water users' groups have been formed with an apex body in charge of administration. A watershed development fund has been initiated and through this a sum of Rs. 60,000 has been deposited at the Indian Overseas Bank, Illuppur.

The data from Pommakulam shows that there are 61 water users and the water-spread area is 21.50 acres; more than 98 per cent of the users hold less than an acre and more than 50 per cent of the users belong to the SC community. The tank rehabilitation has benefited the most disadvantaged class. By following the watershed guidelines prepared by the government, the community has contributed 15 per cent of the cost of the rehabilitation of the rainfed tank.

Microirrigation and pedal pumps: Effective irrigation and micro irrigation are essential for enhanced crop production. In this connection, micro irrigation training was conducted. Pedal pumps were introduced in 4 farmers' fields for lifting water for irrigation. The farmers generally spend an average of Rs. 3,500 for purchase of water in addition to the cost of labour days for irrigating water, hence such measures has helped them reduce expenses.

Check dam: As per the decision of the Pommakulam Water Users' Association, a check dam along with an inflow channel was constructed for controlling soil erosion and increasing water recharge, by facilitating with the engineering section of the Agriculture Department. This has increased the water-holding capacity and more water is available for farming.

Compartment bund: To put up compartmental bunds on land owned by SC families, 16 women farmers from the hamlet have been mobilised. In total, the women and their families own 20 acres of land. As of now, the Dalit Women Farmers' SHGs have been linked with a nationalised bank.

Community-managed integrated community pond: For enhancing the livelihoods of the residents as well as preventing floods in a Dalit colony of 23 families, the project facilitated the establishment of an earthen bund of 160 m length and 3 m width with the support of the panchayat and the engineering wing of the Agriculture Department. After excavation and formation of the bund, the water-spread area of the community pond is 1,600 m^2. The women have been mobilised into a SHG and have taken up cultivation of vegetables, fodder grass, annual *Moringa*, and pisiculture activities along with the management of the pond and the bund. The project has also facilitated the marketing of the produce from these enterprises.

Integrated farm ponds: Eight individual farm ponds were excavated between 2007 and 2009 in Thalinji and Ennai panchayats, with the assistance of the engineering wing of the Agriculture Department. This has resulted in a changed cropping pattern and has enhanced yield. Of the 8 farm ponds, 5 are integrated farm ponds that irrigate about 8 acres of rainfed paddy, harvesting approximately an average of one and half tonnes per acre. The ponds are also used to rear fish and vegetables, trees and fodder are cultivated on the bunds..

Soil management techniques

Summer ploughing: Summer ploughing is necessary to control weeds, pests and for soil moisture conservation and water infiltration,

but this needs rainfall. Due to decreased rainfall and fewer rainy days, only 45 farmers went in for summer ploughing on 52 acres.

Removal of Ipomea carnea: Thalinji Periyakulam is spread over a land extent of about 85 acres, of which more than 30 acres have been overgrown with *Ipomea carnea* (water spinach) for the last 10 years. This has lead to reduced water-storage capacity and changed water colour and quality, resulting in infestation of poisonous insects that affect the health of the villagers. Moreover, it is an inefficient fuel. In association with the Thalinji panchayat, the invasive species was removed through NREGS activities.

Vegetation development

Fallow land has been brought under cultivation to prevent soil erosion. Tree cultivation was introduced by aligning with the National Horticulture Mission, through which 22 acres were planted with about 900 mango saplings. In addition, to revive the landscape with native species like neem (*Azadirachta indica*), *eluppai (Madhuca indica), gulmohur (Delonix regia), pungam (Pongamia pinnata),* and *naval (Syzigium cuminii)*, 353 saplings were planted on community lands like tank bunds, bunds of community ponds, and school gardens. Fencing was done in Pommakulam by the National Social Service (NSS) students and Pommakulam Water Users' Association, while for the bund of the M.S. Swaminathan community pond, Thalinji, it was done partly by the panchayat and MSSRF, Illuppur site.

Introduction of new crops: During this year, we introduced Castro TNV -1, 2 trap crop for paddy cultivation, with 40 farmers taking it up as bund planting. Other crops introduced were Bhavanisagar blackgram perennial variety in addition KRH-2 paddy, T-9 blackgram and Vamban-3 blackgram.

Pulse cultivation: We have initiated mobilising and creating awareness among dry land farmers for pulse cultivation and wet land farmers for rice fallow pulse cultivation. Pulse cultivation and development of a pulse village are major objectives in enhancing livelihoods and the soil health of the area. Through the subsidy provided by the Agriculture Department for seeds, this year 76 farmers cultivated blackgram on 55 acres.

Systems of Rice Intensification

An Agricultural Well Water Users' Association with the support of the Agriculture Department (National Food Security Mission) has been facilitated to popularise SRI. Twenty farmers have joined in and have availed inputs worth Rs. 2 lakh at Rs.10, 000 per farmer. In addition, nearly 40 farmers have adopted the line sowing method of paddy cultivation in Thalinji panchayat for which paddy ADT-39 seed was procured from the Agriculture Department at a subsidised rate.

Bioindustrial initiatives as alternative livelihood source

Thirty-one women have accessed loans from the Indian Overseas Bank to start small dairy farms. This activity has been initiated to supplement the livelihood options of asset-less women. Forward and backward linkages have

been established for an integrated dairy model. Towards this, 5 animal health camps have been conducted with the assistance of the Veterinary Assistant Surgeon where 829 cows, 58 work bullocks, 586 goats, and 372 sheep have been vaccinated. Artificial insemination was also done for cows. In addition, the veterinarian gave advice and training regarding the diagnosis and treatment of common ailments of livestock. Backyard poultry and sheep rearing have been introduced. IFFCO Airtel SMS cards have been distributed to five women who own sheep to get advisories.

Cultivation and income details of the integrated percolation pond

Cultivation of buffalo grass (fodder) and vegetables as well as fish rearing, *azolla* production, etc., were taken up in the integrated percolation pond area. On the economic front last year, 98 kg of vegetables were produced and sold for Rs. 640, castor seeds were grown and sold for Rs. 520 and 26 kg fish were sold for Rs.1,500. The integrated percolation pond earned Rs. 2,660 during 2008-2009. However, due to lack of rainfall this year, it was not possible to go in for vegetable cultivation, but the water users planted tree species like neem, *jamun*, mango, silver oak, and *gmelina* and also went in for fish rearing.

This integrated percolation pond has also acted as a community fodder bank, as the periphery area has been planted with buffalo grass for grass carp feeding and the grass carp faecal matter used as feed for common carp. Till last year 15 women were collecting fodder grass once in two days. However, this year only 3.5 tonnes of fodder grass could be harvested.

Community Learning Centre

A Community Learning Centre (CLC) has been established at Thalinji panchayat to provide education on rural development for improving the income and quality of life of both farming and non-farming families. The Centre operates as a single window system and government departments have approached it for dissemination of their schemes. The user group break-up shows that from June 2009 to April 2010, more than 2,652 members have accessed CLC, of which 1294 were female and the rest male. It is noteworthy that more than 40 per cent of the women sought information related to health. CLC has collaborated with the Primary Health Centre for regular medical camps.

One of the main aims of the CLC Management Committee is that the Centre should provide basic computer knowledge to all sections of the community of both genders. Towards this, 34 students have been trained in basic computer applications.

Timely distribution of seeds is important for farmers and in this connection, CLC has facilitated with various line departments for procurement of seeds of paddy and blackgram in Thalinji and Kadvampatti which was provided at a subsidised rate by the Agriculture Department. CLC was able to organise the distribution of 800 kg ADT-39 paddy seeds (40 farmers over 35 acres) and 188 kg blackgram

seeds (64 farmers covering 30 acres) at a subsidised rate.

In addition, CLC also takes up other social activities like assisting drop-out students to continue their education, employment schemes, schemes for handicapped villagers, addition and deletion of PDS cards, and so on.

Adult education also is an important concern for CLC and in this regard, it has conducted a survey on literacy levels habitation-wise and households-wise. During this year CLC imparted basic literacy to 74 people of which 60 were women.

CLC has prepared 67 IEC materials on subjects such as computer training, adult education, agriculture, health-related issues, government schemes, etc.

Custom-hire facility for farm machinery and tools: The concept of custom hiring machinery has been introduced in Thalinji panchayat based on the CLC management committee's demand for equipment like drum seeders, sprayers and cono weeders for paddy cultivation. Two drum seeders, two cono weeders and two sprayers were purchased. The CLC committee has decided that animators will be in charge of hiring out the equipment to farmers and will take a 10 per cent commission from the total hiring charges. From November 2009 to April 2010, 294 persons have hired such equipment for their agricultural activities. Further, the CLC management committee has given a requisition for purchasing a power tiller and towards this a business plan has been prepared.

Thalinji panchayat pays the electricity bill and does not charge any rent for the CLC. Also the panchayat clerk takes the readings from the mini observatory in case the animator is unable to do so.

Capacity building of project stakeholders

To promote self-governed water users' associations, the community-managed small-scale irrigation water users' group deepened Vellaiappachikulam for agriculture and allied activities at an expenditure of Rs. 12,000. The area deepened was 360 sq.m, based on the water users' group's resolution. All the deepening activities were managed by the water users' group without any assistance from MSSRF, Illuppur.

Another milestone of the community-managed bio-industrial watershed has been the fencing of the integrated percolation pond at Gounderkulum. The Gounderkulam Water Users' Association approached us to install a wire mesh fencing at the integrated percolation pond at Gounderkulam with their contribution. With the fencing completed, the community has planted various fruit-bearing and forest trees for sustainable income and other benefits.

A three-day workshop in the regional language (Tamil) on 'Livelihoods Orientation', which included topics on livelihood aspects, business plans and value-chain analysis was organised for the two project sites in Tamil Nadu. The participants included both project staff and select community members who were able to have hands-on experience in business

plan preparations for their livelihood projects and also the preparation of a value-chain analysis.

Convergence with line departments, research institutions, marketing and finance institutions

Substantial outlays are available under several on-going programmes like the Rashtriya Krishi Vikas Yojana, National Horticulture Mission, National Food Security Mission, Mahatma Gandhi National Rural Employment Guarantee Scheme and National Rural Livelihood Mission. Funds from such schemes were used in the community-managed bio-industrial watersheds to the tune of Rs.28,37,053 during this year. The departments approached were the Agriculture Department and its engineering wing, Horticulture Department, Forest Department, Animal Husbandry, PRIs, etc., for inputs like crop seeds and tree saplings, support for check dams, community ponds, recharge softs , tank deepening, inflow channel cleaning, fencing and so on.

Sub Programme Area 403

Hill Regions

403.1 Thonimalai

The traditionally-managed coffee-based multi-tier cropping system in Thonimalai has been strengthened into a professionally-certified organic farming system. This has been achieved through adopting the group certification method, which is designed for small and marginal farmers. Internal and external inspections were carried out last year and certification was completed in 220 ha by IMO. The certification has been entered into a web-based traceability programme for organic products. Efforts continued to address productivity as well as quality aspects through-need based training and capacity-building programmes and establishing market linkages. Towards market services, an agreement has been signed with Lin Foodz, Chennai. Value-chain analysis has been carried out for coffee, lemon and pepper and initial assessment has been done for coffee processing in consultation with the Coffee Board, with a proposal completed and submitted for financial assistance. In order to strengthen soil and water conservation in this hilly terrain check dams and stone bunds have been built with the technical and financial support of the engineering section of the Agriculture Department.

Need-based training programmes to improve quality and productivity were continued and last year 1270 trainee days (360 for women and 910 for men) were completed. Training programmes addressed the themes of nutrient management (composting, biofertiliser application, use of *panchakavya* and biodynamic products) and non-pesticide-based integrated pest management for major pests (coffee berry borer, canker in lemon, root rot in pepper and stem weevil in banana). The recent evaluation study indicated that there has been a reduction in pest / disease infestations in coffee, lemon, pepper and banana.

In coffee, coffee berry borer *(Hypothenemus hampei)* is a notorious pest affecting total

productivity as well as quality of the seeds. A combination of agronomic as well as integrated pest management practices excluding chemicals, such as pruning, manual collection of affected berries, use of biological control agents (parasites and predators) and mechanical traps have been selected for the management of the pest. The pest infestation in the fruits before intervention in 2007 was 14.4 per cent in Thonimalai, 15.6 per cent in Pudur, 17.7 per cent in Pulayar colony. It came down to 1.9 per cent, 2.3 per cent and 6.4 per cent, respectively in 2009. Where it was not adopted the incidence continued to be at 14.8 per cent. Berry yield also improved from 1240 kg per plant with parchment value of 248 kg in 2006-07 to 1463 to 1628 kg per plant with parchment values of 292.60 to 325.60 kg in 2009. On an average, 309.50 kg of parchment is recorded in the demonstration plot as against 232 kg in the control plot, which is 77.5 kg higher than the untreated plot. It is mainly due to the reduction in the berry infection as well as more number of berries in branches.

Similarly, pseudo stem weevil *Odoiporus longicollis* (Curculionidae: Coleoptera) poses serious threat in banana. An integrated method of control measures was demonstrated, in which mechanically killing the insect with bait using the bark, following proper field sanitation measures, removing dried bark around the pseudo stem, applying biocontrol agents like *Beauveria* and *Paecilomyces* helped to control the further growth of the insects and its young ones: in Thonomalai from 75.6 per cent to 27.3 per cent, in Pudur from 83.4 per cent to 30.5 per cent and Pulayar colony from 68.6 per cent to 37.4 per cent. In control where no treatment was given, it increased from 76.6 per cent to 81.2 per cent. Also, the application of neem cake and stem injection of neem oil as pro-active protection strategies to arrest the pest damage were demonstrated.

In lemon, pruning and spraying of garlic extract were the control measures. The increase in the fruit yield over control varied from 5.85 per cent to 11.78 per cent across the demonstration sites. The highest yield increase was in Pudur. **Table 4.3** sets out the details.

In the case of pepper, application of *Trichoderma viride* and *Paecilomyces lilacinus* near the root zone after the first rain resulted in a reduction in the rate of infestation as shown in **Table 4.4**.

The experience shows that the rate of adoption of these technologies has ranged from 70-80

Table 4.3 ***Effect of pruning and garlic extract application on fruit yield of lemon***

Village	fruit yield per acre (kg) 2008 (April - June)	per cent increase over control	fruit yield per acre (kg) 2009 (April - June)	per cent increase over control
Thonimalai	1415	7.52	1480	8.74
Pudur	1550	17.78	1520	11.78
Pulayar colony	1378	4.71	1402	5.85
Control plot	1316	-	1365	-

Table 4.4 ***Effect of bioproducts on reducing incidence of quick wilt in pepper***

Village	per cent of trees affected by wilt in a field		per cent of reduction in wilt damage over control	
	June 08	June 09	June 08	June 09
Thonimalai	8.33	6.66	53.34	66.70
Pudur	7.46	6.04	58.23	69.68
Pulayar colony	8.96	7.48	49.83	62.45
Control plot	17.86	19.92	-	-

per cent among the participating farmers. The training methods and approach adopted as well as the selection of simple and cost-effective technologies helped in increasing their adoption. An exploratory survey has been carried out in the Adalur and Pandrimalai region to scale up the area under organic farming with the support and guidance of the Coffee Board, in which around 500 small and marginal farmers were identified.

The Village Knowledge Centres (VKC) in Thonimalai and Pulayar colony provide need-based information, especially market prices for primary agricultural produces and entitlement schemes, and also imparts functional literacy. The Thonimalai centre reached 95 per cent of the illiterates in the hamlet and facilitated around 2654 trainee days. During the year, 720 members accessed the centre for information, of which 72 per cent were related to market information. Of the users, 22 per cent were women and 88 per cent were men.

Stall-fed goat rearing was initiated in both the villages as a multiple livelihood initiative. Feed and disease management training was provided and members planted additional forage trees. Apiculture was stabilised in about 45 boxes and members harvest honey twice a year with an annual average of around 3.2 kg per beehive.

403.2 Koraput

The bio-industrial watershed programme in Koraput is being implemented in the Tolla watershed area comprising the villages of Tolla (revenue village), Bebartaguda, Kadamguda, Pukaguda, and Maliguda (coming under the Mohuli panchayat} and Bolliguda of Boipariguda block at a distance of 20 km from Jeypore town. The project is in the third year of its implementation. The total geographical area of the watershed has been 638.2 ha. With the inclusion of a new village Boliguda (coming under the Chandrapoda panchayat of Boipariguda block) which drains to the same watershed this year, the total geographical area has increased to 769 ha.

The BIWS programme has been successful in making considerable interventions in the watershed area with regard to the introduction of new crops, improved varieties, creation of new water sources for irrigation for *rabi* cultivation, formation of SHGs involving

mainly women, setting up of micro-enterprises like goat and sheep rearing, mushroom cultivation, vegetable cultivation, leaf plates making, provision of micro-irrigation systems like sprinklers, pump sets, liasioning with government departments for credit linkages, etc.

Land and water management

Two water-harvesting structures,(WHS) one at Tolla and the other at Bebartaguda, with a total command area of nearly 65 acres were put in place. The total capacity of Tolla WHS is 1,850 m^3 with a command area of 50 acres and that of Bebartaguda is 1,387.53 m^3 with a command area of 16 acres. The creation of water harvesting structures as irrigation sources has helped in cultivating the fallow areas lying downstream during the *rabi* season. The structures were provided with open surplus outlets, especially the one at Tolla village, with pipeline outlets of 550 m length and diversion slots to draw water as and when required. The construction of these water storage structures has brought nearly 65 acres under cultivation. They have remained as an assured source of irrigation during *rabi* and also as protective irrigation source during *kharif*. Besides increasing soil moisture regime in the command area, they have additionally been used for pisciculture by the water users' group.

To augment irrigation, two sets of sprinkler systems, two pump sets and two sets of irrigation pipes connected with sprinkler systems (104 pipes X 20ft length) were provided to two user groups at Tolla and Maliguda. The construction of a minor irrigation system to irrigate more than 100 acres in Malliguda was also facilitated. Further, we have sunk 23 wells to meet the water demands.

As part of land management, compartmental field bunding of nearly 27 acres was completed, thereby preventing soil erosion and, in turn, bringing uncultivated wasteland under cultivation in new areas. Staggered trenches were created on a few plots at the foothills to prevent gully formation as well as to conserve soil and moisture in the fields below. Afforestation to check soil erosion was undertaken by planting nearly 4,700 saplings of Simaruba (*Simaruba glauca*) across wastelands and as avenue plantations.

Field bunds: As upland and low land regions with harshly undulating topography is a marked feature of the watershed area, there is a high prevalence of soil erosion in the region, leading to the degradation of farmlands into wastelands. To overcome this, soil conservation measures through compartmental field bunds with turf were initially introduced in 4 acres of eroded farmland of a farmer whose land had remained fallow for long. After the intervention, the farmer was successfully able to cultivate *ragi* (finger millet) in 2 acres and niger, an oil seed crop, in the remaining 2 acres. The field bunds ran to a total length of 1995 running feet. The farmer was able to get a yield of 4.5 quintals of *ragi* and 215 kg of niger. Water for irrigation was tapped from the water-harvesting structure put up by the project. For construction of field

bunds, 50 per cent subsidy was provided from the project and the remaining cost was borne by the farmer himself.

Seeing the success of this farmer, other farmers in the region have shown keen interest to turn their fallow lands into cultivable lands with field bunds. This year field bunds have been raised in Tolla, Maliguda and Bebartaguda villages covering a total area of 27 acres.

Staggered trenching: Staggered trenches to reduce flow of surface run-off were introduced as soil conservation measures in Pukaguda village which has remained uncultivated for long. Staggered trenches of dimensions 20 ft in length, 3 ft in width and 3 ft in depth were dug in two rows with trenches in one row alternating with two trenches of the other row (staggered). Totally 7 trenches have been dug initially in eroded farmlands.

Summer ploughing: Summer ploughing is advantageous in retaining the moisture obtained through summer showers; it helps in increasing the permeability of soil by breaking the hard pans. It improves aeration in the soil thereby promoting soil microbes. Keeping these advantages in mind, summer ploughing of agricultural fields was carried out during 2009. A total of 158 acres were ploughed using both bullocks and tractors. The ploughs used were mainly country ploughs in the case of bullock ploughing and cultivators in the case of tractor ploughing.

Sprinkler systems: Sprinklers were provided to the farmers in the watershed area to enable them to use water judiciously during cultivation in the *rabi* season. Sprinklers were provided with 2 sets of lateral pipes (each set 1040 ft length) and 2 pump sets to two user groups.

Custom hiring of pump sets was carried out by the user group members wherein Rs.20 per hour was charged for members of the watershed committee and Rs.30 for other villagers. The group has taken a decision to utilise the amount for maintenance of the units.

Introduction of new varieties and crops

It is noteworthy that the introduction of improved varieties of millets has enabled farmers to register nearly 220 per cent increase in yield (480 kg yield compared to 150 kg from traditional varieties). This has helped in addressing the issues of food and nutritional security as millets remain one of the important cereals consumed by the households. Demonstration of SRI method of paddy cultivation, improved varieties of millets (*Nilanchal,* HR374, BR308) and introduction of maize (*Juari* variety) during *kharif* and blackgram during *rabi* in the watershed area has also helped the farmers.

Another case worth mentioning is the enhancement of mixed cultivation of vegetables in Maliguda, wherein 3-5 types of vegetables (leafy, radish, knolkhol, runner and bush beans, cabbage, and brinjal) are cultivated in single landholdings either as intercrops or in separate rows by best utilising the space between the rows and plants. This has helped the farmers

obtain a secure income through the sale of different vegetables just after one month of plantation till about six months, providing insulation from local market fluctuations. A model on 25 cents has been worked out which fetches an income of Rs. 26,200.

Introduction of new crops like maize, groundnut, blackgram, etc., have all facilitated farmers to attain more returns compared to their traditional crops. Earlier, groundnut had been introduced in the area and this year, the cultivation was increased to nearly 101 acres. Intercropping with the introduction of crops like millets with redgram and enhancement of mixed vegetable (4-5 crops) cultivation in Maliguda has helped in high crop intensification giving better returns from the unit area with vegetables like carrot, ginger, radish, runner beans, etc.

Testing SRI and line sowing

SRI was demonstrated in the project site during the *kharif* season of 2009 in 0.5 acres and a field trial was conducted in 1.5 acres.

The line sowing method facilitates better inter-cultural operation like weeding using the cono weeder and decreases the competition between plants, in turn leading to better yields. Weeds incorporated into the field help in enhancing soil nutrition through decomposition. The line sowing method was taught to the farmers in the watershed area under the Farmers' Field School programme. Line sowing was carried out for paddy, maize and vegetables in our watershed region, with 4 acres under paddy, 11 acres under maize and 80 acres under vegetables taken in during *kharif* and *rabi*.

Technology diffusion

A mini agro-meteorological station has been installed at our campus to collect data on meteorological information like maximum and minimum temperatures, relative humidity, rainfall and wind velocity which are analysed and disseminated to the farmers.

Bio-industrial initiatives as alternative livelihood sources

Towards enhancing livelihood options, interest-free loans were arranged from the Community Bank, MSSRF, Chennai, for setting up goat and sheep rearing enterprises in Maliguda and Bebartaguda, through which members of the community bought 74 animals. We have also initiated micro-enterprises like leaf-plate making and mushroom cultivation for SHGs. Training on microfinance for SHG functionaries, organic pesticide preparation, pickle making as a means for value-addition and poultry farming, goat and sheep rearing have been imparted comprising 378 trainee days.

