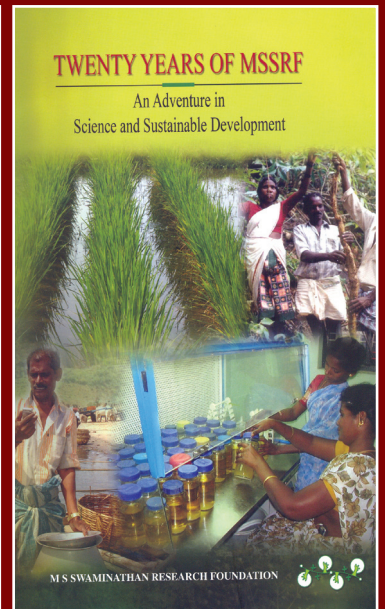


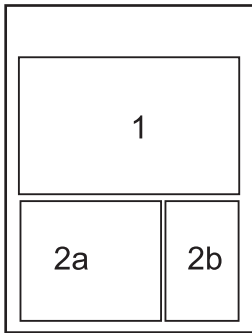


M. S. SWAMINATHAN RESEARCH FOUNDATION

**2008-2009
NINETEENTH**

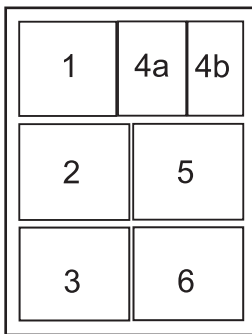
ANNUAL REPORT
CENTRE FOR RESEARCH ON
SUSTAINABLE AGRICULTURAL
AND RURAL DEVELOPMENT,
CHENNAI





Front Cover

1. Chilean President Dr Michelle Bachelet on her visit to the Foundation
- 2a. Devaki, a Kuruma farmer from Alammoola Colony, and Achappan, a Kurichiya farmer from Palukappil Colony, Wayanad, receiving the 2nd Genome Saviour Award from Minister for Agriculture Sharad Pawar at New Delhi
- 2b. Publication bringing out the salient achievements of 20 years of MSSRF

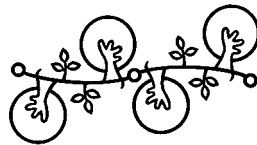


Back Cover

1. 1 Paddy cultivation under the SRI method where liquid biofertiliser applications were tested at Puducherry
2. Visit of the Board of Governors of IDRC to the restoration sites at Pichavaram mangroves
3. One of the high-yielding *Jatropha* accessions identified for the National Trials
- 4a. *Stemona tuberosa* – endemic plant identified in the Eastern Ghats
- 4b. Publication on the policy dialogue held on adaptation in climate change
5. The mobile teleophthalmology van at one of the VRC sites
6. World Food Prize Intern at the Pudukottai watershed

Nineteenth Annual Report

2008-2009



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

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Chairman's Introduction

MSSRF completed 20 years of institutional life in 2008. This occasion was utilised to launch thorough programme and management reviews designed to assess how far the original mission of imparting a pro-nature, pro-poor, pro-woman and pro-sustainable livelihood orientation to technology development and dissemination has been converted into accomplishments at the field level. The Management Review was undertaken by Krysalis Consultancy Private Limited, involving a team headed by Mr. C Venugopal, Managing Director and Chief Executive Officer. The Programme Review was carried out by Professor Uma Lele, Development Economist and formerly Senior Advisor, the World Bank, and Ms. Kavita Gandhi, Regional Manager, Oxfam, India. The reviews were carried out in a participatory manner with the active involvement of MSSRF management, scientists and scholars. The following are a few highlights of these reports.

Both reviews have underlined the need for strengthening the financial foundation of the institution, in order to ensure the sustainability of the programmes in the years to come. They have reaffirmed the contemporary relevance of MSSRF's research and outreach strategies, particularly in the context of potential adverse changes in temperature, precipitation and sea level arising from climate change. Anticipatory research for adapting to climate change has resulted in the development of novel genetic combinations possessing tolerance to salinity and drought, as well as in the conservation of underutilised crops and mangrove wetlands. Participatory research involving scientist-farm/tribal family partnerships in the conservation of biodiversity, promotion of community food, seed and water security systems, and

creation of multiple livelihood opportunities through biovillages have all yielded results of considerable applied and theoretical significance.

The Programme Review Team concluded as below:

"MSSRF is a unique non-governmental organisation, combining modern science and action research, working with society using community organisations and individuals while also using their traditional knowledge. Thus MSSRF has no parallels in its entirety. Its activity and influence have a broad reach and the Institution has established substantial credibility in specific areas ranging from the global to the local levels."

The Management Review team pointed out that "MSSRF had won several accolades over the years for its meritorious work and is perhaps one of the very few non-government science and society institutions in the country which has linked science and society in a symbiotic manner. Having said this, the team felt that there appears to be a feeling among the leadership team and others that MSSRF, while having delivered path-breaking solutions on the one hand, has not performed to its full potential taking into account the tremendous brand equity of its Chairman and the competence of its scientific team. While there have been examples of very good work at the individual level, collectively the Foundation could have performed much better."

Both reviews have made valuable suggestions for maximising the scientific and social strengths of MSSRF, and for minimising its weaknesses, particularly in the field of team work. The

recommendations were considered in detail by the MSSRF Trustees and Staff in February 2009 and steps have been taken to take MSSRF to new heights of excellence, both in the fields of science and in taking science to society. Our sincere gratitude goes to Professor Uma Lele and Ms. Kavita Gandhi as well as to Mr. C. Venugopal and his colleagues for their in-depth study of the programmes and management culture of MSSRF and for showing us the way forward.

A Committee of the Board of Trustees consisting of Dr. Vijay Mahajan, Chair, Dr. Tushaar Shah and Mr. K. Rajiv examined the reports of the Management and Programme Review Teams and developed an implementation plan. This was later approved by the Board of Trustees of MSSRF. My gratitude goes to all Trustees for the time they so generously spared for getting the review process organised in a meaningful manner and for spelling out the way to prompt follow-up action.

From the beginning, MSSRF has been working at two levels: at the grass-root level to test the social acceptability and sustainability of technological interventions, and at the policy makers' level for scaling up desirable technological and management innovations. The grass-root level partnerships have shown how to create an economic stake in conservation, how to develop participatory watershed management, and how to promote sustainable self-help groups of both women and men small farmers through backward linkages with technology and credit and forward linkage with markets.

Partnership with policy makers has led to the development of the Protection of Plant Varieties and Farmers' Rights Act, the Biodiversity Act, the Biotechnology Regulatory Authority Act, Integrated Coastal Zone Management procedures, and the institution of Genome

Saviour and Breed Saviour Awards for recognising and rewarding the invaluable contributions of tribal and rural women and men in the area of genetic resources conservation and enhancement in plants and animals. Technical support was given to the Ministry of Water Resources, Government of India, in initiating a Farmer Participatory Action Research Programme to test and promote water conservation and management technologies leading to more crop and income per drop of water. Assistance was also given to the Government of India on the steps needed to alleviate agrarian distress in the Allapuzha and Idukki districts of Kerala.

Partnership with the private sector led to the installation of solar street lamps in the tribal villages of Koraput district, Orissa, and in the establishment of a Capacity Building Centre for tribal families at the Biju Patnaik Medicinal Plant Garden and Research Centre at Jeypore, Koraput district. The partner in this adventure in taking science to tribal areas is the Mitsubishi Corporation, which has extended generous assistance under its Corporate Social Responsibility programme.

A major initiative in the field of education for sustainable development is the partnership with the Indira Gandhi National Open University in organising courses in the field of sustainability science. The first course was initiated on 19 November 2008 and three courses have so far been held. Under this series, there will be courses on topics like Nutrition and Sustainable Development, Biodiversity and Sustainable Development, Population and Sustainable Development, and Water Security and Sustainable Development. In addition, there will be courses based on the principle of **Action Education**, i.e., education based on field level action and experience. Courses on

the sustainable management of the Kuttanad Wetlands in Kerala which is a Ramsar site, and water security in Meghalaya (particularly in the Sohra or Cherrapunji area) will be based on field level action programmes, carried out jointly with local communities. Another significant area of collaboration with IGNOU is the organization of Community Colleges at Koraput, Kalpetta, Puducherry and Poompuhar. A Community College on Sustainable Coastal Zone Management will be established in Chidambaram in association with the Ministry of Earth Sciences, Government of India.

At the international level, partnership with the Chinese Academy of Sciences started in 1993 for spreading in China the biovillage paradigm of human-centred village development initiated by MSSRF in Puducherry in India in 1992. The biovillage model of sustainable human livelihood security has also been adopted in Bangladesh, and is now proving to be the template for the Millennium Village Programme, initiated by the Earth Institute of Columbia University in Africa. More recently, the Government of Chile and MSSRF signed a Memorandum of Understanding for working together in spreading the Village Knowledge Centre movement in Chile and for promoting the integrated coastal zone management programme. The agreement was signed on 20 March 2009 on the occasion of the visit to MSSRF of H.E. Madam Michelle Bachelet, President of Chile. Technical support has also been given to the Ministry of External Affairs, Government of India, for developing an action plan for agricultural renewal of the Northern Province of Sri Lanka.

Some of the programmes initiated by MSSRF have been scaled up by government departments. Thus, the Genome Clubs started by MSSRF in schools to promote genetic literacy has now taken the form of DNA Clubs promoted all

over India by the Department of Biotechnology, Government of India. The Concept of Ever-green Revolution developed by MSSRF (ie, increase in productivity in perpetuity without associated ecological harm) became the focal theme for the 50th anniversary conference of the American Society of Agronomy and the Crop Science Society of America. The title of the Conference was "From Green to an Ever-green Revolution"

Another significant event during the year was the visit of the Board of Governors of the International Development Research Centre of Canada (IDRC). Dr David Malone delivered a Millennium Lecture of *The Hindu Media Resource Centre* on 23 January 2009. The Chairman of the Board announced a Corpus Grant as well as a Project Grant to MSSRF for strengthening its research and educational programmes in the fields of Coastal System Management and Village Knowledge Centres, based on the integrated application of the internet, cable TV, FM radio and mobile phone. The IDRC Board also visited MSSRF projects in Puducherry and Chidambaram. They noted the work done in the Pichavaram area on mangrove regeneration and the development of mangrove and non-mangrove bioshields following the tsunami of 26 December 2004.

Several changes were made during the year in the field of management. These included Dr. Ajay Parida, who has served as leader of MSSRF's Biotechnology Programme with great distinction for over 17 years, taking over as Executive Director. Also, the Council of Directors was assigned the responsibility of taking all major decisions relating to the day-to-day functioning of MSSRF and its centres. Mr. Achyut M. Gokhale, who joined as Executive Director on 25 October 2007, retired from this position on 1 March 2009. We are grateful

to him for his valuable contributions to the development of MSSRF during the 16 months of his leadership.

This report contains the principal results obtained during 2008-09 in the major programme areas. I shall not repeat them but would like to draw attention to some significant results.

In the field of Coastal System Research, over 300 hectares of mangrove plantation were raised in partnership with fishing families. Over one million mangrove seedlings were planted and a mangrove bioshield was established in about 150 ha. This work covers 21 villages in Tamil Nadu and Andhra Pradesh. Different sustainable livelihood opportunities were demonstrated and many Self-Help Groups of coastal families started diversifying their income sources. The other important achievement is the development of farming techniques using seawater. Seawater farming is an agro-forestry-cum-aquaculture system. Considering the vast shoreline of India extending to 7500 km and the Andaman and Nicobar Islands and the Lakshadweep group of islands, seawater farming opens up a new window of opportunity for the livelihood security of coastal communities.

In the area of agrobiodiversity, the important contributions include saving 16 endangered tree species, enlarging the food security basket by including several nutritious millets and tubers, and promoting genetic literacy relating to the equity provisions of the Biodiversity Act and the Protection of Plant Varieties and Farmers' Rights Act. The *Kurichya* and *Kuruma* tribal communities of Wayanad, Kerala were conferred with the Second Plant Genome Saviour Award established by the Protection of Plant Varieties and Farmers' Rights Authority. An important aim of the agrobiodiversity conservation project is to create an economic stake in conservation.

This was achieved by finding markets for the produce of tribal families in Kolli Hills in Tamil Nadu, Wayanad in Kerala and Koraput in Orissa. The Kolli Hills farm families have formed an Agrobiodiversity Conservers' Federation as a registered body under the Tamil Nadu Societies Registration Act. The Federation has obtained a trademark from the Intellectual Property Authority of India for its products named 'Kolli Hills Natural Foods'.

The Biotechnology programme has achieved considerable success in pyramiding genes for stress tolerance and has developed homozygous pure lines for two of the pyramided genes. The work on the development of high yielding but salt and drought tolerant rice varieties using as parents popular *Indica* varieties like ADT 43, IR 20 and IR 64 has made very good progress. The bioprospecting work, as well as the work on *Jatropha*, has also yielded results of practical value.

The JRD Tata Ecotechnology Centre imparted training in a wide range of activities relating to the production and marketing of the biological software essential for sustainable agriculture. Both Integrated Farming Systems (IFS) and the System of Rice Intensification (SRI) were popularised and over a thousand families have adopted them. Integrated Dairy Management practices involving cattle and goat are getting well accepted. The Farmers' Federation at Kannivadi has launched a producer company. The Federation also manages the hub of the Community Learning Centres (CLCs), which provide need-based information on market prices, input prices, weather conditions, etc. The Bioindustrial Watershed programme being implemented jointly with the Punjab Agricultural University, Ludhiana, Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur and

the Ohio State University, USA is making good progress.

In the field of Climate Management, which is one of the earliest projects started by MSSRF in 1990, much progress has been made in the development of adaptation strategies in Andhra Pradesh and Rajasthan. A course has been developed for empowering one female and one male member of every panchayat to serve as Climate Risk Managers.

In the area of Food Security, an updated version of the *State of Food Insecurity in Rural India*, prepared with support from the World Food Programme, was released in February 2009. Women farmers in Vidarbha are being empowered to take to economically-rewarding agricultural practices through a Mahila Kisan Sashaktikaran Pariyojana. Also, a Coalition for the Elimination of Agrarian Distress in Vidarbha was formed in Nagpur in February 2009. It is hoped that this network will help to generate convergence and synergy among all the ongoing programmes and bring to an end the sad era of farmers' suicides.

The work on Information and Communication Technology has made further progress through the establishment of additional Village Resource Centres and Village Knowledge Centres. The Last Mile and the Last Person Connectivity is being achieved through synergy between the internet and mobile phones. Small-scale fishermen operating catamarans have been empowered with information on wave heights and location of fish shoals with the help of the Ministry of Earth Sciences. Digital boards have been put up at various locations giving information on wave heights for the benefit of fishermen going out into the sea. Both the Jamsetji Tata National Virtual Academy for Rural Prosperity and the Jamsetji Tata Training School have achieved national and international reach.

During the year, the research and educational infrastructure was further strengthened through the establishment of capacity building and training centres at Kalpetta, with generous assistance from the Government of Japan, and at Koraput with the help of the Mitsubishi Corporation under their CSR programme. The Fish for All Training Centre at Poompuhar, established with the help of Tata Trusts, will shortly be available for starting training courses. This is a unique centre which provides training on an end-to-end basis (i.e., from capture to consumption). An Integrated Coastal Zone Research and Training Centre will be established in the near future near Chidambaram.

All the above work would not have been possible but for the kind help and support of the Tamil Nadu Government and Central and State Government Departments and the generous and sustained support of donors, for which we are very grateful. Equally, the work of such scientific and social significance could not have been carried out without the enthusiastic and emotional involvement of scientists and scholars. Human Resource Development has continued to be high on the priority of MSSRF's management culture. During the year, three students took their Ph.D. degree of the Madras University based on their work carried out at MSSRF.

My gratitude goes to Drs. Ajay Parida, Sudha Nair, V.A. Nambi and Ms. R. V. Bhavani for their painstaking efforts in compiling this Annual Report and to Ms. Gita Gopalkrishnan for her thorough editing. The printing was ably done by AMM Screens.

M. S. Swaminathan

COASTAL SYSTEMS RESEARCH

Activities to strengthen the livelihoods of the tsunami-affected communities were the focus of projects implemented in 14 villages in Tamil Nadu and Andhra Pradesh and a total number of 1411 poor families participated in these activities. Integrated Mangrove Fishery Farming System has been extended to 7 ha. Evaluation of one of the major projects on strengthening the resilience of tsunami-affected communities was completed during the year. Capacity building of farmers in natural resources management was the focal point in the activities implemented in the rain-shadow coastal villages of Tamil Nadu. A GIS based model to periodically monitor the health of mangrove wetlands has been developed and tested.

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Sub Programme Area 101

Mangrove and Non-mangrove Coastal Bioshields

The exercise of developing and demonstrating models of mangrove and non-mangrove bioshields that integrate the ecological security of coastal areas and the livelihood security of coastal communities was initiated immediately after the tsunami in December 2004. In 2008-2009, two major projects relating to mangrove and non-mangrove bioshield and allied activities (such as community mobilisation and organisation, livelihood support, capacity building, etc.) implemented in 21 villages in Tamil Nadu and Andhra Pradesh came to an end. In 2009, one of the projects, which was co-funded by the International Development Research Centre (IDRC) and the Canadian International Development Agency (CIDA), New Delhi, was evaluated by an external consultant.

101.1 Ecological rehabilitation of the coastal areas of Pichavaram: Establishing community-based mangrove and other coastal vegetation as bioshield

Models of a community-based bioshield with mangrove and other coastal vegetation to mitigate the impact of natural calamities such as cyclones, storm surges and tsunamis were developed, demonstrated and implemented in three fishing hamlets, namely, Muzhukkuthurai, MGR Thittu and Mudasalodai in the Pichavaram region of Cuddalore district. All these villages

had been severely affected by the tsunami in terms of both human and material loss. In each of the villages, a village-level institution called Village Welfare Society (VWS), consisting of a General Body and an Executive Committee, was formed to plan, implement and monitor project activities. This ensured the active participation of traditional leaders, women, and youth. Both district-level and field-level staff of the Revenue Department also actively participated with the community in project planning, implementation and monitoring.

Mangrove bioshield

Table 1.1 shows the area of mangrove bioshield raised since the inception of the project in 2006 and including work in about 8 ha in 2009. It also shows the number of propagules planted and the present survival rate.

The canal method, consisting of main canals and feeder canals that facilitate the free flow of tidal water in and out of the plantation area, was followed to raise a mangrove plantation in the 25 ha of island area in MGR Thittu. A total of 1,98,000 propagules (seedlings) of *Avicennia marina* have been planted, including about 65,000 propagules planted in December 2008 in the gaps that existed between the feeder canals as well as 18,000 propagules planted to replace losses. The survival rate of this plantation as on April 2009 was about 54 % and the average growth is about 64 cm. In the fringe area of 10 ha, about 48,000 *Rhizophora* propagules were planted, including 17,000 propagules planted in September 2008. The survival rate of *Rhizophora* has not

Table 1.1 *Area of mangrove bioshield, types of plantation and rate of survival in the Pichavaram region*

| Village | Area of bioshield (ha) | Type of Plantation (ha) | | Rate of Survival | |
|-----------------|------------------------|-------------------------|-------------|-------------------------|--------------|
| | | Island | Fringe area | Planted | Survival (%) |
| MGR Thittu | 35 | 25 | 10 | <i>Avicennia marina</i> | |
| | | | | 1,98,000 | 54 |
| | | | | <i>Rhizophora spp.</i> | |
| Mudasalodai | 10 | 00 | 10 | 48,000 | 20 |
| | | | | <i>Avicennia marina</i> | |
| | | | | 32,000 | 66 |
| Muzhukkuthurai* | 3 | 3 | 0 | <i>Rhizophora spp.</i> | |
| | | | | 2,000 | 78 |
| | | | | <i>Avicennia marina</i> | |
| Total | 48 | 28 | 20 | 12,000 | 72 |

*An area of 30 ha was demarcated for Muzhukkuthurai village, which was taken up by the Tamil Nadu Forest Department for raising mangrove plantation; the Muzhukkuthurai VWS is now protecting and maintaining this area.

been satisfactory. In the initial stages, nearly 70 % of the propagules died immediately after plantation due to poor storage and delay in transport from Andhra Pradesh. However, after freshwater flow in the backwater area in December 2008, these propagules sprouted from lateral shoots and showed a survival rate of 52 %. Again, in May 2009, mass mortality was noticed and now only 20 % of the 48,000 propagules survive. The reasons for the poor survival rate are being analysed.

In Mudasalodai, measures to rehabilitate a mangrove plantation in 10 ha, that had been raised by a community leader but had been totally damaged during the tsunami, were undertaken. This year, a bamboo fence was erected around the plantation and a

canal system was established within the site for improved tidal flushing. About 32,000 *Avicennia marina* propagules, collected from Muthupet mangroves, were planted along the banks of the feeder canals. Around 2,000 *Rhizophora* propagules, from Pichavaram mangroves, were planted along the sides of the main canals. The survival rate of *Avicennia marina* and *Rhizophora* was 66 % and 78 %, respectively. The average height attained by *Avicennia marina* was 42 cm and that by *Rhizophora* 54 cm.

Sand dune restoration and stabilisation

There is a stretch of beach, about 2,300 m long, between the project villages and the sea. Before the tsunami, this beach was characterised by the presence of sand dunes,

which varied in height from 3 to 12 feet. The tsunami totally damaged the dunes to a length of 1,000 m and the remaining 1,300 m were partially affected. Last year, the totally damaged sand dunes were restored using traditional methods and sand binders were planted to stabilise them. This year, the stabilisation of the partially damaged dunes was taken up by planting sand-binding creepers like *Ipomea pes-caprae* and *Spinifex* sp on the top of the sand dunes as well as on the seaward side. In September 2,008, 4,800 seedlings of *Ipomea* raised in the nursery were planted along with 6000 stem cuttings of *Spinifex* sp. The survival rate of *Ipomea* seedlings was about 60 % and they have grown to a length of about 1.8 m to 2.2 m. The survival rate of *Spinifex* was about 47 %.

Multispecies non-mangrove bioshield

A multispecies non-mangrove bioshield was raised with the participation of the VWS of M.G.R. Thittu in two places, one on the beach and one within the village. The beach bioshield consists of a sand dune developed 30 m away from the high tide line; it was initially 1 m in height but now has extended

to 2.3 m due to natural piling of sand. After this sand dune is a multispecies bioshield, which consists of 15 rows of plantation. In the first 3, just after the dune, *Pongamia pinnata* (local name *Pungam*) has been planted, followed by 2 rows of *Calophyllum inophyllum* (local name *Pinnai*). Then come 5 rows of coconut, and again 2 rows of *Calophyllum* and 3 rows of *Pongamia pinnata*. Altogether, a total number of 794 plants, including 202 coconut, 380 *Pongamia pinnata* and 212 *Calophyllum inophyllum* saplings have been planted. Biofertilisers such as *Azospirillum* and phosphobacteria, and farm yard manure were used for manuring. No chemical fertiliser was applied. The multispecies non-mangrove bioshield developed within the village also consists of 5 rows of coconut, with 2 rows of *Calophyllum inophyllum* and 3 rows of *Pongamia pinnata* on either side. The VWS has appointed two community watchers to look after watering, manuring, loss replacement, and protection against sand deposition and animal grazing. **Table 1.2** shows the growth performance of the different species.

The survival and growth performance of the multispecies bioshield of Madavamedu

Table 1.2 Growth performance of saplings planted in the multispecies bioshield established in the beach and within MGR Thittu

| Bioshield site | Non-mangrove Bioshield (beach) | | | Non-mangrove Bioshield (village) | | |
|-------------------------------|--------------------------------|--------------|-------------|----------------------------------|--------------|-------------|
| | Planted | Survival (%) | Height (cm) | Planted | Survival (%) | Height (cm) |
| <i>Pongamia pinnata</i> | 380 | 74 | 132 | 56 | 88 | 244 |
| <i>Calophyllum inophyllum</i> | 212 | 80 | 121 | 86 | 85 | 112 |
| Coconut | 202 | 23 | 176 | 180 | 98 | 157 |

village, which was the first to be initiated in 2005, was observed to be good. Most part of the sand dune, which was established in front of this bioshield, was stabilised by planting of sand binders. In areas where the sand dune was not stabilised, villagers re-established it following traditional methods. Since the *Pongamia*, neem and coconut saplings had grown to considerable size, the village community wanted to take care of the management of this bioshield, and the panchayat is protecting and managing it with the help of a community representative. An important development observed during this year was that the sand dune in Madavamedu provided a suitable nesting ground for sea turtles. A total number of 6 nests were found in and around this sand dune. The Tamil Nadu Forest Department collected eggs from these nests and established a small hatchery in the sand dune developed within the bioshield site. The Forest Department, MSSRF and the village community have jointly protected the eggs and about 1,680 turtle hatchlings were successfully released into the sea.

Training

The following training programmes were organised for the community in the three project villages:

- i) The leaders of the Executive Committee of the VWS and traditional panchayat, leaders and members from Women SHGs and youth of MGR Thittu were given orientation on leadership development through a

one-day training programme. A similar kind of orientation workshop was also held for Muzhukkuthurai and Mudasalodai villages. Experts from Annamalai University, Chidambaram, as well as from the Women's Development Corporation, Government of Tamil Nadu, served as resource persons for these workshops.

- ii) A one-day training programme on accounts and records maintenance was conducted by resource persons from the Indian Bank, who are experienced in handling institutional and financial aspects of Self-help Groups. Leaders and members of the VWS and animators of the three project villages also participated in this training programme.
- iii) A one-day orientation programme was conducted on Disaster Management for the community leaders, women, and youth of Muzhukkuthurai village by the NGO — Institute of Participatory Environment and Disaster Management, Chidambaram.
- iv) The President of the elected panchayat and ward members of Killai town panchayat were given one-day training on the role of panchayats in mangrove and non-mangrove bioshield development.

Livelihood support

Major problems were faced in identifying and implementing livelihood support programmes. As per the demand of the people and further analysis, each village was provided with a four-wheeler for the use of fish-vending women, to reduce their drudgery and increase profit in fish

vending. However, in all the three villages, this initiative has been a failure, the main reasons being the inexperience of women groups that managed the vehicle, poor fish landings that reduced the number of women fish vendors hiring the vehicle, poor management by the VWS (such as leasing out the vehicles for long distance travel, inexperienced drivers, poor vehicle maintenance, etc.) and conflict between traditional leaders and Executive Committee of the VWS over the ownership of the vehicle. The VWS of MGR Thittu sold the vehicle and deposited the money into the village common fund, whereas the VWS of Muzhukkuthurai has been leasing the vehicle to a private company for Rs.6,000/month.

A detailed study was conducted with the help of an external resource person on opportunities available to strengthen the livelihoods of the fishing families of the three project villages. It was shared with various grass-roots NGOs and government agencies for implementation.

101.2 Indo-Sri Lanka Project on strengthening the resilience of tsunami-affected communities

The goal of the India-Sri Lanka project has been to reduce the vulnerability of the rural poor to natural disasters in coastal areas. Implemented from April 2006 to March 2009 in 14 villages, 8 in Tamil Nadu and 6 in Andhra Pradesh, in partnership with grass-roots NGOs, it is aimed at:

- rehabilitating and improving mangrove and non-mangrove bioshields and introducing

new village-level management bodies to share benefits.

- expanding livelihood opportunities for women and other groups through access to information.
- strengthening the capacity of local organisations and governments to prepare for, and mitigate, natural disasters.

In Tamil Nadu, the three sites chosen were Vembar (3 villages) in Tuticorin district, Manamelkudi (4 villages) in Pudukottai district and Thondi (1 village) in Ramanathapuram district. In Andhra Pradesh, the project sites were Krishna (3 villages) in Krishna district and Kakinada (3 villages) in East Godavari district.

Community mobilisation and organisation

In all the project villages, a village-level institution comprising a General Body and an Executive Committee was formed to plan, implement and monitor project activities. The members of the Executive Committee included representatives of women's groups, traditional panchayats, Panchayat Raj institutions, partner NGOs and MSSRF. It met regularly once a month and prepared micro plans for village-level activities with the approval of the General Body. Both the General Body and Executive Committee played important roles in resolving conflicts that arose within the villages and with neighbouring villages, especially in bioshield development and management.

Bioshield

Mangrove bioshield in Tamil Nadu

The mangrove bioshield in Tamil Nadu was raised in about 90 ha during this year.

In the initial phase of the project, an area of 38 ha in Kattumavadi village was identified as being suitable for raising the mangrove bioshield. But, the mangrove plantation was established only in 20 ha (Plot I) since women wanted to retain 18 ha of land for village expansion in the future. Since the growth and survival of the mangrove plantation raised in Plot I was good, the Village Development and Management Council (VDMC) wanted to expand the bioshield in other sites situated close to the village. Accordingly, the VDMC located another 15 ha (Plot II) of land and obtained permission from the panchayat for raising the mangrove plantation. Adopting the fish-bone canal method, a system consisting of two main canals and a number of feeder canals was established in this area. Planting in Plot II was completed in January 2009, with *Avicennia marina* propagules collected from Muthupet and *Rhizophora* spp collected from Pichavaram. About 1,50,000 *Avicennia marina* propagules were planted with 0.3 m spacing and 10,000 propagules of *Rhizophora* spp were planted at intervals of 1 m. In April 2009, the survival rate of *A. marina* was 97 % and the average height reached was about 20 cm. A community representative, who resides nearby, takes care of all management activities including protection against grazing, removal of seaweeds deposited in the canals, blocking boat landings in the plantation site, etc.

In Melasthanam village, the mangrove plantation was taken up in 15 ha of land owned by the Revenue Department. The mouth of the estuary that connects the sea and the Melasthanam mangrove bioshield area was opened up by digging a canal 10 m wide and 1.5 m deep for a distance of about 150 m. As a result, a huge amount of tidal water comes into the estuary and mangrove site during high tide. This has not only helped in creating suitable biophysical conditions for the establishment of mangroves but also provides breeding and feeding grounds for fish, prawn and crab.

Another important initiative taken up this year was raising a mangrove plantation without a canal system in about 60 ha area located near village Muthuregunthapuram, in Ramanathapuram district. So far, mangrove plantations in Tamil Nadu had been set up only in upper tidal areas, where artificial canal systems established for proper tidal flushing create suitable biophysical conditions. In Muthuregunthapuram, for the first time a mangrove plantation has been raised in a large intertidal area without any canal system. Two main reasons this has been possible are first, the topography of the intertidal area in this coastal stretch is smooth and slopes gently towards the sea and, as a result, tidal water inundates the entire area during high tide and drains out completely during low tide every day. Thus, suitable soil, moisture and salinity regimes are naturally created for the growth of mangrove plants. Second, wave energy being low due to the sheltered nature of the coastal zone here, there is not much chance that mangrove seedlings planted in

this area would be uprooted by wave action. Therefore, an intertidal area covering a distance of about 3,000 m along the coastline and 200 m towards the sea was selected for raising the mangrove plantation. About 1,80,000 propagules of *Rhizophora mucronata* and *R. apiculata* sourced from Pichavaram mangroves in Tamil Nadu and Krishna and Godavari mangroves in Andhra Pradesh, and including 50,000 nursery-raised seedlings, were planted from January to March 2009. The survival rate of the propagules in April 2009 was 98 % and the average height was 60 cm. The Muthuregunathapuram VDMC is in charge of the management of the plantation. Sea grass was found to be washed ashore in large quantities during the monsoon (October to December) and post-monsoon (January to March) seasons, completely covering the mangrove propagules in many places. They were removed manually by women from the SHGs. The plantation area was demarcated

and marked by poles with flags and villagers requested not to fish in the plantation area till the seedlings grow to a considerable size.

A mangrove bioshield was raised last year in about 30 ha in Keezhavaipar village. The VDC of the village has appointed a person from the community to manage this mangrove bioshield. A total number of 1,80,000 propagules were planted consisting of 1,40,000 *Avicennia marina* and 40,000 *Rhizophora* propagules in December 2007. Monitoring of this plantation indicates that the survival rate of *Avicennia marina* and *Rhizophora* spp. was 39 % and 58 % in April 2009. The poor survival rate of *Avicennia marina* was mainly due to the siltation of the canal system by sand deposited from the sand mining activity in the vicinity. The VDC of Keezhavaipar is negotiating with the sand mining company to avoid mining near the plantation site.

Table 1.3 shows the area of mangrove bioshields raised in Tamil Nadu sites since

Table 1.3 Area of mangrove bioshield in Tamil Nadu sites, species planted and their survival rate

| Village | Area of bioshield (ha) | Type of plantation | Species | Plantation Number | Rate of Survival (%) |
|---------------------|------------------------|--------------------|-------------------|-------------------|----------------------|
| Kattumavadi Plot I | 20 | Canal | <i>Rhizophora</i> | 45,000 | 72 |
| | | | <i>Avicennia</i> | 85,000 | 62 |
| Kattumavadi Plot II | 15 | Canal | <i>Rhizophora</i> | 10,000 | 97 |
| | | | <i>Avicennia</i> | 1,50,000 | 93 |
| Melasthanam | 15 | Canal | <i>Avicennia</i> | 1,00,000 | 85 |
| Keezhavaipar | 30 | Canal | <i>Rhizophora</i> | 40,000 | 58 |
| | | | <i>Avicennia</i> | 1,40,000 | 39 |
| Muthuregunathapuram | 60 | Open mud flat | <i>Rhizophora</i> | 1,80,000 | 99 |
| Total | 140 | | | 7,50,000 | |

the inception of the project, total number of propagules planted and their survival rate.

Mangrove bioshield in Andhra Pradesh

In Andhra Pradesh, the mangrove bioshield was raised only in one village — Sorlagondi in the Krishna site. Large areas of mangroves that were present in the lands owned by the Revenue Department near this village had been illegally cleared for the development of prawn culture. However, due to continuous loss in prawn culture, many of the farmers abandoned their farms. These degraded mangroves were restored with the permission of the District Administration as part of the mangrove bioshield programme. Last year, the bioshield was raised in about 60 ha of degraded mangrove area. A total number of 1,42,000 propagules of *Avicennia marina*, including 72,000 nursery-raised seedlings were planted, of which 75 % have survived as of April 2009 and the mangrove seedlings have grown to a height of 80 cm. This year, a mangrove bioshield was raised in another 80 ha of degraded mangroves through the canal system. About 1,80,000 propagules of *Avicennia marina* were planted in this area and the survival rate was 70 % in April 2009. Since Sorlagondi is in an area prone to cyclones and storm surges, the villagers, aware of the impact of such natural disasters, actively participated in raising the bioshield. Canal digging and planting seedlings provided employment opportunities to a large number of men and women in the village, who are also being hired by the Andhra Pradesh Forest Department in their mangrove restoration activities.

Non-mangrove bioshield

In Tamil Nadu, a multispecies non-mangrove bioshield was established only in about 1 ha of land available nearby Rojmanagar village. Three tree species — *Pongamia pinnata* (140 numbers), Coconut (100) and Casuarina (300) — have been planted in the 1 ha area. The VDC of Rojmanagar is responsible for after-care and management activities. In Andhra Pradesh, a non-mangrove bioshield was raised in about 11 ha in the Kakinada site. As desired by the community, casuarina was the main species planted in the bioshield and high survival and growth rates have been achieved. A few other tree species such as coconut, soapnut and cashew have also been planted in the bioshield area. However, the survival rate of cashew and soapnut has not been satisfactory because of salinity.

Livelihood

In each project village the community has been facilitated to identify target groups as participants in the livelihood projects. The wealth-ranking exercise of participatory rural appraisal was used as a tool to identify such groups. Women-headed families and other assetless families were identified as the poorest, and these two groups have been targeted as participants in all the livelihood programmes. Apart from this, in each village, the livelihood pattern of the communities was also analysed thoroughly by conducting a) resource mapping (resources that support livelihood of different sections of the community), b) seasonal mapping (income generating and employment opportunities available in different seasons for

women and men of different sections of the community), c) access and control analysis (who is having access and control over what resources, income-generating opportunities and employment opportunities), d) credit facilities through Venn diagram and matrix analysis and e) marketing, etc. These exercises provided information on opportunities available and interventions to be taken to strengthen the livelihood of the community.

Three different kinds of activities have been identified to strengthen livelihoods: direct interventions to strengthen existing livelihood activities, demonstrations of new livelihood opportunities available, and training to impart vocational skills.

Livelihood activities in Tamil Nadu

A total number of 826 families were identified as target groups in the 8 project villages in Tamil Nadu, which included 122 women-headed families (14.8 %). Out of the 826 families, 512 families participated in different livelihood activities. At the Vembar site, group-based activities such as selling fishing gear, rice trading, running grocery shops, rearing goat and milch animals were the major livelihood activities implemented. A revolving fund for fish-vending women and a variety of other micro enterprises were also set up.

In Manamelkudi, two major activities were taken up to strengthen the livelihood of the target groups. A total amount of Rs.3,00,000 was provided to 6 Women SHGs as a revolving fund to undertake different micro enterprises of their choice as additional income-generating

activities. As shown in **Table 1.4**, these SHGs identified 16 micro enterprises for the utilisation of the revolving fund. The fund has initially been given to start 7 enterprises and payment of monthly installments will be used to fund other identified income-generating activities. Another major activity initiated in two villages has been making coir rope from coconut pith, involving 30 women from Melasthanam village and 22 women from Ponnagaram village. These women were provided hands-on training by the staff of the District Industrial Centre of Pudukkottai in all the steps of the process involved in making coir rope. They were also taken to various private coir rope-making units operated by women groups in neighbouring villages, for practical exposure. Funds have been provided to develop infrastructure and purchase of machinery and raw materials. The coir rope manufactured at the two units was sold locally. The income generated has, however, been poor, with each member of the unit getting only Rs. 50 per day. Since the government-initiated National Rural Employment Guarantee Scheme (NREGS) pays Rs.100 a day as wages, many of the trained members opted to undertake NREGS work. However, they have said that they would return to the coir rope units in the lean season, when no work is offered under NREGS.

Livelihood activities in Andhra Pradesh

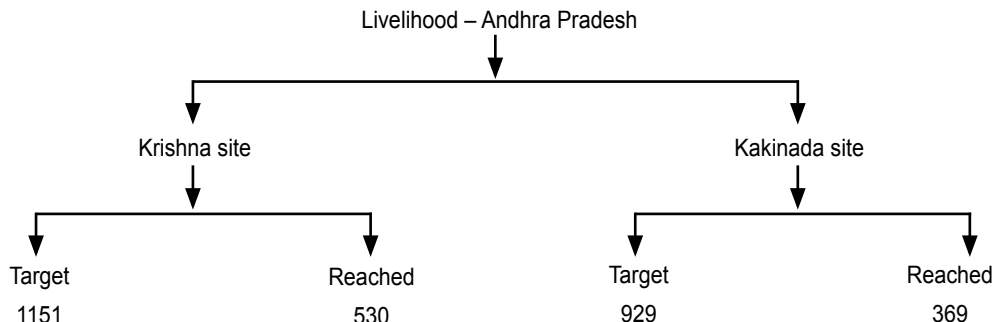
Figure 1.1 shows target groups identified for livelihood strengthening and the main activities implemented in 3 villages each in the Krishna and Kakinada sites. Out of 2080 families identified, 227 (10.9 %) families were headed by women.

Table 1.4 *Various income-generating activities identified for the utilisation of revolving funds by women SHGs*

| Micro enterprises | Number of women opted for different micro enterprises from different SHGs | | | | | | Total |
|------------------------------|---|----------------|-----------------|--------------|----------------|-----------|------------|
| | Sister Nivenitha SHG | Sarasvathi SHG | Ramamirtham SHG | Vanvizhi SHG | Jansi Rani SHG | Indra SHG | |
| Dry fish vending | - | 3 | 2 | 4 | 3 | 3 | 16 |
| Fish vending | 4 | 2 | 6 | 6 | 7 | 12 | 37 |
| Shrimp vending | 3 | 3 | 8 | 2 | 8 | 2 | 26 |
| Crab vending | - | - | - | 3 | - | - | 3 |
| Redemption from outside debt | 7 | 3 | 1 | - | 2 | 2 | 15 |
| Squid vending | - | - | - | 2 | - | - | 2 |
| Saree business | 2 | 1 | - | - | - | - | 3 |
| Goat rearing | 3 | 2 | - | - | - | - | 5 |
| Selling washing powder | - | - | - | 1 | - | - | 1 |
| Petty shop | - | - | - | - | - | 1 | 1 |
| Purchasing fish nets | - | 2 | - | - | - | - | 2 |
| Coconut thatch production | - | 1 | 1 | 1 | - | - | 3 |
| Sewing | 1 | - | - | - | - | - | 1 |
| Boat repairing (maintenance) | - | 1 | - | - | - | - | 1 |
| Medical expenses | - | 2 | - | - | - | - | 2 |
| Puffed rice business | - | - | - | 1 | - | - | 1 |
| Total | 20 | 20 | 18 | 20 | 20 | 20 | 118 |

Reclamation of agriculture land: Early in 1990, many of the farmers in the Andhra Pradesh coastal area converted their fertile agriculture lands into aquaculture farms for prawn culture. However, in the late 1990s and early 2000s, continuous loss in prawn farming due to viral disease, increase in input costs and reduced market prices led to the closure of many of these prawn farms. The land could not be used for agriculture because of salinity. Thus, many of the small farmers who had converted their landholdings into prawn farms lost their livelihood. In one of the project villages — Sorlagondi — nearly 80 acres of such abandoned prawn farms belonging to 48 small farmers were identified for reclamation as per the request of the VDMC. The land was leveled by earth movers, and then deep ploughed twice. Gypsum (1 ton / acre) was

Figure 1.1 **Number of families targeted and reached for livelihood strengthening and major livelihood activities implemented in Andhra Pradesh**



- Reclamation of agriculture land from abandoned prawn farms
- Eco-friendly aquaculture
- Integrated mangrove fishery
- Farming system
- Irrigation and drainage facility for saline-affected lands

- Revolving fund
- Post-harvest storage facility
- Lime making

added before the second ploughing. The fields were then filled with freshwater for more than a month, and thereafter paddled by tractors to dissolve subsurface salts. The water was then drained to flush out the salt water. The entire procedure was repeated twice to remove the salinity in the soil.

Paddy was cultivated in an area of about 50 acres, but the results were good only in about 32 acres and growth was severely affected in the remaining 18 acres because of poor leaching of salts. In December 2008, the average yield obtained was about 30 bags per acre (2.25 tonnes). In addition, farmers also got enough fodder for milch animals. Following the same reclamation process with additional work of desilting irrigation and drainage

canals, about 417 acres of abandoned shrimp farm were reclaimed for agriculture in village Nali. Paddy has been grown in about 175 acres during *kharif* 2008 and 382 acres in *rabi* 2009.

Reclamation of agricultural land has provided job and food security to the villagers. The land value has also increased. Apart from this, many of the farmers have started rearing milch animals again, adding to their incomes. Earlier, nearly 90 % of the farming community in village Nali used to migrate for about 6 to 9 months to other areas for agricultural work, leaving the children and elders behind. After the revival of agriculture, migration has now completely stopped.

Eco-friendly aquaculture: The demonstration of eco-friendly aquaculture has been another major livelihood activity implemented in Andhra Pradesh during the reporting period. In some areas reclamation of agricultural land from abandoned shrimp farms has not been possible because of seepage of salt water deep into the soil as well as into groundwater. It was decided to introduce eco-friendly shrimp farming in these areas, with the participation of the community and the National Centre for Sustainable Aquaculture (NaCSA) of MPEDA.

Analysis of the recurrent loss in shrimp farming clearly indicated that the main causes were the high stocking density of prawn, diseased prawn juveniles, use of artificial feed in large quantities, use of chemicals and increase in input costs. In eco-friendly shrimp farming, the stocking density of prawn was reduced from 7 to 8 prawn juveniles per sq. m to 2 per sq. m. Because of reduction in stocking density, no artificial feed was used. NaCSA played a critical role in training the shrimp farmers in selecting disease-free prawn juveniles and also helped the farmers in identifying prawn hatcheries that produce disease-free juveniles. The use of antibiotics and other chemicals was thus completely avoided. Also, previously each shrimp farmer operated his own diesel motor to pump out brackish water, with nearly 200 diesel pumps in use. These diesel pumps have now been replaced by 22 electric motors — provided to the farmers through establishing a revolving fund — which they use in a cooperative manner. This has greatly reduced input costs.

Nearly 192 farmers (of which 102 belong to poor families and 58 are from the medium rich group), have been practising this eco-friendly shrimp farming system in about 355 acres of land. So far, two crops of prawn have been harvested. In the first crop, only 9 farmers incurred losses and the remaining farmers got a profit of about Rs.5,000 to Rs.15,000 per acre. In the second crop, initiated in June-July 2008, 140 farmers got a profit of about Rs.10,000 to 20,000 per acre and others of about Rs.5,000 per acre. After seeing the success of this approach, the rest of the farmers in Sorlagondi and Nali have been interested in starting eco-friendly aquaculture in their abandoned ponds in about 410 acres of land. The NaCSA has formed a society with these farmers to help them in this endeavour.

Village Resource and Village Knowledge Centres

Establishing Village Resource and Village Knowledge Centres is another important component of this project. Activities carried out in the component are described under Programme Area 600: Information, Education and Communication.

Evaluation of the project

The project processes, activities and output, outcomes and impacts were evaluated by a consultant (appointed jointly by the IDRC and CIDA) on the basis of presentations made, reports submitted, self-assessments by MSSRF and partner NGOs, interaction with the community and other stakeholders, and observations during field visits.

The consultant concluded that the project-derived framework (**Figure 1.2**) could be used in future disaster preparedness and strengthening the resilience of poor coastal communities. While the nature of activities and their relative emphasis might differ, the integration of environment, livelihood and Disaster Risk Reduction (DRR) will be better understood. He was of the view that this work would be of special relevance in efforts of governments, donors, NGOs and local communities in determining what an

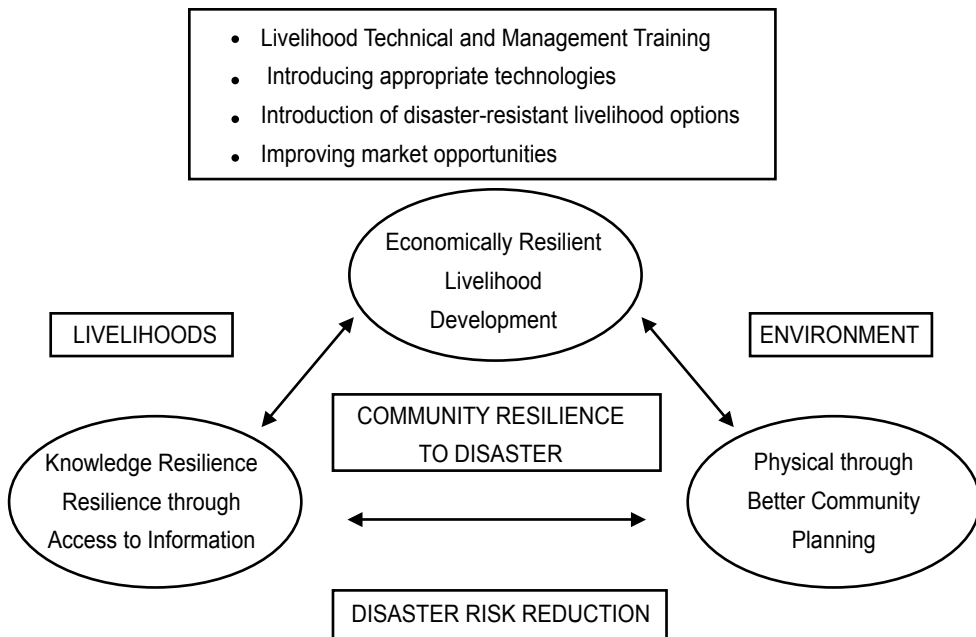
appropriate response to climate change might look like.

The following are the recommendations of the evaluator:

Bioshield

- a) Continue bioshield work and follow-up so that the impact can be experienced by local communities. A minimum of one year is critical.

Figure 1.2 **Framework for future disaster preparedness and strengthening resilience to disasters**



Village Information Centre and Library
 Developing content for local information needs
 ICT services to community
 Disaster early warning & weather information
 Livelihood Centre for local livelihoods

Disaster-resistant infrastructure planning
 Community DM planning
 Coastal resource management planning
 Bioshield establishment
 Drought and flood mitigation

- b) Advocate and network for scaling up where the areas are small.
- c) Increase emphasis on documentation and dissemination (what has been done, tenure, negotiation, the process, including social and institutional issues and technical recommendations).
- d) Utilise the major opportunity on hand for sharing mangrove-based work between MSSRF and Sri Lankan organisations (earlier CIDA supported work).
- e) Organise cross visits within Indian project sites (beyond Pichavaram) for mentoring. Communities are receptive in a manner never experienced before.
- e) Make hard decisions on the closure and transfer of failing VIC/VKCs.
- f) Set up MOUs on the custodianship of facilities and equipment (where they do not exist) and management plans for maintenance, income sharing arrangements, etc.

Disaster management

- a) Increase the emphasis on this area of work. Consider sharing the Disaster Reduction (DR) frameworks, the Demand Side Management (DSM) and Coast Conservation Department (CCD) approaches and the agricultural rehabilitation with the wider community.
- b) Take up further action research on the modalities of addressing saline water incursion and salinisations of land and water in areas (climate change influences).
- c) Pursue practical action engagement in India in the areas of business planning, Participatory Market Chain Analysis (PMCA), etc., undertaken within the Disaster Resistant Sustainable Livelihood (DRSL) framework

Livelihood

- a) Consolidate what has been started in the area of revolving funds and agricultural rehabilitation.
- b) Develop management plans for the wide range of agricultural rehabilitation projects that have emerged.

VKCs and VRCs

- a) Recognise the value of Village Knowledge Centres disseminating information on government programmes and as early warning entities.
- b) Recognise their value as educational centres on ICT for young people.
- c) Seriously enhance the relevance of VKC/VRC/VIC content for adults.
- d) Develop video-based educational media for adults (video case studies).

Documentation priorities

Bioshields and coastal shelter belts, agriculture rehabilitation, rehabilitating traditional crafts and trades (including linking producers to markets), integrating disaster management and coastal resource management at the village levels.

Policy areas

Round Table, multi-stakeholder participatory

write shops to produce policy briefs, (partners, line agencies, researchers and academe).

Programme management

On the regional nature of the project, the strength so far has been the joint planning and peer review process and sharing. The focus then shifted to implementation and in that connection exchanges were conducted. Active participation is noted in workshops, Project Advisory Committee meetings but collaborative work between India and Sri Lanka in its real sense has not yet occurred. The concept of boundary partners and deploying professional MSSRF staff to the district level has been strategic with resulting positive effects (especially PPSS and PAD).

- a) Organise a “truly collaborative” activity between MSSRF and Sarvodaya on VKCs: learning-centered exchange followed by internships and workshops for change.
- b) Practical Action and Sarvodaya to consider assisting MSSRF sites with business idea generation and business planning and DRSL dimensions.
- c) Establish learning centres (not more than 10) in both countries. Consider closing down sites where self-assessment indicates poor performance. Concentrate on quality, quantification, networking with the markets, sharing and cross-community mentoring.
- d) Bring in the climate change community to meet with the agricultural rehabilitation community of NGOs/GOs.

Extension and new phase

A one-year extension of the project is *absolutely* essential, otherwise a serious problem of sustainability will be experienced in a wide range of activities. Numbers and targets are not the only basis for measuring impact. Measuring inputs alone are not adequate for performance assessment.

A *follow-up new phase* is desirable to capitalise on the emerging successes centered around the focal points of learning that are emerging. The follow-up phase should narrow down its geographic and activity coverage, retaining the integrity of the earlier project components. The over-encompassing framework for disasters should be maintained but broadened to include resilience to climate change (floods and drought included), cyclones, etc.

Sub-Programme Area 102

Integrated Mangrove-Fishery Farming System (IMFFS)

IMFF model system

A new brackish-water-based farming system that integrates the cultivation of mangrove tree species, halophytic shrubs and creepers, and fish, prawn and crab has been developed and demonstrated in an area of about 1 ha near Pichavaram, with the participation of the community. This farm has physical provisions to grow mangrove trees and halophytes and enough water-spread areas to culture fish, prawn and crabs. As part of the integrated

system being demonstrated, about 1,700 nursery-raised seedlings of *Rhizophora* and 320 seedlings of *Avicennia marina* were planted during February 2006. All these plants have survived and the *Rhizophora* has now grown to an average height of 168 cm and the *Avicennia marina* to 127 cm. Each *Rhizophora* plant has around 32 stilt roots and *Avicennia* has about 47 aerial roots. The development of these root systems is important since they provide enough shelter for fish, prawn and crabs. Apart from this, a succulent halophyte — *Sesuvium portulacastrum* — which has commercial potential as a component of salads, was planted on the top of the outer and inner bunds of the farm as well as on the sides. Stem cuttings of about 15 cm in length were planted at intervals of 1 m. The fresh weight of the plantation was about 1344 g / m² in April 2009.

A total number of 425 fingerlings of sea bass (*Lates calcarifer*), a commercially valuable fish, was released into the system in February 2008 and 125 kg of fish harvested in October 2008. This was sold in the market for about Rs.17,000. Apart from these, about 161 kg of other fishes such as milk fish, mullets, tilapia and prawns were also harvested, which brought in Rs.7000. However, the cost-benefit analysis indicated that only Rs.4,000 was earned as profit. Steps to improve the situation will be taken up this year.

Replication of IMFFS

In Sorlagondi village in the Krishna site in Andhra Pradesh, 10 *yenadi* tribal families,

who are the poorest in the village, live near the mangrove forest, making their livelihood by collecting fishes and crabs. Mercilessly exploited by middlemen, they collect crabs indiscriminately including moulted crabs and juveniles, which affects the stock of crabs in the mangrove water. The option of IMFFS as a livelihood source, whereby they could get regular and sustainable incomes and also use the crab resources of the mangroves sustainably, was put forth to these families and they accepted the idea. A 4 ha area of abandoned prawn farm was selected for the development of two IMF farms, the design being more or less similar to the model farm near Pichavaram. These two ponds occupy a total area about 40,020 sq. m of which the inner bunds occupy about 10,512 sq. m and peripheral bunds occupy about 8220 sq. m. The water-spread area occupies about 21,000 sq. m. In October 2008, 4000 propagules of *Rhizophora* and 5000 propagules of *Avicennia* were planted along the inner and peripheral bunds of the two farms. The survival and growth performance of the plantation is being monitored; *Rhizophora* and *Avicennia* seedlings have reached an average height of 36 cm and 27 cm, respectively. In October 2008, about 3000 fingerlings of sea bass were released in each pond. They were about 20 g to 30 g in weight while stocking and now the weight has increased to about 600 g. A large number of other fishes, prawn and crabs, which have entered into the system through tidal water are also breeding in the ponds.

In Tamil Nadu, another IMFFS is being developed just north of Pichavaram, in about

4.5 acres of land provided by a local fisherman. It has two models: in Model 1, inner bunds are developed in the form of “mitochondria”. These inner bunds are nothing but the extension of peripheral bunds. The length of the inner bunds varies from 29 m to 30 m and the breadth is about 6 m. The mangrove plantation will be set up along the borders of both the inner and peripheral bunds. In Model 2, the inner bunds have been replaced by mud mounds, which vary in size from 10 m to 13 m. The breadth of these mounds is about 6 m. Mangroves will be grown along the peripheral bunds and mounds in September 2009 and at the same time fish culture will also be initiated in the farm.

Sub Programme Area 103

Nuclear and Biotechnological Tools for Coastal Systems Research

The DAE-MSSRF project working in rural coastal villages for the proper management of natural resources has focused on the following key thrusts: working with farmers as partners; focusing on the agri-horticultural model farming system, supporting diverse production — crops, livestock, trees and fish; treating farming as a family business, acknowledging that rural communities are linked to markets and that farm families need income for off-farm products and services; adopting agricultural practices that link production to conservation; and using watershed approaches.

The project has begun to extend its technology from village to village and has achieved approval and success through proper replication of tested models. On-site field training programmes designed especially for ATMA farmers, SHGs members, and participants in the National Horticulture Mission (NHM) and the National Floriculture Mission (NFM) are being conducted.

103.1 Activities at Kudankulam

BARC seed multiplication

This year BARC oil seeds (TAG 24) have been distributed to 7 farmers. Four farmers have harvested groundnut, with yields varying from 200 kg / acre to 410 kg / acre and crop duration of 100 to 105 days. The weight of 100 dry seeds was approximately 35 gm. Yield data was found to be quite satisfactory compared with 300-400 kg / acre in rainfed areas. Lower yield and loss of crop were observed in some fields due to heavy rain during the last twenty days of crop maturation.

The performance of mutant varieties of pulses, particularly green gram (TARM 1), has been well appreciated by the village farmers. They have traditional knowledge of seed storage for the following season and distribute the seeds among themselves. Under intercropping with horticulture plots, yields varying from 140 kg / acre to 310 kg / acre were found to be good.

Fodder Bank

Fodder grass KKM 1 Cumbu-Napier Hybrid has been found to be ideally suited for cultivation in the red soil areas of Radhapuram taluk. A

derivative of a cross between inter-specific cross of Cumbu IP 15507 and *Pennisetum purpureum* FD 429, this hybrid grass has long broad leaves, softer in comparison with those of Co 2 and Co 3 hybrids. It has a much quicker regeneration capacity and much higher yield than these two: the KKM1 yield is 44 % higher than that of Co 2 and 50 % more than that of Co 3. It has recorded an average green fodder yield of 60 tonnes to 80 tonnes per acre per year, over a period of 4 years. The leaves contain large amounts of calcium, potassium, magnesium, phosphorus and thiamine, with low oxalate content, as well as micronutrients such as zinc and manganese. The fodder also has more crude protein (9.85 g / 100 g dry matter). Mainly propagated vegetatively through stem cuttings and root slips, the hybrid grass is maintained as a perennial crop for up to 4 years. Endowed with quick regeneration capacity, it is harvested once in 45 days. The hybrid grass is free from pests and diseases in field conditions.

Velli masal (Hedge leucern) is another fodder crop introduced in the fodder bank for seed multiplication. Enough seeds have been collected for distribution to farmers.

Table 1.5 shows area brought under cultivation of different crops including pulses, fruit trees, fodder and jatropha.

As part of its regular activities, MSSRF reached out to farmers (more than 60 last year) with advice on various crops, agricultural practices, and soil and water conservation practices. Based on their soil and water

Table 1.5 Area brought under cultivation (2008-2009)

| Crop | Area |
|-------------------------------|--------------|
| Pulses | 10 acres |
| Oil seeds | 7 acres |
| Cashew | 3 hectares |
| Mango | 4 hectares |
| Fodder crops/Azolla | 50/3 farmers |
| Jatropha | MLT-2 |
| Jatropha farmers' fields | 4 acres |
| National Floriculture Mission | 6 farmers |

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

Capacity building

- This year, site demonstrations have specifically covered pest and disease control in various crops like tomato, mango, drumstick, guava and coconut.
- Extensive field visits of new and two-year-old planted plots under NHM were carried out in May 2008. On-site demonstrations were given on practices such as applying of vermicompost, taking care of root stock development and avoiding early stage flowering.
- Demonstrations of vermicompost application during field preparation (25

kg / acre, Ammonium sulphate 2 kg / 10 cents) were conducted in the fields of two farmers to ensure uniform flowering in paddy crop.

- On-field demonstrations were conducted to tackle the problem of leaf yellowing in paddy and the application of kitazine (2 ml per l of water) was recommended.
- Adoption of fertigation method suitable in water-scarce areas was demonstrated for groundnut cultivation under precision farming in a farmer's field (50 cent experimental and 50 cent control plot) in Kudankulam. The Convener of the ATMA programme in Radhapuram Block along with the Agriculture Officer participated.
- Field trial and demonstration of growth promoter cytosine was carried out on horticulture crops to induce uniform flowering; in the demo plot it was sprayed on all fruit crops in the genetic garden, and on mango and cashew in the fields of farmers, in 1 ha each.
- A two-day training programme was organised for 25 farmers on Organic Farming, under the ATMA scheme.
- Control of leaf hopper disease was demonstrated in a mango farm and control of leaf folder attack (quite common in cashew) was demonstrated in the field of a farmer at Vairavikinaru.
- Ten farmers from Kudankulam village participated in a one-day training programme on System of Rice Intensification at the Rice Research Institute, Ambai, Tirunelveli district.

- Soil samples were collected from different farmers' fields and important parameters were analysed to decide the specific soil nutrient management process needed for different crops like oilseeds, paddy, pulses and fruit.
- NFM was initiated by identifying 10 new farmers in S.S. Puram village in Radhapuram taluk and they planted 200 numbers of *Pitchi poo* in their fields.
- A group of students from Tirunelveli Dakshina Mara Nadar Sangam College who are working on the topic of 'Vermicompost Production as Social Enterprises' visited vermicompost production units at KKNPP project site and township.

Micro-watershed development

The 3 farm ponds that have been constructed under the state government scheme have evoked a lot of interest and the Village Administrator has received 5 more applications, which have been submitted to the concerned department through the village panchayat.

Biodiesel crop (Jatropha)

Jatropha plants planted in 4 blocks have achieved 99 % survival and attained heights of 2 to 4 feet. Different management and environment descriptors were outlined to record the site-specific data, which was entered in the prescribed format for agrotechnology practices. Mature and immature seeds were collected for RNA studies along with leaves from early to mature stage and sent to TERI to identify the genetic character of different accessions. Neem oil and neem

cake were applied to control the pest attack in the *Jatropha* trial plot.

Data collection on multi-location network trials phase I and II is under progress and will be undertaken round the year for analysis of growth, flowering, fruiting, diseases, etc. Field survey around Kudankulam village was also conducted in June 2008 for multi-location trails. Six acres of land have been earmarked to develop a demo field, and field preparation and plantation will be completed after receiving the first rains in the current season.

In September 2008, an expert group comprising Dr. D. K. Tuli, CEO, Indian Oil Corporation (IOC), Faridabad, Dr. R. L. Srivastava, Director, AFRI, Jodhpur, Dr. H. M. Behl, National DBT Biofuel Network Coordinator, Biotech Park, Lucknow and Meenakshi Munshi, Joint Director, DBT, New Delhi visited the genetic garden and network trials phase I in the Kudankulam region, for evaluation of progress.

Alternative livelihood

- Pasumai SHG, Vijyapathy, opened a fertiliser shop in April 2008.
- One farmer in Kudankulam has released freshwater fish fingerlings in his farm on a trial basis with help from the state Fisheries Department. Growth rate and other factors have been quite satisfactory.
- Direct linkage for SHGs was provided during this year.
- Assessment of SHG was conducted by Tamil Nadu Mahallir Thittam at the taluk office at Radhapuram in July 2008.

Village Knowledge Centre

Ten VKC students participated in an Internet Training Programme at the MSSRF office in Kudankulam in June 2008. TALLY 9 examination was successfully completed by 25 VKC students.

On the eve of the first Global Hand-Washing Day (15 October 2008) initiated by UNICEF, VKC Kudankulam raised awareness among the noon-meal school students about the importance of washing hands with soap before meals and after going to the toilet.

103.2 Sustainable ecological and economic rehabilitation

Ecological rehabilitation: Bioshield

Mangrove and non-mangrove nurseries have been set up by women SHGs as kitchen garden nurseries and community nurseries at Keelavanjore, Chandrapadi, Nethyalvasal and Pudukuppam, for raising saplings to be supplied to the bioshield establishment programme in coastal areas. In the current year, 40,000 mangrove saplings (*Avicennia* and *Rhizophora*) and 15,000 non-mangrove saplings (*Casuarina*, *Thespesia*, *Pongamia*, *Mahua*) have been supplied to municipalities, NGOs and panchayats.

Maintenance of bioshield plantation in the coastal areas

Four-year-old bioshield plantations are being managed by traditional leaders and SHGs at Sadras (mangrove in 2 ha and non-mangrove in 3 ha) and 3-year-old mangroves (in 8 ha) at Karaikal; 2-year-old non-mangrove (in 5 ha) at

Chandrapadi; 3-year-old sand dune vegetation (in 2.2 ha) and 3 ha of non-mangrove at Pudukuppam; and 2-year-old sand dune vegetation (in 3 ha) at Pazhayar. Areas planted with mangroves and non-mangroves have been handed over to the respective village panchayats, traditional panchayat leaders, CBOs, and the Forest Department for effective maintenance.

Economic rehabilitation:

Micro enterprises

Women SHGs bioshield nurseries: Women SHGs run 23 backyard nurseries, 14 individual nurseries and one community nursery for mangrove and non-mangrove plants at Keelavanjore, Chandrapadi, Nethyalvasal and Pudukuppam. During the current year, SHGs earned Rs 6.2 lakh from the supply of saplings to the Forest Department, NGOs, and municipalities.

Micro enterprises — training and activities: Five micro-enterprise training programmes have been conducted for SHGs and farmers. These include training on the production of mushroom, establishment of mangrove and non-mangrove nurseries, production of vermicompost, crab fattening and freshwater aquaculture. SHGs are engaged in mushroom, mangrove and non-mangrove activities at Keelavanjore, Sadraskuppam, Chandrapadi and Pazhayar. A farmer has set up a crab culturing pond in 1 acre at Chandrapadi and a community freshwater aquaculture pond at Tenpathi has been integrated with nutritional gardens, coconut, fodder, and valuable tree species on its bund.

Coastal Village Knowledge Centre

Two VKCs in Nagai district, one in Karaikal and one in Sadraskuppam provide need-based information to the coastal communities. In addition, women SHGs are trained to maintain accounts, and computer literacy classes are conducted for schoolchildren, youth and women. A training programme for VKC volunteers was conducted at T.R. Pattinam, Karaikal. The Centres in Nagai district and Karaikal have been handed over to the respective village panchayats in March 2009.

Sub Programme Area 104

Remote Sensing and Geographical Information Systems (GIS)

104.1 Coastal Systems Research (PA 100)

During the year, three projects in PA 100 utilised remote sensing and GIS tools: Coastal Zone Studies, Suitability Mapping of Mangrove and Non-mangrove Bioshields, and Mapping and Monitoring of Godavari Mangrove Wetlands.

Coastal Zone Studies: Three components make up this project: a) mapping and monitoring Marine Protected Areas (MPA), b) mapping mangrove vegetation zonation of the Tamil Nadu coast, and c) assessment of mangrove health using remote sensing and GIS data.

The first component involves detecting change within and near MPAs of Tamil Nadu, namely, Pulicat Wild Life Sanctuary, Pichavaram Reserved Forest, Vedaranyam Wild Life Sanctuary and Ramnathapuram mangroves.

This was done by overlay analysis of coastal wetland maps prepared using IRS L4 data of the year 2005/2006 and the earlier wetland maps of 1990s compiled by the Space Application Centre. This analysis provided inputs to suggest modifications required in the MPA boundaries.

In the second part of the project, mangrove species zonation was mapped for the entire coast of Tamil Nadu, except Muthupet and Gulf of Mannar mangroves and the Puducherry coastal region, using IRS L3 data. The major mangrove species found was *Avicennia marina*. Other major species recorded were *Rhizophora*, *Excoecaria* and *Acanthus ilicifolius*. An 'Atlas of Mangrove Vegetation Community of Tamil Nadu', with layouts and documentation of the mangrove zonation, is being prepared in collaboration with the Centre for Advanced Studies in Marine Biology (CASMB), Annamalai University and the Space Application Centre.

Developing a remote sensing and GIS-based model to assess the health of mangroves is the third component of the project. A prototype of this model, which can also be used for other mangrove ecosystems, was prepared and tested for the Pichavaram mangrove wetlands. The indicators used in this model were related to mangrove density, canopy cover, floral diversity, natural regeneration, freshwater flow, hindrance to freshwater flow, anthropogenic pressure such as formation of bunds across rivers and creeks, drainage density, aquaculture farms, pollution from settlements / industries and sedimentation.

The thematic maps of the indicators were prepared using remote sensing data and GIS. Grid maps of 1 ha unit areas were generated out of these thematic maps. The maps were assigned with weightages depending upon the influence of the indicator on mangrove health and then overlaid to assess the status of mangrove health. In this model, score 100 indicates good health and score 1 indicates completely degraded state. For Pichavaram mangrove, the value is around 58. The model was accepted by the Space Application Centre, Ahmedabad, which sponsored the project, and other partner agencies involved in mangrove health assessment. To use this model for other mangroves, hands-on training was imparted to the scientists from Orissa Remote Sensing Application Centre, Bhubaneswar; Forest Survey of India, Dehra Dun; CASMB, Annamalai University, Parangipettai; M. S. University, Vadodara and Institute of Environmental Studies & Wetland Management (IESWM), Kolkata

Suitability mapping for mangrove and non-mangrove coastal bioshield: Suitability mapping for bioshield was carried out for the Manamelkudi block, Pudukottai district of Tamil Nadu and Nagaylanka mandal, Krishna district of Andhra Pradesh. The thematic maps, village maps, and perception of the local community on the bioshield were used for the preparation of suitability maps.

Land use/ land cover map of the coastal zones of Manamelkudi block and Nagaylanka mandal was prepared using visual interpretation techniques and finalised with ground truth information collected from the field. The

existing mangrove area in Manamelkudi block is around 128 ha and other coastal plantation and forests occupy another 353 ha. In Nagaylanka mandal, mangrove vegetation is present in about 7684 ha and coastal plantation in 625 ha. Areas under other land use / land cover categories along the coast in both study areas are given in **Table 1.6**.

Table 1.6 Area of coastal land use/land cover categories in hectares

| Land use/ Land cover | Manamelkudi | Nagaylanka |
|---------------------------------|--------------------|-------------------|
| Agriculture | 3668 | 4575 |
| Aquaculture | 200 | 6793 |
| Beach | 210 | 343 |
| Fallow | 576 | 3142 |
| Forests (terrestrial) | 353 | – |
| Mangrove | 78 | 7684 |
| Mud/Tidal Flat | 148 | 4802 |
| Other vegetation | 113 | 1021 |
| Salt Pan | 23 | – |
| Sand | 42 | 1995 |
| Settlements | 455 | 422 |

The administrative boundary such as blocks with revenue village boundaries, location of hamlets and other infrastructure were also mapped for Manamelkudi block and Nagaylanka mandal. The cadastral maps were digitised in GIS and integrated with data collected from the field for each of the project villages. These maps were also integrated with contour information which helped to map flood-prone areas for different flood levels.

The land use/ land cover map, geomorphology map, topography of the coast and perceptions

of the people were used to derive land suitability for the mangrove and non-mangrove bioshield. This shows that about 383 ha (248 ha for mangrove and 165 ha for non-mangrove) land has been found suitable for the development of the bioshield in Manamelkudi. In the case of Nagaylanka mandal, 7860 ha (5532 ha for mangroves and 2338 ha for non-mangrove) land can be used for the bioshield.

104.2 Ecotechnology (PA 400)

Remote sensing and GIS-based spatial database has been developed for three project sites — Ennai and Thalinji panchayats of Pudukottai district, Karasanur village of Villupuram district of Tamil Nadu, and Tolla village of Jeypore district of Orissa, which fall under the Bio-Industrial Watershed project of PA 400. Base maps such as village maps, cadastral boundaries, contours, drainage and surface water resources were prepared using secondary data, and land use and land cover maps for the year 2007 were prepared using remote sensing data. The data base also contains the following details: i) sub-divisions within each cadastral boundary, ii) maps of soil quality parameters such as micro and macro nutrients, and iii) household data of the three sites, which were spatially linked with location of houses for all three sites. In addition, a pilot study was undertaken in Karasanur village to map the land suitability for various horticultural and tree crops based on biophysical parameters. Societal suitability was also analysed by collecting data directly from the farmers, which was applied to fine-tune the suitable areas for different crops.

The database developed is now being used in planning and prioritising the watershed development activities in the study area..

Development of spatial database was initiated for the villages Keezhamuvarkarai, Keezhayur, Madathukuppam, Mandhakarai, Nayakkarkuppam, Nethyavasal, Poompuhar and Vanagiri, which come under the Fish for All project of PA 400. The location of freshwater and backwater fishponds were also integrated in GIS using GPS locations.