State-level advisory and local advisory meetings

The District Advisory Committee meeting was held in the month of October in which the Collector also participated, who extended support to the work done by MSSRF.

Capacity building of project stakeholders

The community from the watershed sites have been trained on micro finance as the majority

of the farmers are small and marginal and credit facilities are difficult. Exposure visits to PRAYAS to observe the various livelihood activities that the community can take up were organised. A three-day workshop was held in November 2009 to introduce and highlight to all the participants the importance of integrating community participation, gender and livelihoods into the watershed project sites.

Convergence with line departments, research institutions, marketing and finance institutions

Apart from watershed-related activities, infrastructural improvement of the villages are also important and towards this, we have assisted in the construction of bridges and other infrastructure facilities at Tolla and Bebartaguda, including laying of a road to Bebartaguda by liasioning with the village panchayats. Departments and Missions like the Spice Board, National Horticulture Mission, Forest Department, Agriculture Department, QUAT, Tribal Welfare Department were approached and Rs.125,13,811 has been leveraged, which apart from items like vermicompost pits, fruit saplings, avenue and forest trees, mini seed kits, planting material of spices, vegetables, horticultural and floricultural varieties also includes major infrastructural development of the villages. The community has contributed Rs. 18,172 while credit facility for the SHGs has been to the tune of Rs.2,18,000.

Sub Programme Area 404

Land-Lab-Land Linkages

The Integrated Pest Management (IPM) and the Integrated Nutrient Management (INM) labs provide support for ecotechnology development by identification, demystification and adoption of ecofriendly technologies (biological software, viz., biofertilisers, biocontrol agents, etc.) in the farmers' fields. They also conduct soil testing to analyse the nutrient status of the soil and maintain soil health cards for the farmers under the bioindustrial watershed programme. Details of the INM lab can be found under PA 301 (SPA 305) and the details of the IPM lab are reported below.

The work carried out during the year in the IPM laboratory was on the biological control of *Aphis craccivora* and *Maconellicoccus hirsutus* using PGPRs, namely, *Azospirillum, Phosphobacteria* and *Pseudomonas*. The compatibility between *Trichogramma achaea* and *Trichogramma japonicum* was evaluated and it was also attempted to identify a moderately pesticide tolerant strain of *Trichogramma chilonis.* Preliminary screening rhizobacteria against *Helicoverpa armigera* had resulted in the identification of some efficient strains with insecticidal activity.

Mass multiplication of biologicals (egg parasitoid, predators and entomopathogens) and mushroom spawn is being continued. Training programmes on pest management

were conducted. Field trials using liquid formulations of plant growth promoting rhizobacteria (PGPR) were conducted in the Biocentre. Pest surveillance in *Morinda citrifolia and Morinda pubescens* in the west coast of Kerala and Karnataka was documented. The physical, chemical and biological properties of soil from different bio-industrial watershed sites were analysed and soil health cards are maintained based on the data. The microbial potential, viz., total microbial population and soil dehydrogenase activity, was studied.

Biological control of different stages of Aphis craccivora and Maconellicoccus hirsutus using Azospirillum, Phosphobacteria and Pseudomonas

Effect of *Pseudomonas* on *A. craccivora* and *M. hirsutus*: *Pseudomonas* grown in nutrient broth (NB) and Kings medium (KB) was tested on *A. craccivora* and *M. hirsutus* using four different concentrations — 1×10^3, 1×10^4, 1×10^5 and 1×10^6 cells / ml. Distilled water, neem (0.06 per cent) and Cypermethrin (0.01 per cent) served as controls. The percent mortality and the nymphal length (in mm) for every 24 hours until 96 hours of incubation were recorded in all the treatments. In *A. craccivora*, the highest nymphal mortality (63.33 per cent) was observed at the end of the 96th hour of incubation in 1×10^4 cells / ml concentration treatments and least (0.56 mm) nymphal length was recorded in 1×10^4 cells / ml of *Pseudomonas* treatment. In *M. hirsutus*, highest mortality (80 per cent) was observed at the end of the 96th hour of incubation at 1×10^4 cells / ml concentration. The least mean nymphal length of 0.05 mm was recorded in neem followed by 0.33 mm at 1×10^5 cells / ml of *Pseudomonas*.

Effect of *Phosphobacteria* on *A. craccivora and M. hirsutus*: Phosphobacteria grown in two different mediums, Pikovskaya's medium (PKM) and NB and four different concentrations — 1×10^3, 1×10^4, 1×10^5 and 1×10^6 cells / ml — was tested on the above mentioned insects. In *A. craccivora* highest mortality of 40 per cent was observed at the 96th hour of incubation in the concentration of 1×10^5 cells / ml and least (30 per cent) in 1×10^4 cells / ml and the least nymphal length (0.75 mm) was recorded in 1×10^6 cells / ml. The highest mortality (66.66 per cent) and least mean nymphal length (0.47 mm) of *M. hirsutus* was recorded at the 96th hour of treatment with 1×10^5 cells / ml of the phosphobacteria. In all the treatments, phosphobacteria grown in NB exhibited enhanced activity compared to the Pikovskaya's medium.

Effect of *Azospirillum* on *A. craccivora and M. hirsutus*: *Azospirillum* was grown in *Azospirillum* specific medium and NB and the following treatments with 1×10^3, 1×10^4, 1×10^5 and 1×10^6 cells / ml were tested on *A. craccivora* and *M. hirsutus* till the 96th hour. In *A. craccivora*, the highest mean mortality rate (30 per cent) and the least nymphal length (1 mm) was recorded in 1×10^6 cells / ml treatments. Whereas in *M. hirsutus* at the end of the 96th hour, the highest mean mortality rate of 50 per cent in 1×10^5 cells / ml and lowest mean mortality rate of 36.67 per cent in 1×10^3 cells / ml was observed. The neem treatment

at 0.06 per cent concentration recorded a maximum mean mortality of 90 per cent.

Mass multiplication of biopesticides

The multiplication of three species of *Trichogramma — T. chilonis, T. japonicum* and *T. achaea* — was continued and supplied to the field sites when required. 550 cc of *Corcyra* and 325 cc of *Trichogramma* have been multiplied during this year; 125 cc of *Corcyra* and 70 cc of *Trichogramma* have been sent to Kannivadi. The promising entomopathogens, viz., *Beauveria bassiana, Metarhizium anisopliae, Verticillium lecanii, Nomureae rileyi* and *Paecilomyces lilacinus*, were also mass produced and sent to the fields to manage a wide range of insect pests. In addition, larval parasitoids *Bracon hebetor* and *Goniozus nephantidis* were mass multiplied and four batches of more than 5000 adults per batch were sent to the farmers' fields at Kannivadi for demonstration of the management of coconut black-headed caterpillar.

Compatibility between T. achaea and T. japonicum

The compatability between *T. achaea* and *T. japonicum* for 5 generations were assessed with the following treatments: T1- *T. achaea* (female) x *T. japonicum* (male); T2- *T. achaea* (male) x *T. japonicum* (female); C1- *T. achaea* (male) x *T. achaea* (female) and C2- *T. japonicum* (male) x *T. japonicum* (female). Consistent improvement in the indicative fecundity and progeny production in the successive generations were observed. Between the two treatments, 30.3 per cent fecundity was noticed in inter-specific cross, whereas in controls it showed 27.6 per cent fecundity. In the case of adult emergence, it was found at 15.6 per cent in inter-specific cross, which was on par with control (15.2 per cent).

Effect of nutrition source on 5th generation progenies

Both males and females fed with honey (10 per cent) exhibited more fecundity (16.44 per cent) than adults provided with water alone (10.88 per cent). Similarly, the adult emergence was high (8.0 per cent) in adults provided with honey (10 per cent) compared to those provided with water.

Tolerance of Trichogramma chilonis to different pesticides

An experiment was conducted to test the tolerance level of *T. chilonis* to different concentrations of Cypermethrin (0.05 per cent , 0.06 per cent , 0.07 per cent and 0.08 per cent concentrations), Endosulfan (0.08 per cent, 0.09 per cent, 0.10 per cent and 0.11 per cent concentrations), Malathion (0.21 per cent , 0.22 per cent, 0.23 per cent and 0.24 per cent concentrations), Chlorpyriphos (0.25 per cent , 0.26 per cent, 0.27 per cent and 0.28 per cent concentrations) and Neem Plus (0.29 per cent, 0.30 per cent, 0.31 per cent and 0.32 per cent concentrations) for 6 generations. It was found that *T. chilonis* was moderately tolerant to Cypermethrin (0.06 per cent) and Endosulfan (0.08 per cent) after six generations. Malathion and Chlorpyriphos

caused a delay in parasitisation and had no adult emergence, proving incompatibility with *Trichogramma*. In contrast, Neem Plus increased the parasitisation compared to the other treatments.

Laboratory bioassay to test the insecticidal activity against Helicoverpa Armigera using soil-isolated bacteria

Seventy-five Rhizobacteria isolated from the paddy soil of Puducherry, Villupuram and Dharmapuri were tested for their insecticidal activity on *H. armigera*. Among them, four strains (MSSRFS8, MSSRFS9, MSSRFS11 and MSSRFS20) showed insecticidal activity against *H. armigera*. The percentage larval mortality ranged from 53.3 to 63.3 percent. Total protein and the protein profile were determined by SDS PAGE of the bacteria-treated and untreated *H. armigera* larvae. The total protein in haemolymph showed variation among the treated and untreated samples. The total soluble protein was highest (6.35 mg / ml) in MSSRFS20 treated *H. armigera* when compared to untreated (3.89 mg / ml). The SDS protein profile showed the absence of a 25 kDa in the haemolymph treated with the two strains MSSRFS8 and MSSRFS11 compared to the control. The effect of the bacterial treatment on the gut epithelial cells was studied and it exhibited physiological disruption with aberration in the epithelial cell which was normal in untreated insects. Identification of these bacterial strains using a polyphasic approach is under process.

Surveillance of insect pests of Morinda citrifolia L. and Morinda pubescens in the west coast of Kerala and Karnataka

The pest surveillance in two species of *Morinda — M. citrifolia* and *M. pubescens* — was studied in 6 districts of the coastal belt of Kerala and 5 districts of Karnataka. Seventeen visits were made from February 2009 to March 2010. Pest surveillance in natural vegetation as well as farms was carried out during the summer, rainy and winter seasons. Kasargod, Kannur and Alapuzha were visited twice, while Kozhikode, Ernakulam and Thrissur were visited once. Mandya, Hassan, Bengaluru, Mysore and Kolar (farms) districts in Karnataka was visited once. Overall results proved that plants in the natural habitat are less susceptible to pests, whereas those found in the farms are more susceptible to insect attack. The major pests recorded were Membracid bugs, *Leptocentrus tarus,* white fly, *Dialeurodes kirkaldyi,* green plant bug, *Nezara viridula,* leaf folder, *Cnaphalocrosis medinalis,* unidentified stem girdler, Sphinx moth, *Macroglossum gyrans.* black fly, *Aleurocanthus woglumi, Psara obscuralis, Dolycoris indicus, Coreid* bug, *Cletus sp,* short-horned grasshopper, *Orthacris maindroni*, *Phaneroptera gracilis,* green hopper, *Flata ocellata, Hylamorpha hyala, Heliothrips* sp., Noni scale, unidentified cicada and Eriophyid mites.

The natural enemies and pollinators present were weaver ants, *Oecophylla smaragdina* predatory bug, *Alcaeorrhynchus grandis* ladybird beetle, *Cheilomenes sexmaculatus*, valley carpenter bee, *Xylocopa varipuncta* and unidentified mantis.

Training and capacity building

Ninety trainee days have been completed during the period on various aspects related to plant protection. In-depth training to women and men on IPM and ecofriendly management of pests and diseases in plantation crops at Thonimalai was organised. Training on management of secondary pest infestation in *Corcyra* production at Dharmathupatti was continued. In addition, training on good laboratory practices was imparted for 40 women SHG members involved in ecoenterprise organised at Dharmathupatti.

Field testing of the liquid formulation of Azospirillum, Phosphobacteria and Pseudomonas in SRI

A demonstration trial was conducted at the Biocentre, Puducherry, during the late *samba* season (February-May 2009) using SRI method of rice cultivation to test the performance of liquid biofertilisers against carrier-based formulations and chemical fertilisers. The liquid formulations of the biofertilisers, *Azospirillum*, *Phosphobacteria* and *Pseudomonas* were standardised in the laboratory using cell protectants. The colony forming units (CFU) and the shelf life in the formulations were tested in laboratory conditions; the shelf life was maintained up to 3 months with 10^8 fu / ml in the liquid formulation whereas in the control (without cell protectants) the CFU was maintained only up to 10^3. The nutrient status of the soil was evaluated by estimating the different soil parameters, viz., pH, EC, organic carbon, available NPK and exchangeable cations. Soil was analysed initially before ploughing and at 15-day intervals for each treatment up to 60 days. Rice CV ADT 37 was selected for the trial and a half-cent nursery was raised using 2 kg of seeds and transplantation was done after 15 days. The field trial was carried out in 400 m^2 with 12m^2 / plot. The 11 treatments included were: T1-*Azospirillum*; T2-*Phosphobacteria*; T3-*Pseudomonas*; T4-*Azospirillum*+ *Phosphobacteria*; T5-*Phosphobacteria*+*Pseudomonas*; T6-*Pseudomonas*+*Azospirillum*; T7-*Azospirillum*+*Phosphobacteria*+*Pseudomonas*; T8- *Azospirillum*+*Phosphobacteria*+*Pseudomonas* (carrier), T9-chemical fertiliser application based on soil analysis; T10-farmer's practice and T11-chemical fertiliser+25 per cent of *Azospirillum*+*Phosphobacteria*+*Pseudomonas*. Initially, the seed treatment was given with 150 ml of suspension of *Azospirillum / Pseudo* and made up to 1 litre. The seeds were soaked in the bacterial suspension overnight, filtered and sown. Four applications of the liquid and the carrier formulations were given as seed treatment, root dipping and soil application at 15-day intervals at 0.25 litre / acre were mixed with one litre of water and given as soil drenching.

The results showed that the number of tillers was highest (19.40 numbers) in T11 followed by T9 and T10. Similar was the trend in case of root length and shoot length, whereas the plant height was highest (116.0 cm)

in T9 as against least (96.6 cm) in carrier-based biofertilisers. The number of healthy grains was highest (197.73 numbers) in T9 as against the least (149.3 numbers) in T4; the grain yield was high (49.0 g) yield in T11 which is in correspondence to the high number of productive tillers and the long root length. The overall trend was that there was a steady increase in the nutrient status and overall improvement after 60 days of treatment compared to the rest of the treatments. The organic carbon was high (1.20) in T1 and least (0.81) in T11 on the 60th day. The available nitrogen after 60 days was highest (88.2 kg / acre) in T5 and least (56.0 kg / acre) in T3. The available phosphorus after 60 days was highest (58.9 kg / acre) in T8 and least (33.0 kg / acre) in T3. The highest (84.0 kg / acre) available potassium content was recorded in T10 as against least (47.7 kg / acre) in T5. The qualitative indicators such as good crop stand and less pest incidence in plots treated with liquid formulations than in chemical fertilisers confirmed the fact that liquid formulations are better in improving the quantity and quality of the crop yield. Though the results were not concrete in this trial, this would be confirmed by subsequent trials.

Soil analysis and soil health card

Crop production depends on a well balanced nutrient status and need-based application of fertilisers to attain the expected maximum yield. Hence soil health cards have been developed and maintained to record the nutrient status of the soil annually, based on which the fertiliser recommendations were made (Puducherry and Pudukottai). The recommendation for the fertiliser's application was based on the results of the soil-testing and up-to-date agronomic research on the crop. In all, 505 samples from Puducherry, Pudukottai, Jeypore, Nagapattinam and other sites have been tested for pH, electrical conductivity, major nutrients, exchangeable cations and microbial load. Physical properties like soil type, bulk density, particle density and water-holding capacity were also tested. In general, the available N content was low (42.0-138.6 kg / acre) in soil samples collected from the three sites, Puducherry, Pudukottai and Jeypore; P was found to be low-medium (2.6-54.7 kg / acre) and K was medium to high (38.0-390.0 kg / acre). The NPK status of the three sites was the same as observed last year. Organic carbon was normal in Puducherry and Pudukottai soil samples, while it was high in Jeypore. The status of organic carbon observed last year was similar in Puducherry and Jeypore and was low in Pudukottai. 12-25 per cent of Pudukottai soil samples are acidic, 45 per cent neutral and 33 per cent alkaline. Invariably all the samples from Puducherry were alkaline while in Jeypore, it was acidic. The farmers were given advisories based on the results. The microbial load in Pudukottai samples was 30-125 colonies at 10^{-3} dilution on NA after 24 hours. The soil dehydrogenase was 0.3-3.7 µg / g of soil.

Sub Programme Area 405

Climate Change and Bioenergy Initiatives

Vulnerability assessment (V&A) and enhancing adaptive capacity to climate change in semi-arid regions of India

The V&A Programme implemented by MSSRF along with partner agencies entered into its final and consolidation phase during this period. The participatory research and knowledge management systems adopted under this programme during the past five years provided many useful insights for policies and strategies towards developing climate-resilient farming and livelihood systems, specifically in the semi-arid context.

For the V&A study, Rajasthan and Andhra Pradesh were chosen for developing climate change adaptation measures. The districts chosen were Udaipur in Rajasthan and Mehabubnagar in Andhra Pradesh. The approach adopted was to bring about a blend of traditional wisdom and modern science through farmer participatory research. A variety of interventions were undertaken related to agriculture, water and rural energy. Best local adaptation practices were identified and fine-tuned and re-introduced with local community participation. Based on the field learnings, the following five case studies have been documented.

- **Water conservation and sustainable and equitable use**: Families in the desert regions of Rajasthan have long experience in harvesting every drop of rainwater and using it economically and efficiently both for domestic and agricultural use. The traditional methods were reinforced with modern scientific knowledge, like the gravity-flow method of water management and revival of strategically located wells along the stream, resulting in improved irrigation water use efficiency. The water-based interventions resulted in increase in area under irrigation during the *rabi* season by 31 per cent, from 18 acres in baseline year of 2006-2007 to more than 23 acres in 2007-2008. This significant increase was realised in spite of much lower levels of annual rainfall in 2007-2008, as compared to 2006 (in 2006, 1158 mm of rainfall was recorded for Jadhol block; in 2007 and 2008 it was only 556 mm and 626.9 mm, respectively).
- **Promotion of fodder security**: Livestock and livelihoods are intimately related in arid and semi-arid areas. The ownership of livestock is also more egalitarian. The sustainable management of common property resources, particularly pasture land, is essential for ensuring fodder security. Therefore, high priority was given to the regeneration of pasture land and the equitable use of grazing land. It can be established that the intervention contributed to a significant improvement of the livelihood situation of the families. Earlier, farmers had to purchase additional fodder from outside during summer

seasons when degraded lands were dried out, but after the intervention this situation improved. In 2008, the number of bundles from 5.5 ha of joint pasture land undertaken by the local community went up to 2460 as compared to 2100 in 2007 because of the protection and soil and water conservation measures, vegetative fencing, etc.

- **More crop per drop of water**: In areas where water for irrigation is the constraint, it is important that agronomic techniques which can help to increase yield and income per drop of water are standardised and popularised. One such method introduced under this project is the System of Rice Intensification (SRI). SRI was popularised in Andhra Pradesh, since this system of water and crop management helps to reduce irrigation water requirement by 30 to 40 percent. This method thus helps to avoid the unsustainable exploitation of the aquifer. More than 70 per cent of the farmers of the project villages in Andhra Pradesh adopted SRI. It was demonstrated that the amount of water required for irrigation was significantly lower under SRI than under the conventional method. Under SRI, approximately 40 irrigations of 2 pumping hours per acre were sufficient over the entire *rabi* growing season, whereas under the conventional method approximately 60 irrigations of 2.7 pumping hours were needed. Taking into account different discharge rates of farmers' pumping systems, it was calculated that on average, 1608 m^3 of water were required for irrigation of one acre of land under SRI, compared to 2500 m^3 under the conventional method of rice cultivation. Hence, 35 per cent of irrigation water could be saved through SRI adoption in the project areas of Kothur and Srirangapur villages in the Mehabubnagar district of Andhra Pradesh.

- **Weather information and climate literacy**: What farmers need is location-specific meteorological information at the right time and place. Generic weather data will have to be converted into location-specific meteorological advice. For this purpose, mini agro-meteorological stations managed by the local community were established. The study clearly shows a marginal increase, about 13 per cent (which brought an additional income of Rs.11,600) in the productivity of wheat crop for small farmers who have practised weather-based farming (experimental) as compared to small farmers (control unit) who had not used the services of the agro-met stations. This has helped to impart climate literacy related to food, water and livelihood security.

- **Strengthening community institutions**: Effective implementation of adaptation measures will need active group cooperation and community participation. Steps were taken to involve the grass-root democratic institutions like panchayats and gram sabhas. Also, Smart Farmers Clubs were organised to give the power of scale in water harvesting, soil health management and other adaptation measures undertaken by

farmers with small holdings. A preliminary conclusion to be drawn from the V&A experience is that formal committees of farmers have great potential for enhancing the adaptive capacity of communities. They can provide a forum for the exchange of knowledge and experiences, and also an entity that absorbs information, e.g., on weather projections and on best farming practices.

The above interventions were supported by training, skill development, education and social mobilisation. A training manual was prepared by MSSRF for training one woman and one male member of every panchayat as Climate Risk Managers. Such local-level Climate Risk Managers are well trained in the art and science of managing weather abnormalities. The present project has highlighted the need for location-specific adaptation measures and for participatory research and knowledge management. The V&A interventions have also highlighted the need for mainstreaming gender considerations in all areas. Women will suffer more from climate change, since they have been traditionally in charge of collecting water, fodder and fuel wood, and have been shouldering the responsibility for farm animal care and post-harvest technology.

The last five years have been an extremely rewarding learning period. The results and experience have shed light on the way forward. It is clear that to promote location-specific and farmer-centric adaptation measures, India will need a Climate Risk Management Research and Extension Centre at each of the 127 agro-ecological regions in the country. Such centres should prepare Drought, Flood and Good Weather Codes what can help to minimise the adverse impact of abnormal weather and to maximise the benefits of favourable monsoons and temperature. Risk surveillance and early warning should be the other responsibilities of such centres. Thus the V&A programme has laid the foundation for a climate-resilient agriculture movement in India. The importance of such a movement will be obvious considering the fact that 60 per cent of India's population of 1.1 billion depend upon agriculture for their livelihood. In addition, India has to produce food and feed for over 1.1 billion humans and over a billion farm animals. Scaling up the findings of the current project is therefore the pathway for a sustainable food, water and livelihood security system in rural India.

Policy innovation systems for clean energy security (PISCES) project

PISCES – Policy Innovation Systems for Clean Energy Security – a DFID-sponsored research programme, which seeks to redefine policies and principles that governments in developing regions can apply to enhance the role of bioenergy in delivering energy access and diversifying livelihood options for the rural poor, entered the second year.