104.3 Information, Education and Communication (PA 600)

In PA 600, participatory GIS was applied in developing Household Information System

and Farm Information System of Athani, one of the VKC villages of the Annavasal Village Resource Centre in Pudukottai district. The systems comprise farm details and household details developed using Participatory GIS techniques which involved spatial data collection using GPS along with commonly practised Participatory Rural Appraisal tools such as transect walk, time trend analysis, social mapping, wealth ranking, resource mapping and Venn diagram. Overlaying of two or three thematic maps such as community, income and social status helped in identifying the target groups for developmental activities in these project villages.

BIODIVERSITY

The focus of the Biodiversity Programme Area has been the involvement of local communities in the management of biodiversity resources within their ecological, social and cultural contexts. A significant highlight of the biodiversity programme this year is the institutionalisation of the efforts. In Kolli Hills, the Kolli Hills Agrobiodiversity Conservers' Federation, a community-based institution comprising 31 SHGs, has been established, which would carry out several activities implemented as part of the biodiversity projects. The Panchabati Grama Unnayan Samiti and the Kalinga Kalajeera Rice Growers' Cooperative Society in Jeypore would carry out similar functions. In Wayanad, the Arani Community Training Centre, a residential training facility in the CAbC campus, was formally inaugurated by the Consul General of Japan.

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Programme Area 200

Biodiversity

The Community Agrobiodiversity Programme of MSSRF is implemented in three biologically important sites: Wayanad in the Kerala Western Ghats, a globally acknowledged biodiversity hotspot; Jeypore in Orissa, recognised as a secondary centre of origin of rice; and Kolli Hills in Tamil Nadu, known for its diversity of millets. The focus of the Programme Area has been the involvement of local communities in the management of biodiversity resources within their ecological, social and cultural contexts.

The curtains on the Concluding and Consolidation (CC) phase of the project drew to a close in Jeypore and Wayanad in June 2009. To enable completion of some of the activities in Kolli Hills and Chennai, the Swiss Agency for Development and Cooperation (SDC) has provided an extension to the project until March 2010. MSSRF wishes to place on record its gratitude to SDC for having supported the biodiversity programme over the period of a decade, ensuring immense opportunities for the group to experiment, grow and mature in its work.

An external review of the activities of the biodiversity programme was carried out by Dr. Uma Lele and Ms. Kavita Gandhi, followed by an internal review by the group. It was decided that the focus of the programme would

be targeted at Neglected and Underutilised Species (NUS) and it would work more closely with a strong focus on food security as well as on Rare, Endangered and Threatened (RET) species.

A significant highlight of the biodiversity programme is the institutionalisation of the efforts carried out under various projects by establishing the Kolli Hills Agrobiodiversity Conservers' Federation (KHABCoFED), a community-based institution consisting of 31 SHGs. This legally established body will gradually take over the activities of various projects that address millets and organically-produced pineapples.

In Jeypore, efforts have been taken to strengthen the Panchabati Grama Unnayan Samithi (PGUS) and revamp the institution to enable effective functioning. Many of the activities carried out as part of the biodiversity projects would be gradually taken up by PGUS and Kalinga Kalajeera Rice Growers' Cooperative Society (KKRGCs).

In Wayanad, work is in full swing on RET species and NUS crops like leafy green vegetables and tubers. VKC and VRC activities and Every Child a Scientist Programme are also in an advanced state, making an important contribution to biodiversity. A noteworthy development this year was the formal inauguration of *Arani*, the Community Training Centre (CTC) by the Consul General of Japan. The Japanese Consulate has partially supported the construction of this residential training facility at the CABc campus.

Sub Programme 201

Community Conservation Efforts in Kolli Hills

201.1. Biodiversity conservation, utilisation and enhancement (BCUE)

Kharif 2007 data collection

Data was collected from 31 farmers who had planted little millet during *kharif* 2007, using improved agronomic methods.

Relay cropping

Seeds of coriander, greengram, horsegram, lab lab beans, bitter gourd, radish, bottle gourd, tomato, ridged gourd, leafy vegetables, white beans, and ladies' finger were distributed to 31 millet farmers spread over 7 settlements (Arippalapatty, Arippalapatty Colony, Vilaram, Vendalappady, Adukkam, Chinnamangalam, and Periyakovilur). Analysis of the data indicates that 20 farmers have cultivated crop varieties in small parcels over 1.48 acres and have produced 4.90 qtl of these crops, of which about 89 % was utilised for home consumption. Some of the farmers did not cultivate vegetables due to lack of access to water close to their fields, compounded with inadequate rainfall last year.

Mini percolation pond

To enable farmers address the issue of water during the non-rainy season, a mini percolation pond was established in the field of a millet farmer at Vendalappady village and another at Alathur Oorpuram.

Seed storage system

The construction of a seed storage system (*thombai*) was facilitated in Sulavanthipatty village in Devanur Nadu. Training on seed selection was conducted for farmers at Vendalappady in February 2008. Farmers raised some of their pressing problems like need for bullocks for ploughing and rat attacks on crops.

Identification of farmers for kharif 2008

A new strategy for conservation of different landraces of millets has been put in place, integrating various experiences of the past with current and emerging understanding. This was done by ensuring seed availability in the respective settlements, a common seed storage system, a package of modified methods of cultivation and the presence of a group of skilled farmers to demonstrate the modified methods during *kharif* 2008. The project team identified suitable locations and farmers for demonstration of cultivation of 22 small millet landraces in 15 villages spread across 7 panchayats. Village level meetings were conducted at Valkulippatty, Chinnamangalam, Velikkadu, Navakkadu, Arippalapatty, Periyakovilur, Karaman Kadu and Settur to select farmers. Farmers were identified based on their interest in millet cultivation, experience and possession of their own seeds. Inputs from the village headman and farmers' knowledge about millet farming were also used. Farmers participating in the effort acted as nodal farmers for their villages and formed a group of interested millet farming families. It is proposed that the project would

extend support to such groups, in terms of providing start-up quality seeds and storage bins, and demonstrating improved methods of cultivation, training people in value addition and facilitating market linkages. During the second cropping season, support would be extended for raising relay cropping in suitable locations and mini percolation ponds would be established for irrigation. Viability test has been conducted on 22 landraces.

Village Millet Resource Centres

MSSRF adopts an integrated 4 Cs approach — Conservation, Cultivation, Consumption, and Commerce — for conserving landraces of millets in Kolli Hills. Village Millet Resource Centres (VMRCs) have been established with the view that this entity would be managed by key resource persons / VMRC committees established as part of the protocol. Villagers can access seeds, inputs, materials and training, resources such as processing mills, as well as marketing support in the area of millets through VMRCs. Up until now, 15 VMRCs (see **Table 2.1**) have been established with the support of farmers' committees, and the project has supported the provision of seed storage bins, technical advice on modified methods of cultivation, market linkages and processing support where available.

Distribution of seed storage bins

Traditional storage structures at individual households, such as *thombai* (grain storage units) and *kuthir* (large mud pots for grain storage), have in recent times been abandoned in Kolli Hills. Revival of traditional conventional

implements such as *thombai*, *man panai* (mud pots used for seed storage) and *kuthir* has become difficult as associated communities such as *Kuyavar* (potters), *Thappa Kuravan* (bamboo craft workers), *Ottan* (stone workers) are no longer available at Kolli Hills. Managing earthen seed banks is also difficult, as it requires concentrated attention. Therefore, the project has tried to provide food-grade seed storage bins to the VMRC at 10 locations, namely, Arippalapatty, Sulavanthipatti, Periyakovilur, Vandalappady, Adukkampatti, Chinnamangalam, Periyamangalam, Alathur Orpuram, Valikkadu and Puliampatty. This enabled the farmers to store quality seeds in labeled cloth bags to prevent damage from rats, fungus and pests.

Distribution of landraces during kharif 2008

Landraces of millets were distributed to 21 demonstration farmers for *kharif* 2008. These included little millet landraces (*kattavettisamai*, *vellaperumsamai*), Italian millet landraces (*senthinai*, *koranthinai*), kodo millet (*thirivaragu*), finger millet (*perunkelvaragu*, *arisikkelvaragu*, *karunguliyankelvaragu*, *suruttaikelvaragu*, *kuruvaikelvaragu*). Modified methods of cultivation were demonstrated in about 3.20 acres of land in different locations.

Seed collection of landraces and line sowing for kharif 2008

The collection of all available landraces of millets was attempted in 6 agro-climatic zones in Kolli Hills: Bail Nadu, Thiruppuli Nadu, Alathur Nadu, Gundani Nadu, Devanur Nadu

Table 2.1 *Village Millet Resource Centres in Kolli Hills*

| Village | Panchayat | VMRC Volunteers | Varieties Available |
|------------------|------------------|----------------------------------|--|
| Arippalapatty | Devanur Nadu | Chinnammal w/o Ponnusamy | <i>Malliasamai,</i> <i>Vellaperumsamai,</i> <i>Sattaikelvaragu,</i> <i>Perunkelvaragu</i> |
| Sulavanthipatty | Devanur Nadu | Jayam w/o Chinnasamy | <i>Arisikelvaragu,</i> <i>Panivaragu</i> |
| Settur | Devanur Nadu | Kuppayee w/o Chinnapaiyan | <i>Perunthinai,</i> <i>Perunkelvaragu,</i> <i>Vellaperumsamai</i> |
| Periyakovilur | Valappur Nadu | Elaiyan s/o Chinnasamy | <i>Vellaperumsamai</i> <i>Perunkelvaragu</i> <i>Surutaikelvaragu</i> <i>Perunthinai</i> |
| Adukkampatty | Selur Nadu | Selvem s/o Seerangan | <i>Sundangikelvaragu</i> <i>Malliyasamai</i> |
| Vendalappady | Selur Nadu | Selvaraj s/o Duraisamy | <i>Perunkelvaragu</i> <i>Palanthinai</i> <i>Perunthinai</i> |
| Padasolai | Thiruppuli Nadu | Nadesan | <i>Sadansamai</i> |
| Thuvarapallam | Thirupuli Nadu | Sellammal | <i>Kuruvaikelvaragu</i> |
| Puliyampatty | Thiruppuli Nadu | Theevali s/o Periyam | <i>Thirikulasamai</i> |
| Karamangadu | Bail Nadu | Chinnamuthu s/o Annamalai | <i>Sadansamai</i> |
| Chinnamangalam | Alathur Nadu | Palanisamy s/o Andi | <i>Karumulian kelvaragu</i> <i>Perunsamai</i> <i>Vellaperumsamai</i> <i>Karunsamai</i> |
| Alathur Oorpuram | Alathur Nadu | Koona Muthan s/o Kulanthaiyan | <i>Karakelvaragu</i> <i>Perunthinai</i> <i>Mookanthinai</i> |
| Velikkadu | Gunadani Nadu | Sellammal w/o Kulanthaisamy | <i>Kattavettisamai</i> <i>Senthinai</i> |
| Seekkuperai | Valavanthi Nadu | P.Murugesan s/o Palani | <i>Koranthinai</i> |
| Navakkadu | Bail Nadu | Lakshmi w/o Palanichamy | <i>Kuruvaikelvaragu</i> |

and Selur Nadu, totalling 14 settlements. Twenty-one landraces of millets were cultivated under line sowing method during *kharif* 2008. Morphometric data was collected in 21 demonstration fields as per the required procedure.

Distribution of vegetable seeds

Seeds of brinjal, ladies finger, coriander, greengram, cluster beans, drumstick, tomato, carrot, beetroot, radish, snake gourd, sponge gourd and leafy greens were distributed to 21 selected millet farmers for raising a relay crop in 2008.

Study on the importance of draught animal for millet farming

To demonstrate the importance of draught animal power within millet systems under changed social and economic conditions, the role of livestock was studied. A loan of Rs.20,000 was extended to Mrs. Kuppayee, of Settur village of Devanur Nadu for purchase of a pair of bullocks. The family has been successfully repaying the loan in installments. The role of cattle in dry land agriculture and associated dynamics were recorded and monitored. The family has extensively used the bullock pair for millet, paddy and tapioca cultivation for both ploughing and post-harvesting tasks and has also utilised the dung as manure. In addition, the bullocks were hired out to other farmers.

Survey and Documentation

- A survey on the current status of millets and patterns of agriculture at Velikkadu,

Gundani Nadu was completed. Data from 54 respondents were collected and are presently being analysed.

- The impact survey of MSSRF intervention area is being carried out at Adukkampatti, Vilaram, Arippalapatty, Vendalappadi, Sulavanthipatti, Periyakovilur, Periyamangalam, Chinnamangalam, Alerippatti, Alathur Oorpuram, Velikkadu and Puliampatty.
- Survey on methods of mixed and relay cropping was organised in 13 villages in Kolli Hills.

201.2 Biovillage

Training in value-added millet products

A series of trainings was organised related to the preparation of value-added products and skill development in marketing for members of Nanbargal SHG, Kuchakiraipatti, at Namakkal from 7-8 January 2008, and on 24 January 2008. As part of improving the quality standard of the millets, new steel sieves were purchased from Salem and the sieving method was demonstrated to the millet grain procurement group. Training on value-added millet products was conducted on 1 February 2008 in Kolli Hills for SHG members from Nanbargal SHG, Kuchakiraipatti and Thamarai SHG. During the reporting period, the project team facilitated Nanbargal SHG to tie up with Thamarai SHG to monitor the Vaniga Valagam shop in Namakkal for the sale of value-added millet products. A similar training was organised for the representatives of Nanbargal SHG,

Kuchkairaipatti, Thamarai SHG, Singlipatti, Ponnuthamman SHG, Padasolai at Vaniga Valagam on 19 February 2008.

Marketing of millets

The breakup of cost sharing by various players in the millet supply chain is highlighted in **Table 2.2**. The figures are based on loss of 40% while processing. During the year, market linkage has been created for little millet whole grain with Green Fiesta, Delhi .

Market linkages

Millet supply chain has been established with 17 organic farming product outlets in Namakkal and other places in Tamil Nadu.

Six new linkages have been facilitated for SHGs with Marutham Iyarkai Angadi, Thittakkudi; Amudham Iyarkai Arisi, Kumbakonam; Thirulogaswaran, Kallakurichi; Annora Illumination, Erode; Green Fiesta, Delhi; and Nalan Hotel, Karur.

Table 2.2 *Breakup of cost sharing in the millet supply chain (Rs.)*

| Weight (kg) | Farmer | Procurement Group | Processing charges | Nodal Marketing Group | Transport Kolli hills to Vaniga Valagam | Packing Material | Packing Charges | Marketing Commission |
|-------------|--------|-------------------|--------------------|-----------------------|---|------------------|-----------------|----------------------|
| 1 kg | 7 | 1 | 1.25 | 14.50 | 1.25 | 1 | 1 | 1 |

Table 2.3 *Millet marketing during 2008-2009*

| Month | Little Millet Grain (kg) | Samai Rava (kg) | Thinai Rava (kg) | Samai flour (kg) | Thinai flour (kg) | Amount (Rs.) | VAP (kg) | Amount (Rs.) |
|--------------|--------------------------|-----------------|------------------|------------------|-------------------|------------------|---------------|------------------|
| April 2008 | 150 | 52.5 | 69.0 | 31.5 | 164.5 | 11867.00 | 90.40 | 4130.00 |
| May | | 31.5 | 39.0 | 25.5 | 53.5 | 4643.00 | 54.00 | 2733.00 |
| June | | 17.5 | 22.0 | 21.5 | 30.0 | 2833.00 | 21.00 | 1115.00 |
| July | | 69.5 | 85.0 | 29.0 | 48.0 | 5784.00 | 50.63 | 3392.00 |
| August | | 78.0 | 68.0 | 15.0 | 38.5 | 6981.00 | 75.50 | 5403.00 |
| September | | 19.5 | 43.5 | 6.5 | 58.5 | 4040.00 | 27.25 | 1985.00 |
| October | | 32.5 | 60.5 | 3.0 | 24.5 | 3551.00 | 74.13 | 5280.50 |
| November | | 72.0 | 48.5 | 26.0 | 31.5 | 5749.00 | 10.50 | 1471.00 |
| December | | 117.0 | 15.5 | 21.5 | 20.5 | 5300.00 | 161.75 | 8880.00 |
| January 2009 | | 65.5 | 68.5 | 31.0 | 25.5 | 5794.00 | 67.90 | 5984.00 |
| February | | 62.5 | 32.0 | 40.0 | 43.5 | 6568.00 | 73.75 | 5544.00 |
| March | | 65.5 | 21.5 | 25.0 | 57.5 | 7157.00 | 124.65 | 8327.00 |
| Total | 150 | 683.5 | 573.0 | 275.5 | 596.0 | 50,924.00 | 831.46 | 46,266.50 |

Participation in Bharat Nirman exhibition

Members of Nanbargal SHG, Kuchakiraipatti, and Kaliyamman Sutru Sulal Pathukapoor Sangam, Arippalapatty, participated in the Bharat Nirman Public Information Campaign held in Kolli Hills from 3 to 7 February 2008. Five members from 2 SHGs participated and the value-added millet products sold (Rs. 1679 worth) included thinai rava (3 kg), thinai flour (4.5 kg), samai rava (5 kg), samai flour (1 kg), thinai payasam mix (2 kg), samai uppuma mix (1.5 kg), samai bajji mix (2 kg), samai rava dosa mix (1 kg), and thinai laddu (5 kg). Books on recipes and folk songs were displayed at the stall.

Processes for institutionalisation

Dana settlement and signing of MOU with the Block Development Officer: Kaliyamman SHG, Arippalapatty, purchased 5 cents of land and registered the document in the Sub-registrar's camp office at Kolli Hills on 15 May 2008. The group agreed to hand over 3 cents of land to the Block Development Officer (BDO) through a registered *Dana* settlement. The SHG entered into a MOU between members of the group and the BDO, Kolli Hills. A building worth Rs.3,75,000 was constructed by DRDA, Namakkal.

The project team facilitated Nanbargal SHG, Kuchakiraipatty to modify the deed of *Dana* settlement based on the conditions similar to Arippalapatty. However, the modified *Dana* settlement has not been registered. Instead, an MOU was signed between group members and BDO, Kolli Hills, on 12 June 2008, similar to that of the Arippalapatty millet processing mill.

Partnership deed for Nanbargal SHG: Realising that a deed was mandatory for undertaking business activities in a group, Nanbargal SHG was enabled to prepare a group partnership deed, which was formally registered in April 2008. Following the registration of the partnership deed, a business partnership registration certificate was issued.

Tax Payer's Identification Number (TIN): Nanbargal SHG has received the Tax Payers Identification Number (TIN) and Central Sales Tax (CST) numbers from the Commercial Tax Office, Rasipuram, which had been necessary for undertaking marketing. The project team facilitated the whole process for the Nanbargal SHG which involved several visits to the Commercial Tax Office until TIN (33783163560) certificate was issued on 21 May 2008.

Central Sales Tax (CST): After filing several applications and providing annexures like the partnership deed, Nanbargal SHG members, with assistance from the project team, were able to register with the CST Office. CST certificate (948831) was finally issued on 21 May 2008.

Initiatives related to millet processing mills

Small Scale Industry (SSI) certificate: The project team facilitated 7 millet processing mills in Kolli Hills to acquire the SSI Certificate from the District Industry Centre (DIC), Namakkal. This involved a lot of paperwork. The certificate would enable the SHGs to get

electricity on a subsidised basis and also avail other benefits from the government.

Discussions with government functionaries for approval of power connectivity: Efforts are being taken to clear administrative constraints in issuing special orders to provide power connections for millet processing mills. Discussions with officials of Small Scale Industries, Electricity Board and Project of DRDA (Industries) have been held to resolve issues. Scope for replicating the Public-Government-Private Partnership model for small scale rural industries is being explored.

Provision of storage bins for millets: Bulk storage facility is a precondition for ensuring continuous supplies to markets and millets are no exception to this. SHG members have been assisted to plan and purchase a storage facility to enable them to procure and store surplus millets for ensuring a consistent supply of processed millets to markets. This effort has also helped them control moisture and free millets grains from pests and spoilages.

MEM proposal for Arippalapatty millet processing mill: After three meetings it was decided that the group would prepare a proposal for the establishment of a minor millet processing mill. Staff of MSSRF helped the SHG to survey 10 neighbouring villages to explore the feasibility of establishing a mill. After construction of the infrastructure of the mill, the SHG passed a resolution to receive support from Community Banking Programme of MSSRF, which in turn has considered the request of the Kalamman Sutrusulal

Padukappor Sangam of Arippalapatty, Devanur Panchayat to assist them with a loan of Rs. 2,11,343/- under the MEM scheme. Subsequently, the SHG has been facilitated to purchase the appropriate machinery and the assembling of the machinery and material from Salem and Coimbatore is under way. Prompt action has been taken to get certificates and clearances from the various government authorities.

Awareness creation during the Adi festival in 2008

As part of awareness creation, SHGs participated in the *patinettam peruku* festival during the Tamil month of *Adi* in 2008, to disseminate learning on the collaborative conservation programmes undertaken with MSSRF. Folk artists spread the message to the general public and pilgrims on the role of millets in food and nutritional security. The play *Sarachandran Parasakthi*, based on conservation, was performed.

Six SHGs — Tamarai SHG, Nambargal SHG, Arappaleeswarar SHG, Sri Thayammal Iyarkkai Ezhil Pathugappor Sangam, Iyyanar Pattan Sangam and Kalamman Suttru Soolal Pathugappor Sangam — actively participated in the preparation and marketing of value-added millet products during the festival, under the overall guidance of the KHABCoFED. They were encouraged to display flex sheets and distribute pamphlets on the concept of the 4 Cs — Conservation, Cultivation, Consumption and Commerce — of millets and organic farming. Millet products promoted by KHABCoFED were displayed and sold in stalls at Semmedu

and at the Arappaleeswarar temple. The efforts of the SHGs and KHABCoFED received the appreciation of local officials and state ministers.

Promotion of millet procurement agents in villages

Millets are cultivated and stored in villages in scattered and remote locations. At times, getting consistent supplies through SHG members becomes difficult as they are involved in other livelihood activities. Therefore, a parallel strategy was put in place to identify a person or set of members in a millet cultivation zone who would be interested in millet procurement. Such a person could be a part of SHG or could be a member of a VMRC in the villages of Puliampatti, Sundakkadu, Periyakovilur, Nedunkapulipatti, Kulivalavu, Velikkadu, Kadampalampatti, Nathukkulipatti, Alathur, Padasolai and Arippalapatty. These procurement agents collect grains from farmers at a reasonable price suggested by KHABCoFED. Procured millets are then supplied to the processing mills at Kuchakiraipatti. A commission of Rs.100 per quintal is paid to the procurement agent. This strategy has helped resolving issues in continuous supplies for the market.

Distributorship for marketing millet products

To meet the emerging demand on the market front, a marketing agent was identified to coordinate the supply of millet products. A local agent has been trained to understand the field realities of the millet supply channel

and to interact with the various actors in the supply chain. He has also been introduced to the marketing units already linked in 11 districts. He operates from the district supply and marketing centre at Namakkal. Through this changed strategy, concerns such as consistent supply to the market, popularisation, quality checking of the products and packing, diversification and innovation of products based on demand, customer relationship, scale up of supply and accountability have been addressed. Additional organic product outlets in 5 districts have been established and added to the existing 35 linkages. SHG members participated in exhibitions at Thiruchengodu and Coimbatore in July and December 2008.

201.3 Organic farming and export linkages

With regard to organic farming, a review of documents relating to the previous year has been conducted. Passbook data of the farmers were verified and village-level field maps prepared. Field visits were made to Thuvareppallam, Vellakuli, Kalungu, Ellagiraipatty, Sundakkadu, Seenginadypatty, Ariyur Solakkadu, Padasolai, Sempoothu Valavu, Oormalai, A.Thannimathipatty and Puthuvalavu to assess the addition of new hamlets for growing organic pineapples. Paravarur, Karuthamani, Thegavai, Kampipparai and Kulivalavu. Settur, Kattakkadu, MettuVilaram, Vilaram, Sulavanthipatty, Arippalapatty, Pariyur, Puliyampatty, Thiruppuli Orpuram and Valkulipatty were added as organic

millet cultivation areas. Preliminary training was organised for SHG representatives on internal control systems (ICS) management. Discussions were held with the Horticulture Department, Coffee Board, BDO, and banks for linkages to SHGs members for training and mobilisation of funds. The Department of Horticulture has evinced keen interest in changing pineapple varieties and conducting training programmes. Discussions were held with new buyers from ITC, Srestha Bio Products, Secunderabad and Mallol Food Products, Trichy for marketing tie-ups for organic produce.

Follow-up action: Public-Private Partnership with Mallol Food Products

Subsequent to a series of discussions, an institutional agreement has been made between MSSRF and Mallol Food Products, followed by a discussion with farmers at Thuvavaravallam, to arrive at consensus and work out the modalities of procurement commencing from 2009 onwards. However, Mallol Food Products have raised two points before entering into an agreement with the farmers’ association: First, procurement of pineapples will be possible at the premium price only after receiving organic certification during the year 2009, and second, 25 % conversion of Queen or Kew varieties must be carried out by the year 2012. Based on the acceptance of these conditions, Mallol has agreed to support certification costs, training costs and consultancy charges as determined in the institutional agreement.

Reorganisation, resurvey, ICS management

Apart from these activities, training in basic data collection has been offered to the representatives from Vellakuli, Thuvavarapallam, Ariyur Solakadu and Ellakiraipatti. Based on the revised area and farmers lists, fresh farmers’ diary was prepared for 293 farmers (239 males and 54 female farmers) from 25 villages. Revised details of the crop, area and farmers are provided in **Tables 2.4** and **2.5**. District officials from NABARD as well as the District Collector have visited project sites at

Table 2.4 **Crops and area planted for certification in 2009**

| Crop | Area/Numbers of Plant |
|-----------|-----------------------|
| Pineapple | 280.70 acres |
| Banana | 6151 nos |
| Guava | 662 nos |
| Coffee | 13282 nos |
| Pepper | 3912 nos |
| Millet | 53.5 acres |

Vellakulipatti. Discussions have also been held with officers of the Coffee Board for technical advice on planting material and inputs, and AD–Horticulture, AD-Agriculture, Krishi Vigyan Kendra and Veterinary College at Namakkal for training support.

Analysis of estates in Kolli Hills

To understand the development of estates in Kolli Hills and trends in land conversion, a survey has been conducted covering 65 estates that have reached a level of maturity and yields (**Tables 2.6** and **2.7**.) The size of the estates range from 2 acres to 120 acres.

Table 2.5 *Farmers included in organic certification for 2009*

| Village | Total no of Farmers | Male | Female |
|----------------------------------|---------------------------|------------|-----------|
| Organic Pineapple Growers | | | |
| Ellakiraipatti | 12 | 3 | 9 |
| Sundakkadu | 8 | 8 | 0 |
| Vellakulipatti | 33 | 33 | 0 |
| Seenginadipatti | 7 | 7 | 0 |
| Ariyur solakkadu | 11 | 0 | 11 |
| Thuvarappallam | 34 | 32 | 2 |
| Kalungu | 6 | 5 | 1 |
| Padasolai | 18 | 8 | 10 |
| Sempoothuvalavu | 17 | 7 | 10 |
| Nathukkulipatti | 20 | 20 | 0 |
| Ariyur Kashba | 19 | 19 | 0 |
| Sub Total | 185 | 142 | 43 |
| Millet Growers | | | |
| Adukkampatti | 10 | 10 | 0 |
| Settur | 5 | 4 | 1 |
| Sulavanthipatti | 5 | 2 | 3 |
| Vendalappadi | 6 | 6 | 0 |
| Velikkadu | 11 | 11 | 0 |
| Oorpuram | 12 | 12 | 0 |
| Chinnamangalam | 8 | 8 | 0 |
| Arippalapatty | 9 | 2 | 7 |
| Puliyampatti | 7 | 7 | 0 |
| Valkulipatti | 10 | 10 | 0 |
| Padasolai | 5 | 5 | 0 |
| Kattakkattupatti | 5 | 5 | 0 |
| Pariyur | 5 | 5 | 0 |
| Vilaram | 10 | 10 | 0 |
| Sub Total | 108 | 97 | 11 |
| Total | 293 | 239 | 54 |

The years between 1991- 2000 have seen a boom in the growth of estates to 34, compared to 1970-80, when Kolli Hills had only 5 estates. About 65 % of the sample estates exclusively practise organic methods of cultivation. An average of 1 tonne of organic manure / acre, produced locally in Kolli Hills or other near points in the plains, is used in agricultural operations.

However, the livestock population in the estates is very low as essential operations are carried out by machinery due to shortage of labour in livestock management. Though produce from the estates do not reach the local *sandai* (market), they are available in other markets through middlemen, wholesale buyers, or directly sold by the farmers.

201.4 Building grass-root institutions

Formation of Kolli Hills Agrobiodiversity Conservers' Federation (KHABCoFED)

Over the years, with the support of the various project interventions, 31 SHGs having 398 members (171 men and 227 women), actively function in Kolli Hills. Many of the SHG-managed enterprises and infrastructures like processing mills (9), procurement centres (3), mini auto (1), and grocery shop (1) were initiated through the support of state and development agencies. During the year, the KHABCoFED was formed with the participation of members of SHGs. Clusterwise meetings at Nariyankadu for Roja cluster, Padasolai for Mullai cluster and Arappaleeswarar temple for Sembagam cluster were conducted to select management committee members. Meetings were organised to select executive

Table 2.6 *Cropping details in private estates (major)*

| Crop | Cultivation (acres) | Under Organic method (nos) | Under Inorganic method (nos) | Expected yield (kg) | Average yield (kg)/ acre | Crop duration | Harvest season |
|------------|---------------------|----------------------------|------------------------------|---------------------|--------------------------|---------------|-------------------------|
| Pepper | 1132.35 | 42 | 28 | 1808190 | 1596.85 | 12 months | February-March |
| Coffee | 1132.35 | 42 | 28 | 865118 | 764.00 | 12 months | October-November |
| Tapioca | 18.00 | 0 | 4 | 135000 | 7500.00 | 12months | June-July |
| Paddy | 1.30 | 0 | 3 | 700 | 538.46 | 3 months | May, October |
| Vegetables | 1.85 | 2 | 1 | 12260 | 6627.03 | 3 months | June, December, January |
| Turmeric | 0.70 | 2 | 0 | 550 | 785.72 | 12 months | December-January |
| Ginger | 1.20 | 2 | 0 | 850 | 708.33 | 12 months | December-January |

Table 2.7 *Cropping details in private estates (minor), Duration - 12 months*

| Crop | Cultivated Plants (nos) | Under Organic method (nos) | Under Inorganic method (nos) | Expected yield (kg) | Average yield (kg / acre) | Harvest season |
|-------------|-------------------------|----------------------------|------------------------------|---------------------|---------------------------|-------------------|
| Clove | 1303 | 15 | 10 | 1300 | 0.997698 | June-August |
| Banana | 50808 | 28 | 14 | 50808 | 1 (Nos) | All months |
| Cardamom | 8145 | 12 | 10 | 5920 | 0.726826 | June-July |
| Orange | 8401 | 17 | 9 | 124130 | 14.77562 | October-November |
| Citrus | 1074 | 6 | 3 | 10950 | 10.19553 | June-August |
| Mango | 172 | 6 | 3 | 4500 | 26.16279 | April-June |
| Jack | 2196 | 25 | 16 | 30625 | 13.94581 | June-August |
| Red Guava | 58 | 7 | 0 | 710 | 12.24138 | September-October |
| White Guava | 61 | 8 | 0 | 1035 | 16.96721 | September-October |

committee members (Chairman, Vice Chairman, Secretary, Assistant Secretary and Treasurer). Based on the resolution of the management committee, the Registration Deed has been prepared under the Societies Act in consultation with the legal advisor and auditor.

Bank linkages

A sum of Rs.7.51 lakh was mobilised from the banks to support SHG internal lending processes and entrepreneurship development at their own settlements. The details are given in **Table 2.8**.

Table 2.8 *Financial mobilisation by SHGs in Kolli Hills*

| SHG | Village | Loan | Bank |
|--|-----------------|----------|--------------|
| Iyarkai Vali Vivasayigal Sangam | Ellakiraipatti | 60,000 | Indian Bank |
| Perumalsamy Iyarkai Valam Padukappor Sangam | Keel solakadu | 1,00,000 | Indian Bank |
| Nanbaragal SHG | Kuchakiraipatty | 90,000 | Indian Bank |
| Kaliamman Sutrusulal Padukappor Sangam | Aripalapatty | 60,000 | Indian Bank |
| Ponnuthamman Men SHG | Padasolai | 30,000 | Indian Bank |
| Malaisaral Munnetra Sangam | Thuvarapallam | 60,000 | Indian Bank |
| Thayammal Iyarkkai Ezhil Padhugappor Sangam | PeriyaKovilur | 95,000 | Lamp Society |
| Kurinji Magalir Suya Uthavi Kuzhu | Moolakkadai | 56, 000 | Lamp Society |
| Perumal samy Iyarkkaivazham Padhugappor Sangam | Keelsolakkadu | 2,00,000 | Indian Bank |

NVA Fellows for 2008

As part of cross links across programme areas, 48 candidates were proposed for National Virtual Academy 2008; of these 17 candidates from Kolli Hills, 4 candidates from Veerapayangaram, and 27 from Namakkal attended the screening camp.

Sub Programme Area 202

Community Agrobiodiversity Centre, Wayanad

The Community Agrobiodiversity Centre (CAbC) has entered the 12th year of its work at Kalpetta, Wayanad district, in Kerala. CAbC has set up 16 goals to address sustainable agricultural and rural development involving local communities, to be achieved over the next decade.

CAbC has streamlined its focus by delineating four themes interlinked with biodiversity. Each of these four key areas is headed by a senior scientist assisted by competent team members:

- Community Agrobiodiversity Conservation and Enhancement
- Education, Communication & Training
- Sustainable Livelihoods and Food Security
- Community Agrobiodiversity Farm

202.1 Community agrobiodiversity conservation and enhancement

Conservation and sustainable use of biodiversity, especially agrobiodiversity, is the core of this thematic area, with 6 goals to be achieved between 2007-2017.

Neglected and underutilised crops (NUS)

Started in 2000 as a research study to understand the neglected and underutilised food crops that can play a prominent role in enhancing the food security of tribal groups through the sustainable use of wild and traditionally cultivated edible species, the focus of this exercise has gradually broadened over the years. In 2007, a pilot level initiative of establishing home gardens in tribal hamlets

was undertaken at the Ponkuzhy *Kattunaika* tribal colony, Muthanga.

Currently, home gardens have been implemented in 5 tribal hamlets covering 250 households: The *Kattunaikka* colonies at Ponkuzhy, Kadambakattu and Kuttimoola and the *Paniya* colonies at Ponkuzhy and Kuttimoola. The impact of the intervention can be gauged from the report of the SSA teacher that her students are no longer demanding food by 10 a.m. and by the observation that people are able to cook meals even in lean times because of the assured supply of food. In case of bumper yields, the harvest is also marketed.

A cursory look at the harvest yields from these 250 households is noteworthy. Totally 9129 kg of yams were harvested — 4527 kg of dioscorea, 2140 kg of elephant-foot yam, 2462 kg of colocasia. This year, seed and planting materials of 1325 kg of dioscorea, 720 kg of colocasia, 600 kg of elephant-foot yam, 100 kg of arrowroot, 3 varieties of sweet potato and 7 varieties of plantain were distributed to a new set of tribal hamlets. To ensure quality and timely seed materials, two *Dioscorea* community germplasm centres have been initiated at Puthoorvayal and Madakki.

Table 2.9 lists the species and varieties that have strengthened the germplasm collection of edible plant species at the Centre.

A SHG Group consisting of 7 women and 5 men from the Kuttimoola tribal colony has been trained in nursery management. With financial support from the Tribal Department,

Table 2.9 *Germplasm collection of edible plant species*

| Name | Species/Varieties |
|----------------------|---------------------|
| Cultivated Dioscorea | 12 var. (3 species) |
| Canna | 2 species |
| Wild Dioscorea | 13 species |
| Asparagus | 1 species |
| Wild Colocasia | 4 varieties |
| Sweet potato | 3 varieties |
| Cultivated Colocasia | 5 varieties |
| Alocasia | 2 species |
| Arrowroot | 2 varieties |
| Tuberous orchids | 2 species |
| Amorphophallus | 1 specie |
| Costus | 1 species |

the SHG has raised a 2000 sq.ft nursery with 14,000 seedlings of wild plants and 1000 each of pepper, cashew and coconut, making a net profit of Rs.76,000. This is a remarkable achievement, as *Kattunaikka* and *Paniya* communities are usually reluctant to take up any such work. A major upshot has been the Department of Tribal Welfare and the District Panchayat asking CABc to design and implement a tuber-based food security programme for tribal groups in the district.