During this phase 4 case studies have been identified across the country to understand how bioenergy-centered programmes have helped in enhancing local livelihoods and in

reducing emissions in a given context. One of the chosen case studies is an electric power project at Malwa, the Punjab, which has had a 7.5 MW capacity biomass-based IPP since April 2005 — the first of its kind in the Punjab — at village Gulabewala in Mukatsar district and another similar plant of 8 MW capacity since February 2009 at village Gadadhob in Abohar tehsil of Ferozepur district. Both the plants are using a variety of available biomass fuels, some of which have never been used earlier. Cotton stalks are the primary biomass that has been used as the feedstock. The specific study objectives related to this particular case study are to determine the factors that decide current energy vulnerability in relation to the livelihood of the region, the capacities of the rural community and the power plant to combat energy vulnerability,and the role of the power plant in livelihood diversification to reduce energy vulnerability. Secondary data collection has been completed and field visits to the villages around the Malwa power plant are going on to get a firsthand understanding of the operational issues and the efficacy of the venture in terms of reduction in emission and improvement in the quality of life of the local communities. Three other projects have been selected in Andhra Pradesh, Karnataka, and Uttarkhand. Also, health aspects related to indoor pollution of cooking stoves is being studied in selected areas in collaboration with local partner institutions. Two publications — one on the status of the fuel wood situation and the other on the bioenergy profile of India — have been brought out during this year.

In the coming year it is planned to quantify the emission profiles of the case study projects to gain a better understanding of the choice of bioenergy feed stocks and processes. The energy-livelihood nexus will also be scrutinised more intensively in the chosen case study projects to gain insights that would help construct good policies. A policy working group has been created and the first meeting is scheduled to take place in October 2010.

Strengthening the capacity for policy research on mainstreaming adaptation to climate change in the agriculture and water sectors

This project — to strengthen the capacity for policy research on mainstreaming adaptation to climate change in the agriculture and water sectors — funded by the Asia Pacific Network (APN) Japan, is a three-year research project (2009-2012) in collaboration with the Institute for Environment & Development (LESTARI) Universiti Kebangsaan Malaysia, Institute of Meteorology & Hydrology, Vietnam and Institute of Global Environment Strategy, Japan. The main objectives of the project are

- to assess technical, institutional and regulatory barriers to integrating climate change adaptation concerns at both policy and operational levels and to propose counter measures
- to develop metrics for monitoring the progress in mainstreaming adaptation in sectoral policies and operations

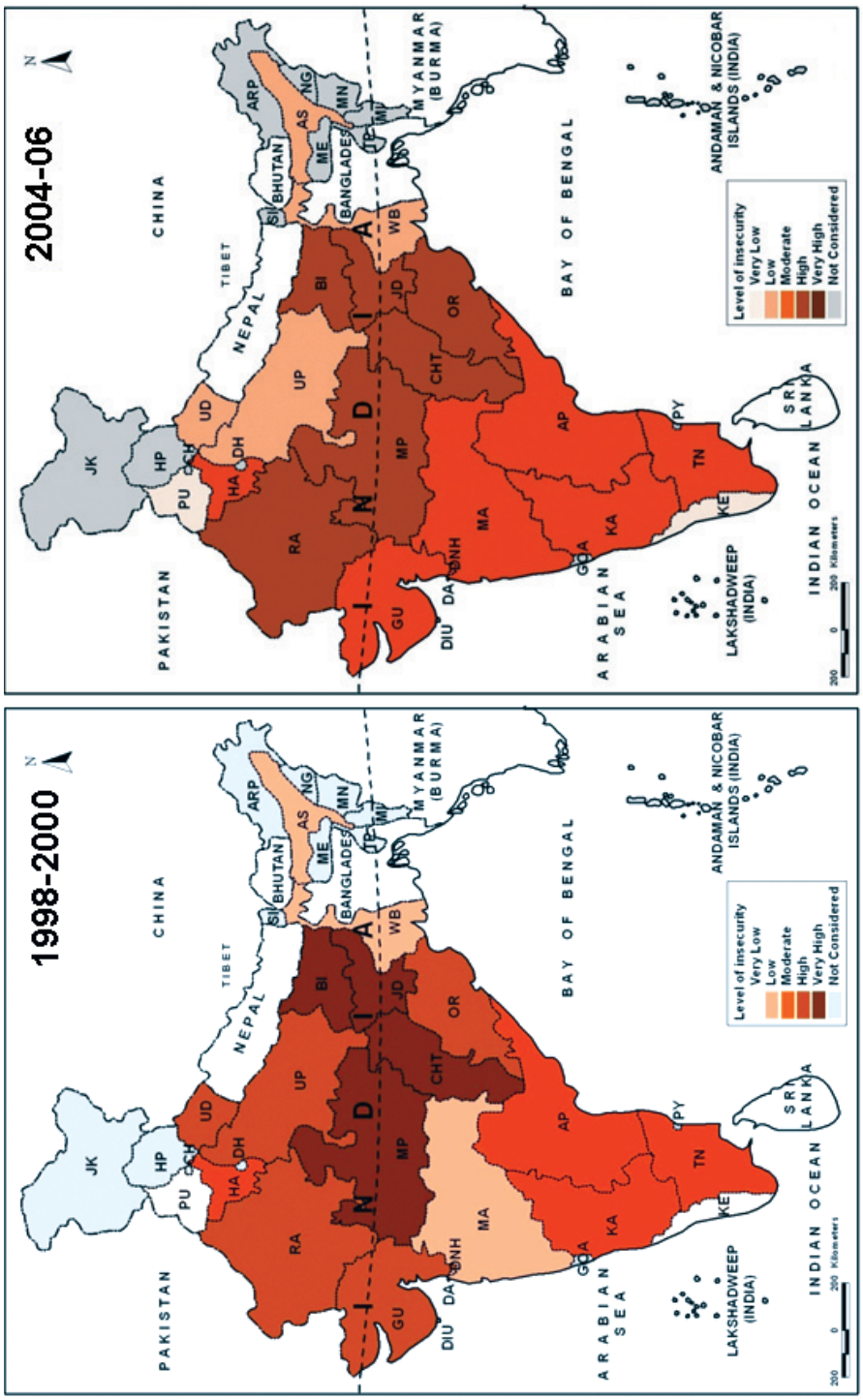
- to identify characteristics of selected policies that will enhance adaptive capacity
- to disseminate project outcomes to a wider audience and enhance knowledge on adaptation in Asia through policy dialogues

In the first phase, where the primary activity is to gather secondary data, literature surveys on various national and State policies pertaining to climate change, water and agriculture have been take up. The work on developing a framework for identification of primary and secondary barriers is in progress.

Programme Area 500

FOOD SECURITY

Mahila Kisan Sashakthikaran Pariyojana, a programme initiated by MSSRF to empower women farmers in the Vidarbha region, has gained national level recognition. The Government of India announced the launch of a scheme by the same name in the 2010 Union Budget to address the specific needs of women farmers and has allocated Rs.100 crore for the same. Two publications, one on the status of food security and the other on large-scale feeding programmes, have been prepared and will be published in 2010. In Odisha, MSSRF has been recognised as a resource organisation to impart training on community grain bank management.



Food Insecurity in Urban India

Programme Area 500

Food Security

The Food Security Programme Area has been engaged in research, advocacy, field-based interventions, training, and awareness-creation relating to food security issues under the aegis of the B. V. Rao Centre for Sustainable Food Security and the Ford Foundation Chair for Women and Sustainable Food Security.

Sub Programme Area 501

Research and Advocacy

501.1 Report on the State of Food Insecurity in Urban India

The *Report on the State of Food Insecurity in Urban India* has been under preparation over the reporting year, with support from the United Nation's World Food Programme (UNWFP). This Report will be published and formally released in 2010. The thrust of the Report is in developing an index of urban food insecurity for India as a whole as well as for 15 major States. Eleven indicators have been identified for comparison of performance across the States. These are:

- Percentage of urban population consuming less than 1890 Kcal per consumer unit per day
- Number per 1000 of urban male workers not "regularly employed"
- Number per 1000 of urban female workers not "regularly employed"
- Percentage of urban households without access to safe drinking water
- Percentage of urban households without access to toilets
- Percentage of ever-married women (15-49 years) with any anaemia
- Percentage of ever-married women (15-49 years) with chronic energy deficiency (CED)
- Percentage of children (6-35 months) with any anaemia
- Percentage of children (6-35 months) who are stunted
- Percentage of children (6-35 months) who are underweight for age
- Percentage of children (6-35 months) who are wasting

Using 8 or 9 of the 11 indicators at a time, six variants of a composite index of food and nutrition insecurity in urban India has been obtained and one of these variants has been chosen as the preferred variant. The rankings of the States have been worked out for two time periods, 1998–2000 and 2004–2006. The map obtained using the eight indicators between the two time points for the preferred variant is given below.

The report argues that while there has been an improvement between 1998-2000 and 2004-06 in the food security situation in urban India, as measured by any of the six variants of the

composite index, it has been only modest and has also not been commensurate with the rate of economic growth that has occurred over the period. The Report concludes that the problem of urban food insecurity continues to remain a massive challenge in India and offers some policy recommendations to promote urban food security in the country.

501.2 Study of large-scale feeding programmes and their linkages with small farmers

An exploratory study was undertaken to investigate the possibility of linking small and marginal farmers directly to large-scale public feeding programmes for market access. The feeding programmes studied were the Mid-Day Meal Scheme (MDMS), the Integrated Child Development Services (ICDS) and a supplementary feeding programme run by an NGO. Feeding operations in Government hospitals, hostels and prisons were also studied. The research questions that were asked were:

- Would it be economically advantageous for farmers to be linked with the programme?
- Would there be sufficient demand for food materials at the local level and would there be capacity for local supply?
- How would such a linkage influence policy and implementation issues?

The study was carried out in 36 villages in Andhra Pradesh, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu and West Bengal.

There was sufficient demand for foodgrains throughout the year in rural areas in all the six States to warrant a group of farmers, in theory, to undertake supply to MDMS and ICDS, even though no cooked meal was served in the ICDS programmes in Andhra and Madhya Pradesh at the time of the study. While rice and wheat were supplied in kind to the centres in all the States, cash was provided for local purchase of other supplies. The cash support varied from State to State depending on the number of items to be purchased, though in all of them it was found to be inadequate to provide a balanced meal according to the norms prescribed. This applied equally to other public institutions such as hospitals, hostels and prisons. Private industrial canteens proved to be viable propositions for market linkage for farmers.

Besides economic viability to farmers, there are several policy implications to be considered in linking farmers directly to local feeding programmes. At present, for running its feeding programmes, the government purchases paddy directly from the farmers through its procurement centres at a minimum support price. The question arises as to why a localised, decentralised method of purchase should be attempted at all. The procurement centres are present only in limited areas and a majority of small and marginal farmers with limited production capacities may not find it economically feasible to transport the grains to these centres. Hence linking farmers directly

to the programmes at the village level seems more sensible.

On the other hand, insofar as each State has its own agricultural policies and programme-implementation strategies, the issue of linkage has to be considered in a diversity of situations. Another aspect is that the issue of linkage should be seen in the context of the macro-agrarian scenario. The NGO that ran a massive feeding programme in rural Andhra Pradesh, though providing competitive rates to its suppliers, reported the lack of local supply of millet due to drought conditions and overexploitation of groundwater. Marketing support and linkages to farmers have to be integrated with overall stimulation for agricultural development and facilities for storage of grains locally.

Both general and State-specific recommendations included an increase in the financial allocation for local purchase of food materials in the large-scale feeding programmes across the States, particularly for MDMS and ICDS, and enhancement of marketing support to farmers for a number of crops. A federation of small and marginal farmers at the local level would be a useful strategy to promote marketing. Local procurement of foodgrains has to be stepped up through setting up of more procurement centres. Storage facilities for farmers have to be created in villages where groups of small and marginal farmers can store surplus grain for marketing.

501.3 Activities of the Ford Foundation Chair for Women and Sustainable Food Security

The mandate of the Ford Foundation Chair is to undertake research work related to concerns of women in attaining equitable access to various issues such as food and drinking water, livelihoods, resources and healthcare, and to disseminate the results through publications and presentations of papers.

Women Farmers' Entitlement and Empowerment Bill

With increasing feminisation of agriculture as well as the marginalisation of women farmers, MSSRF decided to moot a Women Farmers' Entitlement and Empowerment Bill to be tabled in Parliament as a Private Member's Bill by our Chairman, Professor M. S. Swaminathan, who is also a Member of Parliament. The Ford Chair was involved in coordinating this exercise. It was proposed to develop the features of the Bill through a series of consultations with participants drawn from various disciplines, with voices from the field, from different parts of the country and from different groups, and facing different kinds of problems being represented.

The first consultation was held on 29 January 2010. The participants consisted of lawyers, economists, policy makers, non-governmental and bilateral organisations. The discussion highlighted the fact that there had to be a clear definition of *women farmers*. Though the National Policy of Farmers — which in

principle applied equally to men and women — included all categories such as cultivators, consumers and those owning livestock, there needed to be a more specific definition of women farmers to make the law more inclusive and applicable. The aim and scope of the Bill had to be clearly spelt out to make it both mandatory and enabling. Since women's access to land was limited to family inheritance or transfer through government policies, there had to be an enabling mechanism to help them hold ownership and control over land. The issue of land and water had to be taken together. Credit and marketing services had to be extended to make the land productive. There had to be an institutional framework for the law to benefit both the individual woman as well as women's cooperatives. Maternity entitlements to address the special needs of women in agriculture for childcare services had to be considered at two levels: first, wage compensation through cash assistance during the period of childbirth and the subsequent period of lactation and second, for childcare support after resuming work. Accountability and feedback mechanisms in implementing the scheme had to be ensured.

The second consultation held on 12 February 2010 dealt comprehensively with the issue of the definition of women farmers and it was decided not to enumerate this too much but to stick to broader definitions. The interests of the landless as well as group rights had to be considered. Since 90 per cent of ownership of land was individually held under family cultivation and acquired through inheritance, it was here that women's individual rights became important. Many of the existing schemes/orders for distribution of all waste and surplus government lands to women have not been implemented. It was felt that group access can be increased through measures such as group leases only to women, restrictions placed on sale of usufructory rights to CPR and prioritising women's groups for access to markets, credit, technology and inputs. The needs of single women needed special consideration. Sub-marginal holdings redesignated as homestead lands, intended for intense cultivation and preservation of biodiversity, should be solely in the names of women. Since the emphasis on land rights for women was in order to secure access to other resources, an alternative pathway would be to delink ownership from access to resources, preferably without going through the legislative process. With regard to water rights, women needed the rights both for domestic and agricultural purposes. Other suggestions were the need for recognising women's knowledge of seeds and seed management practices and protection of IPR, and ensuring mechanisms to include women in decision-making roles on this aspect. Assuring mobility for women for market access through subsidised transport and provision of a Bioresource Centre in each area to guide women's groups in activities like value addition, seeds, etc., would be other types of support. All tools, implements and machinery in future should be 'women friendly'.

The third consultative meeting held on 17 April 2010 drew varied inputs on the current situation and problems of women farmers and possible solutions. The weak position of women in the north-east of the country

with regard to decision making as well as the absence of representation for women in either elected or traditional bodies in tribal areas was highlighted. In matrilineal societies, though property held in the name of women was inherited by the youngest daughter, the management of lands and properties is done wholly and solely by the senior men of the family. For land rights as well as problems related to farming and livelihoods, ranging from credit, water and inputs to marketing, storage and value addition, group activity and group farming was the only possible solution for a majority of poor women farmers, because most of them were either landless or had very small holdings. Hence, it was important for empowerment to be focused primarily on groups to benefit the majority.

It was decided that an effort should be made to come out with a draft bill on women's rights to have access to, and control over, all assets needed for agriculture, especially land. A small group consisting of two lawyers and other interested members from the consultations was requested to take up the task of drafting the bill. The aim was to produce a draft which would be circulated to a larger group for comments before the next session of Parliament.

Research study on maternity entitlement

A research study was jointly undertaken by MSSRF, Public Health Resource Network and Tamil Nadu Forum for Creche and Childcare Services to analyse the current implementation of the Dr Muthulakshmi Reddy Maternity Assistance Scheme (DMMAS) in Tamil Nadu. This pioneering scheme provides Rs. 6000 for nutritional support to women during pregnancy and compensation for wages during delivery. The study to identify its processes, problems and outcomes included both rural and urban areas of Dharmapuri and Kanchipuram and covered 207 mothers. In-depth interviews were conducted with 32 village health nurses and 33 ICDS workers from both districts. Data has been analysed and the preliminary draft report is under preparation.

501.4 Studies on the technological dimension of the agricultural crisis

In the reporting year, two publications have emerged from the research study, *Designing Rural Technology Delivery Systems for Mitigating Agricultural Distress*: one pertaining to Wardha district in Maharashtra and the other to Anantapur district in Andhra Pradesh. The study has identified the key factors that have contributed to agricultural distress in these districts and has offered some recommendations to tackle them. Though the nature of the problems varied across the two districts, they broadly related to the following issues: poor soil health, high levels of soil erosion, inadequate water conservation measures, non-availability of good quality seeds and bio-inputs, and insufficient and ineffective agricultural extension services. The publications have been well received and translations into Marathi and Telugu are being undertaken.

As a sequel to the study on Wardha district, the important exercise of drawing up an agricultural plan for the district is currently ongoing. The attempt is to prepare a comprehensive

agricultural plan for a scalable and sustainable model of agricultural development. Ideally, a district agricultural plan should incorporate the agricultural plans of all village panchayats in the district. However, considering resource and time constraints, the attempt here is to develop a district agricultural plan using the case study of one gram panchayat. These studies are funded by the Office of the Principal Scientific Adviser to the Government of India.

501.5 Household-level food security issues, Kolli Hills

A household survey to understand various aspects of food security is being carried out in all the 188 households of Navakkadu village in Bail Nadu panchayat, Kolli hills. The methodology involves household surveys, interviews with key informants and village level enquiries. While the focus of the study would be to capture the status of food consumption, aspects relating to food availability, drinking water and sanitation will also be considered. Analysing the results will throw up appropriate interventions towards food security.

Sub Programme Area 502

Field-based Interventions

502.1 Odisha

Community grain banks

The 10 grain banks and 12 self-help groups promoted earlier under different projects in ten villages in Koraput district and 1 grain bank in Kalahandi district are monitored and reviewed periodically to strengthen their management system and functioning. In the villages of Boliguda, Gunthaguda and Nuaguda in Koraput district, our focus has continued to be on capacity building of the management committees, facilitating them regularly on different aspects to manage the transaction process from the grain banks and to solve related problems. A series of village-level capacity building programmes was organised to strengthen the management committee members. Joint review meetings were organised twice with members from the management committees of these villages to review the progress and management aspects of the grain banks. In these meetings the member households also participated and discussed general problems related to the management and functioning of the grain banks. Month-wise loan and repayment status from the grain banks are being monitored for every commodity separately using a standard format. . Awareness programmes are conducted on scientific grain storage at the household level combining indigenous knowledge with modern methods. In each grain bank, monthly meetings are organised by the management committee to discuss the following points: grain stock, loans transacted by the members, management of excess grain stock, performance of the management committee, cooperation of the general body members in management, maintenance of the storehouse, etc. Across all 10 grain banks, rules and regulations were reviewed and revised to make their functioning more flexible, convenient and member-friendly.

Some of the salient activities carried out by the grain banks in Boliguda, Nuaguda and Gunthaguda include the following:

- 15 households in Boliguda village joined as new members in the grain bank with a contribution of 1 kg per member, taking the total number of member households to 60.
- Each member household of Gunthaguda grain bank contributed 10 kg of paddy as annual contribution to the bank to enhance the grain stock.
- 100 kg of *ragi* from the excess stock at the grain bank was sold for Rs.1000/- and deposited in the village development fund.
- The Gunthaguda grain bank supported one of its member households whose house was gutted by fire with 20 kg of rice.
- Each member household of Nuaguda grain bank contributed 2 kg of paddy to enhance the stock as per the decision in the general body. This bank supported a household with 10 kg of rice when the head of the family expired at a young age.
- 376 kg of paddy was loaned from the grain bank to conduct a religious festival at the village temple, which was duly returned.
- In Nuaguda, construction of an extension store room (15 ft. x 10 ft.) was completed and is being utilised for grain storage. One of the grain bank members donated the land for this purpose and the member households contributed labour towards construction.
- 161 member households have benefited in all the 3 villages.

In Boliguda, Nuaguda and Gunthaguda, village development funds, managed by the concerned village development committees, are being raised through members' contributions, sale of excess grain from grain banks, interest on loans, community farming, etc. In Gunthaguda village, each household contributes Rs.2 towards the village development fund, which now stands at Rs. 7000. In Nuaguda village, the fund is raised through various sources and now amounts to Rs. 1,00,000. In Boliguda village, the development fund is to the tune of Rs.4000. The funds are also used by the members to cater to their personal needs, with a minimal interest being fixed with relevant rules and regulations.

A one-day workshop was organised for the community grain bank management committee members from 10 grain banks established in the Jeypore tract. The objectives of the workshop were to review functioning and management of the grain banks, sharing of experiences / benefits / learnings among the management committee members, preparation of an action plan to convert all the grain banks into a gene-seed-grain bank continuum, etc.

Awareness creation programmes on entitlement schemes continued at the village level and follow up action was taken up in three villages.

Health and nutrition security initiatives

Two nutrition security initiatives — infant and young child feeding practices (IYCF)

and introduction of nutrition concerns in the existing home gardens — initiated during the previous year in the three villages of Boliguda, Gunthaguda and Nuaguda were continued. An external evaluation of IYCF was undertaken by a local agency PRAYAS in the three villages to know the impact of the intervention. The results of the evaluation suggested that all mothers reported having initiated breastfeeding within the first hour of birth. Most of them were aware that complementary feeding should begin after six months. Most mothers said that they needed support in preventing and managing childhood illnesses.

However, a majority of the children continued to be undernourished. A child diet survey conducted in the villages suggested that the differences in the nutritional status of well-nourished and malnourished children were due to differences in feeding frequency and in the quantity of food ingested. MSSRF began growth monitoring in the three intervention villages to help mothers understand that monthly weighing of children and the use of the growth chart would be useful tools in seeing how children grow. It was decided to undertake this programme since ICDS was present in only one village and even here it was inadequate and irregular in monitoring the growth of children. 68 children between 0-3 years age group were registered under this programme, which continued for 14 months till mothers started demanding that ICDS undertake growth monitoring on a regular basis. In each village, one day — the mother-child day — was devoted to record the growth and morbidity profile as well as food intake of each child in the previous month and to discuss improvements in the nutritional status.

Health committees were formed in the three project villages to monitor health and nutrition security aspects. The committees consisted of both male and female members: Nuaguda – 4 female + 1 male; Gunthaguda – 3 female + 2 male; Boliguda – 4 female + 2 male. The committee members were helped to put forth their demands to the concerned government departments for entitlement schemes on food and nutrition meant for mothers and children. The committee members were taken on an exposure visit to Dongaria Charitable Trust at Narsapur, Hyderabad, where they had an opportunity to see the various health and nutrition activities undertaken by the Trust under its health and nutrition programme.

A two-day residential workshop was organised for the health committee members on complementary feeding practices for children 6 months to 3 years old, with focus on appropriate feeding practices based on the availability of local food and culture. The participants in the workshop were taught to divide complementary feeding into four stages (6-9 months, 9-12 months, 1-2 years and 2-3 years) and to prepare and disseminate suggestions for each stage in local languages and local songs.