Speciality rice varieties

In the final year of the project supported by the National Medicinal Plants Board (NMPB) on *Medicinal and Specialty Rices of Kerala*, the main objective was to conduct clinical trials with *Navara* rice. With help of the Institute of Applied Dermatology, Kasaragod, the initial formalities to proceed with the trials including the formation of an Institutional

Ethics Committee (IEC) as per research norms has been completed.

In relation to our efforts to collect and conserve traditional rice cultivars, 20 varieties were submitted to the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Authority, Ministry of Agriculture, Government of India for recognition under the Plant Genome Saviour Community Recognition Award. The Wayanad District Tribal Development Action Council, facilitated by MSSRF, forwarded the nominations from the *Kurichiya* and *Kuruma* tribal communities who were subsequently conferred with the 2nd Genome Saviour Award, a major impact of CABc's work with the primary conservers.

An experimental trial plot for multiplying the Gene Bank Accession rice from MSSRF has been established. More than 25 awareness programmes on the need for conserving traditional rice varieties, biodiversity conservation, wild resources and their role in food security have been arranged for the *padasekhara samities*, students, teachers, farmers, women's groups, etc., of the district. A documentation of wetland diversity, especially of the paddy fields of the district, has been initiated. Paddy yield enhancement techniques like System of Rice Intensification (SRI) and Modified Rice Cultivation Practice have been demonstrated and monitored at 3 field sites.

Conservation of rare, endangered and threatened (RET) plants

The study on rare, endemic and threatened (RET) plants, sponsored by the Sir Dorabji

Tata Trust, has entered the final year of the first phase. Of the 8 Research Fellows, 4 Fellows have completed data collection for their doctoral degree programme, two Fellows have received the Young Scientist award from the Department of Science and Technology and one Fellow has qualified in the National Eligibility Test (NET) of CSIR. As a result of the mid-term evaluation, the project has been extended till June 2009.

A total of 15,895 seedlings of 80 target species (7 endangered trees, 10 woody climbers, 9 medicinal trees, 7 narrow endemic species, 8 rare *Syzygium* species, 9 endemic and rare plants, 9 rare monocotyledons and 9 endemic species from the plains of Kerala; 12 species had already been multiplied earlier) were multiplied in the nursery either through seed germination or vegetative means.

In order to get people from all walks of life to conserve RET species, CABc has encouraged establishment of tree groves, starting with an initial collection of baseline data. For demonstration, a garden to conserve RET plants, with 300 seedlings of 50 target species, has been established on 5 acres at the CABc campus.

The highlight of the biodiversity conservation and enhancement movement has been the discovery of new plants by our researchers: *Miliusa gokhalae* (Annonaceae), two new species of *Oberonia* Lindley, *Gastrochilus obliquus* Lindl. and *Oberonia pyrulifera*.

World Environment Day was observed in June 2008 by organising a lecture on climate

change and distributing RET species to 80 people. Regular monitoring is done to ensure survival of the seedlings.

Some of the notable activities in this thematic area during the reporting period include:

- Completion of the study of plant diversity of Variyad Estate in Muttill Grama Panchayat on request from the Kerala Biodiversity Board
- Completion of the study of taxonomy and morphology of the orchid genus *Oberonia* Lindley in Wayanad district
- Ongoing study of plant diversity in the Wayanad Wildlife Sanctuary and preparation of a checklist of flowering plants
- Ongoing study of scapigerous *Impatiens* species from Wayanad
- Ongoing taxonomic and molecular studies in association with TBGRI on *Memecylon* species of the southern Western Ghats

202.2 Education, Communication & Training (ECT)

The Community Agrobiodiversity Centre envisions 'the emergence of an eco-sensitive, self-reliant society empowered in conservation and the sustainable and equitable use of biodiversity.' The core objective of ECT is to contribute to this vision by building the capacity of various stakeholders — particularly the local farming communities, including their children — in the area of sustainable and equitable utilisation of bioresources.

The two main initiatives under this are:

- ECT through the SDC-supported Knowledge Centres — Village Resource Centres and Village Knowledge Centres
- ECT through the DBT-supported Every Child a Scientist (ECAS) programme (see SPA 604)

Apart from the above, additional initiatives are:

- Capacity building of stakeholder institutions like the Wayanad Agriculture & Rural Development Association (WARDA) and the Wayanad District Tribal Development Action Council (WTDAC)
- Establishment of an IPR cell

ECT through Knowledge Centres

The three pillars of VKC/VRC activities are training and capacity building, developing content, and establishing linkage and networking for delivery services to the local community. ICT-based education and certificate courses like MUPP for youth are also part of this initiative. Four batches have passed out during the reporting period.

Training and capacity building of villagers: Twenty-one training programmes related to agriculture, health and education were conducted through the VRC located at the CAbC campus and the VKC located in the tribal village of Thachampath, wherein 494 women and 330 men benefited; with 60 % of the trainees belonging to the Scheduled Tribes communities. 1694 men and 1639 women utilised the facilities at all the VKCs,

the majority of the users again belonging to the Scheduled Tribes groups.

Content development: Based on need assessments, user-friendly contents in the form of videos, audios, interactive CDs, posters, brochures, booklets, pamphlets, etc., have been prepared. These include 15 interactive CDs (9 on agriculture, 5 on health and 1 on wild edible plants, 12 folders (crop-wise package of practices, Biodiversity Act, health and food matters), 4 video and audio presentations, 10 brochures/pamphlets, and 3 booklets. A monthly community newspaper was introduced and Entitlement Passbook is available for ready reference.

Linkage and networking: To help getting various schemes, credit, entitlements and training, linkages between the government and the community are absolutely necessary. CAbC has been successful in establishing linkages with district panchayats for undertaking training programmes and with the Agriculture Department for content and training. As a result, the Kalpetta Municipality has given two projects through the Agriculture Department, one for the preparation of the People's Biodiversity Register and the other to prepare a watershed plan. As the health of the community is important, VRCs are also looking at linkages with both private and government hospital networks for medical camps and health-related content.

ECT through Every Child A Scientist activity

The ECAS activity, on-going at CAbC since 2002, looks towards imparting knowledge on

biodiversity to children and youth belonging to deprived and backward communities, using ICT tools.

ECAS training at CAbC: A total of 126 classes for 52 students on various aspects of biodiversity such as medicinal plants, wild food plants, apiculture, mushrooms, butterflies and their host plants, birds, propagation techniques, bio-pesticidal plants, etc., as also on confidence building programmes, spoken English, computer basics, and so on, were conducted under ECAS. Visits to places like the Centre for Water Resources Development and Management (CWRDM) Kunnamanagalam, and the Regional Science Centre and Planetarium, Calicut helped them to understand science through interaction with experts.

The notable outputs in this thematic area were:

- Addressing the issue of school dropouts by encouraging 9 dropouts back to school (3 from *Paniya* community, 4 from *Kuruma* community and 2 from *Kattunaikka* community)
- Helping 8 children from tribal hamlets secure admission in Model Tribal Residential Schools
- Teaching and learning materials prepared on topics like butterflies and freshwater fishes
- Screening of a video documentary on butterflies, prepared by a Biodiversity Conservation Corp member, at a state-level video festival

- Encouraging two mothers of ECAS students to pass the SSLC equivalent Certificate course under the Saksharatha mission.

The major outcome of this programme was raising the level of sensitisation of the students to nature and the environment.

ECAS training in schools: This initiative, started in 2008, looks at establishing DBT's Nature Awareness Clubs in upper primary schools, high schools and higher secondary schools in Calicut and Wayanad districts. Teachers from the selected schools have been given orientation on the DNA project activities and 4 Nature Awareness Clubs have been formed. All important days like World Environment Day, Children's Day, Science Day, etc., were marked by conducting activities pertaining to biodiversity, like lectures, field studies, essay competitions, exposure visits, project works, and quiz competitions.

A 21-day residential vacation training programme for 30 students, including 5 from tribal communities, was conducted. The course was structured around issues relevant to biodiversity conservation and its sustainable use, through classroom lectures, exposure visits, group work, documentaries, debates and discussions.

At the schools selected for DNA Club activities — the Immigration Jubilee Memorial H.S.S, Kottiyoor, Kannur; Achuthan Girls Higher Secondary School, Calicut; De Paul Public School, Wayanad — activities like identification of plant species found in the campus, painting

competitions, expert lectures, watching videos, exposure visits to institutes which have done exemplary work on biodiversity conservation, etc., were organised throughout the year.

ECAS training at tribal hamlets: Five more hamlets were added to the on-going ECAS programme in the tribal areas: Thachambath (62 classes conducted), Kuttimoola (58 classes conducted), Vazhakandy (38 classes conducted), Ponkuzhy 1 & Ponkuzhy 2 SSA Alternate School (82 classes conducted in each). Keeping in mind the role that women play in the health and hygiene of the family, awareness was conducted exclusively for them on the importance of good dietary practices along with herbal medicine preparation.

Observation of special days: World Environment Day, World Literacy Day, Children's Day, National Science Day, etc., were all observed.

The major programmes conducted as part of this thematic area are described below:

- Students observed World Environment Day in collaboration with OISCA International, by planting 11 endangered species in common lands and forest peripheries.
- In collaboration with the District Literacy Mission, the message of education was spread to students and parents on World Literacy Day.
- 62 students from 55 schools participated in the National Science Day celebrations by listening to a lecture on 'The Expanding Horizon of Science' and holding a debate and quiz on 'The Importance of Science'.

- Children's Day was observed at the Vivekananda Primary Residential School, Niravilpuzha, with an interaction with experts on the need to conserve nature, and a discussion on deforestation and disappearance of the forest ecosystem at De Paul School, Kalpetta.
- A two-day Science Fest was organised in which more than 1250 students from 120 schools of Wayanad participated. Expert talks on climate change, Chandrayan I, bioresource mapping, and the role of students in protecting the environment, etc., as well as an exhibition on wild edible tubers, mushrooms, agriculture implements, etc., marked the Fest.

Biodiversity Conservation Corps (BCC)

BCC members attended training as part of the Kerala Government's 'Shuchithwa Keralam' (Clean Kerala) programme. Street plays performed in tribal hamlets created awareness about the role of mosquitoes in spreading diseases. BCC mobilised students from 10 SSA Multi-Grade Learning Programme schools to establish medicinal plants in their schools and learn about their uses. The BCC also took the initiative, with the participation of the community members, to construct a loose boulder check dam over the stream flowing adjacent to the tribal hamlets, resulting in clean and assured water supply to the hamlets.

ECT through Community Training Centre

This year saw the formal inauguration of **Arani** — the Community Training Centre (CTC) — by the Consul General of Japan. The Japanese

Consulate has partially supported the construction of this residential training facility at the CAbC campus. Through the CTC, it is aimed to impart training to varied stakeholders on issues related to CAbC's area of work. Up until now, the CTC has been utilised for over 120 days to conduct workshops and residential training programmes.

Over and above this, the CTC was utilised for about 70 days by other institutes to impart training for over 700 people.

202.3 Sustainable livelihoods and food security

Since 1998, through its Green Health Programme, CAbC has been in the forefront of promoting primary health care traditions through conservation and sustainable use of medicinal plants. This also specifically focuses upon women from economically and socially marginalised sections in order to improve their livelihood status by teaching them the preparation, consumption and marketing of herbal products of nutritive and cosmetic value. The thematic area also looks at other bioresource-based livelihood options to increase livelihood security.

Capacity building of women SHGs

Campaigning and mobilising people through elected panchayat representatives and local leaders as well as personal interaction, and organising local and taluk level meetings were effective in bringing in the participation of women through SHG formations. The members were trained on cultivation, harvest, and

Table 2.10 **Training and capacity building programmes at CAbC**

| Training on | No. of Participants |
|---|---------------------|
| Tribal Promoters Programme on Tribal Rights | 120 |
| Training in Documenting Local Environmental Problems | 16 |
| Counseling programme for Farmers Club | 50 |
| Medicinal Plant Cultivation, Value addition and Marketing | 190 |
| Training for the Youth Farmers of Kerala | 25 |
| Summer Camp for Students | 40 |
| Vacation Camp for Tribal Children | 49 |
| Summer Camp for ECAS Children | 41 |
| Forest Rights Act | 25 |
| Environmental Awareness Campaign for Students | 40 |
| Essay Competition for Higher Secondary Students | 19 |
| Environmental Education for Students | 44 |
| Investors Meet in Poultry | 60 |
| Sustainable Food Production for Wayanad | 30 |
| Science Fest & Exhibition | 1200 |
| BIO DIVA Workshop | 40 |
| Workshop on Plant Taxonomy for Taxonomy Teachers and Researchers | 20 |
| PPV & FR | 30 |
| Regional Seminar on Pepper | 50 |
| Project Cycle Management | 20 |
| Value addition of the Jackfruit, Pineapple and Mango (Women's SHGs) | 20 |
| Spice Farmers meet with Union Minister | 150 |
| Vocational Training for ECAS students | 22 |
| Training on Bio resource Mapping for Students and Teachers | 36 |

management practices of the medicinal plants. 75, 000 seedlings from 15 species were raised for distribution among 23 SHGs for cultivation. Two of the SHGs raised field-level nurseries while a mother nursery with 30 species was established at CAbC. As a result, 350 women learnt the skill of cultivating and utilising medicinal plant species and contributed to the sustainable utilisation of medicinal plants.

175 people were also trained in Bio-Intensive Gardening (BIG) and given seeds, ensuring an assured supply of vegetables for their families. One of the SHGs has been given the responsibility of catering for all training programmes at the CTC, with additional training being imparted for professional catering.

Study of RET medicinal plants

Exploration, collection and *ex situ* conservation of 7 RET medicinal plants, selected under the network project on RET medicinal plants funded by NMPB, was carried out. 275 samples from 35 localities from 6 districts through 30 field trips resulted in a collection of more than 35,000 individuals either as seeds/seedlings/stem cuttings for raising in the nursery.

Strengthening the market outlet

The facilitation to procure and market organic produce from farmers at the outlet in Kalpetta town is making progress. The products currently sold are organic vegetables, fruits, speciality rice varieties like *Navara*, *Gandhakasala*, *Mullanchana*, etc., and forest products like honey, collected by tribes. In addition, herbal medicines, handicrafts, value-added food

stuffs etc., produced by the WSHGs are also sold. Currently, the market outlet is linked with more than 25 WSHGs, who have been trained and supported by CAbC in producing organic vegetables. The progress can be gauged from the fact that the outlet no longer procures produce from outside sources but is able to stock its shelves with produce from within the district and also with the home garden initiative of CAbC.

Study on Kattunaikka traditions

A small research grant has resulted in exploring the Kattunaikka tribal community's traditions of bioresource utilisation and management so as to formulate suitable livelihood options for this most marginalised semi-nomadic hunter-gatherer communities. As an initial step, 50 members have been trained in the good collection practice of NTFPs and on value addition to gooseberry, one of the commonest NTFP collected by the community. The value addition has increased the income generated as opposed to raw selling done earlier.

202.4 The Community Agrobiodiversity Farm

The CAbC is one of the unique sites of MSSRF. Located on 42 acres of land — with 5 acres being utilised for office infrastructure, the guest house, bio-software labs, and mushroom unit — it is a farm with standing coffee and areca nut plantations along with trees like silver oak and jackfruit, and pepper vines, among others.

Though it has commercial crops, the objective of running the farm is not commercial in the

pure sense but only to ensure its expenses are met through farm operations. More importantly, the vast area is well utilised to showcase conservation efforts that are meant to protect the biological wealth of Wayanad. The conservation farm is extensively visited by people from all walks of life to understand the importance of all forms of biodiversity, be it the rare and threatened endemic plants of Western Ghats, the tuber plot, organically cultivated vegetables, paddy demonstration plot, nurseries of medicinal plants or the butterfly garden and the orchid collection.

Since last year, effort has been put into making the farm not only an economically viable one but one that would also serve as a model for replication of smaller units. Thus, integration of organic vegetable and fruit production, poultry unit, cattle unit for milk and manure for the farm plus fuel for biogas units, etc. was promoted on a small scale.

Apart from the standing crops of coffee, arecanut, pepper, jackfruit and pepper, most of the work undertaken at the farm is an attempt to demonstrate to marginal and small farmers the feasibility of taking up varied methods of cultivation and income generation. .

The entire area of land possessed by CAbC has been mapped with the help of the Revenue Department to demarcate areas for specific activities based on soil, topography, and elevation.

Organic cultivation

On an experimental mode, about 3.5 acres of the farm land has been demarcated to

demonstrate organic mode of cultivation under multi-cropping and inter-cropping cultivation where coffee, arecanut, jackfruit and pepper were already present. To showcase the varietal richness of banana, varieties like *Nenthran*, *Mhalipoovan*, *Nadanpoovan*, *Mysorepoovan*, etc, have been planted. Similarly, pepper vines, fruit trees and coconut trees have also been planted.

To demonstrate the varied ways that marginal or poor farmers can diversify their production to increase livelihood options, 10 bee hives have been set up for honey production as a demonstration unit. On 35 cents of land, vegetables like brinjal, chillies, ladies' finger, tomato, amaranth varieties, beans, and also pulses have been raised. Cool season vegetables like cauliflower, cabbage and carrot, not generally grown here, have been successfully cultivated. All organic inputs like vermicompost and herb-based pesticides are produced in the farm. All the produce is sold to local people and through the eco-outlet. The idea is to demonstrate the economics of organically cultivating a small farm.

Mushroom cultivation

Mushroom cultivation was demonstrated as yet another livelihood option. CAbC Farm is continuing this through production of spawn, which is in great demand; training programmes are conducted for interested people.

Bio-software laboratory

As part of an earlier project, the lab is utilised to produce bio-control agents like *Trichoderma* and *Trichogramma*, along with a vermicomposting unit.

Cattle / poultry unit

A small-scale cattle unit is run to supply farmyard manure and fuel for the domestic biogas plant — another example for small-scale farmers to replicate.

Beekeeping

As an initial effort, 10 bee hives have been set up, as honey can be a very simple way of increasing the income of the household with minimal expense and work.

Farm

Twenty-eight acres of land continue to be covered with crops like coffee, intersected with silver oak, jack fruit, areca nut, with new plantings done between the gaps. Small patches of area ranging from 30 cents to 1 acre have been utilised for inter-cropping with paddy, turmeric, banana, tapioca and vegetables. **Table 2.11** shows the 2008-2009 income-expenditure for each individual crop and the stock.

In addition, the land also generated income by way of firewood and scrap sales. For the financial year April 2008 to March 2009, the total expenses were Rs. 7, 44,783.

The following efforts serve to demonstrate CAbC's conservation efforts:

- Medicinal plants nursery: 45 species on a half-acre plot, in addition to 275 species in pots in the shade house
- RET nursery: 20,000 seedlings of 50 species

Table 2.11 *Income and expenditure of the Community Agrobiodiversity Farm*

| Crop | Expenditure (Rs.) | Income (Rs.) | Stock (kg) |
|------------|-------------------|--------------|------------|
| Coffee | 2,41,965.00 | 5,97,500.00 | 25 |
| Pepper | 10,105.00 | 9590.00 | 45 |
| Arecanut | 34,518.00 | 71,350.00 | 300 |
| Intercrops | 1,81,007.00 | 11,985.00 | |
| Paddy | | | 100 |
| Turmeric | 5460.00 | | 330 |
| | | | 80(dry) |

- Conservation plots: A RET *ex situ* conservation area of 300 seedlings from 30 species covering 5 acres of coffee
- Arboreteum: 156 endemic tree species
- Orchidarium: 125 species
- Fernarium: 30 species
- Climbing plant zone: 156 lianas
- *Ex situ* collection and conservation of wild and traditional species/varieties of tuber crops and legumes
- Dioscorea: 13 wild species and 3 cultivated species
- Legumes: 5 species, 13 varieties
- Colocasia: 4 wild and 5 traditional varieties
- Arrowroot: 2 varieties
- Curcuma, wild ginger and other tuberous plants: 9 species
- Butterfly Garden: Attracts 73 species of butterflies, with 800 butterfly host plants from 151 species as nectar and larval food, on a half-acre plot

Sub Programme Area 203

Biju Patnaik Medicinal Plants Garden and Research Centre (BPMPGRC), Jeypore

203.1 PAN MSSRF Initiative: Integrated management of biodiversity resources

The project being implemented under this initiative covers four thematic areas: Biodiversity Conservation Utilization Enhancement (BCUE), Biovillage (BIOV), Food Security (FS), and Village Knowledge Centres (VKCs). Work done under the first two is reported here while the FS and VKC sections have been covered under the FS and IEC Programme Areas.

203.1.1 Biodiversity Conservation Utilisation Enhancement

Large-scale cultivation and market promotion of Kalajeera paddy

Since 2005, *Kalajeera* (a scented landrace of rice) is being marketed to National Agricultural Cooperative Marketing Federation of India Ltd (NAFED) by tribal and farm families through the Kalinga Kalajeera Rice Growers' Cooperative Society (KKRGCS). The activities of KKRGS this year included monitoring and management of marketing process, detailed survey of Kalajeera farmers, distribution of income from sales, meetings with the Director, Agriculture and Food Production, Orissa, and preparation of the plan of action for *kharif* 2008.

The produce was lifted by NAFED and a demand draft for Rs. 8,43,460 was handed over to the Society for distribution among farm families.

The survey conducted on 307 Kalajeera farmers threw up the following key points:

- The farmers were unhappy with late payment by NAFED; as a consequence of this, small farmers were forced to sell their produce at Rs. 1000 / qtl to fulfill their immediate needs.
- Farmers reduced the area under cultivation as the price of Kalajeera was too low and the declaration of increased price by the Director of Agriculture was delayed. Farmers are not willing to cultivate more area in *kharif* 2008-09.
- 26 landraces are still cultivated by farm families and marketed like Kalajeera. Of these, 3 landraces, viz., *Machhakanta*, *Assamchudi*, and *Sapuri*, need to be improved.
- Farmers faced difficulties in storing large quantities of Kalajeera, due to non-availability of storage space at cooperative Large Area Multipurpose Society godowns

(LAMP). In addition, grain had to be stored for a month before being lifted by the marketing agency and the loss of grain weight had to be borne by KKRGCs.

- In the annual district tribal festival, PARAV 2008, 75 kg of Kalajeera rice was sold at Rs 30 / kg. Around 2500 kg were sold by MSSRF locally at Rs 30 / kg.
- Out of 159 farmers 76 farmers from 30 villages of 3 blocks sold Kalajeera at Rs1500 / qtl to NAFED through KKRGCs and the amount has been distributed among the farmers.
- The average yield range recorded this year has been 9 to 14 qtl / acre.

Greengram trials

Greengram is a traditionally grown crop with local strains, cultivated in the summer after the paddy harvest. Nine trials were taken, 3 at Nuaguda, 4 at Gunthaguda and 2 at Boliguda in an area of 12708.2 sq m (3.14 acres). Farmers were motivated to go for the high-yielding variety as well as local varieties. Five varieties (PUSA 9531, PUSA VISAL, K 851, Local, PDM 1) were provided to 7 farmers and one variety given to 2 interested farmers.

Table 2.12 **Marketing details of Kalajeera paddy, 2008**

| Pick-up points | Blocks | No. of farm families | Total quantity of grain (kg) | Date of lifting |
|-------------------------------------|--------------|----------------------|------------------------------|-------------------|
| Boipariguda cooperative LAMP godown | Boipariguda | 14 | 10,899.50 | 17, 18 March 2008 |
| Kundura cooperative LAMP godown | Kundura | 37 | 29,662.00 | 15, 16 March 2008 |
| Balia pick up point | Balia | 47 | 43,784.50 | 19 March 2008 |
| | Total | 98 | 84,346.00 | |

Before sowing, seeds were amended with *Rhizobium* culture and *Phosphobacter*. Seeds were sown in line with appropriate spacing. Agronomic data like number of plants, number of pods, pod weight and seed weight were collected from 2 sq.m. Crops were damaged by heavy rain and waterlogging at the two-leaf stage,

- The yield of PDM-1 is the best and has been scaled up as food security component.
- The yield of local variety ranks next and needs to be popularised.

Plan for rabi 2009: A series of meetings were conducted at Gunthaguda. Two SHGs were mobilised for seed production of high-yielding variety, and two other SHGs were selected for BCUE intervention. One acre was taken by two SHG groups in Gunthaguda to test the high-yielding TERM-1 variety provided to them for lowland cultivation. *Rhizobium* and *Phosphobacteria* were applied to seeds. As farmers did not have sufficient organic manure to use for greengram cultivation, FYM and NPK were supplied in the ratio of 2:1.

Limitation: Rainfall fluctuation hampered the extent of cultivation. In October, the cultivation

was halted and, as a result, moisture from medium lands drained into standing crops of paddy. Medium lands are not suitable for greengram cultivation during the *rabi* season. Low-lying land dries during January-February. Hence, local varieties are not suitable. Heavy rain in January 2008 led to waterlogging in these areas, and the entire crop was damaged because of stunting at the two-leaf stage of the germinated greengram seeds.

Sample trial of finger millet

Compared to other cereals, millets are generally suited to less fertile soils and poorer growing conditions, such as intense heat and low rainfall. In addition, they require shorter growing seasons. The most common millets cultivated in Jeypore were traditional varieties like *Bada Mandia* and *Sana Mandia*. However, farmers employed the traditional manner of uniform broadcasting of impure seeds, and without weeding and thinning, which lead to poor production.

During *kharif* 2007 an experiment on available landraces of finger millets was conducted in 3 villages, using both a Randomised Block Design (RBD) and farmer’s method. It was concluded that out of 5 finger millet landraces,

Table 2.13 *Kalajeera cultivated area 2008*

| Block | No. of farmers | No. of villages | No. of G.Ps | Quantity of seed (kg) | | | Area (acre) |
|-------------|----------------|-----------------|-------------|-----------------------|------|-------|-------------|
| | | | | MSSRF | Own | Total | |
| Jeypore | 08 | 4 | 02 | -- | 140 | 14 | 07.5 |
| Boipariguda | 77 | 24 | 06 | 25 | 666 | 691 | 52.0 |
| Kundura | 74 | 16 | 05 | 80 | 1212 | 1292 | 62.4 |
| Total | 159 | 44 | 13 | 105 | 2018 | 2123 | 121.9 |

Table 2.14 *Performance of greengram varieties*

| Name of the varieties | No. of Plants (n) 2 sq.m | No of pods (n) 2 sq.m | Pods weight (gm) 2 sq.m | Seed wt (gm) 2 sq.m |
|-----------------------|-----------------------------|--------------------------|----------------------------|------------------------|
| <i>PUSA 9531</i> | 28 – 1207 | 98 – 1820 | 136.2 – 415.0 | 67.6 – 282.8 |
| <i>PUSA VISHAL</i> | 20 – 80 | 83 – 440 | 29.0 – 160.0 | 20.0 – 98.6 |
| <i>K 851</i> | 81 – 250 | 950 – 1720 | 244.0 – 424.2 | 152.0 – 231.0 |
| <i>PDM 1</i> | 50 – 1206 | 82 – 2000 | 90.6 – 494.6 | 58.8 – 307.4 |
| LOCAL | 30 – 850 | 69 – 2035 | 113.8 – 532.6 | 78.6 – 302.2 |

two, *Bada Mandia* (long duration) and *Sana Mandia* (short duration), performed well under existing climatic conditions. These two finger millet landraces have now been taken up for large-scale cultivation in 3 villages. This *kharif*, a sample trial of finger millet in two villages (Nuaguda and Gunthaguda) for pure seed production of two landraces has been taken up, with 45 seed samples of finger millet collected from 45 farm families.

Experiments were conducted in an area of 608 sq.m in Nuaguda and 750 sq.m in Gunthaguda village. Each finger millet sample was sown in 3 lines after adding adequate FYM in the plot. The distance between hills is 10 cm and rows 20 cm, with thinning and weeding carried out at the appropriate time.

A participatory sample selection was carried out in 2 villages. Two groups were formed and the samples were decoded before the groups entered the field for selection. The groups described the best, better and good varieties as per their visual ranking. Agronomic characters like plant height, number of tillers, panicle length, finger length, number of fingers, grain and straw weight from 10 plants of each sample were taken and analysed.

Results

- There is difference between farmers' selection and experimental justification. The data corroborates the view of farmers when grain yield data of 10 plants is considered. But a different result is obtained when plot yields of each sample are considered. This discrepancy occurs as farmers selected the sample by watching 2-3 plants of the plot and not the crop as a whole.
- Farmers suggest that application of chemical fertiliser can give good yield. An Integrated Nutrient Management strategy may be required.
- Line sowing will be accepted by farmers, if some sowing equipment is provided to them.

Large-scale trial of F8 generation of rice landraces (Participatory Hybridisation System)

A total of 160 kg of seeds of 4 populations (40 kg from each population) were collected last year. Three farmers from 3 villages (Pujariput, Kashiguda and Boliguda) selected seeds of 4 populations along with 5 parents (*Para, Mora, Gathia, Sapuri, Limbachudi*) for cultivation on

2.5 acres. Data on agronomic characters along with vegetative characters were collected.

Table 2.15 sets out the details.

Results

- From the crop cutting (1m x 1m) of 4 populations, S1 and S2 showed better yield in Pujariput.

- S3 & S4 populations of Kashiguda showed better yield from (1m x1m) crop cutting compared to the other two villages.

- S1 & S2 populations have bold grain with better yield, whereas S3 & S4 populations have slender grain with better tillering density.

Table 2.15 Large-scale trials of F8

| Mid term data of F8 trial | | | | | Result of (1m x 1m) crop cutting | | | |
|---------------------------|----|---------------------|----|-------------------|----------------------------------|-----------|----------------------------------|----------------------|
| Name of the samples | PC | DB | DT | Ds/ Ins (%) | DFI | DF (50 %) | Grain weight (gm) | Straw weight (gm) |
| Village: Pujariput | | DS: 25.06.08 | | | DT: 29.07.08 | | (Average wt from three trials) | |
| S1 | 2 | 3 | 09 | 10 | 08.09.08 | 18.09.08 | 383.3 | 453.3 |
| S2 | 2 | 3 | 10 | Nil | 08.09.08 | 18.09.08 | 300.0 | 316.7 |
| S3 | 2 | 3 | 10 | Nil | 25.09.08 | 05.10.08 | 216.7 | 466.7 |
| S4 | 2 | 3 | 10 | Nil | 25.09.08 | 05.10.08 | 175.0 | 425.0 |
| Village: Boliguda | | DS: 05.07.08 | | | DT: 17.08.08 | | | |
| S1 | 2 | 2 | 9 | Nil | 05.10.08 | 15.10.08 | 197.3 | 216.7 |
| S2 | 3 | 2 | 9 | Nil | 05.10.08 | 15.10.08 | 244.3 | 290.0 |
| S3 | 4 | 2 | 8 | Nil | 30.10.08 | 10.11.08 | 215.0 | 231.7 |
| S4 | 3 | 2 | 9 | Nil | 30.10.08 | 10.11.08 | 240.0 | 253.3 |
| Village: Kashiguda | | DS: 05.07.08 | | | DT: 22.08.08 | | | |
| S1 | 2 | 2 | 9 | 20 | 10.10.08 | 17.10.08 | 250.0 | 308.3 |
| S2 | 2 | 2 | 9 | 20 | 10.10.08 | 17.10.08 | 225.0 | 350.0 |
| S3 | 3 | 1 | 9 | 20 (stem borer) | 28.10.08 | 10.11.08 | 291.7 | 333.3 |
| S4 | 3 | 1 | 10 | 50 (Blast, Chita) | 28.10.08 | 10.11.08 | 191.7 | 208.3 |

Scores

PC – Plant Canopy: Open – 1, Semi-compact – 2, Compact – 3, Highly compact – 4

DB – Density of Biomass: 1-Poor, 2-Fair, 3-Good, 4 – Best

Ds/Ins - Disease & Pest incidence: 10% - Very low, 11-20%: Moderate, 21 – 50% - High, > 50%: Very high

- All populations maintain their uniformity and stability.

Popularisation of PPB-led-PCS programme

Seeds of 500 gm of 36 landraces from Nuaguda Field Gene Bank were distributed to 34 farm families from 9 villages in Kundura block. Farmers were trained on the modified package of practice and were given details of the characters of the landraces. Farmers selected landraces of their choice. After receiving the selected sample seeds, the team discussed the importance of conservation and improved package of practice for enhanced production. To popularise the model, the variety was cultivated at the border of the main field.

Vegetative, flowering, harvesting and post-harvesting agronomic characters were collected at different stages. Farmers were trained on the improved package of practice. Farmers harvested seeds from the mother panicles and returned some to the VSB of Nuaguda after retaining seeds for their own use.

Results and impact

- In 2005 one low-land variety *Sunaseri* (300 gm) was provided to Trilochana Ghiuria, a progressive farmer of Nuaguda village, under the PPB-led-PCS programme, which, today, is cultivated in 3.5 acres by 5 farmers indicating popularisation of the landrace.
- Ramsingh Kamara and Dhanurjoy Kamara of Gunthaguda cultivated 3 landraces

(*Banusaganthi*, *Samudrabali* and *Chepti Masuri*) in an area of 1.5 acres of land, and cultivation has also been extended to a larger area.

Conservation and characterisation of rice landraces

Fifty gm each of 90 landraces of rice (70 from *khari* 2007 and 20 newly explored landraces) were sown at BPMPGRC. These were placed on a wet bed nursery and transplanted in 3 lines each. Out of 90 landraces, 56 were also raised at Nuaguda to assess performance under non-ideal conditions. The agronomic characters were collected at different stages of plant growth such as seedling, vegetative, late vegetative, flowering, harvesting and post-harvesting. 300 gm each of 62 varieties are ready for depositing at the Community Gene Bank, Chennai. Herbaria of panicles of 90 landraces were prepared. Remarks on the differentiation on flowering dates as well as on plant height and productive tillering have been shown in **Tables 2.16** and **2.17**.

Results

- The flowering dates of the 20 varieties both in ideal and non-ideal conditions have shown a lot of differentiation in 50 % flowering, ranging from 4 days to 30 days.
- Out of 45 characters recorded, analysis of two characters showed that all 18 varieties except *Alasikiba* and *Surudaka* are taller. Under ideal conditions, *Raskadam*, *Dangar Chudi*, *Farm Chudi* and *Baring* have more

Table 2.16 *Differentiation on flowering dates (50 % and 100 %) of landraces*

| Varieties | Date of 50 % flowering | | Date of 100 % flowering | |
|------------------------|------------------------|---------------------|-------------------------|---------------------|
| | Ideal condition | Non-ideal condition | Ideal condition | Non-ideal condition |
| <i>Patadhan</i> | 09.10.08 | 20.10.08 | 17.10.08 | 28.10.08 |
| <i>Muktabali</i> | 03.10.08 | 12.10.08 | 10.10.08 | 18.10.08 |
| <i>Ojan</i> | 03.10.08 | 16.10.08 | 11.10.08 | 24.10.08 |
| <i>Surudaka</i> | 30.09.08 | 11.10.08 | 09.10.08 | 18.10.08 |
| <i>Merlo</i> | 21.09.08 | 12.10.08 | 30.09.08 | 20.10.08 |
| <i>Sapuri</i> | 03.10.08 | 15.10.08 | 15.10.08 | 23.10.08 |
| <i>Baunsidubraj</i> | 16.10.08 | 20.10.08 | 28.10.08 | 30.10.08 |
| <i>Kakmarang</i> | 26.09.08 | 15.10.08 | 10.10.08 | 23.10.08 |
| <i>Alasikiba</i> | 09.10.08 | 20.10.08 | 23.10.08 | 28.10.08 |
| <i>Leder</i> | 05.10.08 | 23.10.08 | 12.10.08 | 30.10.08 |
| <i>Assamchudi</i> | 13.10.08 | 22.10.08 | 22.10.08 | 29.10.08 |
| <i>Dangar basumati</i> | 05.10.08 | 12.10.08 | 20.10.08 | 19.10.08 |
| <i>Chipiti</i> | 13.09.08 | 08.10.08 | 25.09.08 | 17.10.08 |
| <i>Cheteka</i> | 12.10.08 | 15.10.08 | 19.10.08 | 22.10.08 |
| <i>Raskadam</i> | 20.09.08 | 08.11.08 | 02.10.08 | 17.11.08 |
| <i>Dangar chudi</i> | 15.09.08 | 21.10.08 | 29.09.08 | 29.10.08 |
| <i>Farm chudi</i> | 12.09.08 | 18.10.08 | 24.09.08 | 25.10.08 |
| <i>Baring</i> | 22.09.08 | 11.10.08 | 04.10.08 | 22.10.08 |
| <i>Kerandi</i> | 08.10.08 | 22.10.08 | 30.10.08 | 29.10.08 |
| <i>Kuyerkuling</i> | 17.10.08 | 20.10.08 | 29.10.08 | 28.10.08 |

Ideal condition : Date of sowing: 04.07.08 Date of transplanting: 07.08.08

Non-ideal condition : Date of sowing: 21.07.08 Date of transplanting: 23.08.08

productive tillers, whereas all the other 16 varieties have similar productive tillers.