The health committee members counselled the mothers on adopting appropriate feeding practices for their undernourished children. Demonstrations on preparation of cereal-pulses combination (3 parts of cereal and 1 part

of pulse) were organised. Regular village level programmes were held to create awareness on food and nutrition, health care for pregnant and lactating mothers, hygiene and sanitation, childcare, breast feeding and complementary feeding practices, immunisation for pregnant mothers and children, and nutrition for mothers and children as well as on entitlement schemes for food.

Kitchen gardens and cultivation of cereals and pulses

A one-year study of existing kitchen gardens and their contribution to household nutrition security was carried out in the villages of Boliguda, Gunthaguda and Nuaguda. Data was collected from 147 households on a monthly basis on types of crops grown, number of harvests, yield and utilisation of the produce. Three workshops were also conducted jointly with men and women from the community to understand about management and maintenance of home gardens. Some of the findings from the study were:

- Generally, 31 varieties of crops were cultivated in the kitchen gardens throughout the year.
- Maximum numbers of vegetables (22 varieties) were available during winter and the least number in summer.
- 18 types of vegetables were grown in the summer season; however the choice of vegetables varied from village to village and from household to household.
- Papaya was harvested by a maximum number of households in Boliguda and Nuaguda villages.
- About 19 varieties of vegetables were harvested in monsoon season and the common varieties were brinjal, bitter gourd, papaya, kunduri and pumpkin.
- Cultivation of fruits and green leafy vegetables was comparatively not that much.

A one-day residential workshop was organised to sensitise farmers on the contribution of vegetables in maintaining household nutrition security and their importance for children and pregnant and lactating mothers. In addition, managerial aspects, gendered division of labour in maintenance, sharing of economic benefits, nutrition literacy, and planning for a nutrition garden were also points of discussion. Micro level in-depth studies have been initiated and data is being collected from fifteen households on aspects such as area of cultivation, number of plants in the garden, varieties of plants, gender division of labour, method of cultivation adopted, sources of advice for optimum yield, total production and its utilisation.

Village level training programmes on the topic “Package of practices for vegetable cultivation and management of kitchen gardens” were organised to train farmers. These activities have stimulated farmers to grow a combination of green leafy vegetables, roots, tubers and other vegetables without any external support. Seedlings of *Dioscorea* were provided to

households in two villages. Each household was given 5 seedlings, covering 30 households in Nuaguda and 40 in Gunthaguda.

A model kitchen garden has been established at the Biju Patnaik Medicinal Plants Garden and Research Centre, Jeypore, with 18 varieties of plants including 6 types of green leafy vegetables, 3 types of root vegetables, 7 types of other vegetables and 2 types of fruit-bearing plants. 200 farmers were given orientation during the year. Taxonomic characters of 86 wild food species used by the tribes were documented. The *ex situ* conservation garden of 68 forest food plant species (11 herbs, 13 shrubs, 29 tree species and 15 climbers) in the campus was monitored regularly.

As part of the preservation of existing landraces, regular and timely technical support was given to the farmers to cultivate greengram, finger millet and horsegram **in** their fields. In three villages, around 50 acres of land were cultivated by 55 farmers. They now have their own seeds and some have also availed loans from the seed bank.

502.2 Maharashtra

***Mahila Kisan Sashakthikaran Pariyojana* (Women Farmers' Empowerment Initiative), Vidarbha**

A two-day camp was held at Sewagram in January 2010 under the aegis of the Mahila Kisan Sashakthikaran Pariyojana (MKSP) for the members of the Mahila Kisan Samitis in which about 180 women from 37 Samitis participated. The camp was inaugurated by Ms. Leena Bansod, Project Director, DRDA, Wardha district and Mr. Vijay Jawandhiya. A booklet titled *Kasturi* comprising of inspirational songs in Marathi was printed and released during the camp. This booklet was greatly appreciated by the Samiti members. The objective of the camp was to create awareness on sustainable agricultural practices, on issues relating to food and nutrition security and on measures to reduce drudgery for women. Importantly, the camp created an opportunity for the Samiti members to express their needs and expectations as well as to chart out a road map for development of their Samitis in future.

The capacity building of the Samitis is in progress in the following areas:

- Organisational capacity building on Samiti operation and management (12 camps were organised in which 184 women farmers participated).
- Exposure to, and training in, sustainable agricultural practices
- Legal literacy on rights, governance issues, rights under Panchayati Raj (allocation of 10 per cent funds for women, representation in panchayat sub-committees like those for health, education and water), awareness about RTI, NREGS, issues of health and sanitation.

This is being done through a series of workshops.

As regards capacity building of women farmers on various elements of sustainable agricultural

practices, nutritional and health issues and legal literacy, the following initiatives were taken up:

- *Demonstrations*: 16 demonstrations in 8 villages on bio-pesticide preparation; 12 demonstrations in 4 villages on preparation of integrated fertiliser (a mixture of organic and inorganic fertilisers); 35 demonstrations in 15 villages on methods of seed selection and treatment. Further, 36 soil samples were collected in 12 villages.
- *Contour bunding*: Following the training in April 2009, contour bunding was completed on the fields of 10 women farmers from 7 villages, covering 35 ½ acres. One farmer from village Talegaon Talatule reported a yield of six quintals of soyabean on half an acre, even after erratic rainfall and pest attacks, which he attributed to the effectiveness of contour bunding.
- *Promotion of local varieties*: 30 women farmers sowed 40 kg seeds of *samridhi jowar* in 40 acres, with seed provided by an organic farmer. 30 Women farmers sowed 23 kg of shubhra cotton seed in 16 acres, with seed provided by local NGO Dharamitra. 56 women farmers cultivated mixed cropping with the main and cash crops like cotton, soya, *toor*, *moong*, *urad*, sesame, turmeric, *motichura*, etc. in 56 acres, the seeds being provided by NGO BAIF. Promotion of local varieties helped in reducing cost of cultivation and mixed cropping promoted consumption of a variety of items. This was done in Wardha, Deoli and Hinganghat taluks of Wardha district and Ralegaon taluk in Yavatmal district.
- *Kitchen gardens*: 80 women farmers have kitchen gardens in their backyards as a result of an orientation provided to them through NGO Dharamitra. Women farmers grew a wide range of vegetables and this helped their families' consumption levels.
- *Awareness camps*: Four camps were organised to create awareness on issues regarding Panchayati Raj in which 180 women participated.
- *Blood tests*: Blood tests were carried out for 406 women during camps that were held in collaboration with the Department of Health of the Government of Maharashtra. Doctors discussed the blood test results with the women and gave appropriate advice. Six such camps were held.
- *Eye check-up*: 12 camps were organised, in collaboration with our colleagues from Informatics, in which 699 patients were screened.
- *International Women's Day*: On International Women's Day, three events were organised in which 120 women farmers participated.
- *Van Bhojan* (Collective lunch in the field): 3 events were organised in which 76 women farmers participated.
- *Exposure trips*: 4 trips were organised to provide exposure on organic farming, vermicomposting, horticulture, micro watershed, etc. 63 women farmers participated in these trips.

In 2009-2010, 27 Mahila Kisan Samitis have been formed in the Wardha and Yavatmal districts of Vidarbha.

Other activities of MKSP:

- *Cotton seed production*: Seed plots were promoted among farmers for production of seeds of NH44 cotton. The parent lines of the NH44, namely, female parent BNBt, and male parent AC738, were supplied by CICR. Initially 11 women farmers took up seed production in 5 ½ acres under the technical guidance of CICR, Nagpur. But due to erratic rain and non-availability of labour, 6 farmers discontinued their efforts.
- *NSS camp*: A week-long NSS camp for students of Kumbhalkar College of Social Work, Wardha, was held in village Talegaon Talatule. It was organised in collaboration with the Mahila Kisan Samiti of the village. 45 students camped in the village. The activities undertaken included cattle vaccination (200) and blood tests for women (115).
- *Cattle vaccination*: 6 camps were held in 6 villages in which 1275 cattle (720 cows, 360 bulls and 195 buffaloes) were vaccinated for foot & mouth disease and black quarter. The camps were organised in collaboration with the Department of Animal Husbandry, Government of Maharashtra.

Educational support programme for children from families affected by suicides of farmers

105 children from 59 families in Wardha and Ralegaon (in Yavatmal district) are being supported under the ongoing educational support programme. Of the 105 children, 24 per cent are at the primary level, 26 per cent at middle school, 28 per cent at secondary level and 22 per cent at higher secondary classes. Three girls, who completed class X with good performance have enrolled in nursing courses in Pune and Nagpur, while one boy got admission to the B.E. course at Bapurao Deshmukh College of Engineering, Sewagram.

A four-day residential exposure visit for children from neighbouring villages studying in classes 7 to 9 was held in November 2009 at the district headquarters, Wardha, under this programme. 27 children (15 boys and 12 girls) actively participated. 25 local families hosted their stay. During the exposure visit, children were taken to important institutions such as Gandhi Ashram, Sewagram, Vinoba

Table 5.1 ***Class profile of children***

	Primary School		Middle School		High School		Higher Secondary		Total
	M	F	M	F	M	F	M	F	
Wardha	5	4	6	7	15	7	10	9	63
Ralegaon	12	6	8	5	5	2	3	1	42
Total	17	10	14	12	20	9	13	10	105

Ashram, Pavnar, Gandhi Vichar Parishad and Centre of Science for Villages. They also visited religious sites such as the mosque, the,church, the gurdwara, the Jain mandir, the Baudha Vihar and the Laxminarayan mandir where they interacted with the various religious heads. This trip helped the children in many ways and enhanced their confidence. The exposure visit was conducted in collaboration with Gandhi Vichar Parishad, Wardha.

Five bicycles received as donations from well-wishers were given to 5 children studying in classes 8-10. A girl student who was supported under our educational programme is being funded for a nursing course by a well-wisher from Ralegaon.

502.3 Tamil Nadu

Household entitlement card, Kolli Hills

An entitlement card pertaining to food, nutrition and health-related schemes of the Government of Tamil Nadu was prepared by the Food Security team in January 2009. The card contains information on eligibility criteria, documents required at the time of application and the department that is responsible for operationalising the schemes. A census was undertaken during September–October 2009 in Sirukampalathi, a tribal village in Kolli Hills comprising 47 households, to identify the level of awareness on existing government schemes. Analysis of this data set showed that though awareness of the major food delivery schemes like PDS, ICDS and MDMS was reasonably good, other schemes like the midday meals for old age pensioners and special provision of foodgrains to destitutes (like Annapoorna schemes) were not widely known and utilised. As a follow up, a series of awareness campaigns was organised for effective utilisation of the existing schemes.

Sub Programme Area 503

Training and Capacity Building

- MSSRF was identified by the World Food Programme (WFP) as resource organisation to impart training on Community Grain Bank Management to members of women self-help groups (WSHG) in seven backward districts of Odisha — Koraput, Rayagada, Gajapati, Kalahandi, Nabarangpur, Malkanagiri and Kandhamal — where WFP has extended grain support to promote grain banks through WSHGs. 321 women were trained on various aspects of grain bank management.
- A State-level workshop was organised to disseminate information about the grain bank models established by MSSRF in the Koraput region and also to discuss the replication of the models in the Koraput-Bolangir-Kalahandi (KBK) region. 37 NGOs representing KBK districts, WFP, Orissa Tribal Empowerment and Livelihood Programme (OTELP), Food Supply and Consumer Welfare Departments of the government, PRI members and management committee members participated. Grain support to

promote grain banks in Koraput district was assured by the Food Supply department, under the central revised scheme.

- A three-day residential workshop was organised in October 2010 at Sewagram by the Food Security team, Wardha, to provide orientation on gender issues to 29 participants representing 8 NGOs.
- A one-day consultation was organised at Ralegaon in Yavatmal district by the Food Security team, Wardha, in which 15 NGOs participated. The objective was to explore avenues for working together.

Programme Area 600

INFORMATION, EDUCATION AND COMMUNICATION

Jamsetji Tata National Virtual Academy (NVA) has been reaching out to millions of farmers and fisherfolk through two mobile applications, namely, Fisher Friend Mobile Application and IKSL-AirTel Green SIM card programme. Twenty-six INCOIS Electronic Display Boards were set up in Tamil Nadu and Andhra Pradesh. The 6th NVA Fellows convocation, the 6th GGA convention, the Intel Learn Programme certificate distribution function, as well as several conferences and workshops, were organised. The Training School has conducted a number of capacity-building programmes to the staff of different ICT-models. The Hindu Media Resource Centre organised several public forums, millennium lectures, press interactions, seminars/lectures, etc. The "Every Child a Scientist" programme covered two zones of Chennai and conducted a Science Fest Competition and summer classes. Web-based Open Archives of MSSRF has been set up.

Glimpses of ICT activities for development

Programme Area 600

Information, Education and Communication

The Jamsetji Tata National Virtual Academy (NVA) programme is intended to bring together experts and grass-roots-level communities in two-way communication with the objective of making knowledge accessible to every home and hut and to build a cadre of capable **Transformational Leaders** in rural India. NVA carries out these activities through four wings: Informatics (Research & Development) Division, Village Resource Centres (VRCs) and Village Knowledge Centres (VKCs), Training School and Outreach, Extension and Partnership.

This year NVA focused more deeply on bringing out several publications, disseminating locale-specific demand-driven information through mobiles and electronic display boards with GPRS facility as well as SMS alerts, conducting several need-based capacity-building programmes for NVA staff and those of other ICT-models, applying for and getting projects from government agencies, building a cadre of grass-roots social workers, strengthening networking and partnership with different stakeholders regarding content and capacity building, implementing programme reviewers' suggestions, developing a road map for the Training School, and developing participatory sustainability plans for VKCs, among other activities.

Sub Programme Area 601

Jamsetji Tata National Virtual Academy (NVA)

Since 1992, the M.S. Swaminathan Research Foundation (MSSRF) has been setting up and managing Village Resource Centres (VRCs) and Village Knowledge Centres (VKCs). The Jamsetji Tata National Virtual Academy for Rural Prosperity (NVA), established in 2003, is the umbrella organisation for the ICT-enabled development activities of MSSRF, including VRCs and VKCs. NVA mainly provides need-based, locale-specific, demand-driven information content (both dynamic and static) based on collection of secondary data and a well-planned need assessment. It has also been conducting training and awareness programmes and establishing linkages with several leading institutions / organisations for translating the content into field-based applications.

The VRCs are connected through ISRO uplink / downlink satellite for video conferencing among rural communities from different and even distant regions, communicating with experts, sharing data from one VRC to another, conducting tele-ophthalmology, etc.

VRCs and VKCs use a number of communication tools such as notice boards, flash cards, CDs, GSM / wired / wireless-based public address systems, mobile phones — text-based menu, icon-based menu, audio and SMS — VSAT-

based video conferencing, fixed wireless group audio conferencing, mobile vans, etc.

NVA has also developed expertise in setting up other dissemination modes such as electronic notice boards with GSM, GSM / wired / wireless-based public address systems, fixed wireless group audio conferencing within selected rural communities, among others

At present VRC and VKC programmes are active in the districts of Cuddalore, Nagapattinam, Thanjavur, Pudukkottai, Dindigul, Ramanathapuram and Nagercoil of Tamil Nadu; Puducherry and Karaikal in Union Territory of Puducherry; Jeypore in Odisha, and Wardha, Yavatmal, Amaravati and Washim in Maharashtra.

Socially-committed grass-roots experts in different areas such as agriculture, animal husbandry, fisheries, health, education, disaster management, etc., are identified for NVA Fellowships through various institutions and experts. This Fellowship does not contain any monetary benefits. This is only for social recognition.

Based on the experiences of ICT-enabled development activities, NVA initiated a network called Misison 2007: Every Village a Knowledge Centre, in 2003. Since 2007, this network is referred to as Grameen Gyan Abhiyan – Rural Knowledge Centre Movement. Grameen Gyan Abhiyan develops several policy recommendations to take the benefits of ICT all over India in a consortium mode.

601. 1 Village Resource Centres and Village Knowledge Centres

INCOIS programme for fisherfolk

The Indian National Centre for Ocean Information Services (INCOIS) provides ocean information and advisory services through sustained ocean observations. NVA has embarked on a programme for effective use of INCOIS scientific information in the aspects of livelihoods and safety on the sea as well as for the development of a network for dissemination of INCOIS fisherfolk services in Tamil Nadu and Puducherry

Under this programme, NVA selected 40 coastal villages from the districts of Nagapattinam, Cuddalore, Ramanathapuram, Pudukkottai, Kanyakumari and Thanjavur in Tamil Nadu and the Union Territory of Puducherry. Some of the villages already have VKCs and some are getting the VRC and VKC services in different modes. A few villages were selected based on demand by the community. The purpose of the selection is to decide how to effectively disseminate early warning information and potential fishing zone (PFZ) information (availability of fish shoal) on a daily basis using different communication tools. NVA provided training to the project team in handling of GPS, particularly to document the longitude and latitude for the INCOIS project villages (40) and major fish-landing centres (89). Secondary data (including availability of major fish species, fishing nets use, etc.) were also collected for planning various fisherfolk services

INCOIS electronic display boards (EDB) were installed in 18 locations — VRCs, VKCs, prawn auction centre, harbour, Fisheries Department office, panchayat office, etc. — to provide satellite pictures, animations, short films, ocean information, disaster information and disaster warnings and warning systems, in addition to the normal multi-lingual text information. The electronic display board has many features: 32" LCD display panel, two communication channels (via GSM / GPRS / CDMA / dial-up as primary channel and satellite radio as secondary channel), built-in single board computer, facility of on-line broadcast of voice messages and play back of recorded messages, secured siren system with audibility up to 1 km, power backup, web-based dissemination, etc. EDBs will be set up in 8 more locations shortly. They will also be installed in 8 locations in Andhra Pradesh identified by the Coastal Systems Research Programme, Andhra Pradesh.

NVA has conducted 6 capacity-building training programmes for VRC staff and animators (37 persons) on how to effectively disseminate INCOIS scientific inputs to the local community. This includes providing information on: INCOIS and its fisherfolk-related services, details of potential fishing zone, awareness of ocean state forecast (OSF), tsunami warning, facilities available in INCOIS EDB, how to upload locale-specific demand-driven information into the INCOIS board, do's and don'ts in handling the INCOIS board, etc.

VRCs have also been selecting socially-committed fishing community members, with a minimum of 3 to 4 years of experience in fishing or fishing-related activities and / or working with the community, to be trained as "master trainers". These master trainers have been taught to effectively utilise and disseminate INCOIS information to other fisherfolk, officials from the Department of Fisheries, NGOs, NVA Fellows, etc. They provide regular feedback to MSSRF about the usefulness of the INCOIS information and its impact on their livelihoods. So far 68 master trainers from 25 INCOIS project villages have been selected for this training programme. NVA has conducted 3 such Master Trainers' Training Programmes.

Village level / district level fisheries stakeholders meetings have been organised at VRCs for creating awareness about INCOIS services. Fisherfolk in and around the venue villages, representatives from fishermen's associations, traditional panchayat leaders, NGOs (PAD, SPEED and Sathak Trust), officials from the Department of Fisheries and fisherfolk leaders participated in these awareness programmes. During December 2009 and May 2010, 29 awareness meetings were conducted for fisherfolk, with 906 (both men and women) participants.

In the INCOIS project villages, VRCs have developed calendars with information on season-based major fish catch species, the size of the fish species (fingerlings or adult), types of wind and direction and the effects of these on the kind of fish usually caught,

weather patterns (turbulence, rough, calm, etc.), the kind of nets the fisherfolk use for catching different fish species, etc. So far such seasonal calendars have been developed for 7 fishing villages.

In December 2009, the NVA team working with the INCOIS project visited INCOIS, Hyderabad to familiarise themselves with various INCOIS services. This included:

- advice on connectivity issues related to INCOIS EDB
- procedures for maintaining INCOIS EDB in an effective manner
- methods to upload the local content through web into INCOIS EDB
- feedback on the draft PowerPoint programme disseminating INCOIS scientific information, ways to extend INCOIS EDB in fish-landing centres / major coastal villages
- setting up of an INCOIS board at MSSRF
- production of the INCOIS corporate film
- exposure on how PFZ is processed and disseminated: species-wise information (first layer / second layer / etc.)
- information on generation of ocean state forecasts (particularly for dissemination of sea surface currents, high wave alerts)
- working of the tsunami warning centre
- inputs related to market studies

This visit was a very useful one and the project team could clarify several doubts.

During the INCOIS EDB awareness / feedback meetings, the fisherfolk expressed a need to be trained in GPS methods so as to be able to reach the potential fishing zone as soon as possible using the shortest access mode. To start with, NVA has organised GPS training to fisherfolk at Poomphuhar VRC.

NETFISH- supported programmes

With the support of the Network for Fish Quality Management and Sustainable Fishing (NETFISH), VRCs and VKCs conducted awareness programmes on fish quality management and sustainable fisheries in 129 coastal villages in the districts of Nagapattinam, Cuddalore, Kanyakumari and Ramanathapuram of Tamil Nadu and the Union Territory of Puducherry. Between January 2008 and May 2010, 218 such programmes were conducted with the active participation of 6636 (M: 5409; F: 1227) fisherfolk. There is seemingly good result in the areas of handling of fishes, use of ice while bringing in and preserving fish, cleanliness and hygiene maintenance. This is greatly reflected by the fisherfolk in the training villages where they have brought about changes in various practices resulting in enhanced cleanliness. There has been realisation and attitudinal change among the fisherfolk in terms of avoiding plastics to carry drinking water, not catching endangered species like turtles, releasing mother crabs back into the sea, and conserving mangroves, coral reefs and seaweed beds.

The purpose of the training is to create awareness and conduct skill empowerment

for fishing communities on various marine and coastal-related aspects such as sustainable fishing practices, conservation of coastal ecosystems, hygienic handling of marine products, use of GPS, turtle excluder devices, etc.. The topics dealt with included: the present status of coastal resources and its dependent population, marine ecosystems and their significance, marine food chain and its importance, value of coastal resources like mangroves, sea grasses, seaweeds, artificial reefs and sea turtles, reasons for the depletion of fish and other coastal resources, seasonal and spatial closure of fishing, environmental factors affecting fisheries resources, etc. In addition, the role of fishermen in marine conservation and sustainable fisheries was also covered.

With the help of NETFISH, VRCs and VKCs conducted awareness programmes on sustainable fisheries and marine biodiversity conservation (including cleanliness of coastal areas) to the school students of Nagapattinam, Thangachimadam and Puducherry, with 188 students having participated till May 2010.

With effect from January 2010, European Union countries have introduced a new scheme requiring Fish Catch certification from all marine products exporting countries. India exports around 35 per cent of the total catch of fish to European countries. If a fishing vessel does not have the catch certification, the fish from that particular vessel will not be allowed to be imported. To create awareness among the fishing community on the EU requirement, a mass campaign was conducted in all the maritime States of the country by the Marine Products Export Development Authority (MPEDA).and the scheme was introduced in 50 major harbours on a pilot basis. With the support of NETFISH, VRCs at Nagapattinam, Chidambaram, Thangachimadam and Nagercoil organised a series of meetings with the fisherfolk, fish traders, auctioneers in and around Nagapattinam (Nambiyar Nagar, Kallar, Akkaraipettai, Keechankuppam, Ariyanattu street, Samathanpettai, Nagoor), Pazhayar, Mandapam, Chinnamuttam and Kolachal fishing harbours. In all about 70 programmes were conducted on this topic, covering 14 villages (apart from major harbours}, with 1772 participants.

Under the special programmes scheme, 6 general health camps were conducted in Rameswaram island, and. 501 (M: 157; F: 334) patients (fisherfolk) were screened in these camps.

Services through the Indian Coast Guard

The Indian Coast Guard regularly provides inputs to the fisherfolk regarding sea safety measures and necessary clarifications on security issues through video conferencing. The topics cover a range of issues on sea safety measures (importance and purpose of various equipment such as life jackets, life buoys, sound warning devices, engine repair kits, manual propulsion devices and anchors, boiler or hand pumps, navigation lights, waterproof pocket torches, fire extinguishers, first aid kits), weather forecasts, importance of vessel registration certificates, fishing permits, seaworthiness certificates, warning signs,

distress flares, external cardiac massage, recovery of unconscious person, etc.. Apart from video-conferencing, two community interactions / demonstration programmes were conducted with the help of the Coast Guard at Mudasalodai, Chidambaram and Panithitu, Puducherry.

Networking with PONLAIT

In response to requests by livestock farmers, Pillayakuppam VRC started artificial insemination services in November 2007. PONLAIT, one of the strategic partners of VRC, has provided a 35 l liquid nitrogen container, as well as a 3 l one for mobile services, and has also given two artificial insemination guns and sheaths free of cost. However, the semen straws are supplied at the rate of Rs.10/- each. Pillayarkuppam VRC has trained a farmer, Mr K Srinivasan, NVA Fellow, in artificial insemination. From November 2007 to December 2009, 1048 animals were inseminated and 852 animals treated for various ailments. The cost of medicines and service charges were borne by the cattle owners. Between 23 and 27 villages were covered per month.

Impressed with the series of animal husbandry programmes conducted by Pillayakuppam VRC, the Managing Director of PONLAIT requested this VRC to train 15 dairy cooperative societies affiliated to PONLAIT on artificial insemination, pregnancy testing and first aid to dairy animals.

All the milk societies have computer systems. Accordingly, PONLAIT requested Pillayakuppam VRC to conduct the Microsoft Unlimited Potential Programme course for their employees. The three-month course — from November 2009 to February 2010 — included theory classes, field visits, hands-on training and demonstration of slaughterhouse specimens to understand the anatomy of the reproductive organ of cows. The classes were conducted thrice a week, and all the candidates were required to go through the final examination at the end of the course. 15 members from 12 milk societies participated in this course.

More than 80 per cent of the farmers in the Union Territory of Puducherry have one or two dairy animals and supply milk to the cooperative societies. Though most of the farmers had traditional knowledge on maintaining livestock, they were keen on learning the scientific way of maintenance of livestock and breeding. This interest was reflected in many of the interaction meetings and so Pillayarkuppam VRC started training programmes on Clean Milk Production and Quality Milk Procurement for the members of the milk societies of Pondicherry Cooperative Milk Union, under the Government of India scheme “Strengthening Infrastructure for Quality and Clean Milk Production” initiated during the Tenth Five Year Plan period.

From May 2007 to July .2009, Pillayarkuppam VRC conducted 80 training programmes and covered 5016 livestock practitioners (M: 1308; F: 3708) from 54 villages. The course materials were developed in the form of PowerPoint, video and audio. Necessary clarifications

were provided through Closed User Group audio phones, village level meetings, mobile interactions, wireless public address systems, etc. MSSRF staff members, and officials from PONLAIT and Rajiv Gandhi College of Veterinary and Animal Sciences acted as resource persons.

This training has been very helpful for farmers to acquire knowledge about scientific feeding of dairy animals, fodder management, common seasonal diseases and their prevention and treatment, hygienic handling of milk, proper milking methods, etc. Several results of the training have been documented, including ways to increase fat content of milk through balanced feed, and for augmenting income through management of livestock.

Spreading NREGA literacy

Under the UNDP Small Grants Programme, 16 orientation sessions were conducted for panchayat leaders and NREGA workers on how to effectively implement the NREGA programme at different levels. Starting in January 2010, these were conducted in the districts of Nagapattinam, Cuddalore, Ramanathapuram, Thanjavur, Pudukkottai, Kanyakumari and Koraput, with the guidance and support of the district administration and NREGA officials. So far 2 guide books have been produced based on the feedback received from the participants (1308 participants: M:343, F:965). Now VRCs are in the process of documenting best practices.

Training and awareness programmes

VRCs of Tamil Nadu, Puducherry and Maharashtra have conducted 330 training and awareness programmes between May 2009 and May 2010. In all 17461 (M:9765; F:7696) rural men and women participated in these programmes. Apart from this, 3 veterinary camps were also conducted, and 803 animals were treated. Some of the topics covered in the training and awareness programmes were:

Agriculture

- Vegetable cultivation and pest control measures in brinjal
- Coconut leaf beetle
- *Crossandra* root diseases
- Cocoa cultivation
- Seed selection in pigeon pea
- Phosphorus Sulphur Nitrate (PSN) compost making and bio-fertilisers
- Soyabean seed treatment and seed distribution of soyabean (Js- 9305,) and tur (BDS-708)
- Use of neem seed extract for pest control of soyabean
- *Amrutpani* (liquid bio-fertiliser)

Horticulture

- Cultivation of *Coleus* and *Glorisa superba*

Education

- Career counselling for school and college students

Health

- Swine flu, TB and general health issues
- Cervical cancer screening

- Pregnancy care
- First aid for snake bites
- Communicable diseases

Micro-enterprises

- Self-employment
- Screen printing
- Cleaning materials (soap oil and phenyle)
- Jewellery making

Government schemes / entitlements

- Farmers' consumer rights
- Crop insurance

Skills-building

- Motor pump set mechanism and repairing

Animal husbandry

- Ranikhet disease in poultry

Fisheries

Fisherwomen were trained in a structured way in aspects like value-added fish by-products and ornamental fish culture, among others.

601.2 ICT-based education services

VRCs and VKCs provide three ICT-based education services to rural children, women and men.

Microsoft Unlimited Potential Programme

With the support of Microsoft, India, NVA started the Microsoft Unlimited Potential Programme (MUPP) in 2006. The collection of registration fees and examination fees as well as expansion of the programme to colleges, university study centres, milk societies and private schools, have all made this programme self-sustainable now.

In 2009-2010, VRCs have taken several steps to increase the enrolment of trainees, such as

- special batches for long-distance trainees keeping in view their commuting needs
- classes during the weekends,
- examinations at VKC level instead of only at VRC level
- collection of registration fees and caution fees
- separate batches for elderly people, fisherwomen and men, agricultural labourers, SHGs
- special remedial classes for a few MUPP trainees to enable them to grasp the course at par with others

Examination results are announced through the community newspaper, SMS mode and notice boards at VRCs and VKCs. Re-examinations are organised for previously unsuccessful candidates. VRCs also arrange counselling meetings for students, rural youth and women with educational institutions and private consultancy groups to guide them in their future development. VRCs and VKCs regularly conduct career counselling programme for MUPP students and send employment details to the trainers through SMS alerts.

Between April 2009 and June 2010, 1516 (M: 737; F: 779) men and women from 478

villages have been trained in MUPP. 593 trainees (M: 232; F: 361) have successfully passed the final examination.

Computer Aided Learning Programme

In cooperation with the Azim Premji Foundation, NVA initiated the computer-aided learning programme (CALP) in 2005. The target audience for this programme are children in the age group of 6-13 years studying in classes I to VIII. The Azim Premji Foundation has so far produced 62 CDs (interactive play-way methods of learning; simplifying difficult math concepts like fractions, profit and loss, etc., curriculum based on vernacular languages and so on), which have been distributed to the participating institutions. Between May 2009 and May 2010 this programme covered 6663 students (M: 3606; F:3057) from 432 schools.

Intel Learn Programme

The Intel Learn Programme, which has been on from 2006, includes technology literacy, critical thinking and collaboration. So far this programme has covered 1524 students of 170 private and government schools in 268 villages. The age group of the children is between 9 and 15. Over 130 projects under 9 thematic heads — environmental pollution, health and sanitation, water management, disaster risk reduction, tourism, education, social issues, technology and development, and general category — have been created. Some of the projects such as community toilets as well as some domestic ones, access to cremation grounds, building banks for canals, providing lighting, developing parks for play and recreation and making provision for safe disposal of garbage are implemented by village panchayats, the district administration and NGOs.

Between May 2009 and May 2010 the Intel Learn programme covered 523 students (M:281; F:242) from 85 schools. Proficiency certificates were distributed at a function on 1 May 2010.

EduSat Programme

In July 2005, Pillayarkuppam VRC submitted a proposal for setting up a distance education centre through EDUSAT (education satellite) and this was approved in December 2005 by the Department of Science and Technology. Through this system, rural children learn many subjects such as astronomy, health, etc. Three programmes have been conducted for children, namely, weather kit training, awareness on cancer and awareness on biotechnology. 52 students (M:24; F:38) participated.

601.3 Knowledge on Wheels

Mobile soil and water testing laboratory

Soil health is an important aspect in agriculture. Periodic soil testing is helpful to the farming community to improve the fertility of soil and to introduce appropriate cropping patterns and crop rotations. In August 2007, with ISRO's help, the VRC / VKC programme obtained a mobile van from Hewlett-Packard to be used as a soil and water testing laboratory, under the initiative called "Knowledge on Wheels". This mobile laboratory has the basic facilities

for testing all the physical and chemical characteristics of soil such as nitrogen, phosphorous and potash, micro-nutrients, residual sodium chloride (RSC) and sodium adsorption ratio (SAR), as also the quality of irrigation water.

Between April 2009 and May 2010, 24 soil testing camps were conducted, analysing 1473 soil samples in 206 villages. A total of 1083 soil health cards were distributed to the concerned farmers along with appropriate advisories (soil fertility status, fertiliser inputs for next crop, crop advisories, etc.). This service covered nine districts (Thanjavur, Sivagangai, Dindigul, Nagapattinam, Coimbatore, Pudukkottai, Villupuram, Chidambaram and Rameswaram). During this period, 45 water samples were analysed from 19 villages in the districts of Thanjavur, Ariyalur and Coimbatore, and.41 farmers learnt about the quality of groundwater being used for irrigation.

In Vidarbha, this programme was conducted with the help of IFFCO and Shri Shivaji College of Agricutlure. From April 2009 to May 2010, 5 soil camps were conducted, covering 13 villages and testing 594 soil samples. All the results were distributed to the farmers (594) and advisories related to cotton, soyabean, oranges, etc., were provided.

Mobile tele-ophthalmology

Since 2006, the mobile ophthalmological van commissioned with collaboration with Sankara Nethralaya's Medical Research Foundation has been providing eye care facilities through VRCs and VKCs, as has been reported earlier. Until 2008, the tele-ophthalmology services were provided in 8 districts. During the latter part of 2008, a tragic incident (loss of vision) happened in one of the eye camps conducted by a private hospital. After that, eye camps have been temporarily suspended by the district administration. In the current year, this service has been extended only in Ramanathapuram district, under special permission.

In Ramanathapuram district, through Thangachimadam VRC, 83 tele-ophthalmology camps were conducted. This covered 12336 patients (M: 6741; F:5595) from 152 villages. 563 partients were diagnosed for cataract operation and 945 patients were prescribed glasses. In Maharashtra, this programme was extended to all the VRC districts, namely, Wardha, Yavatmal, Amaravati and Washim, and also to Mahila Kisan Sashaktikaran Pariyojana, with 166 camps conducted covering 332 villages. 9945 patients (M:5530, F:4415) were screened. 2080 patients were recommended for cataract operation and 4902 patients were recommended spectacles.

601.4 Mobile Phone Services

IFFCO- Kisan Sanchar Limited-AirTel Green SIM card network

Indian Farmers' Fertilizer Cooperative Limited (IFFCO), Kisan Sanchar Limited (IKSL) and AirTel have launched a novel scheme called Green SIM card. The purpose is to provide five audio advisories (mostly on agriculture and animal husbandry; one message related to government schemes or health or local

news or VRC training programmes) to the subscribers, mostly farmers. Since 25 May 2009, NVA has been providing these audio advisories to the Green SIM card holders.

The NVA-IKSL content manager regularly gets season-based advisories as well as queries and also collects information from various newspapers, journals, research institutions and individual experts. All the material is converted into one-minute voice advisories. Other than the advisories, the messages also cover various subsidy schemes, training programmes, details of farmers' grievances meetings, health-related tips for their family members, etc. The one-minute audio content consists of the title and more specific information on the topic in a colloquial format. The number of subscribers for this Green SIM card has crossed 1,35,000 in Tamil Nadu and Puducherry so far.

In addition, NVA provides clarifications to farmers through the MSSRF help line or links with appropriate experts in a virtual mode, conducts quiz programmes (questions asked based on daily advisories to the subscribers; the persons who give correct answers will get a month's free top-up for his / her SIM card), phone-in-programmes (based on farmers' queries / random check with farmers' needs / season-based issues, etc.), video-conferencing programmes and hands-on training based on the telephone advisories.

Between June 2009 and May 2010, 1434 audio advisories were disseminated through this network in the areas of agriculture (61), horticulture (390), animal husbandry (184), soil tests (44), government schemes (44), health (24), various training details (29), food processing (9), success stories (10) and announcements related to the phone-in-programme, quiz and video conferencing (84). During this period, 541 queries were raised by the farmers from 26 districts of Tamil Nadu in the areas of agriculture, horticulture, animal husbandry, soil testing and fertility management, training details, crop insurance, health, case study enquiries, organic manure, compost making and bio-pesticide preparation, agricultural engineering, bank loans and subsidies, etc.

From January 2010 to May 2010, 10 live phone-in-programmes were conducted. 337 queries were answered. 215 farmers participated. Success stories of farmers have also been documented regularly. This programme establishes regular contact with the farmers and gets feedback on yield improvement, input costs and time saved, land treatment, livestock management, etc. Based on that, cost benefit ratio is calculated.

Apart from the IKSL and AirTel network, Green SIM cards are also available in VRCs and VKCs. With VRCs and VKCs also acting as recharging centres for this SIM card, some knowledge workers and NVA Fellows get modest financial benefits as commission from IKSL.

Fisher Friend Mobile Application

The Fisher Friend Mobile Application, in use since 2007, provides fisheries-related information to fisherfolk on a dynamic basis.

This programme provides the following services in the local language through Tata Teleservices CDMA network.

- Ocean state forecasts like wind speed, wind direction, wave height
- Potential Fishing Zone (availability of fish shoal)
- Cyclone warning
- Tsunami alert and warning
- Rural Yellow Pages - Addresses of manufacturers of fishing boats and nets, exporters of fish products, dealers of GPS, Eco-Sounder, fishing boat repairing yard, availability of fishing net and cost details
- The phone numbers and addresses of officials of the Fisheries Department
- Emergency contact phone numbers like Indian Coast Guard, Indian Navy, Fire Service, Port Trust, addresses of foreign embassies In India
- Fish market information
- Date for "fishermen grievances day" organised by district administration
- Availability of diesel in the petrol stations close to the fishing harbours and other areas
- Procedures followed for the registration of fishing boats under State Fisheries Department, Marine Product Export Development Authority and Port Trust
- Schemes from both the State and Central governments and periodical government announcements related to fisherfolk

In April 2008, on a pilot basis, 40 mobile phones were distributed in 4 districts of Tamil Nadu and one in Puducherry for testing this application. Up until May 2010, 349 users (158 working in a boat as labour; 191 boat / trawler owners) have used these mobile phones on loan basis. Based on their inputs, the application has been further refined. This application is now available in Tata Zone on a commercial basis. Thirty-seven success stories have been documented in the areas of disaster prevention, economic benefit (potential fishing zone), government schemes, etc.

During the next phase, this system will be integrated with GPS, including PFZ locations and indicators for sea wreckages.

601.5 Dissemination

NVA uses a number of communication tools to disseminate locale-specific demand driven information to the rural communities.

Video Conferencing

All the VRCs are connected with the expert centre at MSSRF, Chennai, through ISRO uplink / downlink satellite facilities. NVA regularly holds video conferencing with VRCs on various project activities such as the preparation of short audio advisories to farmers and livestock practitioners, computer maintenance, anti-virus interaction, MUPP course, procedures for conducting examinations, collection of soil samples, inputs for the selection of NVA Fellows, need assessment, content creation, dissemination, linkages with various data generators and providers, etc.

Apart from these regular interactions 15 special video conferences were organised with various institutions and partners between April 2009 and May 2010, covering a wide range of subjects.

Reliance Fixed Wireless Phone – Closed User Group

In April – May 2009, NVA introduced Reliance Fixed Wireless Phone – Closed User Group (CUG) network. This covered 8 VRCs, MSSRF, Chennai and 43 VKCs in Tamil Nadu and Puducherry. CUG is of immense help in conducting audio conferences between experts and rural communities (Lab-to-Land and Land-to-Lab) and also among different rural communities (Land-to-Land).

Due to the CUG network, the information flow between VRC and VKCs and vice versa has increased considerably. The unaddressed queries of VKCs are communicated immediately to VRC and are taken up immediately for necessary action. Sharing content among VKCs has also increased.

Between May 2009 and May 2010, 168 audio conferences were conducted in different thematic areas such as announcements of examination results, career guidance, knowledge workers' meeting, control methods for Rhinocerous beetle, Redpalm, weevil termites in coconut, Dr Muthulakshmi Reddy Maternity Financial Assistance Scheme, groundnut cultivation practices, cattle management, cucumber cultivation, women's reproductive health, advisories based on soil testing, crop insurance, goat rearing, starting *agarbathi* making units, NABARD Farmers' Club, etc.

Google noticeboard

The Google noticeboard is an application that helps people access and share information over the internet using public digital noticeboards. People can create text messages or record voice snippets and post them to one or more noticeboards. Compared to the notion of personal communication using email accounts, the noticeboard metaphor allows users to engage in public communication with communities. Using this technology, VRCs and VKCs have been posting audio messages in different thematic areas, such as training details, government schemes and announcements, employment news, livestock advisories, health issues, agriculture services, VKC / VRC events. Through this mode, 114 audio advisories were shared by VKCs.

SMS Service

VRCs also disseminate locale-specific, demand-driven information through SMS mode to the rural communities in Tamil and English. SMS texts are being disseminated to 1935 farmers and fisherfolk on a regular basis.

GSM-based public address sstem

NVA has introduced a GSM-based public address system in 14 VKCs in Tamil Nadu, Maharashtra, Odisha, Puducherry and Kerala, covering 31 locations. Through this network even remotely located villages receive necessary inputs in audio mode.

601.6 Users pattern

Between April 2009 and May 2010, 29,673 one time users visited VRCs and VKCs of Tamil Nadu, Puducherry and Maharashtra, and 9233 users have used VRCs and VKCs services more than once. All put together 38,906 persons (M:22,423, F:16,483) visited VRCs and VKCs for various purposes. These users have visited VRCs and VKCs 48,881 times. This is apart from trainees, telephone queries, community newspaper readers, public announcement hearers, noticeboard readers, etc.

601.7 Jamsetji Tata Training School & Grameen Gyan Abhiyan – Rural Knowledge Centre Movement

Many of the activities in the above areas are related to the workshops, study tours and hands- on training workshops conducted between May 2009 and May 2010 under report in Sub Programme Area 606.

Capacity building for NGOs in VRCs and VKCs

During October 2008, Welthungerhilfe (formerly German Agro Action) approached Jamsetji Tata Training School (JTTS) to share technical inputs on VKCs with their tsunami rehabilitation partners — People's Association for Development (PAD), Ramanathapuram district and People's Organisation, Education and Training Society (POETS), Cuddalore district in Tamil Nadu and Babuji Rural Enlightenment and Development Society (BREDS), Samband, Odisha. In June 2009, NVA and Welthungerhilfe signed an agreement under the project title "Strengthening Community-based Disaster Risk Management and Village Knowledge Centres in East Coastal Areas". The purpose of the consultancy agreement is to build up the capacity of the partner organisations in the area of Village Knowledge Centres. RedR, Pune is taking care of the component on community-based disaster management. The VKC role is to disseminate the information on disaster risk reduction along with providing locale-specific demand-driven information related to sustainable developmental issues. NVA conducted several training programmes for the NGO partners in the areas of setting up VKCs, general management of VKCs, technical aspects, content development and process documentation. 51 staff members and knowledge workers from partner NGOs (F:18; M:33) participated in these training programmes. Based on the training, all the NGOs have established VKCs in their respective locations.

Developing road map of JTTS

NVA identifies the socially-committed grass-roots experts in different thematic areas such as agriculture, animal husbandry, fisheries, health, education, disaster management, etc. with the help of various institutions and experts and awards them the NVA Fellowship. This Fellowship does not have any monetary benefits. It is only a social recognition. Based on this concept, 1223 NVA Fellows (M:730; F:493) have been selected from 21 States (Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh,

Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarkhand, Bihar and West Bengal) and one Union Territory (Puducherry). NVA has also selected 31 International Fellows from Afghanistan, Bolivia, Chile, Colombia, Panama, Philippines, Nepal, Kenya, Nigeria and Sri Lanka.

JTTS has also conducted a need assessment exercise for 98 Common Service Centres operators which included 12 women and 15 men from 3 States, namely, Jharkhand, Madhya Pradesh and Assam. Based on the need assessment, 10 training programmes in 8 different topics were conducted. 252 telecentre operators and telecentre managers (M:211; F:41) from 10 States (Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Maharashtra, Jharkhand, Assam, West Bengal, Odisha, Uttaranchal, Kerala) and two Union Territories (Puducherry and New Delhi) participated. The entire programme was supported by telecentre.org.

With this background, UNESCO sanctioned a six-month (November 2009 to March 2010) consultancy to develop a road map for JTTS. A series of participatory knowledge management workshops were organised for NVA Fellows to find out their expertise, specific needs in the areas of agriculture, fisheries, horticulture, water management, education, environmental protection and ecological conservation, health, alternative livelihoods, skill sets involved in working with the community for addressing social issues, etc. These needs were also assessed through telephonic queries, video conferencing and field visits. The purpose was to find out the specific inputs for content and capacity building for NVA Fellows.

The same process was adopted for telecentre managers. The telecentre managers preferred training in technical skills (hardware and software training, knowledge of journals and magazines for up-gradation, newer technology for connectivity), soft skills (communication, negotiation and leadership for networking, community mobilisation, conflict resolution and problem solving, decision making), business skills (product and services identification, business continuity, price sensitivity analysis, needs assessment (forward linkages) and demand identification (backward linkages), entrepreneurship development), functional skills (human resources, marketing, basic accounting, project management, community participation, community needs assessment techniques, result-based monitoring and evaluation, financial and content management), fundamental skills (knowledge and awareness of development issues, sensitivity to gender, caste and community issues). The telecentre managers / operators have also suggested three different types of courses, namely, Appreciation course for the practitioners, Certificate course for the beginners and Diploma and degree courses for career movement.

Based on the above requirements, JTTS has done stakeholder analysis to identify the resource institutions for providing content and capacity building for the target audience (NVA

Fellows / telecentre managers or operators) in their own mother tongue and local context.