- From the *kharif* crop, 50 early maturing landraces were chosen to be cultivated in the *rabi* season, to compare their performance.

Nucleus seed production of Kalajeera: The best panicles from 50 lines were collected during *kharif* 2007. Seeds of these panicles were sown at BPMPGRC. The panicles were

transplanted in 3 lines, each with a row-to-row spacing of 20 cm and hill-to-hill spacing of 15 cm. Agronomic characters like plant height, productive tillers, tillering density, grains per panicle, chaffs per panicle, grain weight per hill and straw weight per hill were collected and the data is being analysed.

Seed production for local market promotion: From the market survey (sample of 307), it was seen that farmers preferred 3 important

Table 2.17 *Differentiation on plant height and productive tillering of landraces*

| Varieties | Plant height (cm) | | Ideal condition | Non-ideal condition |
|------------------------|-------------------|---------------------|-----------------|---------------------|
| | Ideal condition | Non-ideal condition | | |
| <i>Patadhan</i> | 104.00 | 92.00 | 3 | 3 |
| <i>Muktabali</i> | 111.00 | 91.52 | 4 | 5 |
| <i>Ojan</i> | 110.30 | 91.24 | 5 | 4 |
| <i>Surudaka</i> | 84.00 | 104.40 | 6 | 3 |
| <i>Merlo</i> | 89.00 | 85.30 | 4 | 3 |
| <i>Sapuri</i> | 113.70 | 90.80 | 6 | 4 |
| <i>Baunsidubraj</i> | 81.82 | 72.70 | 4 | 3 |
| <i>Kakmarang</i> | 98.00 | 91.00 | 5 | 5 |
| <i>Alasikiba</i> | 102.30 | 113.60 | 5 | 3 |
| <i>Leder</i> | 102.80 | 102.80 | 4 | 4 |
| <i>Assamchudi</i> | 89.60 | 97.20 | 4 | 3 |
| <i>Dangar Basumati</i> | 89.90 | 89.80 | 3 | 4 |
| <i>Chipiti</i> | 74.50 | 74.50 | 5 | 5 |
| <i>Cheteka</i> | 101.10 | 85.80 | 3 | 4 |
| <i>Raskadam</i> | 97.80 | 79.00 | 7 | 3 |
| <i>Dangar Chudi</i> | 102.30 | 76.30 | 8 | 4 |
| <i>Farm chudi</i> | 108.80 | 75.80 | 7 | 5 |
| <i>Baring</i> | 110.50 | 89.80 | 7 | 4 |
| <i>Kerandi</i> | 116.60 | 111.60 | 6 | 5 |
| <i>Kuyerkuling</i> | 126.20 | 87.00 | 5 | 5 |

local varieties — *Machhakanta*, *Sapuri* and *Assamchudi*. From the farmers' point of view, these three are slender grained with better local market demand. The seeds of these varieties were collected from farmers and seed production planned on the lines adopted for Kalajeera. Four villages and 4 farmers were identified for this activity and seeds along with FYM supplied to them for raising nurseries, according to given guidelines. From time to time, crop monitoring and preventive measures against pest and diseases were undertaken. Rouging was done in each seed

production plot. Crop cutting (1m x 1m) along with agronomic characters of 10 plants were collected for analysis. Seeds were collected from mother tiller as well as primary tiller and pure seeds of each variety were kept for large-scale production in the forthcoming *kharif* season. The results are given in **Table 2.18**

Results

- 190 kg of mother panicle seeds along with 110 kg of primary tiller seeds were collected from the middle portion of the plot and deposited in Village Seed Bank after post-harvest processing.

Table 2.18 *Pure seed / grain yield of landraces*

| Varieties | Seeds from mother tillers (kg) | Seeds from primary tillers (kg) | Plot size (sq.m) | Grain yield/ plot (ql) | Grain yield / ha (ql) |
|--------------------|--------------------------------------|---------------------------------------|---------------------|------------------------------|-----------------------------|
| <i>Assamchudi</i> | 50 | 50 | 4000 | 11.4 | 28.5 |
| <i>Machhakanta</i> | 100 | 0 | 4000 | 14.6 | 36.5 |
| <i>Sapuri</i> | 40 | 60 | 3000 | 8.6 | 28.6 |
| Total | 190 | 110 | 11000 | 34.6 | 93.6 |

- The production of *Machhakanta* is better than the other two landraces.
- Due to late rain, transplanting was delayed in all the villages.
- There is not much difference in crop cutting data.
- The tribal people understood the experiments easily and are most likely to adopt it during the forthcoming *kharif* season.

Manure trial for VKC content development:

The trial was conducted with the *Machhakanta* variety in a farmer's field at Nuaguda. Nursery was sown in raised wet beds on 1 July 2008 with 4 treatments: no manure, only FYM, only vermicompost, and mixture of FYM and vermicompost (2:1). Four plots (12m x 11m) were prepared and the seedlings transplanted in each plot with 20 cm space between rows and 15 cm space between hills. During each stage, video documentation was done and both vegetative as well as agronomic characters were documented and analysed.

Results

- The production of *Machhakanta* increased when FYM : vermicompost (2:1) was used.
- The straw yield was more in the vermicompost plot, indicating better vegetative growth of the plant.

- There is variation in the flowering dates among the four plots. On 15 October 2008, the plots which received only FYM and FYM + Vermi (2:1) had 50 % flowering, whereas the plot with no manure had flowering at the initiation stage, and the plot where vermicompost was used showed 20 % flowering.

Village Seed Banks

Transactions during the reporting period is provided in **Table 2.19**. VSB committees of 3 villages facilitated seed transactions in the presence of the Central Village Committee (CVC). After verifying transaction records, the CVC finalised their statement. As per the CVCs' suggestion, regular loan defaulters were not to be entertained.

Table 2.19 *Village Seed Bank transactions*

| Seed | Boliguda | | | Gunthaguda | | | Nuaguda | | |
|----------------|----------------------|------------|---------------|----------------------|------------|---------------|----------------------|------------|---------------|
| | No. of farm families | No. of LRs | Quantity (kg) | No. of farm families | No. of LRs | Quantity (kg) | No. of farm families | No. of LRs | Quantity (kg) |
| Rice landraces | 13 | 04 | 264 | 06 | 05 | 68.0 | 10 | 08 | 307 |
| Finger millet | 06 | 01 | 26 | 23 | 01 | 169.8 | 13 | 01 | 60 |
| Greengram | 09 | 01 | 61 | 14 | 01 | 94.0 | 19 | 01 | 104 |
| Total | 28 | 6 | 351 | 43 | 07 | 331.8 | 42 | 10 | 471 |

Results

- The seeds of finger millet and greengram now have a permanent place in village seed banks.
- Distribution of landrace seeds of 36 varieties among 33 farmers of 9 villages from VSB Nuaguda provided an opportunity for farm families to share seeds with other villages.
- Extension of activities in VSB at Boliguda and Nuaguda is essential to provide more seeds according to farm family demands.

Training and capacity building

During the reporting year the following training and capacity building programmes were undertaken. **Table 2.20** has the details.

Panchabati Grama Unnayan Samiti (PGUS)

PGUS is a registered local institution formed after winning the Equator Initiative Award (2002). 96 members from 16 villages represent the PGUS, and the institution has a bank account into which the monthly fees of Rs.25

per village are deposited. The interest money from the Equator Initiative Award fund will be utilised by PGUS for sustainable village development activities as well as for required training and equipment.

203.1.2 Biovillage programme

Various livelihood promotion activities based on the use of natural resources were undertaken during the year.

Mushroom cultivation

Oyster mushroom cultivation is undertaken on a regular basis by 6 SHGs and 5 individual households and straw mushroom by 5 SHGs, totaling 71 households from the 3 villages in which the project is implemented. During the year, the gross income from the sale of mushroom was to the tune of Rs 29,640 for oyster mushroom and Rs. 6500 for straw mushroom. The waste generated by mushroom cultivation is being used as raw material in the production of vermicompost. A team of 23 members from Access Development Services, an NGO from Jharsuguda, visited the oyster mushroom cultivation unit at Nuaguda.

Table 2.20 *Training and capacity building in BPMPGRC*

| Date | Particulars | Target groups | Participants | | Total |
|--------------|---|--------------------------------|--------------|------------|------------|
| | | | Male | Female | |
| 17.04.08 | Training on seed purification | Farmers | 07 | 19 | 26 |
| 19.04.08 | Training on Farmers Rights Act and Biodiversity Act | PRI leaders & village leaders | 11 | 03 | 14 |
| 25.04.08 | Meeting with management body of KKRGCs regarding repayment of seed loan by the farmer | Members of KKRGCs | 05 | 02 | 07 |
| 11.06.08 | General Body meeting of KKRGCs to present the discussion with Director of Agriculture and Plan of Action for Kalajeera cultivation in kharif 2008 | Members of KKRGCs | 43 | 13 | 56 |
| 01.07.08 | Nursery demonstration-cum-training on manure trial | Farm families of 4 villages | 20 | 20 | 40 |
| 29.07.08 | Transplanting demonstration-cum-training on manure trial | Farm families of 3 villages | 15 | 15 | 30 |
| 16.09.08 | Training on Integrated Pest Management in rice | Farm families from 17 villages | 130 | 33 | 163 |
| 20.01.09 | General Body meeting of KKRGCs to discuss on Kalajeera lifting and storage | Members of KKRGCs | 43 | 00 | 43 |
| 10.03.09 | General Body meeting of PGUS | Members of PGUS | 34 | 24 | 58 |
| 25.03.09 | Executive Body meeting of PGUS | Members of PGUS | 12 | 19 | 31 |
| Total | | | 320 | 148 | 468 |

Vegetable cultivation

Commercial vegetable cultivation is being carried out by 78 households and 3 SHGs from three villages. Seeds of cabbage, cauliflower, knolkhol, radish, brinjal, tomato, chilli, bitter gourd, coriander and greens were provided. Income from the sale of vegetables ranges between Rs. 3000 to Rs. 6000 per household. The project monitored and provided technical support and training to farm families.

Vermicompost production

Out of the 55 operational vermicompost pits in the project villages, 20 belong to two SHGs while 35 pits are owned by individual families. During the year, 254 qtl of vermicompost were produced, 126 qtl worth Rs. 37,800 was marketed, and the rest used in their own fields. In addition, earthworms worth Rs.6500 were also sold. There is increased awareness among the local people regarding the use of vermicompost in agriculture.

Tamarind value addition

Value addition to tamarind has been taken up by 3 SHGs from Nuaguda and Gunthaguda. The groups procured 20 qtl of tamarind with the financial support of the MSSRF Community Banking Project. The processed tamarind has been deposited in the cold storage unit and would be sold in October when the demand is high.

Pisciculture

Two SHGs of Nuaguda undertook pisciculture as a group activity, taking on lease 2 ponds over an area of 0.5 acres. Five kg of fingerlings were introduced into the ponds and the 90 kg of fish that they harvested were sold for Rs.70 / kg. The gross income from the activity was Rs.6300.

Arbi and yam cultivation

Rhizomes of elephant-foot yam (*Amarphopphallus sp*) and yam (*Dioscorea sp*) were provided to 91 households and two SHGs, which were planted in their backyards and fields ranging in size from 2 to 4 cents of land. The quantity harvested was between 20 - 40 kg, of which a limited quantity was consumed and the rest retained as seed material.

Papaya and drumstick cultivation

Seedlings of papaya in the male / female ratio of 3:2 were distributed to 10 households in Gunthaguda and 26 in Nuaguda, of which 70 % survived. Seedlings of drumsticks were provided to 10 HH at Gunthaguda and 26 HH at Nuaguda, of which 50 % survived. These aid in the nutritional security of the villagers.

Leaf plate stitching

Leaf plates are in high demand during the marriage season and are sold within Boliguda as well as in the nearby villages of Doraguda, Chikma and Boipariguda. Stitching leaf plates is carried out through a group of 8 women members in the village. Two machines have been provided to the group. Each woman can make 80 to 100 plates in 4 hours. The total volume of sales this year amounted to Rs 12,250. The stitching machine is used during off season to mend clothes which provides additional income.

Banana plantation

Banana suckers were planted by 174 HH (34 in Nuaguda, 70 in Gunthaguda and 70 in Boliguda) in their backyards. There has been 60 % survival; the produce is mainly for self-consumption while small quantities are sold.

Integrated dairy farming

A dairy farming group comprising 10 male members was formed at Boliguda. Project discussions were carried out with the main branch of State Bank of India at Jeypore and the Department of Agriculture to enable linkages under the Krishi Sahayak Kendra (KSK) scheme. Land selected for the activity will be donated by one of the members of the group. The purpose of the activity is to integrate dairy farming with vermicompost, bio-gas and mushroom production.

Process documentation

Process documentation of activities carried out under the project in Nuaguda village has been completed and would provide

lessons in livelihood support and sustainable development using natural resources. Data is being collected from other villages for documentation.

Shallow-dug wells

Water sources are important for carrying out vegetable cultivation and other agricultural activities. Shallow wells have been dug in the fields of farm families to provide irrigation for vegetable cultivation. Ten shallow-dug wells have been provided to 30 farmers in Nuaguda village and 10 for Gunthaguda are under process. Members of the community have commenced vegetable cultivation using water from these wells.

Table 2.21 sets out details of the training programmes conducted during the year.

203.1.3 Monitoring and evaluation from a gender perspective

Monitoring and evaluating the various interventions carried out in the CC phase project from a gender perspective has been the focus of a series of studies carried out by a staff member appointed for the purpose.

Ragi cultivation and use

Ragi is a staple food for people in the Koraput region. Women prepare different dishes like gruel, country liquor, laddu, etc., from ragi. Observations indicated that a lot of time is spent in pounding ragi, which is a monotonous job involving drudgery. During discussion this aspect frequently surfaced and it was suggested that the provision of hullers would bring about significant relief.

It was therefore proposed to undertake a study on ragi to understand the key issues. A draft questionnaire was developed and discussed with the team in Jeypore and Chennai, the format was tested in the field and data collected. Villages cultivating ragi were identified. Out of 6 villages selected for the survey, a total of 164 farmers — marginal, small and big farmers belonging to different social categories (SC, ST and OBC) — were surveyed. Some of the preliminary findings are summarised below:

- All the farmers cultivate ragi in 2 to 4 year intervals in the same field, after rice, little millet, maize or ragi. Such crop rotation helps improve yields and is believed to increase plant height and fingers.
- Leg pounding is used only for preparing liquor (*landa*) but hand pounding and grinding with *chakki* are used daily for *mandia pej*. This activity is carried out by women, who frequently suffer from back pain and aching hands.
- About 15 traditional varieties of ragi are cultivated. Farm households give first priority to paddy for meeting their economic needs and second to ragi for fulfilling their consumption needs.

The data has been tabulated and is in the process of being analysed.

Workshop on infant feeding practices

Observations made during the Infant Feeding Practice Workshop indicated that women were more active and comfortable among other women compared to mixed groups.

Table 2.21 *Training programmes*

| Programme | Venue | Topics | Participants | | |
|--|---------------------|--|--------------|------------|------------|
| | | | men | women | Total |
| Training cum demonstration on straw mushroom cultivation | Gunthaguda | Production and marketing Group sustainability Economic benefit | 2 | 39 | 41 |
| Vermicomposting demonstration cum training | Boliguda | Preparation of vermicompost Pit management Use of the compost | 15 | 11 | 26 |
| Training cum demonstration on straw mushroom cultivation | Boliguda | Production process Marketing Future potentialities | 7 | 26 | 33 |
| Training on tamarind and jackfruit value addition | MSSRF, Jeypore | Pickle preparation process Market linkages | 4 | 36 | 40 |
| 2-day training for SHG members on IGP & Documentation | MSSRF, Jeypore | Group management Leadership skill development IGP and sustainability Book keeping | 1 | 37 | 38 |
| Exposure visit to Central Cattle Breeding Farm | Semiliguda | - | 10 | - | 10 |
| Exposure visit of vegetable groups | Potangi | Cultivation process Varieties of cash crops | - | 16 | 16 |
| SHG leaders training on documentation and income generation activities | Gunthaguda | Group management Book keeping IGA for group sustainability | 2 | 39 | 41 |
| Demonstration cum training on oyster mushroom cultivation | Boliguda | Process of cultivation Marketing Economic benefit | 16 | 23 | 39 |
| Vegetable cultivation training | Nuaguda | Commercial veg. variety Crop Management marketing | 23 | 55 | 78 |
| Vegetable cultivation training | Boliguda & Tolla | Land treatment Market linkages | 30 | 12 | 42 |
| Total | | | 110 | 294 | 404 |

40 % women played a leading role while 60 % were silent. In large discussion groups, women were shy than men in introducing themselves and in expressing their views. There was also the tendency for some women to dominate the discussions. In small groups,

women were more involved and the level of participation higher. During the role playing and cultural programmes, older women were very good at composing traditional songs. The men dominated over the women at all levels during the role playing. Conducting meetings

in villages is likely to have more effect rather than meetings outside the village.

Impact of leaf-stitching machine at Boliguda

Forests and forest resources like minor forest products play an important role in the livelihood of households. Village people collect *siali* leaves (*Bauhinia valli*) in the winter and *sargi* leaves (*Shorea robusta*) during summer. After completing transplanting operations, women go to the forests for collecting leaves. MSSRF has provided a leaf-stitching machine to SHGs in Boliguda, under the biovillage programme, to strengthen their livelihoods.

A short study on the impact of this machine was undertaken. Only two members of the group are using the machines, an important reason being the lack of experience. Information collected over a six-week period revealed that using the machines women were able to stitch 20-22 plates in an hour, whereas they were able to make 27-30 plates by hand, as they have developed the skill from a tender age. The products are sold in the local market at Rs. 25 / 100 plates and stitched ones do not have an edge. Nevertheless, if the stitched leaf plates are pressed like a disc then a higher price can be expected. A press machine would improve the economics of the enterprise.

Strengthening Village Committee in Nuaguda

During 1994-95, JAGARANA, an NGO working in Nuaguda, established a village committee and initiated a village fund generated by members of the village. Two meetings used

to be conducted every month and the funds utilised for internal lending. This effort collapsed after the NGO left the village. Later, the Indo Danish Integrated Livestock Development Project was implemented in Nuaguda for a period of five years, during which the village committee was re-established. Unfortunately, there are no records of collections made by the villagers during this time.

Over the last 7 years, MSSRF has been developing and strengthening the Village Committee (VC) consisting of 32 members. Several activities have been implemented through the VC and weekly meetings are conducted regularly. The village fund has been re-vitalised and the committee has been able to open a bank account in Kundura. Members from the village have borrowed money for conducting marriages and funerals, purchasing agricultural land and livestock, tackling health emergencies, managing small businesses and paying land tax. The Committee now maintains four types of records: Ledger Book, Meeting Register, Passbook and Account Book. Three members are now responsible for handling finances.

Funds from the village committee have reduced borrowing from other sources. Villagers take loans at Rs 1.50 interest on Rs. 100 / month. In case they are unable to repay the money, the committee will cultivate their agricultural land as repayment. The Committee now has a sum of Rs 52,157, of which Rs 34,615 is being circulated as loans. During the agricultural season, all the VC members worked in harvesting and weeding and earned a sum of

Rs.15,920 which has also been deposited in the village fund.

It is therefore appropriate that MSSRF extends some additional financial support to stabilise this group effort.

203.2 Ex situ conservation of medicinal plants

BPMPGRC

At the campus, 347 species of plants belonging to different genre like trees (109), herbs (102), shrubs (91); climbers (39) and others (6) have been planted in 9 gardens, serving as an ex-situ conservation of medicinal plants used by the 9 major tribes of the region.

Association of tribal healers

All the traditional healthcare practitioners and the traditional birth attendants of the *Paroja* tribe — 125 (80 female and 45 male) healers from 72 villages under 3 Community Development (CD) blocks of Koraput district — formed an association. Another one for the *Bondas*, comprising 10 traditional healers (4 male and 6 female) from 6 villages of Kahirput block of Malkangiri district, was similarly established during the year.

Association of panchayat-level healers

A panchayat-level traditional healers' association was established in the *Mohuli Gram* panchayat, involving 38 members (17 female and 21 male) from 9 villages. These healers were given the responsibility of monitoring the status of medicinal plants in their respective villages.

Home herbal gardens

Fourteen different species of commonly-used herbs were supplied to 328 tribal households across 29 villages of 6 gram panchayats in 3 CD blocks of Koraput district. Out of the 14 plant species, a package with a minimum of five plants was given to each farm family to be maintained in their backyard gardens for daily use. A booklet on Home Herbal Gardens (*Ghar Desari*) was published with colour photographs for easy identification.

Students' herbal gardens

During this year, herbal gardens were established in two schools in two CD blocks of Koraput district. 420 seedlings of medicinal plants representing 30 species were supplied from BPMPGRC to these schools.

Prevention of malaria through herbs

A decoction made from four plants — leaves of *Nictanthese arboritis*, whole plant of *Andrographis paniculata*, leaves of *Azadirachta indica*, and branch and leaf of *Tinospora cordifolia* — has been found to be effective in preventing attacks of malaria. 10 ml of this decoction taken with 5 ml of honey for 6 months is the prescription. Demonstrations in the preparation of this herbal medicine were given in 16 villages of three gram panchayats in three blocks of Koraput district as part of an awareness programme on malaria prevention.

This programme was continued for 3 months in all the villages; very good results were noticed, and it was found that the decoction helped in

curing other diseases, like skin problems, joint pains, etc. Around 2358 tribal people (1113 male and 1245 female) got direct benefits from this intervention. The programme was also conducted in some tribal residential schools, where malaria and skin diseases are regular problems seen among the students.

Propagation of medicinal plants species

This year around 12,000 seedlings were raised in 2 shade nethouses and three U.V. stabilised polyhouses at BPMPGRC and distributed to schools, home herbal gardens, community medicinal plants gardens and interested traditional healthcare practitioners.

Twenty-six medicinal plants prioritised by NMPB and found suitable for the Orissa climate were cultivated in the garden in a plot of size 3m x 8 m to demonstrate the commercial cultivation aspect. Agro-technological packages for 3 species (*Rauvolfia serpentina*, *Occimum sanctum*, *Piper longum*) were developed.

A demonstration cum training programme was conducted to orient farm families on the cultivation of medicinal plants like Aswagandha (*Withania somnifera*) and Pipali (*Piper longum*). Around 6 acres were brought under this cultivation by involving 16 farm families from 3 villages.

Preparation of People's Biodiversity Registers (PBR)

People's Biodiversity Registers (PBR) was prepared for two gram panchayats (Mohuli and Asna) of two CD blocks of Koraput district. Around 63 knowledgeable individuals from

14 villages participated in this programme. From the results of the PBR, some plant and animal species were prioritised for immediate conservation in different villages by the respective communities.

Training and capacity building

During this year around 49 trainee days were conducted on various aspects of medicinal plants. A total of 505 persons (233 male and 272 female) were oriented on home herbal gardens, herbal preventive for malaria, propagation of medicinal plants, PBR, training on large-scale cultivation of Pipali and Aswagandha, etc. Apart from this, a skills and capacity building programme was conducted for volunteers of three NGOs on conservation and use of medicinal plants.

203.3 Livelihood enhancement of the tribal poor

Various activities to enhance livelihoods were carried out during the year in 6 villages — Kaudiaguda, Kusumguda, Dhola Jhiligaon, Chendia-Jhiligaon, Uduluguda and Pakanguda — under 3 gram panchayats of Kundura CD block.

This year 120 farm families have been involved in large-scale vegetable cultivation over nearly 72 acres of cultivated land. All together 11 vegetable crops (pumpkin, bitter gourd, spinach, tomato, cabbage, cauliflower, cucumber, water melon, coriander, brinjal and runner beans) were cultivated both in winter and summer. On an average, an additional income of Rs. 1600 per acre per household was obtained through this activity. Around

38 kg of vegetables seeds were supplied to the farm families with 50 % contribution from them. In addition, 24 interested households cultivated ginger, onion, and green chilli in 9 acres of land in the 6 demo villages. This will provide them an additional income of Rs. 3700 per acre. As demonstration on vegetable cultivation, 84 plots were laid out this year over an area of 14 acres, with plot size of 10 m x 10 m for each of the vegetables in all the 6 villages. A campaign was also carried out in the villages to raise 5 plants — yam, drumstick, papaya, lemon and chilli — by each of the tribal farm families to ensure their food and nutritional security round the year. Around 482 household in these 6 villages participated in the programme and helped to develop nurseries in low cost polyhouses. An innovation in the villages has been to grow coconut trees in their backyards. 1000 coconut seedlings were supplied to 452 farm families across the 6 demo villages.

Around 12 acres of land consisting of medium land and upland were brought under land care activities by involving 19 farm families in Kusumguda village. In the upland areas, farm bunds were prepared to conserve rainwater for upland rice. Medium lands were leveled for equal distribution of water, manure and fertilisers.

High quality vermi were purchased from the KVK, Semiliguda and supplied to 101 farm families to establish vermicompost units. Each of these vermicompost units will produce around 2-3 tonnes of manure in a year, which will be utilised in vegetable cultivation as organic manure.

Renovation of 39 individual small farm ponds was taken up in the project villages. Deepening and cleaning of the ponds and dressing of bunds were carried out with part labour contribution from the concerned farm families. The bunds were utilised for vegetable cultivation and plantation of papaya, coconut and drumstick. This in turn will provide adequate vegetables for household consumption. Around 2000 fingerlings of *rohu*, *mircalli*, and *bhakur* worth Rs. 8,000 (50 % of the cost being borne by the farm families) were supplied to the tribal farm families for being raised in these 39 small farm ponds. This will bring in an additional income of Rs. 4,000 to those families.

A village development fund was initiated in all the six villages for credit and savings to meet emergency situations. Per household contribution is Rs. 10 per month. Matching grants will be provided from the project after the successful completion of the process (at least two years). Two VKCs were established — Computer-Aided Learning Programme (CALP) was operationalised in Uduluguda, where around 67 schoolchildren are learning computers, and in Kaudiaguda, around 33 tribal people were enrolled to learn the fundamentals of computer application under MUPP.

During the year, the following training programmes were conducted in the 6 project villages:

- Two-day training on the preparation of vermicompost, for 72 persons (68 male and 4 female)

- Seven trainee days on vegetable cultivation with participation of 121 persons (103 male + 18 female)
- Training on fish farming for 39 farm families
- Training on nursery raising for Five Plant Campaign for 169 persons (100 male + 69 female)

Three field assistants and two village volunteers of the project were trained on SRI cultivation, and natural resources management at SAMBHAV, Nayagarh.

In order to implement different developmental projects as also to avail of subsidies and other entitlements for the holistic development of the villages, linkages with various organisations—government departments like Agriculture, Horticulture, Soil Conservation, Spice Board; PRI sectors like Block Office, Panchayat Office; Cooperative Banks as well as the World Food Programme—were networked with the Village Development Committee. In Uduluguda and Paknaguda villages, the Agriculture Department helped with 3 nos of 3Hp motors (with 50 % subsidy): 44 kg seeds of niger, 40 kg of Bengal gram, 30 kg of greengram; and funds for digging 4 new small farm ponds. One big pond costing around Rs. 5 lakh has been under construction with support from the Block Office at Uduluguda village. Four numbers of pesticide sprayers were mobilised from Soil Conservation Department for Paknaguda village. Through SGSY scheme, Rs. 3,75,000 were mobilised

for a SHG in Uduluguda village to establish a poultry farm. With support from WFP, 40 qtl of rice was given to the village grain bank, where the villagers have contributed 20 qtl of rice.

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

MSSRF has been allocated with 444 grids of the Eastern Ghats covering 7 districts of Orissa. The districts are Kalahandi, Nabarangpur, Koraput, Malkangiri, Rayagada, Ganjam and Gajapati. Out of these 444 grids, 428 grids have been covered so far, of which 419 are workable grids and 9 are non-workable grids. A district-wise digital database listing plant species has been developed. Of the 585 plant species recorded, 163 are trees, 138 are shrubs, 174 are herbs, 66 are climbers and 44 are ferns, grasses, orchids and others. Three RET species, namely, *Gnetum ula*, *Albizia thompsonii* and *Stemona tuberosa* and two endemic species, namely, *Selaginella nairii* and *Stemona tuberosa* have been documented.. Around 240 herbariums of specimens of important species have been set up. About 120 digital flyers have been developed containing photographs and descriptions of important plant species. The RET species recorded in the grids are also conserved in the BPMPGRC garden.

203.5 DNA Clubs

Under the Every Child a Scientist initiative (see SPA604), DNA Clubs have been established in

five schools, one each in 5 districts of Orissa, viz., Koraput, Kalahandi, Khurda, Jajpur and Nayagarh. All together 240 student members participated in DNA Club activities in these 5 schools during the year.

Work on was carried out on 12 different projects on sericulture, vermicomposting, preservation of animal species, and study of diversity by students in these schools. Scientific instruments were supplied to these schools to carry out simple biotechnological experiments. Herbarium specimens of important species were prepared by the students. During the year, four exposure visits were conducted. The DNA Club members of Maharshi Vidya Mandir visited the Sericulture Research Centre and also SAMBHAV, an NGO working on sustainable agriculture and natural resources management. The SASN High School in Koraput district visited KVK and Regional Research Technology Transfer Station, Sericulture Research Station and the Central Cattle Breeding Farm. The Jajpur Zilla High School visited KVK, Forest Nursery and a protected forest area. The B.M. High School in Kalahandi district visited the Horticulture Department, forest nurseries and also went to Vedanta Alumina at Lanjigarh to see the environmental protection measures put in place by the Company. DNA Club students of the Unit-IX Girls High School visited Regional Plant Resource Centre and the Regional Museum of Natural History to get oriented about the bioresources of Orissa.

Children's Day was celebrated at MSSRF, Jeypore, with the participation of 52 DNA Club students (28 boys and 24 girls) from these 5 schools. Essay, quiz, and debate competitions on subjects like natural resources, environment and biotechnology were conducted and selected students were awarded the "Genome Genius Award". Ten awareness rallies on the conservation of biodiversity were conducted on 5 June 2009 to celebrate World Environment Day. 21 invited lectures on biodiversity, biotechnology and natural resources were arranged. Plantation of important species was carried out on Vanamahotsav Day. Computer Training was given to 40 children in Government SASN High School in Koraput district. A bimonthly magazine *Green Dream* was published for DNA Club activities in May 2009.

A vacation training programme was conducted from 1 to 21 May 2009. A total of 33 students (18 boys and 15 girls) from 20 schools from 20 districts of Orissa participated. The vacation training was designed such that the first week would be classroom teaching on bioresources and biotechnology, the second week would include exposure visits to research institutes, industries, conservation gardens, villages, micro enterprises, etc., and the last week would be devoted to project preparation, essays, debates, drawing and quiz competitions.

It is proposed to conduct a visit to Bhitarkanika National Park (the only national park in Orissa) by DNA Club students during this year.

Sub Programme Area 204

Community Gene Bank

The Community Gene Bank (CGB), a medium term storage facility, was commissioned in the early 1990s to revitalise the agrobiodiversity conservation traditions of tribal and rural farm families, with support from the Government of Italy through IPGRI (now Bioversity International). Collections are from select areas in Kerala (Wayanad), Tamil Nadu and Orissa (Jeypore). These collections are very important as they possess very specific character genes resistance to biotic and abiotic stresses.

For the first time, DUS characterisation of farmers' rice varieties stored at this Gene Bank has been planned with the support of PPV & FRA. Fifty-four varieties of rice collected from Orissa have been identified for the trial which will be based on the guidelines for DUS testing and the preference given by the local tribal farmers in cultivating these varieties.

Preparation on viability checking as also measurement of available quantity of the seed material to conduct DUS testing has been completed. As per the guidelines provided by the PPV & FRA, field layout and design for 3 replications has been completed on leased land in Jeypore, Orissa. Overall germination percentage was good in all replications; field

was monitored and managed periodically. Field observation was based on different growth stages of plant growth, either by measurement by a single observation of a group of plants or parts of plants or measurement by a number of individual plants or parts of plants; visual assessment by a single observation of a group of plants or parts of plants or visual assessment by a observation of individual plant or parts of plants. In each replication, 10 plants per varieties were identified and tagged for observation. Specific photographs of the varieties were taken and preparation of herbarium voucher specimen was done.

In order to conduct field DUS testing in Jeypore as well as in Wayanad, suitable land has been identified on lease basis for one crop season. On the onset of monsoon, sowing shall be carried out in each of these locations. Preparation and planning is underway at the Gene Bank to undertake DUS testing.

In addition, multiplication of 98 varieties of rice collected from Orissa has also been completed. As per the mandate of the Foundation, after completion of harvest, duplicate samples have been deposited with National Bureau of Plant Genetic Resources (NBPGR) for long term conservation.

The process of facilitating farmers to file applications for registration of farmers' varieties is in progress based on the guidelines defined by the PPV & FR Authority.

BIOTECHNOLOGY

Pyramid of the genes involved in the oxidative stress tolerance mechanism were selfed and progenies analysed for the selection of homozygous lines. Four new promoters and transcription factors have been isolated and cloned during the year. Prosopis juliflora metallothionein gene showed high heavy metal accumulation in transgenic tobacco plants. From the lichen Drinaria applanata EST library, sequence information of the DnPKS (8162 bp) was obtained, which is an important precursor to many novel secondary metabolites. Thirteen thousand cultures have been isolated and submitted for bioprospecting under the microbial prospecting national initiative.

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Programme Area 300

Biotechnology

Biotechnology and Molecular Genetics have opened up new avenues of research and have enormous promise and implications for food security and human nutrition. During the last few years, the development of transgenic plants has opened up new prospects for building up abiotic stress-tolerant genetic material that is likely to contribute towards addressing problems of water scarcity, increased salinisation in the agricultural sector, increased contamination of groundwater and also solving 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.

Sub Programme Area 301

Ecological Restoration and Ecosystem Monitoring

301.1 Production and demonstration of high quality planting material of *Jatropha curcas* and multi-location trials

A total of 404 *Jatropha curcas* accessions were collected from different agro-climatic regions of Tamil Nadu. A *Jatropha curcas* genetic conservation garden has been established at Kudankulam, Tirunelveli district, for study on yield, biotic and abiotic tolerance. Data collection, seed collection, silviculture and irrigation schedules have been worked out for the National DBT Biofuel Mission programme. Collection and preparation of passport data information from mother plants and F1 generation to register varieties under the PPV & FR Act are being collated. The seeds from the accessions and vegetatively propagated materials have been submitted to the National Bureau of Plant Genetic Resources for conservation and evaluation. Seventy two soil samples were collected from the Kudankulam planting sites and submitted to NBRI, Lucknow, for estimation of the nutrient profile of the soil. Mother plants (234) and F1 (468) generation seed materials have been submitted for analysis of seed oil and fatty acid parameters.