The road map recommendations are as follows:

- JTTS should develop a bouquet of training programmes with the help of appropriate resource institutions. The proposed courseware should be in local language and reflect local culture.
- It should compile a directory of resource institutions and their contact and training details.
- It should develop open platforms in different languages in the multimedia mode to store and easily access such information; This platform should also be capable of conducting programmes through distance learning mode.
- It should provide policy recommendations to policy makers to address knowledge connectivity issues for rural communities and telecentre managers / operators.

601.8 Web-based Knowledge Management System and Multimedia Resource Centre

Extracts from ***M.S. Swaminathan Research Foundation at 21: Report of the Independent Programme Review*** by Dr. Uma Lele, Development Economist and Formerly Senior Advisor in the Independent Evaluation Group (IEG) of the World Bank, and Ms Kavita Gandhi, Regional Manager, Oxfam, India (December 2008-January 2009) are reproduced below.

"Information and Communication Technology: An Umbrella Programme — Google for the Poor —- for MSSRF's entire programme of participatory and resource management of food, agriculture, natural resources, livelihoods. As in the case of social science research, this programme should become a cross-cutting, cross support and a demand-driven programme by communities with strong links between the social scientists to undertake effective monitoring and evaluation and policy research related to IT. It is evident from some of the case studies of the VKC programme, villages are making huge demands for knowledge and indicating areas in which either government services do not exist or are dysfunctional, e.g., agricultural extension. Being at the cutting edge of biology and informatics, the MSSRF programme, working jointly with all other programmes, can greatly increase our understanding of the process for accelerating development which is demand led by the poor."

To implement this idea, the Informatics Division submitted a project proposal to IDRC. IDRC has approved this proposal for a three-year research grant to develop a Knowledge Management System for MSSRF, to develop monitoring and evaluation systems, to integrate GIS applications in different MSSRF programme areas, to strengthen the GGA network and to support one fellowship to improve the research capacity of NVA.

As the first step, with the help of Dr Ganesan Kannabiran, Professor of Management, National Institute of Technology, Tiruchirapalli, two one-day workshops were conducted in the

area of Knowledge Management (KM) for staff in different MSSRF programme areas during 12-13 November 2009. The main aim of the workshop was to introduce basic concepts of KM, and explore the need for KM programmes in MSSRF. Based on that, the basic design for a web page was designed and uploaded. In the same way, a multimedia resource centre was developed as the repository of all the audio and video advisories, photographs and course materials of rural communities.

With the help of Dr Suchit Nanda, Online Services, Mumbai, two three-day workshops (11-13 March 2010; 6-8 May 2010) were conducted on developing the multimedia resource centre. This workshop covered aspects such as digital photography, various digital camera models, various storage options and storage procedures, photo indexing methods, various camera settings, various features and options, digital audio recording, do's and don'ts in digital photography, introduction about Adobe bridge, Irfan view and Geo setter, video shooting and capturing, training on editing software (movie maker), training on Photoshop and Picasso, how to upload videos and photographs in Smugmug, YouTube and Flickr and how to assign keywords and captions for the photographs.

Sub Programme Area 602

Uttara Devi Resource Centre for Gender and Development

A decision was taken in 2008 to support the coordinator of the women farmers' empowerment initiative in Vidarbha from the Uttara Devi Endowment. Details of work during the year have been reported under **SPA 502.2**.

Sub Programme Area 603

The Hindu Media Resource Centre

The Hindu Media Resource Centre (*TH*MRC) was established in 1998 with the endowment provided by *The Hindu* group of publications. It forms the primary interface between MSSRF, media and the lay enlightened citizens. *TH*MRC adopts several approaches to create a platform for interaction with the media and the general public and it provides scope for in-depth discussions on new developments, controversial issues, etc. Various events are periodically organised to bring major development and sustainability issues to the mainstream media and the general public. It especially reaches out to the rural people and helps to bridge the divide between science and society. *TH*MRC achieves its objectives by organising public forums, millennium lectures, media workshops and media tours. *TH*MRC also maintains a concept bank.

Public Forum: Taking advantage of the visits of experts, heads of international agencies, eminent scientists, policy makers, and leaders to Chennai to attend conferences, etc. the public forum is organised as a panel discussion on a particular thematic subject. After brief remarks by the panellists, the floor is open for public discussion. Students,

development experts, media people and general public participate in the public forum.

Millennium Lecture: Distinguished leaders, scientists, policy makers, and heads of states and international organisations are chosen to deliver the Millennium Lectures.

Media Workshops: The workshops provide a platform for the media to acquire credible and multifaceted information from experts through face-to-face interaction on contemporary themes and provide scope for brainstorming on important ethical, social, cultural and scientific issues in a holistic manner.

Media Tours: Media professionals are taken to different field sites of MSSRF and given opportunities to interact with the rural community. This brings out new ideas and in-depth understanding of the issues in sustainable development.

Concept Bank: Brief introductions to, and write-ups on, various themes highlighting the initiatives of the Foundation make up the concept bank. These write ups are helpful to the media / researchers / public to get an idea prior to detailed discussions with the scientists to develop new stories or research papers.

Media Relations / Tracking

A database of print and electronic media professionals is maintained and updated regularly. Press briefs of all the MSSRF events are prepared in English and Tamil for wider dissemination.

News features in developmental sectors (Professor M S Swaminathan's articles, editorials related to climate change, food security, agro-biodiversity, etc.) which are published in various newspapers / journals / magazines are tracked and made available to the staff through in-house notice boards. If it is in electronic media, alerts will be given through intranet.

Ongoing services

Around 40 documentary films have been made on the various programme activities carried out in MSSRF. There is an online video catalogue containing details about access, concept, format, and availability of the films. These films are sold at a nominal price to educational institutions and various organisations to help in the conservation of traditional knowledge and diversity.

Public Relations

*TH*MRC coordinates with many national and international visitors to the Foundation. For instance, the visitors during 2009-2010 included Ambassador Philip Wen-chyi Ong, Taiwan, women delegates (officers from various African, Caribbean and Maldives countries) from 22 countries, students from various agricultural and engineering colleges and trainee IAS officers.

Activities carried out by *The Hindu* Media Research Centre in 2009-2010

Public Forum	
16 February 2010	Climate Change: Role of Biodiversity in Adaptation and Mitigation. Mr..Ahmed Naseem, Minister, Government of Maldives; Dr. Angela Crooper, UNEP, Nairobi; Dr. Parviz Koohafkan, FAO, Rome; Dr Robert Zeigler, IRRI, Philippines; Dr. Kenneth M Quin, World Food Prize Foundation; and Mr N. Ram, Editor-in-chief, *The Hindu,* participated.
Millennium Lectures	
28 November 2009	Achieving the UN Millennium Development Goal No.1 Relating to Hunger and Poverty Reduction in an Era of Climate Change by Dr Kanayo F. Nwanze, President, International Fund for Agricultural Development
Press Interactions	
10 October 2009	Launch of Pan-Commonwealth Forum Dr Latha Pillai, Pro-Vice Chancellor, IGNOU; Professor P. R. Ramanujam, Director, Academic Programme Committee, PCF6; Professor V. N. Rajasekaran Pillai, Vice-Chancellor, IGNOU; and Sir John Daniel, President, COL, Canada, participated.
26 December 2009	Inauguration of the Fish for All Training and Research Centre Professor V. N. Rajasekaran Pillai, Vice Chancellor, IGNOU; Ms. D. Purandeshwari, Minister of State for Human Resources Development; and Ms. K. Kanimozhi, Member of Parliament participated.
27 May 2010	Vacation Training Programme on Bioresources & Biotechnology for schoolchildren Dr. P. L. Gautam, Chairman, National Biodiversity Authority, participated.
Seminar / Lecture	
29 December 2010	Fortified Salt: Technological Solution to Micro-nutrients Deficiency by Dr. S. Ranganathan, Senior Consultant, Nutrition & Nuclear Medicine, Former Head, Isotope Division, National Institute of Nutrition (ICMR), Hyderabad
Book Release	
8 January 2010	Science and Sustainable Food Security (a compendium of selected articles by Professor M. S. Swaminathan) Professor P. Balaram, Director, Indian Institute of Science, Bangalore and Dr Swapan K. Datta, Deputy Director General (Crops), Indian Council of Agriculture Research, New Delhi participated.
Panel Discussion / Dialogue / Consultation	
16 October 2009	Achieving Food Security in Times of Crisis – Prof R Maria Saleth, Director, Madras Institute of Development Studies and Dr A. Arivudai Nambi, MSSRF
22 May 2010	Consultation on Our Conservation Ethos – Community conservers from Tamil Nadu and Kerala showcase their conservation traditions

Sub Programme Area 604

The Every Child a Scientist (ECAS) Programme

The Every Child a Scientist (ECAS) programme is being carried out since August 2002 in Chennai. This programme largely targets students from Corporation schools of Zones IX and X and from schools with economically-underprivileged students. The Centre is equipped with 15 computers and resource materials on environmental science in multimedia format to make learning a pleasant experience. In the past year, the duration of each batch was on average 15 days, with a break of 3 to 4 days between batches to develop additional resource materials and catalogue the projects made by earlier students. At the beginning of the academic year, a calendar for the next 9 months was drawn up with students from all the participating schools, in batches of 10. The students are exposed to a combination of both lectures and science practicals to ignite the young minds. This year, we had 3 more schools from Zone X participating in the programme. With the support from the Zonal Supervisors of Zones IX and X, our Centre has established good rapport with Corporation Middle School headmasters, headmistresses, schoolteachers, orphanage schools and government-aided schools.

The resource materials used during these sessions range over a large number of topics, from biodiversity, information technology, and health and hygiene to global warming and greenhouse effects, pollution, and rainwater harvesting to microbes and dinosaurs, among others. More than 300 students from the two zones participated in this programme during the year 2009 – 2010. At the end of each session, the students presented projects on different topics and expressed their ideas in the form of assignments, charts and models. Their projects were used as a source of information to subsequent batches of students and also in their schools. Some of these charts were on display in their respective schools that helped in appreciation of students' merit and encouraged other students to participate in the ECAS programme.

On 20 January 2010, a Science Fest Competition was organised for the school students who had participated in the current academic year. About 240 students participated in the posters, science quiz and debate competitions. This competition offered a wonderful platform for the students to apply their skills and knowledge and it further encouraged them by way of prizes and certificates. On 4 February 2010, we took 30 students to the Science City where a Science Fest was organised for school and college students. A one-day workshop was organised on 1 March 2010 in which various in-house resource persons interacted with the students.

The Centre has developed resource materials on different topics, which are updated regularly. Apart from learning science through multimedia, students also perform simple science experiments to learn how to observe,

collect evidence, and draw conclusions. This programme has stirred inquisitiveness among the students while giving them "an opportunity to master some of the concepts in science and environmental issues" as mentioned in their feedback forms. During April and May 2010, summer classes were conducted for students of Seva Samajam, Advent Christian School and Rani Meyammai School.

Touch and Smell Garden

This garden was developed to help the visually impaired to experience the joy of nature and learn by exploration through the senses of touch and smell. Children from blind schools, NIVH (Dehradun, Uttaranchal & Poonamallee, Chennai), various NGOs, and private and public school children and college students visit this garden regularly. This year some more medicinal plants in the garden have been added. The name boards of the plants help the students to learn their common names, botanical names and the taxonomy. The garden forms part of the curricula for all teachers passing out of NIVH, Chennai. A complete detailed account of all the plants in the Touch and Smell garden has been developed in the form of a small booklet available for the visitors.

Sub Programme Area 605

Library and Information Services

At present, the MSSRF Library has 17001 books of which 210 were added during this year. In addition, it also holds 362 CDs, 120 journals, 145 newspaper clippings for the year 2009-2010 and 2324 bound journals. The library also regularly collects technical reports and annual reports from various institutions. This year the library has undertaken steps to assess the relevance and significance of the current collection to each of the programme area activities. It is also dispatching extra publications to field offices based on their needs for the site office libraries. The library also provides the services on current awareness services, selective dissemination information related to different programme areas, article alert services, newsletter alert services, etc. The Web based MSSRF Open Access Archives (OAA) has been initiated for the benefit of the research community globally. The CD-ROM library provides assistance to research students working in the areas of biotechnology, agricultural sciences and life sciences. Last year, around 733 students from various national and international universities availed the CD-ROM library services.

Sub Programme Area 606

Conferences and Workshops

Training on Community Needs Assessment for Business Development, 8-11 May 2009, Xavier Institute of Social Services, Ranchi

The purpose of this four-day training programme was to understand the concept of need assessment and its tools, learn the

concept of PRA and service requirement assessment surveys, acquire hands-on experience on methods of data collection, relate community requirements with Common Service Centre (CSC) services and explore the possibility of creating business avenues to address community needs. Altogether, there were 31 participants, including 2 women, from the CSCs, spanning different levels such as district, block and village.

Ms. Nancy J. Anabel worked with Mr. Saiju Chacko, the resource person from ASK, New Delhi, to facilitate the hands-on training, which was held in Vishaka Hattanga, Mandar block, Ranchi district of Jharkhand, one of the working villages of the implementing agency Orion. The participants were divided into groups and practised different PRA exercises and shared the learnings.

Detailed reference material on Community Needs Assessment in English and a PowerPoint programme on the subject in Hindi were provided during the training, and later, the Hindi version of the reference material was given to them.

Training of Trainers on Community Needs Assessment, 17-23 May 2009, Social Development Centre, Ranchi

In order to develop a cadre of trainers among the Common Service Centre managers and operators to take on the training of village-level entrepreneurs, who are in charge of CSCs in different villages, a 7-day course on Training of Trainers (ToT) was organised. The two training modules packaged for implementation were "Community Needs Assessment Techniques" and "Bringing the Community Closer". Twenty participants including 2 women participated in the training programme. Mr. Saiju Chacko from ASK, New Delhi served as the resource person.

The programme broadly covered three areas: designing and conducting training on community needs assessment, developing knowledge on a subject and receiving feedback, and identifying strengths and areas for improvement. The training was video taped and replayed for self critique and peer and trainer critique on the performance of the participants. The course material was prepared in Hindi and circulated among the trainees.

Training on Community Needs Assessment for Business Development, 2 July to 1 August 2009, Guwahati

Twenty-five village-level entrepreneurs participated in a training programme in Guwahati for CSC operators, similar to that organised in Ranchi. Based on the performance of the trainees, 15 were selected for the Training of Trainers on Community Needs Assessment that followed.

Training on Result-Based Management, 27 to 30 July 2009, National Academy of Agricultural Sciences, New Delhi

Going by the view expressed by GGA partners that there is an ever-increasing need to work in a manner which is result oriented and also be able to monitor and document

results (which are more than mere targets), both qualitative and quantitative, a four-day training programme on Result-Based Management (RBM) was designed and organised for telecentre managers. The topics ranged from the concept of RBM at different stages of a project cycle, results and their hierarchical relationship, concept of problem tree, to assumptions and risk management strategies The participants were taken through practical exposure by choosing a problem and developing the problem tree and sequence of changes corresponding to that in terms of output and outcome, developing both quantitative and qualitative indicators and logical framework. A handout in English on RBM was circulated among the participants.

Altogether 17 persons including 3 women participated in the programme, representing 14 organisations. Mr. Manish Koushik from ASK, New Delhi, served as facilitator, joined by Ms. Nancy J. Anabel of MSSRF on the final day.

The participants suggested organising a follow-up programme on this.

Workshop on Graphics on Print, 17-20 August 2009, Puducherry

This programme was conducted by Electronic Media Production Centre, IGNOU, for 24 VKC / VRC staff and animators at Pillayarkuppam VRC, Puducherry. Mr K. Viswanathan, Senior Graphic Designer, Electronic Media Production Centre, IGNOU acted as resource person. The participants learnt how to develop pamphlets, brochures, posters. booklets, CD labels and folders, in various sizes and colours, using Coral Draw software.

Based on the training the participants created several posters, pamphlets, CD labels and folders in the areas of micro-enterprises, MUPP, Intel Learn, livestock maintenance, agricultural methods, health issues, weather advisories, etc. They also designed a template for the community newspaper, *Namma Ooru Seithi* (News of our Village).

Training of Trainers on Community Needs Assessment, 24-30 August 2009, Regional Development Training Centre, Indore

Eighteen men participated in the Training of Trainers programme for CSC operators, similar to the ones organised earlier at Ranchi and Guwahati.

National Workshop on the Role of Gyan Choupals in Spreading Climate Literacy and Building Sustainable Food and Water Security Systems, 2-3 September 2009, National Academy of Agricultural Sciences, New Delhi

The national workshop on the Role of Gyan Choupals in Spreading Climate Literacy and Building Sustainable Food and Water Security Systems was a follow-up of the workshop on Role of ICTs in the Management of Climate Change at the Grass-roots Level held in February 2008. The 2009 workshop focused on the role of Gyan Choupals, telecentre managers and GGA partners in developing climate literacy at all levels by providing locale-specific and community-

centred information. The workshop brought together representatives of the Government of India, research and academia, civil society, the private sector, Gyan Choupals and students. The purpose of the two-day workshop was to develop a road map to deal with the impact of climate change on natural resources, food and water security, biodiversity and livelihoods and to formulate science- and action-based strategies and mechanisms for adaptation and mitigation.

The success of this venture lies in its strong synergies, especially in the total of 416 strong partners in the Grameen Gyan Abhiyan. Convergence and synergy between public and private agencies are crucial. A major aim of the Gyan Choupal movement is to seek and promote convergence and synergy among initiatives launched by public, private and academic sectors.

The workshop highlighted what Gyan Choupals could do to manage climate change. There was consensus that Gyan Choupals could take anticipatory action by creating and propagating drought, flood and good weather codes. They could train Climate Risk Managers at the local level, do nutrition literacy and promote the cultivation and consumption of local foods and underutilised crops.

Training of Trainers on Essential Skills, 15-17 November 2009, Puducherry

There were 19 participants representing four organisations in the programme to explore and identify competencies required to train telecentre operators and managers. The essential skills needed to operate a telecentre include — apart from technical skill — intra and inter-personal skills, communication and negotiation skills, decision-making and problem-solving skills and time management skills. The object was to improve their functional effectiveness and enhance their facilitation skills by conducting mock sessions and reflective practice. The focus was on content and emphasis was on trainers using effective instructional methods during the programme.

The participants expressed the view that such programmes are essential to train their knowledge workers and *sanchalak*s (ITC-eChoupals).

Workshop on the Art of Proposal Writing, 24- 27 November 2009, MSSRF, Chennai

Based on the belief that the financial sustainability of telecentres is a vital issue and that telecentre operators had to be taught the ability to attract funds, a three-day workshop on the Art of Proposal Writing was organised. Nineteen participants including seven women from 8 organisations were the target audience.

Mr. Satya Dev and Mr. Sarfaraz from Access Livelihoods Consulting (ALC) India, Hyderabad, served as resource persons. The programme covered topics such as components to be included in a proposal, clarity on concepts, online tool / formats / templates, types of proposals, dos & don'ts of proposal writing, expectation / norms of funding agencies, synchronisation of donor requirements with

our needs, technology-based proposals, budgeting, new trends in funding proposal, project evaluation and concrete proposals. The participants were also exposed to many livelihood concepts and Income Generation Activities (IGAs).

Training on Facilitation and Rapporteuring Skills, 1-2 December 2009, MSSRF, Chennai

Facilitation and rapporteuring are skills that are essential for any developmental intervention as also for ICT4D. Therefore a two-day programme was organised for the telecentre managers on facilitation and rapporteuring skills. It was also planned to give them the ground to translate their learning into action. Therefore, the same persons were involved in the sixth convocation of NVA Fellows, which was organised on 4 December 2009.

The first day's session on rapporteuring skills was handled by Mr. C. Velayutham, Department of Media Science, Anna University, and the second day's session on facilitation skills was handled by in house expertise.

Twenty-eight participants, including 10 women, from nine organisations took part in the training programme.

Training on Essential Skills to Knowledge Workers, 3-4 December 2009, MSSRF, Chennai

A programme on essential skills was organised for knowledge workers, using the expertise of those who had been trained as trainers earlier. While all the Tamil-speaking knowledge workers were put into one workshop, those speaking various other languages such as Malayalam, Hindi, Marathi and Telugu were placed in a parallel workshop.

In all, 11 participants were in the Tamil group while 25 participants formed the multilingual group.

Sixth Convocation of NVA Fellows, 4 December 2009, Chennai

During 2008-2009, a new batch of 238 (M: 161; F: 77) Jamsetji Tata National Virtual Academy (NVA) Fellows were selected from Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu and Uttar Pradesh and Puducherry. Eight International Fellows were selected from Chile, Bolivia, Colombia, Panama and Peru with the help of the Government of Chile and the World Food Programme. These Fellows were inducted on 4 December 2009.

The Fellows were categorised into different thematic areas such as agriculture, social welfare and awareness, biodiversity, micro-enterprises, fisheries, animal husbandry, knowledge workers, tribal development, etc., and also segregated on the basis of languages spoken. On 2-3 December 2009, a participatory knowledge management workshop was conducted, particularly to document their expertise and identify their needs.

Dr Bruce Alberts, Editor-in-Chief, *Science* awarded the Fellowships and released three

publications: *Directory of NVA Fellows*, *Reaching the Unreached – Community-based VRCs and VKCs* and *Transformative Impact of ICT- Change Stories from Rural India*.

Study Tour of Latin American Delegates, 2-17 December 2009

Dr Michalle Bachelet, Former President, Republic of Chile, visited MSSRF in March 2009 for signing a MoU between M.S. Swaminathan Research Foundation and Chile's Ministry of Agriculture, particularly in the area of taking the benefits of IT to small farmers. During that time she had a video conference with the rural communities of Nagapatinam and Puducherry through the VRC network. The Ministry of Agriculture, Government of Chile decided to replicate the MSSRF ICT-model to address the problems of small farmers. In view of this, some scientists from MSSRF, the Chairman and the Executive Director visited Chile in October 2009. As follow up of this, the World Food Programme and Government of Chile sent a delegation consisting of nationals from Chile, Panama, Bolivia and Colombia for a study tour, from 2 December to 17 December 2009, to visit MSSRF's ICT-enabled development activities and different ICT-models in India.

During the study tour, the delegation held discussions on various issues such as different programme areas of MSSRF, IGNOU-MSSRF's appreciation course on Sustainability Science, Jamsetji Tata National Virtual Academy activities including the concept of VRCs and VKCs, Grameen Gyan Abhiyan, various dissemination technologies, challenges, training aspects related to knowledge workers and the staff of Gyan Choupals, how to develop multimedia resource centre and different ICT initiatives in India. The participants also witnessed video conferencing with rural communities in Dindigul, Nagapattinam, Ramanathapuram and Thanjavur Distircts of Tamil Nadu and interacted with Prof Bruce Alberts, Editor-in-Chief, *Science* and Dr Richard Stone, Asia Editor, *Science*, Beijing office.

The delegation visited several institutions like the Department of Electrical Engineering, Indian Institute of Technology, Chennai; Rajiv Gandhi Veterinary College, Puducherry; Indian Farmers Fertiliser Co-operative Ltd (IFFCO); Media Lab Asia; Indira Gandhi National Open University (Electronic Media Production Centre) and Qualcomm and had discussions about different ICT-initiatives at commercial level and policy level.

The delegation also participated in the sixth convocation of NVA Fellows.

Workshop on Strengthening the Capacity of Telecentre Managers on Social Entrepreneurship, 14-15 December 2009, National Academy of Agricultural Sciences, New Delhi

In the ICT4D world, the various models need sustainability as they are all mostly one-time funded and require to earn their operational costs as also increase the basket of services provided based on the local demand. It was therefore decided to work on the social entrepreneurship concept using the training

platform to facilitate cross learning among different telecentre models and sensitise them on avoiding extremes of grant dependence or business orientation and to develop a module for facilitating this concept. This workshop set the base for initiating this process.

Different methodologies such as individual exercises, group discussions, business simulation games, case studies using short films were used to seed the concept of social entrepreneurship and enable the participants understand the need to balance business and social impact goals.

There were 34 participants, including 7 women, representing 19 organisations. Mr. Muthukumar Maganti, consultant from Hyderabad, and Dr. Arumugam from Welthungarhilfe, Chennai, acted as resource persons.

Sixth Convention of Grameen Gyan Abhiyan, 20-21 December 2009, National Academy of Agricultural Sciences, New Delhi

The focal theme for the convention was "Rural Knowledge Revolution for Agrarian Prosperity and Sustainable Economic Development". This convention gave particular importance to the problems faced by rural communities due to widespread drought in some regions and severe floods in some others. The famine of jobs and inadequate opportunities for sustainable livelihoods in rural India are leading to social unrest, hunger and violence. Climate change and global warming further compound these problems. There is a growing gap between scientific know-how and field level do-how in our dry farming areas, which constitute about 60 per cent of the cultivated area in our country.

The topics discussed included:

- The Role of Knowledge Systems – Sustainable Food Security for over a Billon Human Population and for a Billion Farm Animals
- The Role of Knowledge Systems – Agriculture, Animal Husbandry and Fisheries
- Innovations – Agrarian Prosperity and Sustainable Livelihood Security
- Beyond Copenhagen – Building Climate-Resilient Rural Societies
- Way Forward – Rural Knowledge Revolution for Agrarian Prosperity and Sustainable Livelihood Security

Consultative Workshop on Strengthening the Sustainability of VKCs, 18-21 February 2010, Puducherry

Two two-day consultative workshops on strengthening the sustainability of VKCs were held at Pillyarkuppam VRC. This programme was generously supported by International Development Research Centre (IDRC), INCOIS and Microsoft Unlimited Potential Programme (MUPP). In the first workshop, 18-19 February, the partners were from the Nagapattinam, Cuddalore, Ramanathapuram, Tuticorin and Kanyakumari districts and in the second on 20-21 February, Thanjavur, Dindigul, Coimbatore and Pudukkottai districts were represented.

Cross-learnings among participants were facilitated on the effective functioning of VKCs, steps taken by VKCs to reach out to the community, steps taken for strengthening VKC activities, steps taken for improving the village infrastructure using VKC services, operation and maintenance of VKCs and innovative practices to address the financial sustainability of VKCs. It was decide at the end of the sessions to develop a detailed work plan for each VKC along with the knowledge workers and other partners.

Vacation Training Programme on Biotechnology and Bioresources

MSSRF conducted three vacation programmes for 30 Standard X students from each district of Odisha, Kerala and Tamil Nadu. These were held.in Jeypore, Wayanad and Chennai, respectively. The students were educated on biodiversity conservation, recent trends in biotechnology, and the need for restoration of fragile ecosystems. The month-long programme had a combination of hands-on laboratory experience and exposure visits to biodiversity rich areas and institutions of repute as well as interactive sessions with experts in these fields.

The students from Tamil Nadu visited Kolli Hills, the mangrove ecosystem of Pichavaram, the Madras Atomic Power Station, Rasi Seeds, the Crocodile Bank, and the Adyar Poonga eco-restoration initiative in Chennai. The Odisha students visited institutions like the Regional Sericultural Research Station (RSRS) and the Central Cattle Breeding Farm (CCBF), Sunabeda, Coffee Board, Koraput, National Aluminium Company Limited (NALCO), Damanjodi. They went on field trips to the pine forest at Koraput, the biodiversity hot spot region in Gupteswar, the tribal hamlet in Kusumguda and to cashew mills in Jeypore. The students from Kerala went trekking to the mountaintop of *Manikkunnu* to understand the characteristic features of semi-evergreen shola and grassland ecosystems. They went on a safari through Wayanad Wildlife Sanctuary to distinguish the peculiarities of a sanctuary and also to know the local wildlife resources. The visit to the Kattunaikka tribal hamlet at Muthanaga, near the protected area, was to get an understanding of the issues of forest-dependent communities, man-animal conflicts, etc. The trip to the Kadalundi Mangrove Zone, a proposed Mangrove Community Reserve Area, was to study the coastal ecosystem.

National Training Programme on Sustainable Agriculture and Rural Development for Women Scientists and Technologists, 19-23 April 2010, MSSRF, Chennai

A National Training Programme on Sustainable Agriculture and Rural Development – Biovillage as a Delivery Model for was held for 12 women scientists and technologists working in the government sector. This was supported by the Department of Science and Technology, Government of India and was organised by the JRD Ecotechnology Centre from 19 to 23 April 2010 at the Foundation. The topics covered included development concepts and practices; issues and challenges in sustainable

agriculture and rural development, tools used for assessment and planning interventions; the process to be followed for community mobilisation and social inclusion, gender in development, technology identification, incubation and appropriation, monitoring and evaluation, and strategies to be followed for enhancing convergence among various stakeholders. There was a presentation on the concept of the biovillage as well as lectures and field visits and a visit to the ecoenterprises units. A field visit to Kannivadi and interactions with the grass-root institutions helped in understanding the issues. The participants also attended a special talk on "Nature Nurtures Drug Discovery", delivered by Dr. M. D. Nair, an independent consultant for Pharma/IPR.

Intel Learn Programme Convocation and Certificate Distribution, 1 May 2010, Chennai

Dr. A. Poongothai, Minister for Information and Technology, Government of Tamil Nadu, Mr. A. Raja, Minister of Communications and Information Technology, Government of India, Ms. Kanimozhi, Member of Parliament, and Dr. Praveen Vishakantaiah, Country President, Intel Technology India Pvt Ltd, were among the prominent participants in the Intel Learn Programme convocation held on 1 May 2010. Certificates were distributed to 523 students from 85 schools. The children's projects were exhibited and some locations were connected by video conferencing for the project implementers to share their views.

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Papers Presented in Conferences/ Symposia/Workshops

Arivudai Nambi, V. "Introduction to legislation, institutional arrangements and best practices on ABS implementation in India." Workshop on Access and Benefit Sharing to Biological Genetic Resources. GEF-UNDP, Beijing, China. 11-18 August 2009.

Arivudai Nambi, V. "Climate change and biodiversity." National Seminar on Climate and Development Alternatives. Department of Rural Development Science, Arul Anandhar College, Karumathur, Madurai District. 2-3 March 2010.

Bala Ravi, S. "Important role of neglected and under-utilised crops in complementing food security under changing climate." International Symposium on Second Green Revolution: Priorities, Programmes, Social and Ethical Issues. Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram. 2-4 July 2009.

Bala Ravi, S. "Intellectual Property Rights in Plant Genetic Resources." National Symposium on Recent Global Developments in the Management of Plant Genetic Resources. Indian Society of Plant Genetic Resources & National Bureau of Plant Genetic Resources (ICAR), New Delhi. 18-19 December 2009.

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Nampoothiri, K.U.K. "Natural Resource Management: Initiatives of MSSRF in Odisha State." National Consultation on Bio-resource Governance. RCDC, Bhubaneswar, 2 April 2010.

Padulosi, S., Bhag Mal and S. Bala Ravi. "Livelihoods and food security enhancement with nutritious millets in India." XV Annual International Sustainable Development Research Conference. Utrecht University, the Netherlands. 5-9 July 2009.

Prabavathy, V. R. and Sudha Nair. "Diversity of PGPR associated with the saline coastal ecosystems and their beneficial roles in sustainable agriculture." First Asian PGPR Conference for Sustainable Agriculture. Hyderabad. 21-24 June 2009.

Prabavathy V. R. and Sudha Nair. "Diversity of Pseudomonas associated with rice rhizosphere cultivated in saline ecosystems and their biocontrol potential against rice pathogens under field conditions." National Conference on Advances in Plant Pathology. University of Madras, Chennai. 12-13 March 2010.

Prabavathy, V. R. "Biofertilizer production and technology transfer to women self-help groups." Department of Molecular Phytopathology and Mycotoxin Research, Georg- August University, Gottingen, Germany. 19 April 2010.

Prabavathy, V. R. "Biocontrol and plant growth promoting activity of Pseudomonas strains isolated from saline soils." Julius Kuhn Institute, Federal Biological Research Centre for Agriculture and Forestry (BBA), Darmstadt, Germany. 31 May 2010.

Rengalakshmi. R., M. Devaraj and Sudha Nair. "Role of ICT-based technological and social factors in facilitating functional literacy among rural women and men." Madurai Symposium 2009: People Convention on Information & Communication Technology (ICT) & Millennium Development Goals (MDGs). Dhan Foundation, Madurai. 17 September 2009.

Rengalakshmi. R., M. Devaraj and Sudha Nair. "Empirical study on climate change perception and responses among small and marginal

farmers: Kannivadi region, Dindigul district, Tamil Nadu". Indian Meteorological Society and Regional Meteorology Centre, Chennai. 8-9 October 2009.

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Senthilkumaran, S. "ICTs for Information Access: A Solution against Poorness in Rural Places of India." International Seminar on ICTs: Tools to Improve Competitiveness. Casa Piedra, Santiago. 28 October 2009.

Senthilkumaran, S. "National initiatives and knowledge societies' approaches." Expert Meeting on Knowledge Societies: The way forward. UNESCO, Paris. 1-2 March 2010.

Selvamukilan. B and R. Rengalakshmi. "Importance of awareness and access to quality biofertilizers among farmers: An experience with sericulture farmers of Dindigul district." National Seminar on Vermitechnology, Use of Biofertiliser and Solid Waste Recycling for Sustainable Rural Development. GRI Deemed University, Gandhigram. 23-24 March 2010.

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Shanthakumar, S. P., S. Malarvannan, V. R. Prabavathy and Sudha Nair. "Surveillance of insect pests of *Morinda citrifolia* L. in the west coast of Kerala." Fourth National Symposium, Noni Search. Chennai. 24-25 October 2009.

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Swain, S. "Transforming rural farming communities through ICTs." Holland Alumni Conference. The Hague, The Netherlands. 6 November 2009.

Swain, S. "*Ex situ* conservation of medicinal plants by nine tribes of Orissa." International Certificate Course in Botanic Garden Management. Singapore Botanical Garden, Singapore. 6 March 2010

Valarmathi, R and G.N. Hariharan. "Characterization of lichen polyketide synthase genes to synthesize secondary compounds of pharmaceutical relevance." Indian Youth Science Congress. Sriperumpudur. 5-7 June 2009.

Yenagi, N B., J. A. Handigoal, S. Bala Ravi, Bhag Mal and S. Padulosi. "Nutritional and technological achievements in the promotion of ethnic and novel foods using the genetic diversity of minor millets in India." National Symposium on Recent Global Developments in the Management of Plant Genetic Resources. Indian Society of Plant Genetic Resources & National Bureau of Plant Genetic Resources (ICAR), New Delhi. 17-18 December 2009.

Participation in Training Programmes/ Workshops

Ananthakrishnan, R.K. Training on Sustainable Groundwater Management in Semi-Arid and Arid Regions of India. IRAP and SOFILWM. Institute of Rural Management, Anand. 22-27 March 2010.

Annapurna, S and Pratap C. Jena. Training of Trainers on SHG Management. PRAYAS, Boipariguda. 30-31 December 2009.

Anil Kumar. N. Growers Meet cum Seminar on Black Pepper. Kabani Resort Pulpally, Wayanad. 20 March 2010.

Anil Kumar. N. National Seminar on Conservation and Sustainable Development of Ecosystems in the Western Ghats. Sahyadri Science College, Shimoga. 25-26 March 2010.

Anuradha, G. Pre-Conference Workshop on Assessment of Nutritional Status and Dissemination of the New RDA for Indians. 41st National Conference of Nutrition Society of India. National Institute of Nutrition, Hyderabad. 19 November 2009.

Archana, D. Every Child A Scientist Programme in Paniya Sadas, Shreyas, S.Bathery, Wayanad. Centre for Development Studies and University de Montréal, Canada. 13 March 2010.

Arivudai Nambi, A. Panel Member, Discussion on Climate Change: Risks and Adaptations. United States-India Educational Foundation (USIEF) and MSSRF, Chennai. 13 July 2009.

Arivudai Nambi, A. Asia Pacific Network Meeting. Impacts of Climate Change on Agriculture and Water in Asia Region. University of Kebangsaan, Kuala Lumpur, Malaysia. 10-12 August 2009.

Arivudai Nambi, A. National Workshop on Developing Road Map for Climate Literacy for

Role of Gyan Choupals. NAAS, New Delhi. 2-3 September 2009.

Arivudai Nambi, A. International Conference on Climate Change and Environmental Sustainability in India and Canada: Approaches and Strategies. Department of English, University of Madras, Chennai. 16-18 September 2009.

Arivudai Nambi, V. The Consultation for Code of Conduct Global Plan of Action and Convention on Biological Diversity in Support of Pastoralists / Livestock Keepers for Conservation of Livestock Resources. LIFE Network, New Delhi. 6-8 October 2009.

Arivudai Nambi, A. Seminar on Recent Advances in Agro-meteorology and Space Technology for Sustainable Food Security in Tamil Nadu. Indian Meteorological Society, Chennai Chapter and Regional Meteorological Centre, India Meteorological Department, Chennai. 8-9 October 2009.

Arivudai Nambi, A. Chennai to Copenhagen: Defining Priorities. Preparatory Meeting for COP-15 - Agenda for Chennai. British High Commission, Chennai. 15 November 2009.

Arivudai Nambi, A. Facilitating Adaptation: Critical Factors at the Local Level. Side Event on Local Adaptation to Climate Change COP-15 Meeting. UNFCCC, Copenhagen, Denmark. 10-18 December 2009.

Arivudai Nambi, A. Workshop on Economics of Climate Change Adaptation. Madras School of Economics, MSSRF and South Asian Network for Dveleopment and Environmental Economics, Chennai. 12-13 February 2010.

Arivudai Nambi, A. Workshop on Science and Policy for Climate Change – What should we do now? IIT, Chennai. 17 February 2010.

Arivudai Nambi, A. The Experience Sharing Workshop on Climate Change Action in Semi-arid Areas. Development Alternatives and SDC, Bundelkhand. 27-28 April 2010.

Arivudai Nambi, A. Visioning Workshop, Climate Change Community and the Knowledge Mela. UNDP, New Delhi. 29-30 April 2010.

Arivudai Nambi, V. Traditional Knowledge (TK) and Patents. Interactive Web Conference. US Embassy, Chennai. 27 April 2009.

Arivudai Nambi, V. International Day for Biological Diversity: Invasive Alien Species. National Biodiversity Authority. Chennai. 21-23 May 2009.

Arivudai Nambi, V. Saving Vanishing Crops and Dying Wisdom. Use of Agro-biodiversity. Indigenous Peoples and Rural Communities, Chiang Mai, Thailand. 17-21 June 2009.

Arivudai Nambi, V. National Workshop on Bio-industrial Watersheds. GKVK, Soil Conservation Society of India, Bengaluru. 25-27 June 2009.

Arivudai Nambi, V. Workshop *on* Building Sustainability: Carbon Finance. Swiss Agency for Development and Cooperation & IDEI. New Delhi. 9 March 2010.

Balasubramanian, T.N. Seminar on Recent Advances in Agro-meteorology and Space Technology for Sustainable Food Security in Tamil Nadu. Indian Meteorological Society, Chennai Chapter and Regional Meteorological Centre, India Meteorological Department, Chennai. 8-9 October 2009.

Bhondawe, Manda M. Workshop on Human Rights. Gandhi Vichar Parishad, Wardha. 14 March 2010.

Chaudhury, S.S. Training on Procurement Related Matters and Financial Management. NAIP (ICAR). CRRI, Cuttack. 17-18 September 2009.

Dhanya, C. S. Workshop on Preparation of the Management Plan for the Proposed Malabar Wildlife Sanctuary. Department of Forests and Wildlife, Government of Kerala. Kozhikode. 21 June 2009.

Dhanya, C. S. Workshop on Developing Protocols for Assessing and Monitoring Biodiversity in the Western Ghats. Kerala Forest Department and National Institute of Oceanography, Ernakulam. 22 February 2010.

Geetha Rani, M. National Symposium on Recent Global Developments in the Management of Plant Genetic Resources. ISPGR & NBPGR. New Delhi. 16-18 December 2009.

Geetha Rani, M. Genome Saviour Award Function. The Protection of Plant Varieties and Farmers' Rights Authority, New Delhi. 21 December 2009.

Gopalakrishnan, N., and P. A. Rasheed. Pepper Cultivation. State Horticulture Mission. Sultan Batheri, Kerala. 8 December 2009.

Gupta, Ravi Kumar. Talk on Jatropha Training. Ministry of Renewable Energy Resources, Government of India. Cape Institute of Technology, Kanyakumari district. 15-28 February 2010.

Hrideek, T.K. International Seminar on Mobilizing Neglected and Underutilized Crops to Strengthen Food Security and Alleviate Poverty. ISPGR, New Delhi. 16-18 December 2009.

Hrideek, T. K. and Kartik C. Lenka. International Training on Contemporary Approaches in Genetic Resources Conservation & Use. Wageningen International, The Netherlands. 12-30 April 2010.

Kathiravan, R. National Training on Molecular Approaches for Identification and Characterization of Actinomycetes. National Bureau of Agriculturally Important Microorganisms, Mau, Uttar Pradesh. 1-10 December 2009.

King, E.D. Israel Oliver. Traceability Training ICS Software. APEDA, New Delhi. 15 September 2009.

King, E.D. Israel Oliver. Sahaja Samruja: Conservation NGO. UAS, Bangalore. 26 October 2009.

King, E.D. Israel Oliver. Choice Experiment. Darwin Institute, Australia and CYMMIT, New Delhi. MSSRF, Chennai. 26 January-3 February 2010.

King, E.D. Israel Oliver. Contingent Valuation. CYMMIT, New Delhi. MSSRF, Chennai. 26 January-3 February 2010.

King, E.D. Israel Oliver. Workshop on Building Sustainability: Carbon Finance. Swiss Agency for Development and Cooperation & IDEI. New Delhi. 9 March 2010.

Jagtap, Kishor. Seminar on Indian Farmers' Suicides. Priyadarshini Mahila Mahavidyalaya, Wardha. 2 February 2010.

Jagtap, Kishor. Workshop on Seed Preservation and Conservation. Sewagram Centre for Sustainable Agriculture, Wardha. 13 February 2010.

Jagtap, Kishor. Workshop on Ecological Sustainable Agriculture. Sewagram Centre for Sustainable Agriculture, Wardha. 24 February 2010.

Jagtap, Kishor. National Consultation Meeting on Sharing Grass-roots Development Experiences in Agriculture. FAO, SEWA and NAAS. New Delhi. 10 March 2010.

Jagtap, Kishor. National Meeting of South Asia Forum for Women Farmers. SEWA, IFAD and NAAS. New Delhi. 10 March 2010.

Jagtap, Kishor. Workshop on Human Rights. Gandhi Vichar Parishad, Wardha.14 March 2010.

Kumar, N. Choice Experiment. Darwin Institute, Australia and CYMMIT, New Delhi. MSSRF, Chennai. 26 January-3 February 2010.

Kumar, N. 2010. Contingent Valuation. CYMMIT, New Delhi. MSSRF, Chennai. 26 January-3 February 2010.

Kumar, N. 4th Old Seed Festival. Samata and Sanjeevini Rural Development Society at Santhi Nagar, Anjoda, Araku (Andhra Pradesh). 30 April 2010.

Lenka, Kartik C. National Consultation on Eastern Region Climate Change & Sustainable Agriculture. Gram Vikas, Mohuda, Orissa. 22-23 January 2010.

Menon, Manjula. Meeting on the Coalition for Agrarian Prosperity in Vidarbha. Central Institute of Cotton Research, Nagpur. 25 September 2009.

Menon, Manjula. Pre-Conference Workshop on Assessment of Nutritional Status and Dissemination of the New RDA for Indians. 41st National Conference of Nutrition Society of India. National Institute of Nutrition, Hyderabad. 19 November 2009.

Nageswaran, M. National Conference on Sustainable Agriculture. Tamil Nadu Science and Research Organization, Pudukkottai. 22-23 May 2010.

Nair, Smitha S. Fifth International Canopy Conference: Forest Canopies: Conservation, Climate Change and Sustainable Use. Ashoka Trust for Research in Ecology and the Environment, Bangalore. 25-31 October 2009.

Nair, Sudha. Women in Science Panel, World Science Forum. Budapest. 5-7 November 2009.

Nair, Sudha. International Campaign to Promote Gender and Innovation for Development. TWOWS and UNESCO. Paris. 18-19 January 2010.

Nair, Sudha. Round Table on Women in Science: Challenges Ahead. International Women's Day, Division for Gender Equality, Bureau of Strategic Planning, UNESCO (HQ). Paris. 8 March 2010.

Nair, Sudha. National Conference on Women and Science. Jana Vignana Vedika, Indian Women Scientists Association, Hyderabad, TWOWS-Indian Chapter & Department of Botany, Osmania University, Hyderabad. 8-9 May 2010.

Nair, Sudha. Member, Panel Discussion on Women in Science & Technology: Career in Science & Technology. Centre for Empowerment of Women, Anna University and Indian Academy of Sciences. Chennai. 16 May 2010.

Nair, Sudha. Biotechnology Research Workshop: A Global Look at Women's Leadership in Biotechnology Research. UCSF Campus, Mission Bay, San Francisco, California. 23-24 June 2010.

Nayak, T. R. Workshop on Local Self-governance. PRASUTEE NGO. Koraput. 21 March 2010.

Parasuraman, N. Regional Workshop on ICT in Agriculture. NIRD, Hyderabad. 25 August 2009.

Parasuraman, N. Workshop on Using Information Technologies to Empower Rural Communities to Support Their Food Security and Defeat Child Hunger. Santiago, Chile. 23 October-1 November 2009.

Parasuraman, N. Attracting and Retaining Youth in Farming. Rework India, Youth Employment Summit. New Delhi. 16 November 2009.

Parasuraman, N. Pathways to Reconciliation Summit: Human Security through Community Engagement. Amman, Jordan. 14-17 December 2009.

Parasuraman, N. 97th Indian Science Congress. Thiruvananthapuram. 3-7 January 2010.

Parida, A. Food Security Status and Priorities. Bibliotheca Alexandria, Egypt, 15-18 July 2009.

Parida, A. Harvest Plus Programme Advisory Committee Meeting. Washington DC, USA. 24-26 November 2009.

Parida, A. Strategic Meeting on Metropolitan Agriculture. Transforum, Government of the Netherlands. Voorberg, the Netherlands. 3-5 March 2010.

Parida, P.K. Hands-on Training on Monitoring and Evaluation System for VRC and VKC. Amaravati, Maharastra. 22-26 May 2009.

Parida, P.K. Management Development Programme on Priority Setting, Monitoring and Evaluation for Innovation in Agriculture. IIM, Lucknow. 22-26 March 2010.