Selection of *Jatropha curcas* accessions for national network trials

A total of 1266 plants are under various development stages in the MSSRF-maintained national network programme in the Kudankulam region. So far MSSRF has contributed 7 accessions to the national DBT network trials. The monitoring and evaluation of these trials at various development stages from application of irrigation and fertilisers to disease control practices, at different places in the country, are based on standard uniform guidelines prescribed by DBT.

Of the 20 accessions (high oil content) selected for multi-location trials, 7 accessions are from MSSRF. These accessions were vegetatively propagated and the materials dispatched to NBRI and Biotech Park (Lucknow), PDKV (Akola), Forest Research Institute (Dehradun), The Energy Research Institute-NE (Assam), Indira Gandhi Agriculture University (Raipur) and Arid Zone Forest Research Institute (Jodhpur) as part of the national network trials programme.

Half sib progeny trials were initiated from 15 national accessions (25 plants each) and 3 x 3 meter uniform intervals are being followed at Kudankulam. Data collection and analysis are under progress on a quarterly basis.

The DBT-MSSRF micromission programme has been supplied *Jatropha* cuttings from seven national accessions for bulking at Nandan Biomatrix Limited, Hyderabad. A Material Transfer Agreement (MTA) has been entered into between Nandan Biomatrix Limited and MSSRF. Branches of *Jatropha* cutting materials were dispatched to Nandan to raise 2.6-2.8 lakh cuttings from the first round. The second round is expected to raise 4.5 -5.5 lakh cuttings that would be dispatched to fulfill requirements for the current year.

Training of farmers and establishment of *Jatropha* seed production orchards

Two training programmes were conducted for farmers in Kudankulam and Radhapuram in Tirunelveli district for vegetative propagation, nursery development, cultivation methodology, irrigation schedule preparation, organic manure application, disease control using

biopesticide and importance of establishment of seed production gardens. Eight farmers received saplings from the MSSRF *Jatropha* nursery and planted saplings in 1ha each (total 8 ha).

***Jatropha* nursery establishment and training**

Four training programmes were conducted for Women SHGs and farmers. Farmers from Tirunelveli district participated in a two-day training programme for identification of better seed-yield plants in the field, identification of major characteristics like tree-branching patterns in relation to yield and flowering patterns in relation to seed set, crop maintenance including irrigation schedules, organic fertiliser application and biopesticide application. Women SHGs participated in a two-day training programme on propagation techniques, nursery management and quality sapling production for uniform cultivation. So far SHGs have propagated 35,000 plants and 11 ha seed production gardens have been established.

Micropropagation of *Jatropha curcas*

Direct organogenesis protocols have been completely standardised and uninodal explants were used to induce auxiliary bud break. *In vitro* shoots were used for induction of multiple shoots and a maximum 4 to 5 shoots was obtained. Rooting and hardening process is under progress for mass-scale production. Leaf discs are being used for induction of callus culture in transformation studies and this is being standardised. Initial responses are encouraging and good quality callus was

obtained with subsequent development into embryos.

Data on field-grown, induced and *in vitro* mutated plants are also being studied and interesting results have been observed in the number of branching, branching patterns and flowering, which are different from normal plants. Leaf architecture and appearance also show variation between treated and normal plants and analysis of the data is under way.

The effect of growth regulators in rooting and sprouting behaviour of *Jatropha curcas* and its associated physiological behaviour was studied at the genetic garden. 25 uniform cuttings were given 36 treatments (25 cuttings × 36 experiments = total 900 cuttings + 100 control = 1000 cuttings). Bud break from cuttings and growth parameters were recorded for analysis. In order to identify suitable propagation methods for uniform sapling development, these need to be replicated and standardised for supply to farmers, network partners, and government departments.

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

With the implementation of the integrated afforestation and eco-development project (coastal shelter belt development) supported by the Government of Puducherry at Chunnambar and Thengaithittu, more than 1 ha has been planted during 2008-09. Over 10 ha of planted areas are being maintained by Women SHGs (Kizhavanjur Magalir Sathuppu Nila Kadu

Valarppu Kuzhu). Women SHGs have been doing regular canal maintenance and nursery-raising for supply of saplings to NGOs and Forest Departments.

Ecological restoration

2500 vegetative and 750 micro-propagated plants of *Excoecaria agallocha*, 3500 vegetatively-propagated saplings of *Rhizophora mucronata*, and 7500 seed-raised plants of *Avicennia marina* were supplied to coastal villages (Chandrapadi, Pazhayar and Keelavanjore) for mangrove bioshield plantation and restoration.

301.3 Saving endangered plants

Medicinal plant tissue culture propagation protocols for effective conservation and utilisation are being developed for mass propagation at field sites. This past year, propagation protocols were developed for *Strychnos potatorum* and *Saraca asoca*. In both species, uninodal explants were used for multiple shoot induction. Tissue culture protocols have been established for RET plant species *Syzygium chavaran* through callus proliferation and multiplication from leaf explants. Uninodal explants were used to standardise micro propagation in *Kunstleria keralensis* for multiple shoot induction.

301.4 Lichen diversity and distribution pattern in the Madukkarai region of the Western Ghats and correlation with the disturbance regime

Lichen diversity and distribution patterns were compared in both pollution-affected

and unpolluted macroplots. The polluted macroplots occur in the Madukkarai - Walayar region and were identified on the basis of pollution load and proximity to the pollution source. The pollution load was measured through gravimetric methods. Earlier, the relationship between the environmental variables, including pollution, and lichen diversity was inter-linked using Non-metric Multidimensional Scaling (NMDS) as it is an effective ordination method and assesses the relationship in community ecological data sets, which have non-normal distribution. The NMDS ordination represented 85 % of variation in the data set, with 74 % loaded on axis 1 and 7 % on axis 2 and the remaining in axis 3, indicating that factors such as pollution load, proximity to the factory and number of trees in a particular site are the major gradients in delimiting the lichen diversity of the Southern Cutch Thorn Forests in the Madukkarai - Walayar region. The Lichen diversity and distribution patterns quantified from the polluted macroplots were compared with that of unpolluted macroplots located within the same forest type occurring in the Bolampatti II Reserve Forests.

A total of 81 lichen species were reported from 59 macroplots (59,000 m² area) established within the Madukkarai - Walayar Valley Reserve Forest region in Kerala and Tamil Nadu. A similar number of macroplots in the Bolampatti II Reserve Forests yielded 94 lichen species. The absence of species such as *Arthopyrenia clavaeforme*, *Brigantiana leucoxantha*, *Caloplaca vitellinula*, *Campylothelium nitidum*, *Endocarpon pusillum*, *Glyphis cicatricose*, *Haematomma puniceum*, *Megalospora*

sulphurata, *Pertusaria rimosa*, *Pertusaria amara*, *Pertusaria neilgherrensis*, *Porina interestes* and *Trypethelium tropium* in the Madukkarai - Walayar area show that these are highly sensitive to cement dust pollution. There were smaller colonies (< 2 cm²) of the pollution-tolerant lichen species *Bacidia beckhausii* Körber in unpolluted macroplots whereas it covered host trees fully in calcium-contaminated macroplots. The distribution pattern of pollution-sensitive lichens such as *Drinaria consimilis*, *Heterodermia dissecta*, *Heterodermia speciosa*, *Parmotrema planatilobata*, *Parmotrema tinctorum*, *Physcia tribaccoides*, *Pyxine cocoes* seems to be normal in the unpolluted macroplots in the Bolampatti II Reserve Forest.

Sub Programme Area 302

Molecular Mapping

302.1 A snapshot of genes controlling the floral bouquet in dioecious *Pandanus fascicularis* L.

Pandanus fascicularis is dioecious with either non-fragrant pineapple-like female fruits or highly fragrant male flowers arising out of individual plants. The male flowers are tiny, white, pendant-like, arranged in racemes or clusters with large white bracts and are exclusively used to extract essential oils rich in volatile aromatic compounds. Traditionally, this aromatic oil is used as a natural flavouring agent and in treating several ailments such as skin diseases, leprosy, smallpox, syphilis, sterility,

flatulence, debility, colic infections, cardiac problems, etc. In order to get a snapshot of genes involved in flower development and floral volatiles, a cDNA library was constructed using total RNA isolated from a male flower. A total of 977 ESTs were generated, and 511 unigenes identified by CAP3 assembler and functionally annotated using the tBLASTx algorithm. Differential northern analysis of 26 transcripts involved in flowering and secondary metabolism using vegetative and reproductive tissues of both male and female plants was performed. Almost all of these showed strong expression in the male flowers, while varying expression patterns were observed in the other tissues. Up-regulation of a majority of transcripts related to secondary metabolism in the male reproductive tissue corroborates their function. Chemical profiling of *P. fascicularis* revealed that the volatiles are predominantly monoterpenoid-based and that 2-phenyl ethyl methyl ether (PEME) is the major constituent (> 40%). PEME belongs to the phenyl ethyl alcohol class of compounds, which are synthesised via the phenylalanine metabolism. This reaction is catalysed by a group of enzymes called oxidoreductases. The male flower-specific cDNA library yielded many transcripts coding for these enzymes, which can be used in future as potential candidate genes for metabolic engineering in this plant. Since many of the isolated transcripts are involved in the non-mevalonate pathway, it is suggested that the volatile accumulation is via the plastid-based non-mevalonate pathway. Additionally, 5 putative transcripts were identified, viz., tropinone reductase (TR),

glycosyl hydrolase 17 protein, ankyrin repeat-containing protein, pectin methylesterase and ubiquitin protein ligase (UPL) which were being expressed only in the male tissues. Hence, based on the results obtained from the above work, they can be used as tangible markers for identifying the sexes in this dioecious species.

302.2 Molecular profiling of *Cajanus* species

Pigeonpea (*Cajanus cajan* (L.) Millspaugh) belongs to the sub-tribe *Cajaninae* of the agriculturally most important tribe *Phaseoleae* under sub-family *Papilionoideae* of the family *Leguminosae*. There are 32 species of the genus *Cajanus*, of which 18 species are distributed in India, which has been established as the centre of origin of *Cajanus*. Very little documentation has been done on the landraces being cultivated in the Eastern Ghats region of India, especially in the tribal regions, where this legume is grown by tribal communities.

A study was therefore initiated to collect and examine the nature and extent of diversity among the traditional landraces of *Cajanus* species in this region. 177 seed samples of the local landraces of *Cajanus* species were collected from tribal communities. Last year the analysis of the nuclear DNA isolated from 50 plants using a modified CTAB isolation protocol was reported. This year, DNA from all the 177 plants has been isolated and genetic diversity analyses are under way. Assessment of the isolated DNA samples was

carried out using molecular markers. Random primer marker systems like RAPD, SSR and ISSRs were used for marker analysis and we observed 30 % polymorphism. Phylogenetic analysis of the marker analysis data was done and the dendrogram provided the genetic relatedness or variation among the samples. Bulk segregant analysis of the seed samples has also been carried out based on the seed coat color of the samples.

Sub Programme Area 303

Genetic Enhancement

303.1 Introgression of transgenes *AmSOD* and *GmFerritin* into local varieties of *indica* rice and pyramiding three genes (*AmSOD*, *AmAPX* and *AmMDAR*) involved in oxidative stress tolerance mechanism

Thirty to 34 plants were raised in the BC5F2 generation developed by backcross breeding, by crossing the transgenic donor lines L12 (transgenic for *Amsod*) and Fer (transgenic for *Gmferritin*) with different local varieties, namely, ADT43, White Ponni, IR 20 and IR 64 as recurrent parents independently. The recovery of the recurrent parent genotype was estimated in the BC5F2 generation using SNP and SSR marker systems. The bulk DNA of BC5F2 plants were analysed in the golden gate assay of the illumina platform and the presence of the donor background genome was estimated in the bulks. SSR markers were used in the individual plants in

the regions of genome where the donor region was observed through illumina analysis. The presence of the donor regions in the BC5F2 bulks developed with different recurrent parents was compared and the tentative site of integration of transgene was identified. Linkage mapping using SSR markers in the identified region further confirmed this. The transgene *AmSOD* was localised in the 10 Mb region of chromosome 2 and *Gm ferritin* was localised between 15.4 Mb to 15.7 Mb regions of chromosome 9. The transgene-introgressed homozygous lines with minimum donor background were identified. The *AmSOD* transgenic White Ponni plant WS7 had minimum of 2.03 % of donor genome, ADT 43 plant AS24, IR 20 plant IS9, and IR 64 plant RS26 had minimum of 2.42 %, 2.40 % and 3.41 % of donor genomes, respectively. These selected plants are being screened for their ability to withstand salinity and drought tolerance. The *Gmferritin* transgenic ADT43 plant AF24, IR 20 plant IF19, and IR 64 plant RF19 had minimum of 0.63 %, 1.88 % and 1.53 % of donor genomes, respectively, and grains from these plants are being analysed for iron content.

In an attempt to pyramid all the genes involved in the oxidative stress tolerance mechanism, a cross was attempted between transgenic plants L12 (transgenic for *AmSOD*) and DC2 (transgenic for *AmAPX* and *AmMDAR*). The F1 plant with all the three transgenes was selected using the PCR analysis and the expression of the transgenes were confirmed through northern analysis. The F1 plant was selfed and seeds from it were used to

raise the F2 generation. Among the 73 F2 plants, 34 plants were positive for all the three transgenes, 21 plants were positive for *AmAPX* and *AmMDAR*, 14 plants were positive for *AmSOD* and 4 plants were double recessive. The plants with three genes were selfed and progenies analysed for the selection of homozygous lines.

303.2 Rice iron biofortification for combating micronutrient deficiency: Functional characterisation of IDEF transcription factor with respect to enhanced iron uptake by plants

Iron is the most vital of the elements. Although abundant in mineral soils, iron is sparingly soluble under aerobic conditions at high pH. Consequently, in calcareous soils, which constitute 30 % of the world's cultivated soils, plants often exhibit iron deficiency symptoms manifested as chlorosis and reduced crop yields and poor quality. Higher plants use two major strategies for iron uptake under iron-deficiency conditions: reduction (Strategy I) and chelation (Strategy II), which involves a natural iron chelator, the mugineic acid family phytosiderophores. Previously a rice transcription factor IDEF1 was reported which specifically binds to iron deficiency-responsive *cis*-acting elements IDE1. IDE1-like elements are over-represented in the promoter region of all iron deficiency-inducible promoters. IDEF1 over-expression leads to enhanced expression of the iron deficiency-induced transcription factor gene *OslRO2*, suggesting the presence of a sequential gene regulatory network. The objective of the present study is to understand

the role of the IDEF transcription factor in the regulation of iron deficiency responses, and its tolerance and over-expression in rice for enhanced iron uptake from the soil. Hence, an IDEF transcription factor from *Porteresia coarctata* was isolated and its characterisation is under progress.

Isolation of full-length genomic clone of PclDEF was carried out by genome-walking methods like TAIL PCR, adapter ligation and inverse PCR. A genomic clone of size 4.38 kb comprising nine exons and eight introns was obtained. A putative cDNA clone of size 1.45 kb was amplified using RT PCR from mRNA isolated from iron-stressed *Porteresia* plants. The PclDEF cDNA contains 159 bp of 5'UTR region, 1041 bp of ORF and 260 bp of 3'UTR region. Transcript level analysis of PclDEF both in *Porteresia* leaf and root under iron-deficiency conditions is under way. To understand the role of the IDEF transcription factor in iron deficiency and inducible promoter, and its enhanced iron up-taking ability, the 5' upstream region of an IRT gene from *Porteresia* was isolated by TAIL PCR. A 1120 bp amplicon was obtained. Sequencing of the 1120 amplification product showed that 3' region of the clone overlapped with the 5'upstream region of the IRT gene. Hence it confirmed to be the promoter region of the iron-regulated transporter gene. *In silico* analysis done with the help of PLACE software revealed that several IDEs like *cis*-acting elements were present in the promoter region of the IRT gene.

Future work involves the binding assay of *Porteresia* IDEF transcription factor to IDEs-

like elements. Cloning of the IRT promoter fused with the reporter gene GUS in the downstream region of the IDEF transcription factor in tobacco to understand the behaviour of the IRT gene in iron-deficiency conditions as well as the role of P_{IDEF} in the regulation of the IRT promoter under iron-deficiency conditions is in progress.

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

Dehydrins are LEA proteins (late embryogenic proteins) with YSK segments. Dehydrins are induced under extreme conditions of drought and salinity. As an approach to developing an improved variety of rice, which can withstand adverse environmental conditions, dehydrin was chosen for characterisation. 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 *Bam*HI 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. Hygromycin (50 mg) was used as the plant selectable marker and cefotaxime (250 mg) was used to control the *Agrobacterium* growth. After three selections, the surviving calli were transferred to regeneration medium and finally

to the hardening stage. Plants in the hardening stage were used for PCR analysis with gene specific primers and Hygromycin primers. PCR analysis showed that 5 lines were positive. These lines were analysed in southern hybridisation to check the copy numbers: out of the 5, three lines were single copies, one line was a double copy and the other line turned out to be a false positive.

Dehydrin promoter (*Avicennia marina*) was cloned in pCAMBIA 1391Z and the construct was transformed into *Agrobacterium tumefaciens*. Transformation into tobacco (*cv. Petit havana*) is in progress.

303.4 Co-expression of Active Oxygen Species (AOS) scavenging genes in rice and evaluation of the same for increased salinity tolerance

Twenty seeds from positive lines of T1 generation (lines 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 24) were raised and 20 plants from each line were analysed by PCR using gene-specific UTR primers. Among those lines, all the plants (19 plants) from line 2 showed positive results for both APX and MDAR by amplifying 200 and 300 bp fragments specific for APX and MDAR, respectively. To confirm the homozygosity further, DNA was isolated from all the 19 homozygous lines and digested with *Eco*R I and *Hind* III which would release the MDAR (2 kb) and APX (1 kb) fragments, respectively. Two separate blots were made and probed with UTR probe of APX and MDAR separately. The results revealed that the expected fragments

such as 2 kb and 1 kb specific for MDAR and APX were released in all the lines. To further confirm the expression of APX and MDAR in the homozygous lines, total RNA was isolated from all the homozygous lines and northern blot analysis was performed using UTR probe for both APX and MDAR. The northern data showed that both the genes were expressed in the homozygous lines.

Under *in vitro* conditions, pre-germinated seeds (5 days) of control and homozygous lines (DC2) were transferred to MS medium supplemented with 100 mM and 150 mM NaCl. In the 100 mM NaCl experiment, there was significant difference in the shoot length, root length and chlorophyll content of both control (UT) and transgenics (DC2). But there was no such significant difference when transferred to 150 mM NaCl.

Salt stress

To carry out salt stress, the EC level of the water was adjusted to 6 and the plants (boot leaf stage) were kept in a tray filled with water with EC6 (NaCl was added to adjust the EC level) for 1 month. The untransformed control plants wilted completely whereas the transgenic DC2 was green. All the grains formed in the control plants were chaffy grains and a few filled grains were observed (approximately 20 seeds per plant) in the transgenic plants. Observation on dry weight was recorded one month after treatment. The results revealed that there was no significant difference in the dry matter production in unstressed transgenics and untransformed control. But in the salt-stressed plants significant difference in the dry weight

was recorded between transgenics and untransformed control

Drought stress

In drought stress controls, water was withheld from the trays. After 4 days of drought stress, the plants were re-supplied with water for 1 day to allow the wilted plants to recover. Then, the second round was carried out. The cycle was repeated for at least 45 days. In the first round of drought stress, the control, untransformed plants withered (leaf rolling) very fast within 3 days whereas the transgenic plants looked normal even after 4 days of drought. The control, untransformed plants started flowering and all the grains turned chaffy whereas the transgenics did not flower and grew vegetatively, while the unstressed control and transgenic plants started flowering at the same time. The results revealed that the transgenic plants were able to tolerate the stress created by drought and the plants grew vegetatively whereas in the untransformed control plants the drought stress induced the plants to flower early which resulted in the formation of chaffy grains.

Electrolyte leakage upon NaCl and methyl violgen treatment

Upon MV treatment, the transgenic plants recorded 61.53 % electrolyte leakage whereas the untransformed control recorded 67.69 % electrolyte leakage. In NaCl treatment significant difference was observed in electrolyte leakage between untransformed control and the transgenic at 50 mM, 150 mM and 200 mM.

303.5 PR 244 tissue specific expression of the promoter of a novel gene, Am244, from *Avicennia marina* that is induced by salinity stress, and its characterisation

Localisation study of PR244 aided by GFP by the PR244 promoter was initiated. The transgenic plants were raised and screened for fluorescence. Lines PPG-1, 2, 6, 15 exhibited fluorescence when visualised under the UV microscope. To further confirm and to eliminate the background auto-fluorescence of the chloroplast, callus was raised from individual lines in C1 and C2 medium with Cefotaxime (250 mg/L) and Hygromycin (25 mg/L) for selection. Callus from PPG-1 lines were checked for localisation of PR244 in the cells of *Petit havana*. Fluorescence was observed in the outer membrane of the undistinguished cells. To support the study, northern analysis was performed using RNA isolated from the suspension cells grown. Cells were grown in C2 medium at different NaCl concentrations ranging from 0 mM to 20 mM and RNA was isolated by LiCl – method. Gradual induction pattern was observed up to 20 mM. Additionally, northern profiling was carried out for all the PPG-1, 2, 6 and 15 lines, which showed a strong signal indicating the transcription level of PR244: GFP.

Southern analysis was carried out to determine the copy number of the PR244 gene in *A. marina* using genomic DNA isolated by the CTAB method. The genomic DNA was digested with different enzymes like *SacI*, *HindIII*, *XbaI* and *BamHI*. Full-length cDNA probe was synthesised and used for hybridisation. On

further analysis, the presence of a single copy of PR244 gene in *A. marina* genome was determined, which was confirmed using 3' UTR specific probe.

Rice transformation using PR244 via *Agrobacterium* was carried out with Pusa Basmati and IR64 (*Indica* variety). Transformation in the same variety is under progress with necessary modifications. *Arabidopsis* growth conditions for seed setting were standardised. Transformation in *Arabidopsis* was carried out via *Agrobacterium* for the full-length PR244 promoter. However, after co-cultivation, the plants failed to survive. A new set of transformation is under progress.

Stress studies for the promoter plants are to be initiated and primer extension analysis to mark the transcription start site is also under way.

303.6 Transformation of *Avicennia marina* MYB1 transcription factor into tobacco and assessment of stress tolerance in transgenic plants

For plant transformation, a cDNA clone coding for MYB transcription factor was obtained from the *A. marina* cDNA library and named *AmMYB1*. The complete full-length *AmMYB1* cDNA was amplified with a specific forward primer to introduce a *sacI* restriction site and reverse primer designed to introduce a *kpnI* restriction site. The amplified fragment was cloned into binary vector pCAMBIA1301 between the 35S promoter of cauliflower mosaic virus and

the nopaline synthase poly (A) addition site, creating the pCAMBIA1301-AmMYB1 plasmid. The construct was introduced into *Agrobacterium tumifaciens* LB4401 strain. Leaf disc transformation and regeneration of transgenic plants were performed as previously described. Transformed tobacco plants were selected using Kanamycin (50 µg/ml) as a selective marker. Eleven independent lines from 10 transgenic plants were analysed for presence of single copy integration by southern hybridisation. Stress tolerance assay of transgenic plants under different abiotic stress conditions is under way.

Analysis of the DNA binding activity of single repeat AmMYB1 protein to AtMYB22 and AtERD10 cis-elements

Electro Mobility Shift Assay (EMSA) was carried as described previously. The labelled probes (2 pmoles) were incubated with 500 ng of purified His tag fusion protein in 20 µl 1x binding buffer (25 mmoles /L HEPES /KOH pH 7.9, 50 mmol/L KCL, 0.5 mmol/L EDTA, 0.5 mmol/L DTT, 5 % glycerol, 1µg µL⁻¹ BSA) for 30 minutes on ice. The resulting DNA-Protein complexes were loaded on 0.5x Tris-Borate-EDTA, 5 % polyacrylamide gel. After electrophoresis at 10 V cm, the gel was subsequently dried and visualised by autoradiography. Unlabelled competitors were incubated with fusion protein at room temperature for 30 minutes prior to the addition of labelled probes.

The purified fusion proteins (*AmMYB1*) were examined for their ability to bind to

oligonucleotide that contained the MYB binding sequence found in the *AtMYB22* and *AtERD10* in the EMSA method. Thirty bp and 48 bp oligonucleotides containing one copy of MYB binding site from *Arabidopsis AtMYB22* and *AtERD10* promoters, respectively, were used as probes. To compare the binding specificity of single repeat *AmMYB1*, specific and non-specific unlabelled competitor DNAs were used. In the gel mobility shift assay, the binding activity of *AmMYB1* to *AmMYB22* was reduced by the addition of excess unlabeled specific *AmMYB22* competitor and not by the addition of non-specific competitor (polyidc). These results indicate that even single repeat *AmMYB1* protein is sufficient to bind to *AmMYB22* upstream sequence specifically. Binding assay of *AmMYB1* protein to *AtERD10* is under way. Stress tolerance assay of *AmMYB1* tobacco transgenic plants will be carried out under different abiotic stress conditions. Transformation of *AmMYB1* transcription factor in rice will be done to assess performance of transgenic rice plants in response to different abiotic stress conditions.

Isolation and characterisation of Avicennia marina Zinc finger protein coding gene

Zinc finger (ZnF) is a term referring to protein domains that have a finger-like structure held together by one or more zinc ion (s). Some are known to regulate transcription through DNA binding (e.g., C2H2 and C4 types), while others are involved in protein-to-protein interaction (e.g., RING). This latter binds two zinc ions in a cross-brace arrangement

allowing two different proteins bind to each site, forming a macro-protein complex. Two types of RING zinc finger, RING-HC (C3HC4) and RING-H2 (C3H2C3), possess a diverse range of biological functions. Although RING zinc finger proteins do not bind to DNA, they can regulate expression via direct or indirect interaction with transcription factors or other regulators. Over-expression of RING finger genes in transgenic plants shows improved abiotic stress tolerance.

An EST clone (PR344) coding for a full-length RING finger protein was selected from the *Avicennia marina* cDNA library for further characterisation. *Avicennia marina* seedlings were subjected to different concentrations of sodium chloride stress (150 mM, 250 mM, and 500 mM NaCl). This study revealed that *Avicennia* plants could withstand 500 mM NaCl stress for 48 hours. Northern hybridisation was performed to study the expression pattern of Zinc finger transcript in different tissues of *Avicennia marina* (leaf, stem, root and cotyledons). The results of northern blot assay of unstressed plants revealed that the ZnF mRNA expression was similar in all tissues. One-month-old seedlings were acclimatised in half-strength MS for 3 days and then the stress treatment was carried out at 100 mM, 250 mM and 500 mM concentrations of NaCl under controlled greenhouse conditions. After stress treatment, the leaves were collected and frozen immediately in liquid N₂ for further use. Total RNA was isolated from the frozen stressed leaves. Northern hybridisation was performed to study the expression pattern

of ZnF mRNA under NaCl stress. This study revealed that the ZnF mRNA expression was induced after 24 hours of 250 mM NaCl stress and the expression was comparatively very high at 500 mM NaCl stress after 48 hours.

To study the role of *Avicennia marina* Zinc finger protein in *planta*, transgenic experiments were performed. ZnF full-length cDNA was cloned into pCAMBIA 1301 vector and was transformed into tobacco plants by *Agrobacterium*-mediated transformation. Transgenic tobacco lines (8 plants) were screened for the presence of the Zinc finger gene by using gene specific primers. PCR results revealed the presence of ZnF gene in all 8 lines. GUS assay was carried out to check the expression of the ZnF gene, and around 6 plants were found to be positive. Southern hybridisation to check the insert copy number is under way. Stress tolerance assays will be carried out to analyse the function of Zinc finger proteins in transgenic tobacco plants.

303.7 Characterisation of previously uncharacterised gene with potential implications in drought stress tolerance from *P. juliflora*

A new gene was selected for detailed characterisation to gain further insights into the molecular mechanisms involved in abiotic stress tolerance in *Prosopis juliflora*. In the drought-stressed cDNA library of *P. juliflora*, nearly 26 % of the genes were previously uncharacterised. It is possible that many of them have important functions in abiotic stress tolerance in this plant. In this context, one of

them (*Pj 507*) was chosen for characterisation. A northern analysis of *Pj 507* in *P. juliflora* leaf tissue under PEG (drought) stress showed up-regulation of this gene in early drought stress, indicating a possible role in drought stress tolerance. *Pj 507* cDNA was completely sequenced. The full-length cDNA was 876 bp long. The genomic clone of *Pj 507* was isolated and was found to contain a single intron of 113 base pairs. Protein prediction programmes showed that *Pj 507* codes for a 169 amino acid protein. DNA walking methods like TAIL PCR and adapter ligation were used to isolate the promoter of *Pj 507*. Two specific fragments were obtained, both identical to *Pj 507* sequence in the 5' UTR region. But the sequences differed in the further upstream 5' region. These two putative promoter sequences were cloned in pCAMBIA 1391z in order to drive the expression of reporter gene GUS. These constructs need to be transformed into tobacco model plant systems to check the functionality and temporal and special expression of the reporter gene. The *Pj 507* ORF was fused to Green Fluorescent Protein (GFP) ORF at the N- terminal and cloned into pCAMBIA 1301 under the control of 2X 35S promoter. The construct will be transformed into tobacco model plant systems and the *in vivo* localisation of *Pj 507* protein will be studied following the detection of fused GFP protein. *Pj 507* ORF was cloned into pET expression vector system. Protein properties of *Pj 507* will be analysed after production of protein in recombinant *E. coli* system. The full-length cDNA of *Pj 507* was cloned under

the control of 35S promoter into pCAMBIA 1301 and the construct was transformed into tobacco cultivar *Petit havana*. The transformed plants were selected on Hygromycin selection medium and are currently in rooting medium. The effect of *Pj 507* in imparting tolerance to the host plant will be analysed. Detailed characterisation of *Pj 507* will be done using the latest RNAi technology.

Transformation of tobacco plants with 35S promoter and Pj507

Tobacco plants were transformed with 35S promoter, following the standard protocol. Leaves of a mature tobacco plant were cut and transferred to MSNB medium and incubated in light for 2 days for pre-conditioning. These pre-conditioned tobacco explants were then infected with *Agrobacterium* culture. They were then dried on sterile filter paper and transferred back to the same MSNB plates for 2 days for co-cultivation, after which they were washed thoroughly with sterile distilled water containing Cefotaxime. The leaf pieces were then dried on sterile filter paper and transferred to MSNBCH medium (C = Cefotaxime, H = Hygromycin) where Hygromycin acts as the selection pressure. Subcultures were carried out every 10-15 days to the same medium. Multiple shoots were seen arising after the third subculture. These multiple shoots were individually transferred to MS medium in jars. A small portion of the leaf was cut and checked for Gus expression. Lines 1 and 3 were Gus positive. Tobacco plants were also transformed with *Pj 507*, following the standard protocol outlined above.

303.8 Molecular and functional characterisation of metallothionein genes from *Prosopis juliflora* and over-expression in transgenic system

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) are small cysteine-rich proteins involved in metal homeostasis, detoxification and reactive oxygen species scavenging in response to various environmental conditions. To understand the possible contribution of metallothioneins in heavy metal accumulation in *P. juliflora*, three types of MTs were isolated and characterised.

It was found from our previous studies with *E. coli* that type 1 metallothionein (*PjMT1*) binds to heavy metals (Cd, Cu and Zn) with greater affinity than type 2 MT (*PjMT2*) and type 3 MT (*PjMT3*). To show that *PjMT1* imparts higher heavy metal tolerance and accumulation in transgenic plants, it was cloned in pCAMBIA 1301 vector and transformed into tobacco (cv. *Petit havana*). The ability of these plants was tested for metal tolerance and accumulation and compared with *PjMT2*-transformed tobacco plants. Results of the leaf disc assay showed that leaf discs from the *PjMT1*-transformed plants retained higher chlorophyll when floated in 0 mM, 1 mM, 5 mM and 10 mM solutions containing cadmium for 5 days. Under 10 mM cadmium stress, *PjMT1*-transformed leaf discs

possessed 2.4 times higher chlorophyll content than *PjMT2*-transformed leaf discs.

Cadmium content in the leaves of both the control and transgenic plants treated with 0.3 mM CdSO₄ was estimated using flame atomic absorption spectrometry. Cadmium content was higher in *PjMT1* plants (about 9-fold higher than wild type plants) than in *PjMT2* plants (about 5-fold higher than wild type plants). The ability of transgenic plants to remove cadmium from the liquid medium was demonstrated using *PjMT1* transformants. Two-month-old control and transgenic plants were transferred to half-MS solution containing CdSO₄ (1.5 μM, i.e 100 ppm). After 5 days of treatment, cadmium content was high in the root than in shoot and leaf tissues. *PjMT1* transgenic plants could extract 30 % of cadmium while the wild type plants could extract only 21 % of cadmium from the 1.5 μM cadmium solution on the fifth day of treatment.

The ability of *PjMT1* over-expressing tobacco plants to withstand oxidative stress was studied by exposing the plants to 90 mM hydrogen peroxide. Control plants showed necrosis on the third day of treatment and died on the seventh day, while the *PjMT1*-transformed plant was able to withstand the oxidative stress. It was found in this study that *PjMT1*-transformed transgenic plants showed higher heavy metal accumulation as compared to *PjMT2* plants. *PjMT1* is thus a possible candidate for use in genetic engineering approaches for phytoremediation.

Standardisation of *Agrobacterium*-mediated *Brassica juncea* transformation

Standardisation of *Agrobacterium*-mediated transformation of *Brassica juncea* with Metallothionein (MT1) is being carried out. The surface-sterilised *Brassica* seeds were grown in 3 % MS medium for 8 days. Hypocotyls were cut from the germinated seedlings and infected with the *Agrobacterium*. These were co-cultivated on 3 % MSNB for 2 days, after which the infected plantlets were transferred to 3 % MSNBCHA plates (C = Cefotaxime, H = Hygromycin, A = Silver Nitrate). These explants were transferred to 3 % MSCHA after 15 days. After this, each subculture was done every 10 days. Variations were tried for the Hygromycin concentration used in the medium and it was noted that a gradual increase in the concentration from 10 µg/mL to 15 µg/mL and then to 20 µg/mL was better. Around 6000 explants were infected and the plants grew well till the fourth or fifth subculture. Healthy multiple shoots were also seen, a few showing selection, after which all the explants showed bleaching. Further transformation events are under progress.

Isolation of *PcMT3* cDNA and ORF

RT PCR was performed with the total mRNA of *Porteresia coarctata*. mRNA was isolated from the total RNA of *Porteresia coarctata* using the mRNA isolation kit. From this total mRNA, cDNA was synthesised from which *PcMT3* cDNA and ORF were obtained using the specific primers. These isolated *PcMT3* cDNA and ORF are to be further used for *E.*

coli experiments to study the efficacy visa-vis the MTs from *P. juliflora*.

303.9 Isolation and characterisation of HKT gene from *Porteresia coarctata* (*PcHKT*)

Salinity tolerance in many plants, notably in major cereals such as wheat and rice, is inversely related to the extent of Na⁺ accumulation in the shoot. In *Arabidopsis* rice and wheat there is evidence indicating a central role for members of the HKT gene family (more specifically the HKT 1, 5 subtype) of Na⁺ and Na⁺/K⁺ transporters in controlling Na accumulation and, thus, in determining salinity tolerance. *Porteresia coarctata* is a salinity-tolerant wild relative of rice and would therefore be a good source material to analyse for HKT genes. In the previous year, full sequence information for *PcHKT* cDNA was assembled in two overlapping fragments of sizes 0.75 Kb and 1.05 Kb. The fragments were fused by SOE PCR. The complete cDNA was further cloned in PSF20 under the control of maize ubiquitin promoter.

Similarly the already characterised Nonabokra SKC promoter was isolated from NonaBokra cultivar and the *PcHKT* was further cloned in the binary vector under the control of Nonabokra SKC promoter. The transformation of pSF20+*pCpHKT* and pCAM NonaSKC+ *PcHKT* into rice is under progress. Further, GFP was fused with *PcHKT* ORF and transformed into pCAMBIA with 2xCaMV promoter.

92 clones from *Oryza coarctata* BAC library from Arizona Genomics Institute (Hind III site of pAGIBAC1) in Chromosome1 were obtained, which include clones from both subgenomes (H (45) and K (47)). PCR analysis of BAC clones revealed that among 92 clones, 26 clones were positive for HKT (25 clones in H subgenome and 1 clone in K sub-genome). Further, one clone each was selected from both H (0027O13-A9) and K (0043B05-B1) genome for further studies.

Comparison of amino acids coding for HKT in H genome (after removing introns from the genomic clone) with the PchKTcDNA (K genome) revealed that both the genes were almost identical in the 5' end of the gene, whereas the amino acids were completely different in the 3' end. But when PchKTcDNA (K genome) was compared with the already reported SKC1, it showed almost similar aminoacids in both the 5' and 3' ends. Efforts are in progress to isolate the cDNA of PchKT from the H sub-genome.

303.10 Isolation and characterisation of genes responsible for betaine accumulation in *Avicennia marina* and successive transformation of rice with such genes

Glycine betaine accumulation in higher plants is brought about by the action of at least 3 enzymes: Phospho ethanolamine N-methyl transferase (PEAMT) that converts ethanolamine to choline by successive N-methylation, Choline monooxygenase (CMO) that converts the choline to betaine aldehyde,

and Betaine aldehyde dehydrogenase (BADH) that converts the betaine aldehyde to the final product, glycine betaine.

The cDNA clone of BADH has already been isolated in this laboratory (Parani, M. 1999) from *Avicennia marina*. *A. marina* BADH cDNA clones were also reported by Hibino et al. (2004). It was found that there were some 8 additional amino acid residues at the 5' end in the BADH cDNA sequence reported by the Japanese group. Primers were designed based on the BADH cDNA sequence reported by the Japanese group and the missing nucleotide region for the 8 amino acid residues were isolated from *Avicennia marina* mRNA by RT-PCR and fused with the remaining sequence using SOE-PCR.

Since rice lacks both BADH and CMO enzymes, it is essential that rice with both the genes is transformed for effective accumulation of glycine betaine. Current work is focused on the isolation of CMO from *A. marina*. A dot-blot was performed using RNA isolated from NaCl-treated *A. marina* saplings. A 193 bp region in the CMO-conserved domain obtained from *Suaeda monoica* genomic DNA was used as the probe. The dot-blot showed positive results with respect to *A. marina* RNA confirming the presence of CMO. Further experiments for the isolation of CMO (RT-PCR) are under way.

Since betaine aldehyde, the metabolite produced by CMO, is toxic to the plant, it is essential that rice should be transformed with BADH first, followed by CMO. Experiments to clone BADH cDNA on to the binary vector PSF20 are under way.

303.11 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. A total of 1,097 ESTs were obtained. CAP3 analysis performed on the above data set grouped them into 92 contigs (encompassing 322 ESTs) and 592 singlets, resulting in a 35 % redundancy. The important genes identified were: 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, Clavaminc acid synthetase (CAS), Dynein heavy chain, Protein phosphatase 2A, Serine incorporator (Serinc), PP-binding Super family, and Glycosyl transferases related to UDP-glucuronosyltransferase. The analysed EST pool also contained transcripts coding for enzymes involved in the oxidative stress such as Glutathione S-transferase (GST), Thioredoxin (TRX), 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.

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 *DnPKS* (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. A translation of the *DnPKS* sequence identified the presence of KS, AT, two ACP / PP and TE domains with 8 intervening introns, putative start and stop codons, and a stretch of 1226 upstream of the start codon corresponding to the putative promoter. This sequence shows the presence of putative binding sites for fungal transcription factors such as AflR, AreA and PacC. The comparison of *DnPKS* with other characterised PKSs shows conservation of active site residues in the KS (TACSSS), AT (GHSLGE) and ACP1 (GVDSLMS), ACP2 (GMDSLMS), TE (GWSAGG) (GNHFS) domains. A stretch of amino acid residues corresponding to the FabD domain seen in XePKS1 (FGDQ) was also present at the N-terminus of *DnPKS*.

In the phylogenetic analysis, *DnPKS* was found to cluster with non-reducing fungal PKSs from *Colletotrichum lagenarium* (PKS1), *Glarea lozoyensis* (PKS1) and *Botryotinia fuckeliana* (PKS12). These PKSs contribute to make melanin precursors and are encoded by the most widely distributed fungal PKSs

genes. Interestingly, the domain configuration of PKS proteins in this clade was similar to that of *DnPKS*. Additionally, expression of a *DnPKS*-like transcript was examined under different culture conditions and found to be down-regulated by sucrose and up-regulated by mannitol, UV and neutral pH.

303.12 Identification of genes that are uniquely regulated during oil biosynthesis in *Jatropha curcas* seeds

An alternate source for energy would be a key component of any measure that addresses the recent economic crisis and climate change issues. In this context, it would lead to serious consequences if food crops were diverted for green fuel. Among the many non-edible oil yielding plants available, *Jatropha curcas* has invited much attention due to its adaptability to dry and uncultivable lands. In the previous year, experiments were initiated to identify unique genes that control oil accumulation in the seeds of this plant. A cDNA library representing probable unique genes was developed from maturing seeds of *J. curcas*.

About 1200 ESTs revealing putative functions of genes related to oil biosynthesis were sequenced during 2008-2009. In addition to such a random analysis where genes for oil biosynthesis were identified and annotated, pathway specific analysis was also carried out by selecting two genes reported in literature, from other oil yielding plants. For logical reasons, sucrose synthase (SuSy) and diacylglycerol acyltransferase (DGAT) genes

were selected, the reason being that sucrose synthase functions at the level of source (starting point) and DGAT functions at the level of sink (end point) in the oil biosynthetic pathway. Sucrose synthase was represented in the EST library while DGAT was not, till this report was prepared.

Sucrose synthase breaks down carbohydrates accumulated through photosynthesis in seeds in the initial stages and diverts the products towards oil as the seeds mature. DGAT channels the intermediates in oil biosynthesis towards triacylglycerol (TAG), an unprocessed form of biodiesel stored in seeds. Experiments are under way to isolate full-length seed-specific sucrose synthase from *Jatropha curcas* using different molecular tools. It is planned to concentrate on sucrose synthase only, since many laboratories are working on seed-specific DGAT from *J. curcas*. Next year it is expected to generate more than 1500 ESTs that would help in delineating the highly complex oil biosynthetic pathway in the 'biodiesel' plant.

Sub Programme Area 304

Bioprospecting

304.1 Lichen culture

Lichens synthesise a wide array of secondary compounds which protect them from excess light and UV radiation, desiccation, high temperatures, flooding and also serve as

a defence against microbial activities and herbivory by micro invertebrates and insects. Currently there is an increasing global interest in exploring the bioactive potentials of lichen secondary compounds as well as mining novel genetic combinations to combat biotic and abiotic stresses. Lichens grow extremely slowly and produce low biomass in nature. Hence, establishing culture protocols for biomass (for molecular studies) and secondary compound production is a vital component in a bio-prospecting programme.

Lichen culture protocols were standardised for optimum biomass production and secondary compound synthesis through lichen whole thallus, fungal (mycobiont) and photosynthetic partners of 25 lichen species. The lichen whole thallus cultures of these species produce secondary compounds similar to that of the natural thallus. The mycobiont cultures, upon modulating 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.

The isolated compounds are currently bio-prospected for their anti-cancer and anti-tuberculosis properties in collaboration with the Cancer Institute, Chennai and the Tuberculosis Research Centre, Chennai.

Screening lichen compounds against cancer and tuberculosis

Cancer and tuberculosis are two of the most dreaded diseases, both in India as well as globally. The programme aims to take the already available leads from plants and lichen species that exhibit anti-cancer, anti-tuberculosis, anti-microbial and anti-pest properties in order to develop them as logical products. The screening will be specifically addressed to cancer and tuberculosis, using target site-specific screens in human cell lines and clinical parameters influencing the immunology of the host system and drug receptor sites or subsets for the proper understanding of biochemical and molecular interactions of the drug in collaboration, with suitable partners.

Compounds extracted from lichen and plants were screened for anti-cancer properties in different cell lines. The drug discovery protocol of the National Cancer Institute, Bethesda, USA, (NCI) has been followed for the present study. Three cell lines (NCI H460, MCF-7 and SNB-19) were used in the preliminary screening. All the cell lines have been procured from NCCS, Pune and NCI, and maintained with appropriate medium supplemented with Fetal Bovine Serum. The cells were plated in each well of the 96 well plate to study the cytotoxicity of the compounds and were exposed to different concentrations of the test compounds starting from 10 μ M to 100 μ M for 48 hours. After the exposure, cells were taken for cytotoxicity assay using MTS [3-(4, 5-dimethylthiazol-2-yl)-

5-(3-carboxymethoxyphenyl)-2-(4-sulphonyl)-2H-tetrazolium] reagent.

The Cell Proliferation Assay using the cell lines MCF7-Breast and NCI-H460-Lung tested against 5-methyl-4-acetyl resorcinol isolated *R. montagnei* showed that the survival rate of cancer cells of MCF7 varies from 93 % to 97 % against different concentrations in comparison with untreated cells, whereas in the case of NCI-H460 cells it was 87 % to 100 %. Anti-tuberculosis assays showed 100 % mortality of *Mycobacterium tuberculosis* by 5-methyl-4-acetyl resorcinol dissolved in DMSO. Further anti-cancer assays using various other approaches to measure the potentialities of the target molecules are ongoing. Work has been initiated recently on the compound 6-hydroxy-7-methoxy-2,3,3,9-tetramethyl-2,3-dihydropyridin-4,5-dione isolated from the lichen *Trypethelium eluteriae*.

Large-scale cultures in bioreactor

Large scale bioreactor cultures for target compound production have been standardised (media, time period and culture conditions) for *R. montagnei*, *P. praesorediosum* and *D. applanata*. 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. Target compound has been isolated from the cultures for preliminary screening against cancer and tuberculosis.

3.685 gm of resorcinol from 1500 gm of *R. montagnei* and 0.986 gm of compound from 25 gm of *P. praesorediosum* have been isolated from bioreactor cultures.

304.2 Anti-cancer screening of extract of *E. agallocha*

Plant extract of *E. agallocha* was screened for anti-cancer activity in the 3 cell lines. The concentrations used were 10µg, 20µg, 40µg, 60µg, 80µg, 100µg, 120 µg and 140µg. In NCI H 460, MCF 7 and SNB 19 cell lines, the percentage of survival varies from 50 % to 100 % with different concentrations ranging from 40 µg to 140 µg. Screening for anti-cancer properties in 32 other cell lines are continuing, to know the effect of the compound.

304.3 Bio-prospecting of *Navara*

GC/MS analysis of the crude hexane extract of *Navara* rice powder suggested the presence of linoleic, linolenic and palmitic acids. Fraction-1 of the hexane extract of *Navara* (Black Awned variety) yielded pure oil that was subjected to analysis. TLC (SiO₂ 230-400, Hexane: EtOAc 7:3) elution of the fraction-1 confirmed the presence of a single spot. Mass Spectral analysis (Jeol® GCmate, Ionization Mode: EI+) found the molecular weight of the compound to be 279.86 Daltons. ¹³C NMR (Jeol® GSX 400) revealed the presence of 27 carbon atoms. GC-MS analysis (Jeol® GCmate) of the oil indicated 4 peaks with mass 5.56 (236.68), 7.09 (219.61), 7.51 (239.66) and 8.4 (292.32), respectively. Molecular characterisation of the oil is under progress.

Sub Programme Area 305

Microbial Diversity

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

***Mangrovibacter plantisponsor* gen. nov., sp. nov., a nitrogen fixing bacterium isolated from a mangrove-associated wild rice**

A facultative anaerobic, nitrogen-fixing bacterium (MSSRF40^T) was isolated from roots of mangrove-associated wild rice (*Porteresia coarctata* -Tateoka). On the basis of 16S rRNA gene sequence similarities, strain MSSRF40^T was shown to belong to the family *Enterobacteriaceae*, most closely related to *Cronobacter muytjensii* ATCC 51329^T (97.2 % sequence similarity), *Enterobacter cloacae* subsp. *dissolvens* LMG 2683^T (97.1 % sequence similarity), *E. radicincitans* D5/23^T (97.1 % sequence similarity) and *E. ludwigii* DSM 16688^T (97.0 % sequence similarity). Sequence analysis of *rpoB*, *gyrB* and *hsp60* genes showed that strain MSSRF40^T had relatively low gene similarity (< 91 %, < 84 %, < 90 %) with recognised species of different genera of the family *Enterobacteriaceae* and formed an independent phyletic lineage in all phylogenetic analysis using 16S rRNA, *rpoB*, *gyrB* and *hsp60* genes, respectively, clearly indicating that strain MSSRF40^T could not be affiliated to any of the recognised genera within the family *Enterobacteriaceae*. The dominant cellular fatty acids were C_{16:0}, C_{16:1} ω7c and /

or iso-C_{15:0} 2-OH and C_{18:1} ω7c, similar to that of other members of the *Enterobacteriaceae*. The DNA G+C content was 50.1 mol %. Phylogenetic distinctiveness and phenotypic differences from their phylogenetic neighbours indicated that strain MSSRF40^T represents a novel species and genus within the family *Enterobacteriaceae*, for which the name *Mangrovibacter plantisponsor* gen. nov., sp. nov. has been proposed with strain MSSRF40^T (=LMG 24236^T = DSM 19579^T) as the type strain.

Diversity of phosphate solubilising actinomycetes from the mangrove ecosystem

The role of actinomycetes as phosphate solubilisers has been insufficiently studied. Actinomycetes are gram-positive, non-acid fast, non-motile and non-capsulated filamentous forms of mostly free-living saprophytes. Some are endophytes and form nodulation in the roots of higher plants. A total of 93 actinomycetes were isolated from the rhizosphere soil samples of *Avicennia* and *Rhizophora* from Pichavaram using different pre-treatment methods, viz., dry heat, Calcium Carbonate, air-drying, etc. Among the 93 isolates, 35 showed positive activity for phosphate solubilisation, producing clearing zones ranging from 0.4 cm to 0.5 cm. In addition, these isolates also exhibited antagonistic activity against phytopathogens *Rhizoctonia solani* and *Xanthomonas oryzae*. Screening for extracellular enzymes revealed that 22 isolates produced clearing zones in chitin agar (0.1 cm- 0.5 cm) and 33 isolates showed positive reaction for amylase (0.1 cm-0.8 cm) in

starch agar and 10 isolates produced protease (0.3 cm to 0.6 cm) in skimmed milk. These isolates were further characterised by rep PCR using GTG (5) primers. Among 40 strains of actinomycetes, 36 strains exhibited different banding patterns indicating they belong to different spp. These strains also exhibited morphological and microscopic variation. The actinomycete strains can be exploited as multipotential organisms for nutrient management and disease management in sustainable agriculture.

305.2 Screening for biomolecules from microorganisms collected from different ecological niches

The demand for novel antibiotics to combat the development of resistance by microbes to existing drugs has gained momentum, and 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 project, which envisages mega-scale screening for microbes from different ecological niches distributed throughout the country, involves nine academic institutes and an industrial house, Nicholas Piramal India Limited. The main objective focuses on screening for microbial metabolites with anti-cancer, anti-infectivity and anti-diabetic activity and building up a culture collection centre in parallel. In the present study, soil samples were collected from different ecological regions of the Eastern Ghats and the mangrove ecosystem of Tamil Nadu, and 30 different media were used for the isolation of the microbes. A total of

13,000 cultures have been isolated to purity and colony characteristics such as colony size, configuration, margin, elevation, colour, mucilage, biofilm formation and pigment production have been recorded. Two sets of the cultures were stab inoculated and dispatched to Nicholas Piramal Limited (NPL), Mumbai, where the isolates were screened for novel biomolecules with anti-cancer, anti-diabetes, anti-inflammatory and anti-infectivity activity by HITS (high infectivity throughput screening) tests. Among the 6394 cultures screened, 62 cultures showed three star hits for anti-cancer activity, 68 for anti-diabetic activity and 10 for anti-inflammatory activity. But these cultures showed very low anti-infective activity. Two sets of glycerol vials were stored in cry preservation vials at -80°C. Four set of stabs were prepared, of which one was sent to NPL for screening, one set to National Centre for Cell Sciences (NCCS) for developing a culture collection centre and two sets were maintained at the lab.

305.3 Biological control of diseases

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

Blast disease caused by *Magnaporthe grisea* has been identified as the highest constraint to finger millet production. The yield loss caused by this pathogen has been estimated to be around 19 % to 59 % in all the finger millet cultivated regions. The anamorphic form of the fungus *Pyricularia grisea* (and the teleomorphic stage *M. grisea*) causes yield losses of 20 % to 80 % in finger millet. Around 1500

rhizosphere-associated bacteria were isolated from samples of finger millet rhizosphere soils and screened against *Pyricularia grisea* and *Xanthomonas oryzae*. 66.4 % of strains inhibited the mycelial growth (2.1 cm) of *P. grisea* and *X. oryzae*. The mechanism of antagonism was due to the production of secondary metabolites, cell wall degrading enzymes and competition for nutrition. 13% of isolates produced chitinase, 75 % produced protease and 20 % of the isolates produced cellulase. From the total isolates, *Pseudomonas* spp. was identified by amplifying the 16S rDNA using genus-specific primer for 20-mer [5'-GGTCTGAGAGGATGATCAGT-3'] & rev 18-mer [5'-TTAGCTCCACCTCGCGGC-3']. Among the 1500 isolates, 800 showed positive amplification for *Pseudomonas* spp. Among 50 *Pseudomonad* analysed for genotype pattern through Rep-PCR, nine different genotyping patterns was observed. The diversity of antibiotic coding genes like 2, 4-diacetylphloroglucinol (DAPG), Pyoluteorin (PLT), Phenazine-1-carboxylic acid (PCA) and Pyrrolnitrin (PRN) was determined by PCR using gene specific primers. Sixteen strains showed positive amplification for DAPG, 5 for PLT and 24 for HCN gene. Two strains showed positive amplification for all the three antibiotic coding genes and exhibited high biocontrol activity against *P. grisea* and *X. oryzae*.

305.4 Bioenergy from agriculture biomass using cellulolytic bacteria

Isolation of cellulolytic bacteria capable of decomposing the complex polymer from

different plant sources, viz., rice straw and leaf material of *Prosopis juliflora* and rice husk has been attempted. Three different pre-treatment methods were adopted to break down the lignocellulosic biomass to expose the cellulose. Pre-treatment with 3 % NaOH incubated at 90°C in a hot oven for 24 hours was found to be most effective as it yielded maximum cellulose substrate.

Cellulose degrading bacteria were isolated from soil samples collected from Pachamalai, and Pudukottai on Carboxymethyl cellulose (CMC) agar media and Cellulose (A) media. Eleven bacterial strains exhibiting clearing zones ranging from 2.9 cm to 3.7 cm on cellulose media were isolated, and the biochemical test revealed that these strains were gram-positive, rod-shaped, endospore-forming bacteria. Different parameters, such as pH, substrate concentration and temperature, for enzyme production using different substrates were standardised. Quantitative analysis on cellulose amended media revealed that the strains MS1, MS44, MS25 and MS64 exhibited maximum production at pH7 and maximum enzyme activity was observed at pH 5 at 50 °C. MS64 utilised the substrate *P. juliflora* leaves at 3 % substrate concentration and exhibited maximum enzyme activity (148.4 U/ml/h) in 48 hours as compared to MS25 (128.3 U/ml/h) in 36 hours. With rice straw as substrate, the MS64 strain produced 170 U/ml/h in 48 hours of incubation as compared to MS25 which produced 130.5 U/ml/h in 36 hours. A further study to develop a consortium of microbes capable of breaking down different agriculture biomass is in progress.

ECOTECHNOLOGY

The farmer's federation at Kannivadi has launched a producer company. Twenty-two million litres of water have been harvested at the Pudukottai watershed area. Approximately Rs. 80 lakh have been dovetailed from various schemes and for training. Rs. 2.88 crore have been mobilised as credit linkages to members of Self-Help Groups across sites. The Centre has imparted 55,000 training days.

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Programme Area 400

Ecotechnology

The JRD Tata Ecotechnology Centre has continued to facilitate harnessing developments in S&T and disseminating them to the communities by providing a two-way interaction between the technology developers and disseminators and the end users at grass-root level for nurturing sustainable livelihoods in the rural areas. The focus has also been on need-based capacity building for the adoption of various ecotechnologies for promoting on-farm and off-farm livelihoods through the biovillage framework.

While the Centre's activities were reviewed last year, the Bio-industrial Watershed project was reviewed this year on its completion of two years. These reviews as well as the management and programme reviews at the organisation level have helped the team to introspect and restructure the way forward.

This year the focus has been on enhanced partnerships and networking with agencies like the various government departments and Panchayati Raj institutions (PRI). This has helped in increasing convergence in planning and implementation, thereby enhancing locale-specific interventions by leveraging government schemes with people's participation. The following pages highlight the salient activities and achievements in the various sites. In a few sites, viz., Chidambaram, Kannivadi, Puducherry and Kendrapara, work has been focused on strengthening the grass-

root institutions. In areas where work has been initiated, like in the watershed sites of Karasanur and Pudukottai and the Fish for All centre at Poompuhar, the activities have been directed around community mobilisation and technology incubation/ demonstrations.

A total of Rs. 30,24,343 was distributed to support income-generating activities across the Centre's sites from the micro credit support scheme and two initiatives were initiated under the micro enterprise market (MEM) scheme. Many of the staff participated in conferences and attended training programmes.

Sub Programme Area 401

Coastal Regions

The Centre initiated its work in the coastal areas at Chidambaram a decade ago in the area of demonstrating the approach to integrated farming systems (IFS). There are more than 400 farmers practising this now in this region and this year the focus has been on strengthening the group of IFS farmers into clusters. The experience also helped in chartering interventions for tsunami-affected communities along the coast such as the establishment of a 22,500 sq ft facility — the Fish for All Centre at Poompuhar — to cater to the training needs of the communities.

401.1 Chidambaram

The major focus of the year was on the consolidation of the farmers practising IFS. In addition, need-based support was extended to the Manikollai Lift Irrigation Farmers'

Association, the Thenkoodu clusters and the Athivaraganatham Farmers' Welfare Association.

Strengthening grass-root institutions

Early in 2000, MSSRF started self-help groups (SHGs) in Chidambaram to spread the concept of sustainable agriculture and enhance livelihoods in the Cauvery tail-end, particularly the Sethiyathope Anaicut region. The Manampathan Channel, 36 km in length, is the major water source for this region with 9,157.00 acres of ayacut. Around 30 revenue villages are situated in all the three reaches of the Manampathan channel and the IFS demonstration was conducted at the middle reach of the channel (northern bank). The farming and non-farming families were grouped based on their activities into the Manikollai Lift Irrigation Farmers' Association and the Thenkoodu SHGs clusters.

This year the total savings of the SHGs has been Rs. 15,73,900 and the total internal lending was observed to be Rs. 61,86,579. The average savings of each member was found to be Rs. 2,723 and average internal lending Rs.10,703. Rs. 28.5 lakh was mobilised from

various nationalised banks and circulated among the SHGs members during the year. From inception till date, they have accessed Rs.93.31 lakh from financial institutions. As part of their economic activity, the women are involved in integrated dairy management, lease of land to cultivate fodder crops, paddy and jasmine, goat rearing, and small hotels. In all, 178 women have leased land so far. This year alone 65 women have taken land on lease. In all about 23 tonnes of fodder were harvested at B.Manaveli and Kuriyamangalam through Co-3 fodder cultivation in the community fodder bank, with an average of 290 kg / animal at B.Manaveli and 415 kg / animal at Kuriyamangalam. By comparing the total savings and internal credit, on an average every individual availed internal loans nearly 4.5 times higher than their savings.

A random survey was conducted this year and **Table 4.1** explains the economics of paddy cultivation by women who have leased land. A total of Rs. 6,22,130 was earned as net income, on an average each acre provided Rs. 14,000. These members have the practice of exchanging labour and also use more organic inputs.

Table 4.1 ***Economics of land lease in 2008 - 2009 (paddy cultivation), Chidambaram, Tamil Nadu***

| Name of Cluster | No of Women | Extent (acres) | Total Cost (Rs.) | Gross income (Rs.) | Net income (Rs.) | Govt Relief (Rs.) | Benefit Cost |
|-----------------|-------------|----------------|------------------|--------------------|------------------|-------------------|--------------|
| B.Manaveli | 43 | 28.38 | 3,12,180 | 7,23,690 | 4,11,510 | 85,140 | 2.31 |
| B.Pettai | 14 | 9.24 | 1,01,640 | 2,35,620 | 1,33,980 | 27,720 | 2.31 |
| Manikollai | 8 | 5.28 | 58,000 | 1,34,640 | 76,640 | 15,840 | 2.32 |
| Total | 65 | 42.90 | 4,71,820 | 10,93,950 | 6,22,130 | 1,28,700 | |

Manikollai Small Farmers' Lift Irrigation

The Manikollai Lift Irrigation scheme was initiated in 2002 with 6 farmer groups. It has now been replicated at Vayalamur, Boovalai and Sathapady villages with financial assistance from the Primary Agriculture Credit Co-operative Bank. Two farmer groups obtained government subsidy for electric power for lifting water from the Paravanaru river. About 19 farmer groups are planning to get electricity connections and the Canara Bank is helping them with financial support to the tune of Rs. 8.5 lakh. The farmers' contribution will be only about 12.30 %. The District Rural Development Agency has contributed 42.4 % and Government of India 45.30 % towards the lift irrigation scheme.

The Manikollai farmers also completed the loan repayment due to MSSRF, community banks and nationalised banks.

MSSRF along with the government Agriculture Department has created awareness on groundnut cultivation among the lift irrigation farmer groups by jointly conducting two-day training programmes on oil seed cultivation. Seed multiplication of VR-2 groundnut variety was carried out on 5 acres of land. About 50 acres of land have been brought under SRI (System of Rice Intensification) cultivation.

17 farmers, of which 12 were women farmers, produced 970 litres of *panchakavya*. Out of this, 560 litres were used for their own needs and the remaining 410 litres were sold to other farmers. The panchayat has cleaned five supply channels — approximately 3740 metres — through NREGS, which has helped in water supply too.

A comparison of agronomic practices and economics of three different methods of paddy cultivation in the *samba* season during 2008-2009 was done between SRI, drum seeder method of paddy cultivation and the conventional method of paddy cultivation. This case study was conducted with Sethiyathope Anaicut Farmers' Welfare Association over one acre at Vandurayanpet habitation in the Sethiyathope Anaicut region. **Table 4.2** sets out the details.

The yield was observed to be 29.52 % through the drum seeder option and for SRI it was 13 % when compared to the conventional method.

Replication of IFS in Chidambaram taluk

The physical verification of IFS activities were completed in all the three blocks — Portnova, Keerapalayam and Mel Bhuvanagiri — in Chidambaram taluk. All the relevant details were collected and documented. A total of 406 farmers replicated IFS, as seen in **Table 4.3**.

Table 4.2 **Economics of paddy cultivation (in three methods) 2008-2009**

| Method of Cultivation | Yield in (kg) | Total Cost of Cultivation (Rs) | Gross income (Rs) | Net income (Rs) | Benefit Cost |
|-----------------------|---------------|--------------------------------|-------------------|-----------------|--------------|
| Drum seeder | 2040 | 7,363 | 24,950 | 17,587 | 3.38 |
| SRI | 1800 | 9,650 | 22,250 | 12,600 | 2.30 |
| Conventional method | 1575 | 10,710 | 19,765 | 9,055 | 1.84 |

Table 4.3 **Block and agrarian-wise replication of Integrated Farming Systems in Chidambaram taluk**

| Name of the Block | 1.00 -2.50 (acres) | 2.51-5.00 (acres) | 5.01 and above (acres) | Total |
|-------------------|-----------------------|----------------------|---------------------------|-------|
| Portnova | 57 | 14 | 22 | 93 |
| Keerapalayam | 89 | 51 | 53 | 193 |
| Mel Bhuvanagiri | 46 | 36 | 38 | 120 |
| Total | 192 | 101 | 113 | 406 |

65 % of farmers have their own farm ponds and the remaining have sought the help of the engineering wing of the Agriculture Department to construct ponds. About 10 % needed further landholdings due to remoteness, low storage capacity and unplanned excavation. Strengthening will be done based on the needs.

401.2 Kaveripoompattinam

The Fish for All training centre mainly focuses on imparting training to promote good practices in freshwater aquaculture, marine fisheries and coastal aquaculture activities. This year the work towards the establishment of a 22,500 sq ft of facility is nearing completion. The baseline PRA has been completed in 5 villages.

In freshwater aquaculture, the major thrust is on increasing freshwater fish productivity in community tanks, in individual farm ponds and in derelict water bodies. The Centre is providing technical inputs for individual farmers to reach optimum productivity along with appropriate forward and backward linkages. The community ponds and derelict water bodies are being utilised by grass-

root institutions for demonstrating the LEISA model.

In marine fisheries, the focus is on resource conservation and management, and value chain management. The reduction of the drudgery of the fisherwomen involved in fisheries and allied activities and building their capacity for livelihood promotion are the major tasks. In coastal aquaculture, the promotion of sustainable aquaculture practice through proper technical inputs and attaining optimum productivity by utilising the resource potential is the main aim.

As part of strengthening rural livelihood programmes started post-tsunami, the crab fattening unit at Madavamedu village has picked up and is showing progress. The SHG involved in the activity had taken an interest-free loan of Rs.1,00,000 from the Community Bank of Friends of MSSRF and have expanded their activity by buying additional cages to house more water crabs.

Educational sponsorship and nutritional support for 45 orphan children are continuing to be provided in three villages of Nagapattinam district of Tamil Nadu, through partnership with local NGOs.

Community mobilisation

The participatory rural appraisal exercise has been completed in the 5 fishing villages of the four panchayats — Kaveripoompattinam, Vanagiri, Thenampattinam and Perunthottam — in Nagapattinam district. Three more fishing villages and 18 non-fishing villages along the coast have been identified in the current reporting year for programme interventions. Out of the 4000 households in the newly identified villages, the PRA exercise and the base line survey is in progress. The need assessment carried out in the fishing villages has revealed the requirement for training and capacity building in post-harvest technology, managerial skills and resource management, for the fishermen and fisherwomen.

Community mobilisation has been a continuous process, where the 1311 women of the already 87 existing SHGs participate in our programmes. At the monthly meetings held by the SHGs, the members are facilitated to discuss and express their concerns relating to their livelihoods. 140 fisherwomen involved in dry fish and fresh fish vending have formed 7 Women SHGs in Kaveripoompattinam village. These SHGs have been facilitated for credit linkage to local nationalised banks.

At their weekly meetings, the traditional panchayat leaders of Kaveripoompattinam, Vanagiri, Madathukuppam, Nayakarkuppam and Keelamoovarkarai are regularly updated on the status of the construction work of the Fish for All processing building. Other concerns relating to fisheries resource management and deployment of fish aggregating devices

are being discussed in detail. Unused infrastructural facilities available within the community like the cold storage and the solar dry fish preparation unit are being readied for usage. The project staff has attended around 28 panchayat meetings.

In the current year, 12 farmer groups and 2 women farmer groups have been formed in the coastal villages of Vanagiri and Perunthottam to replicate IFS activities. The area covered by the men farmers is around 132 acres and the area covered by the women farmers is around 42 acres. Rice and pulses and rice and cotton/ groundnut are cultivated on crop rotation basis.

Inland aquaculture

Twenty-one freshwater farmers in and around Poompuhar were identified to receive technical support for fish farming aspects like pond preparation, pre-stocking management, seed selection, stocking density, species selection, feeding, water quality management and sampling. MSSRF facilitated 6 farmers to register with the state Fisheries Department to avail the 50 % subsidy offered for input costs to cover pond construction, fingerlings and feed. Three of these farmers are into monoculture and 17 farmers into polyculture, covering 19.75 acres. Some of the hatcheries were identified to enable the farmers to stock good quality seed. To avail cost- effective and quality feed, a wholesale feed dealer was identified and linked with the farmers.

Community pond aquaculture

Community pond fish culture is feasible in Poompuhar, Vanagiri, Manigiramam, Keelaiyur,

Nayakkarkuppam and Madathukuppam. Leaders of all these villages have requested financial support. Meanwhile, 4 villages came forward to take up the activities on their own, with technical support. Community ponds are sub-leased at the rate of Rs.500 to Rs. 2000 (according to the size of the ponds) to the respective community village leaders (chosen in turn) of the elected panchayats of Kaveripoompattinam, Vanagiri and Perunthottam, and to particular individuals. This amount goes to the common fund of the village. During the winter as well as rainy seasons, the ponds are full of water from the Cauvery river and teem with wild fish. These fishes survive up to summer when the water level becomes low. MSSRF facilitated the leasing of community ponds by 10 SHG members collectively at their own cost, and provided technical guidance for fish culture. Fish production was 1030 kg with an average production of 87.65 kg / acre and the income obtained was Rs.70-80 / kg. The following groups have been formed: Neithavasal Women's Group with 10 members, Vanagiri Freshwater Farmers' Group with 10 members and Kaveripoompattinam Freshwater Farmers' Group with 10 members.

Marine fisheries

Fisheries resource management

Data collected on fisheries resource landings for this period show that there is stagnation, and in some cases decline (3192 tonnes in 2007 and 2787 in 2008), in the catches as the number of boats is on an upward trend. In order to increase the breeding grounds for

fishes and to maintain the optimum potential, the deployment of artificial fish habitats was found to be a good choice. This is being done in a participatory manner with the resource users, using the MSSRF experience in the field and with the technical support of CMFRI. After a preliminary survey it was found that if the artificial fish habitats are deployed in five places in and around Poompuhar, it would be sufficient to cater to the needs of the fishermen belonging to the MSSRF project villages. An awareness meeting and training programme on this aspect has been conducted in collaboration with the IFAD-assisted Post-Tsunami Livelihood Project (PTSLP). After discussions with the district collector, a proposal for Rs. 20 lakh has been mooted.

A detailed value chain analysis for seafood was conducted and it revealed that fishes like sardine, mackerel and tuna form the major portion of the landings. The sardines are disposed to the poultry feed industry, both as fresh and dried, and the tuna sold to Kerala buyers at low prices. The upcoming pre-processing plant would solve this issue by proper value addition. With the support of the state Fisheries Department, training in the preparation of value-added fishery products to be implemented at the household level was imparted to 100 fisherwomen of 4 fishing villages. The community, which would not consume the sardines and tuna earlier, are now willing to do so when they are value added as fish wafers, fish paste, fish cutlet, fish pickle, etc. The price of the products also give a higher profit margin (10-20 rupees / kg) to the fisherwomen.

Coastal aquaculture

In the practice of coastal aquaculture, 10 marginal farmers were selected covering 37 acres of waterspread area. Their main problem was diseases and while there are no medications to treat shrimp virus, management techniques have been evolved to lessen their impact. Keeping this in mind, the farmers were advised to form a cluster and follow ‘Good Aquaculture Practice’ (GAP). The seeds were properly screened prior to stocking through PCR (Polymerase Chain Reaction) tests for White Spot Syndrome Virus and Monodon Baculo Virus. Registration with Marine Products Export Development Authority (MPEDA), which has a scheme to promote the clusters with seed money of Rs.5 lakhs for each cluster, is in the pipeline. A demonstration was carried out in 1.5 ha to show GAP in shrimp farming in a cluster approach, and the economics was worked out.

Agronomic rehabilitation

Post-tsunami interventions in soil reclamation, detailed soil quality analysis and close monitoring of the affected soils show that there is improvement in soil quality. Following the stage when MSSRF gave backing and monetary support, the farmers follow sustainable practices like usage of

green leaf manure and application of FYM and vermicompost. IFS techniques were demonstrated in 4 villages post-tsunami. The crop activity in IFS consists of field crops (60 % - paddy + blackgram, greengram+ bajra+ groundnut), vegetable crops (10 % brinjal, chillies and murungai) and fodder crops (20 % napier hybrid grass (CO 3)) with integration of mulch and vermicomposting. For comparison, traditional farming practice has also been undertaken in one acre for the last 3 years, with paddy + blackgram + greengram + cotton / tomato – brinjal + bittergoard . SRI was also demonstrated in the wetland system at Neithavasal. **Table 4.4** shows details of the paddy crop under IFS.