Patnaik, Santosh Kumar. Seventh International Biofuels Conference. WINROCK International India, New Delhi. 11-12 February 2010.

Punitha,S. GIS Short Course. University of Florida and ICRISAT. Pattancheru, Andhra Pradesh. 27-31 July 2009.

Punitha, S. Map India 2010 Conference. GIS Development. Gurgaon. 19-21 January 2010.

Rasheed, P.A. Vegetable & Fruit Promotion Training. Vegetable & Fruit Promotion Council, Kerala. 9 February 2010.

Raut, Jyotsna B. Workshop on Human Rights. Gandhi Vichar Parishad, Wardha. 14 March 2010.

Rengalakshmi. R. Brainstorming Workshop on Organic Seed Production. Centre for Indian Knowledge Systems and Tamil Nadu Agricultural University. Coimbatore. 3 March 2010.

Rengalakshmi. R. National Workshop on Sharing Grass-roots Development Experiences in Agriculture. SEWA and FAO. New Delhi. 10 March 2010.

Rosario, D. and P. Santhamoorthy. Workshop on Good Agricultural Practices for Medicinal and Aromatic Plants of Puducherry. Mother Theresa Post-graduate and Research Institute of Health Science. Puducherry. 24 November 2009.

Rukmani, R. Meeting on the Coalition for Agrarian Prosperity in Vidarbha. Central Institute of Cotton Research, Nagpur. 25 September 2009.

Rukmani, R. Lecture on Slums and Development. Anna Institute of Management, Chennai. 8 October 2009.

Rukmani, R. International Conference on Development Evaluation. Planning Commission of India. New Delhi. 13 October 2009.

Rukmani, R. National Colloquium on Eco Agriculture – Pathway out of Poverty and Ensuring Sustainable Livelihood. NIRD, Hyderabad. 14-15 October 2009.

Rukmani, R. Workshop on Using Information Technologies to Empower Rural Communities to Support Their Food Security and Defeat Child Hunger. Santiago, Chile. 26 October 2009.

Rukmani, R. Lecture on Training of Survey Enumerators. Centre for Study of Social Exclusion and Inclusive Policy, Manonmaniyam Sundaranar University. Tirunelveli. 5 April 2010.

Sanjeev, R. Training Programme on Sustainable Groundwater Management in Semi- arid and Arid regions of India. IRMA, Anand. 22-27 March 2010.

Selvam, V. Participatory Planning, Monitoring and Evaluation – Managing for Impact. Centre for Development Innovation, Wageningen University. The Netherlands. 1-9 February 2010.

Selvam, V. Workshop on Identification of Research Gaps. National Centre for Sustainable Coastal Management, Anna University. Chennai. 21 June 2010.

Selvamukilan, B. Training Workshop on Mass Production Techniques of Biocontrol Agents. Central Sericulture Research and Training Institute, Mysore. 14-19 December 2009.

Senthilkumaran, S. PAN ALL IDRC Conference. Penang, Malaysia. 11-13 June 2009.

Sivakumar, M.N. Impact of Research on Medicinal Plants. Arignar Anna Government Arts College, Namakkal. 12 September 2009.

Sivakumar, M.N. Training on Plant Genetic Resources, Seeds, Conservation and Use. Wageningen International University and MSSRF. Chennai. 5-21 October 2009.

Sivakumar, M.N. Valnthu Kattuvom. Semmedu, Kolli Hills. 21 January 2010.

Sivakumar, M.N. Millet Value-added Training. Avinashilingam Women's University, Coimbatore. 22-25 March 2010.

Sivan, V.V. National Symposium on Promotion of Cultivation and Marketing of Medicinal Plants. National Horticulture Mission. Kochi. 18-19 July 2009.

Sivan, V.V. National Symposium on Commercial Cultivation of Medicinal Plants in India. Guwahati. 9-10 February 2010.

Sivan, V.V. Symposium on Medicinal Plants in the Hands of Farmers as Commercial Crops. KAU, Thirussur. 23 February 2010.

Shaji, K.V. Farmers Training on Club Formation. NABARD. Thiruvananthapuram. 23 November 2009.

Shaji, K.V. Global Warming and Food Security. Kasargod. 30-31 December 2009.

Shaji, K.V. Global Warming and Food Security. Kalpetta, Wayanad. 26 February 2010.

Subbiah, Vijay R. Preparatory Workshop on Use of Crop Simulation Model to Develop Application Tools for Decision Making in Agro-advisory. Tamil Nadu Agricultural University, Coimbatore. 11-14 January 2010.

Sujana, K.A. Workshop on Conservation of Kole Wetlands: Strategies for Management. Kerala State Biodiversity Board. Wayanad. 18 June 2009.

Sujana, K.A. Workshop on Potential Ornamental Gingers-Domestication, Selection and Popularization. Calicut University, Kozhikode. 25 September 2009.

Sujana, K.A. 22nd Kerala Science Congress. KFRI, Peechi. 28-31 January 2010.

Sujana, K.A. Workshop on Statistical Analysis using Microsoft Excel. UGC. Post-graduate Department of Statistics, Madras Christian College, Chennai. 29 March 2010.

Swain, S. International Training Course on Plant Genetic Resources and Seeds: Policies, Conservation & Use. Jeypore, Odisha. 11- 22 October 2009.

Swain, S. Holland Alumni Conference. The Hague, the Netherlands. 4- 8 November 2009.

Swain, S. First International Certificate Course in Botanic Garden Management. Singapore

Botanical Garden, Singapore. 5-20 March 2010.

Thakare, Charusheela. Workshop on Human Rights. Gandhi Vichar Parishad, Wardha. 14 March 2010.

Thangavel, P. 4th Old Seed Festival. Samata and Sanjeevini Rural Development Society at Santhi Nagar, Anjoda, Araku (Andhra Pradesh). 30 April 2009.

Vijaya Raghavan, M. Kannivadi Kulumai Federation Training. Kolli Hills. 16-17 April 2009.

Vijaya Raghavan, M. Indian Youth Science Congress. MSSRF and SRM University. Chennai. 5-6 June 2009.

Awards/Honours

King, E.D. Israel Oliver. 2009. Guide, PhD in Biodiversity Conservation, University of Madras, Chennai.

Nair, Sudha. 2009. Dr P. Sheel Memorial Lecture Award, National Academy of Sciences, India.

Nair, Sudha. 2009. Member of the Executive Board, OWSDW (Organization of Women Scientists for the Developing World), Italy.

Nair, Sudha. 2009. Member Advisory Committee – Rural Livelihoods Programme, Centre for Economic and Social Studies, Hyderabad.

Nair, Sudha. 2010. Jawaharlal Nehru Birth Centenary Award, The Indian Science Congress Association, Kolkata.

Nair, Sudha. 2010. Board Member, Indian Grameen Group affiliated to BASIX Group, Hyderabad.

Nair, Sudha. 2010. Member of Gender Advisory Committee of Department of Science and Technology, Ministry of S&T, Government of India.

Parasuraman, N. 2009. Star Achiever Award and Gold Medal, National Integrity Cultural Academy, Chennai.

Parasuraman, N. 2009. Member, Global Reconciliation, Australia.

Parasuraman, N. 2010, Member- Senate, Bharathidasan University, Tiruchirapalli.

Parasuraman, N. 2010. Krishi Bhushan Puraskar, Maharashtra Yuva Shakti Samajik Santha, Thane.

Parasuraman,N. 2010. Member, International Sustainable Development Centre, Geneva.

Parasuraman, N. 2010. Member, Youth for Human Rights International - South Asia.

Parida A. 2009. NASI-Reliance Award for Application Oriented Innovation in Biological Sciences, National Academy of Sciences India, Allahabad.

Swain, S. 2009. *Prakruti Bandhu* Award, Department of Environment & Forests, Government of Orissa.

About the Foundation

The 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 sections 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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Mr. P.I. Maria Philip
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Project Associate

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Mr. P. Mugilnilavan
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Attendant

** left during the year*

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Cleaner

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World Bank, New Delhi	International Union Conservation of Nature and Natural Resources, Thailand

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Indira Gandhi National Open University, New Delhi	International Plant Genetic Resources Institute, Rome
National Bank for Agricultural and Rural Development (NABARD)	Mitsubishi Corporation, New Delhi
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List of Acronyms

AD	Additional Director
ALC	Access Livelihoods Consulting
AM	Arbuscular Mycorrhiza
APEDA	Agricultural & Processed Food Products Export Development Authority
APX	Ascorbate Peroxidase
AqIFS	Aqua Integrated Farming System
ATMA	Agricultural Technology Management Agency
ATREE	Ashoka Trust for Research in Ecology and the Environment
AU	Avinashilingam University
BARC	Bhabha Atomic Research Centre
BCC	Biodiversity Conservation Corps
BCUE	Biodiversity Conservation Utilisation and Enhancement
BDO	Block Development Officer
BIWS	Bioindustrial Watershed
BPMPGRC	Biju Patnaik Medicinal Plants Garden and Research Centre
BSI	British Standards Institution
CAbC	Community Agrobiodiversity Centre
CALP	Computer Aided Learning Programme
CARE	Cooperative for American Remittances to Europe
CAS	Clavaminic Acid Synthetase
CASMB	Centre for Advanced Studies in Marine Biology
CBDRR	Community Based Disaster Risk Reduction
CBO	Community Based Organisation
CC	Concluding and Consolidation
CCD	Coast Conservation Department
CD	Community Development
CDMA	Code Division Multiple Access
CED	Chronic Energy Deficiency
CFB	Community Foodgrain Bank
CFTRI	Central Food Technological Research Institute

CFU	Colony Forming Units
CGB	Community Gene Bank
CIBA	Central Institute of Brackish Water Aquaculture
CIC	Community Information Centre
CICR	Central Institute for Cotton Research
CIDA	Canadian International Development Agency
CIFA	Central Institute of Freshwater Aquaculture
CIFT	Central Institute of Fisheries Technology
CLC	Community Learning Centre
CMFRI	Central Marine Fisheries Research Institute
COD	Council of Directors
CRRI	Central Rice Research Institute
CSC	Common Service Centre
CSIR	Council for Scientific and Industrial Research
CSR	Coastal Systems Research
CST	Central Sales Tax
CTAB	Cetyl Trimethyl Ammonium Bromide
CTC	Community Training Centre
CUG	Closed User Group
CVC	Central Village Committee
DAC	District Advisory Committee
DAE	Department of Atomic Energy
DAPG	Diacetylphloroglucinol
DBT	Department of Biotechnology
DFID	Department for Funding International Development
DGAT	Diacylglycerol Acyltransferase
DGM	Deputy General Manager
DI&C	Department of Industries and Commerce
DIC	District Industry Centre
DM	Disaster Management
DMMAS	Dr.Muthulakshmi Reddy Maternity Assistance Scheme
DMSO	Dimethyl Sulfoxide

DNA	Deoxyribonucleic Acid
DRDA	District Rural Development Agency
DRR	Disaster Risk Reduction
DRSL	Disaster Resistant Sustainable Livelihood
DSM	Demand Side Management
DST	Department of Science & Technology
DUS	Distinctiveness, Uniformity and Stability
EB	Electricity Board
EC	Executive Committee
ECAS	Every Child A Scientist
ECT	Education Communication and Training
EDUSAT	Education Satellite
EMD	Earnest Money Deposit
EST	Expressed Sequence Tag
FAO	Food and Agricultural Organization
FC	Farmers' Club
FCC	False Colour Composite
FFARTC	Fish for All Research and Training Centre
FFS	Farmers' Field School
FIG	Farmers' Interest Group
FMB	Field Measurement Book
FOSA	Friends of Swaminathan, Australia
FS	Food Security
FSR	Feasibility Study Report
FYM	Farm Yard Manure
GAP	Good Agricultural Practice
GBPUAT	G.B. Pant University of Agricultural Sciences and Technology
GGA	Grameen Gyan Abhiyan
GIAHS	Globally Important Agricultural Heritage Site
GIS	Geographical Information System
GPS	Global Position System
GSM	Global System Mobile Communication

GST	Gluthathaione S-transferase
HAP	Humanitarian Accountability Partnership
HH	Household
IAD	Institute of Applied Dermatology
ICAR	Indian Council of Agricultural Research
ICDS	Integrated Child Development Services
ICM	Integrated Crop Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICS	Internal Control Systems
ICT	Information and Communication Technology
IDRC	International Development Research Centre
IEC	Information, Education and Communication
IFAD	International Fund for Agricultural Development
IFFCO	Indian Farmers' Fertiliser Cooperative Limited
IFS	Integrated Farming System
IGA	Income Generating Activities
IGCAR	Indira Gandhi Centre for Atomic Research
IGNOU	Indira Gandhi National Open University
IKSL	IFFCO Kisan Sanchar Limited
ILP	Intel Learn Programme
IMFFS	Integrated Mangrove Fishery Farming System
IMO	Institute of Market Ecology
INCOIS	Indian National Centre for Ocean Information Services
INM	Integrated Nutrient Management
IPM	Integrated Pest Management
IPR	Intellectual Property Rights
IRS LISS	Indian Remote Sensing Satellite Linear Imaging Self Scanning System
IRT	Iron Regulated Transport
ISRO	Indian Space Research Organization
ISSR	Inter Simple Sequence Repeat
IYCF	Infant and Young Child Feeding
JTTS	Jamsetji Tata Training School

KB	King's B Medium
KBK	Koraput-Bolangir-Kalahandi
KHABCoFED	Kolli Hills Agrobiodiversity Conservers' Federation
KKNPP	Kudankulam Nuclear Power Plant
KKRGCS	Kalinga Kalajeera Rice Growers' Cooperative Society
KRA	Key Result Area
KS	Keto Synthase
KSSPS	Kaliamman Sutru Sulai Pathukapoor Sangam
KVK	Krishi Vigyan Kendra
KW	Knowledge Worker
LAMP	Large Area Multipurpose Society
LED	Light-Emitting Diode
LEISA	Low External Input Sustainable Agriculture
LPG	Liquefied Petroleum Gas
M&E	Monitoring and Evaluation
MANAGE	National Institute of Agricultural Extension Management
MCC	Microbial Culture Collection
MDAR	Monodehydroascorbate Peroxidase
MDMS	Mid-Day Meal Scheme
MEM	Micro Enterprise Marketplace
MFS	Major Facilitator Superfamily
MIS	Management Information System
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MPEDA	Marine Products Export Development Authority
MPLAD	Member of Parliament Local Area Development
MSSRF	M.S.Swaminathan Research Foundation
MT	Metallothionein
MUPP	Microsoft Unlimited Potential Programme
NABARD	National Bank for Agriculture and Rural Development
NaCSA	National Centre for Sustainable Aquaculture
NAFED	National Agricultural Cooperative Marketing Federation of India Limited

NAIP	National Agricultural Innovation Project
NB	Nutrient Broth
NBPGR	National Bureau of Plant Genetic Resources
NBRI	National Botanical Research Institute
NCBI	National Center for Biotechnology Information
NET	National Eligibility Test
NETFISH	Network for Fish Quality Management and Sustainable Fishing
NFDB	National Fisheries Development Board
NFHS	National Family Health Survey
NFM	National Floriculture Mission
NGO	Non-Governmental Organisation
NHM	National Horticulture Mission
NIN	National Institute of Nutrition
NIVH	National Institute for the Visually Handicapped
NMDS	Non-Metric Multidimensional Scaling
NMPB	National Medicinal Plants Board
NPK	Nitrogen- Phosphorus-Potassium
NPL	Nicholas Piramal Limited
NREGA	National Rural Employment Guarantee Act
NREGS	National Rural Employment Guarantee Scheme
NSS	National Social Service
NTFP	Non-Timber Forest Produce
NUS	Neglected and Underutilised Species
NVA	National Virtual Academy
OCAC	Orissa Computer Application Centre
ORF	Open Reading Frame
ORMAS	Orissa Rural Development and Marketing Society
OSF	Ocean State Forecast
OTC	Open Source Technology Centre
OTELP	Orissa Tribal Empowerment and Livelihood Programme
PAD	People's Action for Development
PAGE	Polyacrlyamide Gel Electrophoresis

PAU	Punjab Agricultural University
PBR	People's Biodiversity Register
PCA	Phenazine Carboxylic Acid
PCR	Polymerase Chain Reaction
PCS	Participatory Conservation System
PDKV	Panjabrao Deshmukh Krishi Vishwa Vidyalaya
PDRA	Participatory Disaster Risk Assessment
PDS	Public Distribution System
PEAMT	Phospho-Ethanolamine N-Methyl Transferase
PGPR	Plant Growth Promoting Rhi
PGUS	Panchabati Grama Unnayan Samiti
PISCES	Policy Innovation Systems for Clean Energy Security
PKM	Pikovskaya's Medium
PKS	Polyketide Synthases
PLS	Piramal Life Sciences Limited India
PM&E	Participatory Monitoring and Evaluation
PMCA	Participatory Market Chain Analysis
POETS	People's Organisation, Education and Training Society
PONLAIT	Pondicherry Cooperative Milk Producers' Union
PPB	Participatory Plant Breeding
PPM	Project Planning and Management
PPSS	Praja Pragathi Seva Sangham
PPV & FR	Protection of Plant Varieties and Farmers' Rights
PPV& FRA	Protection of Plant Varieties and Farmers' Rights Authority
PPVFRA	Protection of Plant Varieties and Farmers' Rights Act
PRA	Participatory Rural Appraisal
PRI	Panchayat Raj Institution
QS	Quorum Sensing
RAPD	Random Amplified Polymorphic DNA
RBM	Result Based Management
REAP	Renewable Energy Agency, Pondicherry
RET	Rare, Endangered and Threatened

RGNIYD	Rajiv Gandhi National Institute of Youth Development
RING	Really Interesting New Genes
RNA	Ribonucleic Acid
RPAD	Random Amplification of Polymorphic DNA
RSAPCOL	Reddiyarchatram Sustainable Agriculture Producers Company Ltd
RSGA	Reddiyarchatram Seed Growers' Association
RTI	Right to Information
S&T	Science and Technology
SAC	Space Application Centre
SBI	State Bank of India
SDC	Swiss Agency for Development and Cooperation
SEED	Schlumberger Excellence in Educational Development
SFC	Smart Farmers' Club
SGSY	Swarnjayanti Gram Swarozgar Yojana
SHE	Self-Help Enabler
SHG	Self-Help Group
SRI	System of Rice Intensification
SSA	Sarva Shiksha Abhiyan
SSI	Small-Scale Industry
SSR	Simple Sequence Repeat
SWOT	Strengths, Weaknesses, Opportunities and Threats
TANUVAS	Tamil Nadu Veterinary and Animal Sciences University
TAP	Tamil Nadu Afforestation Project
TBGRI	Tropical Botanic Garden and Research Institute
TDF	Tribal Development Fund
TePKS	Trypethelium eluteriae Polyketide Synthases
TERI	The Energy Research Institute
THMRC	The Hindu Media Resource Centre
TIN	Tax Payer's Identification Number
TNAU	Tamil Nadu Agricultural University
TOT	Training of Trainers
TRX	Thioredoxin

TSS	Total Sugar Solids
UAS	University of Agricultural Sciences
UAS-B	University of Agricultural Sciences, Bengaluru
UAS-D	University of Agricultural Sciences, Dharwad
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
UNWFP	United Nation's World Food Programme
UPGMA	Unweighted Pair Group Method with Arithmetic Mean
UTR	Untranslated Region
V&A	Vulnerability and Assessment
VAM	Vesicular Arbuscular Mycorrhiza
VC	Village Committee
VDC	Village Development Committee
VDF	Village Development Fund
VDMC	Village Development and Management Council
VIC	Village Information Centre
VIT	Vellore Institute of Technology
VKC	Village Knowledge Centre
VMRC	Village Millet Resource Centre
VRC	Village Resource Centre
VSB	Village Seed Bank
VSGB	Village Seed Gene Bank
VWC	Village Watershed Committees
VWS	Village Welfare Society
WDT	Watershed Development Team
WFP	World Food Programme
WHS	Water Harvesting Structure
WSHG	Women's Self-Help Group

FINANCIAL STATEMENT 2009-10

M.S.SWAMINATHAN RESEARCH FOUNDATION

NO.6, THIRD CROSS ROAD,TARAMANI INSTITUTIONAL AREA, TARAMANI,CHENNAI 600 113

BALANCE SHEET AS ON 31ST MARCH 2010

LIABILITIES			ASSETS		
Particulars	2009-2010 Rs. In Lacs	2008-2009 Rs. In Lacs	Particulars	2009-2010 Rs. In Lacs	2008-2009 Rs. In Lacs
Own funds			Own assets		
Corpus funds	106.35	50.10	Fixed assets	653.78	650.49
General fund & other funds	2,744.16	2,725.85	Investments	1,462.75	1,440.85
Endowment fund	4,284.49	4,036.38	Endowment investments	4,232.42	4,012.70
Current liabilities	135.08	2.74	Current assets		
			advances & deposits	663.85	281.62
			cash & bank balances	257.28	429.40
Total [a]	7,270.08	6,815.07	Total [a]	7,270.08	6,815.07
Ongoing projects			Ongoing projects		
Projects payables	923.36	1,063.64	Projects receivables	346.48	226.26
Current liabilities	644.77	176.28	Advances and Deposits	734.41	3.87
			Cash & bank balances	487.24	1009.79
Total [b]	1,568.13	1,239.92	Total [b]	1,568.13	1239.92
Grand Total [a]+[b]	**8,838.22**	**8,054.99**	**Grand Total [a]+[b]**	**8,838.22**	**8,054.99**

* Provisional (unaudited)

M.S.SWAMINATHAN RESEARCH FOUNDATION

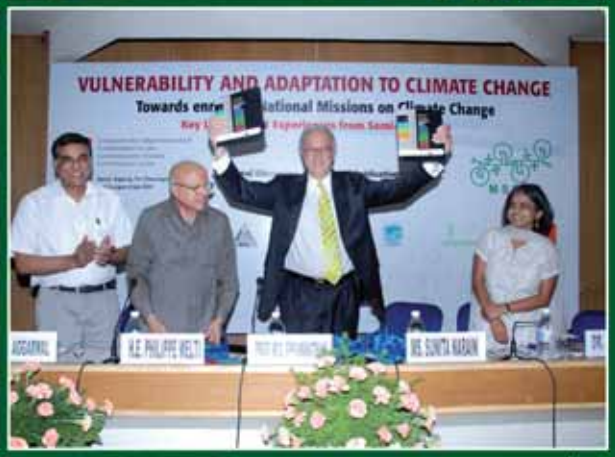
NO.6, THIRD CROSS ROAD,TARAMANI INSTITUTIONAL AREA, TARAMANI,CHENNAI 600 113

INCOME AND EXPENDITURE ACCOUNT

FOR THE YEAR ENDED 31ST MARCH 2010

EXPENDITURE			INCOME		
Particulars	2009-2010*	2008-2009	Particulars	2009-2010*	2008-2009
Administrative expenses	170.89	188.54	Interest income	526.15	460.27
Endowment expenses	334.86	272.18	Donation & overhead recoveries	218.16	227.25
Depreciation	63.11	61.17			
Excess of income over expenditure for the year transferred to the General fund	175.46	165.63			
Total	**744.31**	**687.53**		**744.31**	**687.53**

* Provisional (unaudited); Figures are in Rupees in Lacs



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