The participatory IFS model in Neithavasal, Anaikoil, Vellapallam and Vettaikaranirruppu has helped in its being replicated. Fifty farmers have now adopted this approach.

Concrete pedal pump

The concrete pedal pump (CPP) was introduced into the farmers’ fields as a low-cost technology, which requires no electricity or diesel or even a pump room. Fabricated by a group of farmers, the operation is also very simple. The manpower requirement is very low, with one person being able to operate it. The pump has two concrete blocks, one block for

Table 4.4. Paddy crop in IFS field for 1.00 acre SRI cultivation, 2006 to 2009

| Year | Date of sowing | Date of harvest | Variety | Yield (kg) | Gross Income (Rs.) | Input Cost (Rs.) | Net Profit (Rs.) |
|-----------|----------------|-----------------|---------|------------|--------------------|------------------|------------------|
| 2006-2007 | 15.10.06 | 6.02.07 | ASD17 | 930 | 6045 | 5521 | 521 |
| 2007-2008 | 29.10.07 | 16.02.08 | BPT | 1260 | 8190 | 6772 | 1418 |
| 2007-2009 | 30.10.08 | 19.02.09 | BPT | 1368 | 14364 | 7230 | 7134 |

housing the wooden pedals and the other for water intake and discharge. The second block has two 3" diameter PVC pipes as cylinders housed in it. Two pistons fitted to the wooden pedals operate within the cylinders. One cylinder with its piston functions as the water suction unit and the other as the discharge unit. The alternate action of the pedals draws the water and releases the same. The intake cylinder is fitted to a 7 m length water hose with a foot valve. The water can be drawn from a depth 7 m deep.

Vellapallam village of Vedaranyam Block is situated south of Nagapattinam. This was chosen as a suitable village for manufacturing the pedal pumps. 100 CPP pumps were fabricated at this village in 2008-2009. The main moulds for fabrication of the pumps were received from an engineering concern, Biswakarma Engineering in Kolkata. Other necessary accessories like screws, bolts and nuts, etc., were purchased from a local dealer at Karaikal, thus cutting down transport charges to a large extent.

Concrete pedal pumps were distributed in March 2009 to 72 farmers of Vettaikaranniruppu, Vellapallam, Anaikovil, Vanagiri and Neithavasal villages at a specially organised programme, where the deputy directors of the government Horticulture Department and Agriculture Department were also present. At this meeting the 'how to use' of the pedal pumps were demonstrated by the farmers who manufactured the pumps to those who received them. In addition to this demonstration, a small training session was also organised.

Training and capacity building

Training was imparted to farmers on community pond culture, pond preparation and fish stocking, tuna fishing, fish feed preparation and harvesting, hygienic handling of fishes and the preparation of value-added fishery products. Farmers were also trained in Integrated Farming Systems and SRI as well as in setting up animal health camps and maintaining kitchen gardens. The total number of trainee days covered 888. The training activities were supported by NETFISH / MPEDA / state Fisheries Dept to the tune of Rs.1.2 lakh.

401.3 Kendrapara

During the year, the team at Kendrapara worked through grass-root organisations for strengthening the development programmes, conducting participatory research, introducing innovative practices, and in networking, negotiating and policy advances. A survey was also undertaken in the district to study the replications of some potential interventions.

Grass-root institutions

563 Self-Help Group members from three clusters, namely, Nari Shakti Mahila Sangha, Nembara (12 SHGs), Jeevan Jyoti Sangha, Rajagarh (24 SHGs) and Jhansi Rani Cluster (5 SHGs) of Balipal Panchayat, strengthened their livelihood options in kitchen gardening, mushroom cultivation, apiary management, dairy farming, poultry and duck rearing and conducting small businesses. A *Grama Kalyana Samiti* has also been established with the help of Nari Shakti Mahila Sangha

members to create awareness among the people on village sanitation and health. The total financial transaction in the year was Rs. 13,87,000. Loan recovery was Rs. 2,51,473 and bank loans were Rs. 3,50,000.

After clearing the Community Banking advance, loans have again been provided for different enterprises — Rs. 4,44,000 to Nari Shakti Mahila Sangha and Rs. 2,16,000 to Jeevan Jyoti Sangha. Using these loans, SHG members are continuing dairy farming, poultry rearing, rice trading, hiring out tents, grocery business and agricultural functions. Apart from that, the Bank of India has provided a dairy loan of Rs. 3,50,000 at subsidised rates. Such loans have helped in generating income from micro enterprises in both on-farm and non-farm sectors.

Farm School

MSSRF introduced the concept of Aqua Integrated Farming Systems (AqIFS), managed by a group of women members, in the project area at Manitiri village, for pilot study and successfully running the model through training and demonstration for more than 15 initiatives. Now this IFS concept is gradually being adopted by the farmers and encouraged by government departments like Agriculture, Horticulture, Fisheries, Animal Husbandry, KVK, etc. Its replication in each block, which will be the model of an income-generating source, may be implemented through ATMA. The net income of the IFS model at Manitiri was Rs. 58,894, which has been deposited in the Farm School account.

Besides this income, there have been initiatives providing long-term benefits, such as the following:

- Water was supplied from the pond to 5 acres in the early part of June 2008 to raise paddy nurseries and this covered more than 50 acres of early transplanting in the first week of July. Three quintals of extra yield were obtained per acre, making $50 \times 3 = 150$ qtl of paddy.
- Quick-growing agro-forestry plants have been planted on the pond bund of the AqIFS model, which will give more than Rs. 1.0 lakh after 5 years.
- In dairy farming, only the price of milk and ghee has been considered. Income from cows, heifers and cowdung, which has not been considered, will come to at least Rs. 7,000 per year.
- Azolla is distributed to beneficiaries for multiplication in the main rice field.

Dissemination

Sunflower cultivation: Sunflower cultivation is increasing horizontally in the project area. Cultivation of this oil seed crop started in 0.13 ha during *rabi* 2004. The area has been increased by 191 farmers to 31 ha by *rabi* 2008-09, and based on this trend the district Agriculture Department raised the target to 300 ha. The yield recorded was around 15 qtl / ha. The Agriculture Department has extended 50 % subsidy to the farmers to increase the area under sunflower.

System of Rice Intensification (SRI): MSSRF started the System of Rice Intensification during

2004 in farmers' fields in the district. It is continuing and is gaining popularity year after year. In the project area during *kharif* 2008-09, 87 farmers adopted this practice in 17 ha and grain yields were around 62 qtl / ha of variety *Pratikhya*. After observing the positive results and yield performance, the state government has initiated SRI in *rabi* 2008 in 10 ha in a village under the Rashtriya Krishi Vikas Yojana (RKVY). During *rabi* 2009, the area has been extended to 25 ha by 120 farmers in Aul and Marshaghai blocks and the yield recorded was 72 qtl / ha. To promote this method of rice cultivation, the government has supported farmers to an amount of Rs. 2.3 lakh in the form of agriculture implements, biofertilisers and biopesticides.

Kitchen gardens: While this is has been an age-old practice, kitchen gardens are now being maintained with a wide variety of vegetables, which will afford nutritional security to poor people. During this year, 460 SHG members grew vegetables in their available spaces and reaped the benefit of food and nutrition; the excess produce they sold in the market. In *rabi* 2008-09, the Department of Horticulture, Kendrapara, distributed 12,000 mini kits comprising different vegetable seeds, at subsidised rates.

Paddy seed production: In *kharif* 2006, MSSRF Kendrapara demonstrated paddy seed production with breeder seeds like *Pratikhya* and *Upahar*. Now these varieties of rice seeds have been multiplied by farmers. During *kharif* 2008, the District Agriculture Office, Kendrapara has taken the seed production

programme in 70 acres for certification and has distributed 4500 qtl of rice seeds through its sales centres for multiplication.

Backyard Poultry: One of the most viable of the income generating activities of rural women is rearing poultry birds in a semi-intensive method, where the cost of rearing is low. During 2008-09, 142 SHG members maintained 6120 chicks of breeds like Banaraja, Giriraja, Broiler and Black Rock. They sold 12,000 kg of live birds and got an income of Rs. 8,54,000. Their expenditure was Rs. 3,92,840, hence the net profit has been Rs. 4,61,160.

Mushroom: Mushroom cultivation needs very little space and the crop is harvested within 20-25 days. During 2008-09, 133 SHG members in the project area produced a total of 645 kg of oyster mushroom and paddy straw mushroom, which they sold on an average of Rs. 40 / kg, receiving a net income of Rs. 12,640. Mushroom cultivation is gaining popularity day-by-day and women groups are interested in getting some income through this enterprise. Market linkage of mushroom in Kendrapara is gaining momentum and one private mushroom spawn production unit has come up through the encouragement of MSSRF and the Horticulture Department at Jutil village of Marshaghai block.

Computer Learning Centre: Since 2005, women SHG members, school / college-going and dropout students are using this centre for their computer skills. For women SHG members an account software has been developed through EXCEL to maintain their loan accounts. Now the Centre is maintained

by the Nari Shakti Mahila Sangha and a lady instructor has been appointed.

Training and capacity building: 655 days of training have been conducted in the following areas: Production of fish fingerlings, crop management, INP, IPM and soil testing management, mushroom cultivation, cultivation of sunflower for area extension, rice parboiling, etc. Apart from this, the members also participated in exhibitions and more than 1200 members visited the stalls and understood the activities.

After observing the successful implementation of many interventions under the biovillage framework between 2003 and 2008, government and non-government sectors have been interested in implementing MSSRF initiatives in their respective departments on a large-scale basis and have asked for assistance in the following areas:

- The Agriculture Department, for implementation of System of Rice Intensification through forming of SRI and seed villages and implementation of IFS models in the district for demonstration through ATMA
- The Veterinary Department, for extension activities in poultry and duck rearing and dairy farming in the villages
- The Horticulture Department, for vegetable and mushroom production and setting up kitchen gardens
- The Social Welfare Department, for setting up an AqIFS model in each block like

Manitiri village for social mobilisation and women's empowerment in the district

- The Directorate of Fisheries, for a project on alternate livelihood options for the fishermen community through sustainable natural resource management, capacity building and skill development for the entire coastline of Orissa
- KVK, Kendrapara, for an AqIFS model for implementation in their project area for sustainable development.
- NGOs like CYSD, SAMBAND, IPFP, Bharat, APOWA, etc., for suggestions for sustainable development of farming communities.

401.4. Puducherry

The biovillage programme at Puducherry has been carried out for more than a decade now with the support of various stakeholders — community members, R&D institutions and bankers. The MSSRF Biocentre also coordinates the implementation of the bioindustrial watershed activities at Karasanu, which have gained momentum. The focus this year has been on the strengthening of the grass-root institution, the Innuyir Grama Sangam.

Grass-root institutions

The partnership between the village communities, commercial banks, research institutions, and government and non-governmental organisations is the cornerstone of the biovillage programme. In active collaboration with all the stakeholders, the

MSSRF Biocentre has been promoting, monitoring and strengthening SHGs for 15 years now and so far MSSRF has formed 346 SHGs with a total membership of about 4200 women.

As part of the strengthening process of the Innuyir Grama Sangam, an envisioning exercise was organised for the members of the Sangam on 7 and 8 November 2008 at Puducherry, which focused on drawing up a strategic perspective plan for the next five years. The need was to strengthen the community bank operations which support the income-generating activities of the women; increase their numbers in Panchayati Raj, promote functional literacy and make the Sangam financially sustainable.

For easy operation, 346 SHGs were divided in to 6 clusters and 19 animators identified through cluster level meetings to monitor them regularly and support them on need-based requests. *Adiperukku Vizha* and Women's Day, the two major events always celebrated by the Biovillage Council (BVC), were observed in August 2008 and March 2009. Women's Day is also considered as the Annual Day of the Federation, when the annual report of the activities, progress made by the groups and the Federation's achievements are presented.

Almost 95 % of the SHGs availed credit facility. Loans totalling Rs. 2.21 crore have been credit-linked for 1426 members, which helped them uplift their IGAs and livelihoods. Apart from this, the Innuyir Grama Sangam Community Bank (established in 2007) functioning with annual memberships of Rs. 500 from each

SHG, has been making significant changes in the lives of the SHG members who have been availing loans for the purpose of establishing, promoting or scaling up enterprise activities. About 237 SHGs have been brought under the Community Bank's fold. So far, Rs. 12 lakh has been disbursed as loans to 118 beneficiaries.

In the last year, 6152 trainee days were organised by the Biocentre for SHG members, SHG leaders, cluster level leaders, farmers, staff from government departments, NGOs and other stakeholders. SHG members benefited from attending Animators Meetings for Training Needs Assessment, Village Level Group Leaders Training, Integrated Dairy Management, Micro Enterprise Development Training, and Programmes for Technical Skill Development, Leadership Development, Conflict Management, etc. Orientation programmes on the biovillage model were organised for officials of grass-root NGOs, bank managers, and students of national and international universities. Income generation trainings were given to DRDA, SHGs and others. An average of about 220 days was spent on entertaining national and international visitors.

An impact assessment was carried out using specific indicators on the economic, social and political empowerment of the members of the Women SHGs. The findings included the following:

- Girls previously educated only up to standard 8 are now going in for professional

courses and they are now increasingly recognised as community leaders and authorised signatories at the banks and as decision-makers at the household level.

- Working days have increased.
- Cattle population has increased, dairy activities have gone up by 75 %, goat rearing by 20 %, kitchen gardening by 30 %, backyard poultry rearing by 15 % and mushroom cultivation and vermicomposting by 20 %.
- Fodder development and soil management techniques are being adopted along with INM and IPM techniques.
- The purchasing power of women has increased, and registration of land and *pattas* in women's names is increasing.
- Women panchayat leaders have increased (13 now), and women are recognised as trainers by the government of Puducherry, especially in income-generating activities, and as counsellors by the Women Development Commission.

Partnerships

Partnerships have been forged and activities are being implemented together with the government Agriculture, Horticulture, and Forest Departments, the Tamil Nadu Agricultural University (TNAU), Krishi Vigyan Kendra, PONLAIT, PASIC, nationalised banks, NABARD, DRDA, research institutions, educational institutions, medical colleges, Sankara Nethralaya, veterinary colleges, the Fish Farmers Development Agency, Renewable

Energy Action Project (REAP), various NGOs and other government departments to assist SHGs and the Bioindustrial Watershed (BIWS) Association. In all Rs. 10.5 lakh have been leveraged to support training and as part of different schemes and subsidies for the community.

Bioindustrial Watershed Programme

Various interventions under the BIWS programme were strengthened and new ones initiated, as described below. So far 1158 trainee days have been organised.

Meteorological Mini Observatory: With the support of the BIWS committee, panchayat members and experts from MSSRF, Chennai, a site was identified for the meteorological mini observatory near the Higher Secondary School at Karasanur. A resolution was passed by Karasanur panchayat to facilitate the installation.

Farmers' Field School (FFS): Regular meetings for IPM/INM/ICM activities were carried out on various standing crops: conventional paddy (65 acres), SRI (5 acres), cumbu (1 acre), sorghum (2 acres), ragi (6 acres), onion (5 acres), bhendi (3 acres), brinjal (3 acres), and groundnut (20 acres). Cultural IPM methods such as light trap, bird tables, and *Trichogramma* cards for onion and maize crops were introduced. As a part of the INM training programme, one group was trained on the production of *panchakavya*.

Soil Health Cards: Farmers at Karasanur were encouraged to apply fertilisers based on the

recommendations of the soil test report carried out with the support of the Soil Lab at MSSRF, Chennai. 128 farmers were given soil health cards for wetland cultivation.

Crop Pest Calendar: A survey was conducted with various farmers to identify season-wise crop pests in major field crops, vegetables and oilseed crops. The results were submitted to MSSRF, Chennai for preparation of the crop pest calendar.

Soil microbial analysis for SRI / paddy fields: Soil samples (70 samples) from paddy fields (SRI / conventional paddy) in both wet /dry lands were collected and sent to the microbiology lab at Chennai for soil microbial analysis. Similarly, plant samples of infected crops like ragi were sent to Chennai for diagnosis of diseases and pests, especially sheath rot and stem borers.

Demonstration trials: Participatory demonstration trials were conducted for onion of both varieties — Perambalur variety (40 cents) and Muttalur variety (1 acre) — maize (1 acre), SRI (1 acre), and groundnut (1 acre) .

SRI (ADT 37): To strengthen SRI cultivation in Karasanur free SRI kits (100 kg seeds, MN mixtures, cono weeders, biofertilisers) were distributed with the support of the Agriculture Department in August 2008. SRI trials were also initiated in one acre, based on technological support from MSSRF. During the tillering stage, the average number of tillers/plants recorded in this field was 43 from a farmer's field and the total yield was 1820 kg. In February 2009, water stagnation due

to non-seasonal rainfall damaged the entire SRI field in Karasanur prior to the harvest. This resulted in severe yield loss due to crop lodging. However, the affected farmers could avail crop insurance (paddy) for their losses. Only 5 acres of land under SRI were harvested and the recorded yield was 5750 kg.

Onion (Muttalur variety): Since the Karasanur region is a famous belt for onion, farmers were motivated to go in for onion cultivation during April-May and October-November 2008. Cultivation practices and pest management techniques were provided through the Farmers' Field School. Around 19 farmers raised onion nurseries in nearly 14 acres during May 2008. A participatory demonstration trial was also initiated in 1 acre and the recorded yield was 3362 kg/acre, with the cost-benefit (C : B) ratio being 01: 01.8.

Onion (Perambalur variety): To strengthen onion cultivation in Karasanur, new varieties such as the Parambalur variety were introduced in 40 cents on a trial mode; the yield was 1.3 tonnes. Seven farmers cultivated onion in 2.25 acres during August 2008, based on technological support from MSSRF and obtained a total yield of 9 tonnes. Ties with local markets were also facilitated.

Maize Hybrid (C-555): New varieties of maize (hybrid variety C-555) have been introduced. A comparative study was made between trials carried out in organic and inorganic fields. The trial in an organic field of 20 cents yielded 300 kg with the C : B ratio being 1 : 2 and the inorganic plots (80 cents) yielded 900 kg, with C : B ratio 1 : 1.5. Between July

and October 2008, the crop in the inorganic trial plot showed early emergence and good physiological maturity, including tassel and silking, and showed better grain yield and cob length when compared to maize from the organic trial plot. The recorded yield was 1.2 tonnes / acre.

Groundnut (TN-9 Thangamani): A new groundnut variety (TN9 Thangamani) was introduced for the first time. A participatory study was conducted in January 2009 by sowing groundnut intercropped with two-weeks-old casuarina crop in one acre in the landholding of a progressive farmer, with technological support from MSSRF. The recorded yield was 780 kg / acre.

Backyard kitchen gardens: To strengthen the nutritional security and economical status of the farmers, vegetable seed kits have been distributed to SHG members and established backyard kitchen gardens in 10 households. In future, they will be trained to produce seeds.

Dairy: To identify the status of dairy farming and potential for cattle rearing in Karasanur, a detailed survey was conducted among 377 households selected at random. Awareness and interest about cattle rearing, insurance of the cattle, milk production, fodder management, etc., were some of the key aspects taken up during the survey. The consolidated report was submitted to the JRD Tata Centre. A business proposal to initiate the dairy programme at Karasanur was submitted to the Indian Bank. Co3 fodder was developed in 7 acres.

Vermicompost production: To strengthen organic farming, the Centre has established

vermicompost pits in 12 households and is also proposing to initiate community-based vermicompost production. Business proposals have been submitted to the Agriculture Department and to the Indian Bank. Under the Microenterprise Development Programme (MEDP), this will be eligible for a subsidy of Rs.45,000.

Mushroom cultivation: For the first time in the village, SHG members have been motivated to learn the process of mushroom cultivation and its value addition. Two women SHG members have established mushroom production units at Karasanur.

Community threshing floor: A community threshing floor has been established near Perumalkulam with the support of the Karasanur panchayat and the BIWS committee.

Farmers' Interest Group (FIG): Two FIGs were formed in 2008-2009 for the BC and SC communities. Savings bank accounts were also opened for these groups at the Indian Bank, Perumbakkam.

Water bodies: Preliminary data on water bodies (community open wells, big tanks, *perumal kulam*, *mottan kulam*) were obtained and budget and work estimation completed with the support of the engineering wing of the Agriculture Department.

Introducing new government schemes to the farmers and women groups: A revolving fund of Rs. 90,000 from the Agriculture Department was facilitated for goat rearing. Two groups availed Rs. 20,000 each as government

subsidy for paddy seed production and goat rearing. Farmers attended the Crop Insurance (Paddy) meeting at the Agri-Cooperative society (30 farmers and 25 acres are covered under this scheme). Awareness was created on government schemes to establish artificial recharge pits for individual open wells.

Sub Programme Area 402

Semi-Arid Regions

402.1 Kannivadi

In the role change process with the two grass-root institutions — Kulumai SHG federation and Reddiyarchatram Seed Grower's Association — activities focused on improving and strengthening Internal Control Systems (ICS) and Management Information Systems (MIS). Need-based networking and linkages with government departments, banks, NGOs working in the region, academic institutions, etc., have been promoted.

Kulumai SHG Federation

The current strength of the Federation is 148. During this year, 8 groups were dissolved mainly due to some members leaving the area as well as multiple membership in groups. The annual turn over of the Federation is Rs 3 crore with a repayment factor of around 80 %. The utilisation pattern of the credit to livelihood activities has increased to 80 %, followed by education and health needs. External auditing for individual groups as well as for the Federation was completed and

details of the report were shared with the group members. Around 800 group members were linked to Jana Shree Bima Yojana cum Group Insurance Scheme, which provides insurance cover for eventualities such as death due to natural or accidental causes, and for partial or permanent disabilities. The scheme also provides scholarships to the children (high school or ITI courses) of the insured person. Accounting systems have been streamlined and special software is being used for group level and Tally for the Federation level.

As part of the revamping process, operational guidelines have been evolved for the Kulumai Federation with the participation of Executive Committee members and formats have been regularly used to improve ICS and MIS. The appointment of a professionally trained and qualified person as executive officer of the Federation is helping to enhance the efficiency and quality of the activities. Training and capacity building programmes based on the revised guidelines were organised for EC members, SHG leaders and field staff. Such improvement strategies have helped to enhance the repayment rate to more than 95 %. In December 2008, office premises were constructed and inaugurated with the financial support of Friends of MSSRF and group members.

The procurement of milk from the members of the collective is progressing and efforts are under way to scale up the same with financial support from banks and technical support from TANUVAS. The pros and cons of the existing method of procurement were analysed and a

new design addressing constraints is being prepared.

In order to encourage more members to become entrepreneurs as well as to extend business development services, the Federation proposed to form a 'Livelihood Promotion Cell' as an independent arm. The main objective of the cell is to promote all SHG members into entrepreneurs through providing services for business development, apart from credit links. This will help to streamline the enterprises and markets under the common brand of Kulumai.

Reddiyarchatram Seed Growers Association (RSGA)

RSGA continued their linkages with the Department of Agriculture and commercial organisations. Last year the Association was identified as a centre to carry out trials on precision farming in banana with 20 farmers who are members of the banana thematic group; this will cost around Rs 20 lakh.

Farmers' workshops were organised following exposure visits to the associations managed by BASIX, Hyderabad. Crop-wise technical assessments, village-wise livelihood systems, vulnerability assessment and institutional assessment (both organisational and governance) as also commercial activities were carried out.

Continuing the process to work out RSGA's governing system, various legal formats were assessed and it was finally decided to promote it as a producer company. After consultations with BASIX and the auditing

firm, the Memorandum of Association and the Articles of Association were evolved. In the meantime, 10 members were elected to serve as directors of the company. Registration under the Companies Act will be completed by early June 2009. Simultaneously, input and marketing support and financial services have been planned and initiated. Operational guidelines have been evolved and so far more than 10 groups have been formed. Documentation systems for the group and the Association were discussed and designed with the support and input of new members to the Board of Trustees.

RSGA manages the hub of the Community Learning Centres (CLCs), which provide need-based information on market prices, input prices and availability from different markets, as well as medium range weather forecasts through a decentralised weather station. The station has been approved by the Indian Meteorological Department and recognised to provide district level advisories for 6 districts in south Tamil Nadu. A preliminary survey has also been conducted to install automatic observation systems. The local newspaper *Seithisolai* has been providing seasonal and local cropping system-based information, farmers' experiences and schemes available to the regional farmers. A Hub Centre management committee has been formed with representation from village level centres. This has helped to improve the monitoring of the Centre's functions and promote transparency in its operation.

Community informatics: The main objective of the Community Learning Centres has been

to facilitate functional literacy and serve as knowledge centres to provide need-based locale-specific information. During this year, 10 Dalit villages where the CLCs will be housed were identified with the help of the Block Development Office. These villages were selected based on the low literacy level, especially among women. Four new centres were set up, raising the number to 9 centres that promote functional literacy, and 3 of them have achieved 100 % functional literacy. 4063 trainee days were organised for men learners and 37146 days for women learners. The Dharamathupatty CLC focuses exclusively on women, and as can be seen from the figures, 90 % were women learners and 10 % men.

Nearly 10,869 members visited the centres during the year for various purposes, about 58 % being men and 42 % women, more or less similar to last year's trend.

Management systems have been strengthened at the CLCs and regular monthly meetings have helped to share experiences and rate the progress across centres. Each centre prepares its annual action plan and monthly action plan which are used as planning and monitoring tools by the Village Management Committee as well as the Hub Centre.

Eco-enterprises for livelihood security

The production methodologies of biological products, viz., *Trichoderma viride*, *Pseudomonas fluorescens*, *Trichogramma chilonis*, *Paecilomyces*, *Azosprillum*, phosphobacteria and *Arbuscular mycorrhiza*, were fine-tuned and efforts taken to introduce

liquid based formulations. Initial lab-based experiments have been completed and are in the process of being implemented in the coming season. The groups' information management systems were streamlined and audit has been completed for the groups and shared with group members. With the technical support of the Central Silk Board, the production of egg parasitoid of the uzi fly *Nesolynx Thymus* (a menace in sericulture) was identified as a potential enterprise with area under sericulture increasing in the district and the region. After undergoing training, proposals for the production of the egg parasitoid and scaling up *Trichogramma* production were submitted under the micro enterprise marketplace (MEM) initiative of community banking; the activities have since been initiated.

The production details of the units are: 4000 kg of *T.viride* and 700 kg of *Paecilomyces* (Bionematicide) by the Elayathendral group; 3800 kg of *Pseudomonas fluorescens* by the Durga group; 8000 kg of biofertilisers (4000 kg each of azosprillum and phosphobacteria) and 5000 kg of VAM by the Jhansi group. The handmade paper production unit's partnership with Kalangium Thozilagam Limited, Madurai, is being continued for marketing. The members have improved their skills on production as well as diversification of the products and the unit is generating nearly 280 labour days in a month. Last year, the transaction was around Rs 4.5 lakh. Similarly, the silk reeling unit is progressing well and production efficiencies of the input have improved the cocoon to silk thread ratio and increased the production from 7 kg to 12 kg.

Multiple marketing strategies and intensive efforts to reach more farmers and local dealers have been continued. During the year, around 1540 farmers were directly reached and linkages were established with 24 input dealers in and around Dindigul district.

402.2 Pudukottai

Works undertaken this year related mainly to rainwater harvesting and storage of runoff, both at community level and individual level. Two community-managed small-scale irrigation works (Goundarkulam and Vellaiappachikulam) were excavated, with 10 % of the cost contributed by the water users. These have helped to reduce soil erosion, increase the water table, change cropping patterns, reduce women's drudgery, and increase labour absorption and income and livelihood opportunities.

Land and water management

Community-managed small-scale irrigation (Goundarkulam): The Goundarkulam small-scale irrigation work caters to 16 members with landholdings of 29 acres. The waterspread area is 3500 m² and water capacity is 3.5 million litres, which has benefited the recharge of six wells surrounding the irrigation pond. Converted into an integrated dike pond system, it is bio-fenced with casuarina, annual Moringa, *Sesbania grandiflora* and castor. Vettiver is used as soil binder at the slope of the pond, and banana and cucurbits have been planted at the offset of the pond. Buffalo grass and azolla have been established along the periphery. Fish polyculture has also been

introduced in the pond. Buffalo grass and azolla are used by the farmers as feed for livestock and azolla is also being used as feed for grass carps. All crop yields are monitored and documented periodically and Rs 2,600/- has been the income from vegetables, fish, castor, etc.. The pond system has created good impact even though the work is less than a year old. The pond recharge has reduced the well recuperation period from 24 hours to 12 hours, increased the pumping hours from 30 minutes to 3 hours, lifted the water table from 3 m to 6 m and increased the overall cropped area from 22.90 acres to 24.70 acres. Vegetable cultivation has also increased from 0.75 acre to 1.30 acres. Water has been available in the pond from October 2008 and about 25 families use the water for their domestic purposes. As a result, women's drudgery has been reduced from 3 hours to 1 hour every day. It has been estimated that approximately 16,350 litres of water were fetched from Goundarkulam for livestock maintenance, and the number of milch animals has increased from 14 to 26. Ultimately, energy saving will result, as reduction in the pumping hours of bore wells will mean reduction in electricity consumption.

Community-managed small-scale irrigation (Vellaiappachikulam): With a waterspread area of 1600 m² and water capacity of 1.6 million litres, the pond at Vellaiappachikulam serves 13 members with landholdings of 25 acres. There are no wells in and around the pond. This has also been converted into an integrated dike pond system. The income by vegetables sales is about Rs. 520. While this

small-scale irrigation is basically meant for provision of life-saving irrigation for rainfed crops, however, due to insufficient rainfall, this has not been achieved during the current season (except for one farmer who pumped water from this pond for crop cultivation). Yet the pond water has been used by the women SHG members for developing a community tree nursery and backyard kitchen gardens. In addition, about 15 families have used the water for their domestic purposes.

Individual farm ponds: Since the inception of the community-managed bioindustrial watershed project in the area, 10 farm ponds have been dug by the engineering wing of the Agriculture Department through our lobbying and facilitation. Eight have been completed, with five fully developed as integrated pond systems with buffalo grass, vetiver, *Sesbania grandiflora*, annual Moringa, castor, banana and cucurbits as well as reared fish. Two farm ponds are still under development.

The impact of the excavation of these farm ponds has been felt on several fronts. Consumption of diesel has decreased from 25 litres to 12 litres and electricity from 50 hours to 30 hours, covering 2.5 acres of land. In addition, the work has contributed to assured crop cultivation, increased labour absorption (65 labourers / acre), increased production (0.4 tonne-1.2 tonnes / acre), assured animal feed (paddy straw) and reduced women's drudgery (5 hours to 1 hour).

Excavation of community pond and development of earthen bund: Every year during the rainy

season Thalinji village is flooded for at least 10 to 15 days. Based on the needs assessment MSSRF lobbied with the local panchayat to permit the excavation of a community pond in the location and assisted the engineering wing of the Agriculture Department to dig a pond with a total waterspread area of 1650 m². An earthen bund was constructed to keep in the run-off rainwater, thus preventing waterlogging in the Dalits colony. The estimated cost of this work was about Rs. 1,50,000.

Check dams and recharge of bore wells: Construction of checkdams in Uthukadu village and the outlet at Thalinji Periyakanmai has increased the available storage capacity in the watersheds and enhanced the groundwater recharge in three surrounding bore wells. Checkdams have arrested silt in the upper stream in the gullies, stabilising the gully beds during the monsoon season, and have helped retain monsoon rainwater up to 45 days.

Soil management techniques

Summer ploughing: Summer ploughing is one of the methods for soil conservation and management that is invaluable for rainfed agriculture. It retains rainwater within the land, reduces pest and weed infestations, helps in the retention of moisture, and increases soil porosity, among other benefits. An awareness campaign in this regard has led to 58 farmers practising summer ploughing in about 65 acres of land.

Collection of soil and water samples: In total, 314 soil and 24 water samples were collected and analysed. In each field, the positions where

the samples were taken were marked using GPS. It was found that 40 % percent of the soil exhibited average alkaline pH level of 7.5-8.0, and 26 % showed acidic pH level of 5.0-6.5. The soil is totally deficient in phosphorus content.

Vegetation development

Plantation of forest trees: Continuing last year's work, tree plantation was taken up in wastelands in cooperation with the Forest Department, to restore the ecological balance of rain-fed ecosystems and to conserve soil and water. Seven farmers have replanted 2000 *Gmelina arborea* saplings in their landholdings.

National Horticulture Mission (NHM): This year again, under NHM 14 farmers were provided with 500 mango saplings to be planted in 12 acres of land. Also, 34 farmers replanted 180 guava grafts, 55 lemon seedlings, 32 pomegranate seedlings, 65 jackfruit seedlings, 200 mango grafts, 4 sapota grafts, 444 mango saplings and 812 amla grafts in their land.

Intercropping between trees: To increase cropping intensity with effective utilisation of available moisture, 11 farmers have cultivated various crops such as blackgram, gingelly, cotton, maize, brinjal, tomato, chilies and cucurbits, between the NHM plots and forest tress in an area of 26.55 acres of land. This will get them more income as well as enrich soil health in their landholdings.

Introduction of new crops and varieties: In the community-managed BIWS area, many new

crops and varieties have been introduced this year to increase farmers' incomes and meet the demands of food, fodder and fuel. New varieties of paddy CORH-3 (0.50 per acre), blackgram VBN-3 (12 acres with 15 farmers), groundnut VRI GN -7 (semi spread - 0.20 acre with 2 farmers), castor (GCH-4 with 6 farmers), cocoa (7.50 acres with 6 farmers) and vetiver (10,000 cuttings in 2 community-managed small-scale irrigation ponds and 4 individual farm ponds) have been introduced.

SRI paddy nursery

Farmers were educated about the benefits of SRI, such as the efficient management of water with reduced expenditure and increased yield and income, through the Farmers' Field School, with the help of the Department of Agriculture. A community-managed paddy nursery was set up in Thalinsi panchayat involving 15 farmers, to undertake SRI paddy cultivation in an area of 17 acres. But due to the failure of timely rainfall, only 5 farmers have cultivated paddy through this method, over an area of 5.50 acres.

Farmers' Field School

Under the National Food Security Mission Scheme, a Farmers' Field School was started at Thalinsi village in August 2008 to train 30 farmers, both women and men. In this Farmers' Field School, SRI has been highlighted as the thrust area. Also, various methods of pest control like cultural control, mechanical control and biological control have been practically demonstrated. MSSRF has facilitated the formation of the Thalinsi

Periyakulam Farmers' Association through this Farmers' Field School.

Establishment of livestock-based IFS

The development of livestock-based IFS for on-farm recycling, low external input farming, and optimum utilisation of available resources linked with locally growing crops is the only tool for enhancing natural resources and increasing livelihood options for the rural poor. Particularly in rain-fed areas, livestock keeping plays a crucial role in food security and as a risk-aversion mechanism for sustaining rural families during times of crop failure related to drought. In this connection, 20 farming families have been identified and provided with fodder cuttings. Now all of them are growing fodder crops in their landholdings. Indian Overseas Bank has provided loans for the purchase of 16 milch animals. The average monthly income is about Rs. 3300 / family, by way of selling milk.

Cultivation of fodder

The cultivation of green fodder is very necessary for increasing milk yield and reducing the cost of maintenance of milch animals. Hence, Cumbu-Napier Hybrid (CO-3) slips have been planted by 23 farming and non-farming families. Fodder production has been 16.25 tonnes from 5.05 acres, and the average per day consumption per animal has initially been 3 to 5 kg.

Decentralised community nursery

Community nurseries help to increase livelihoods and enhance the environment

quality in villages. A decentralised community nursery, maintained by SHG women members, was formed to cover the 5 habitats of Meiyagoundanpatti, Veerangadu, Kalingikalam, Keela Ennai and Thiruvannakoilpatti. Totally, 570 annual *Moringa* and 960 *Sesbania grandiflora* (agathi) seedlings were raised in the nursery and distributed to the households. Unfortunately, only 260 annual *Moringa* and 512 *Sesbania grandiflora* have survived.

Seed production

As part of the redgram seed village project initiated with the technical input of ICRISAT, seed multiplication of A and B lines of the hybrids of ICPH 2671 was taken up this year in the Meyagoundanpatti cluster over an area of 3.3 acres and R line multiplication of ICPH 2671 was carried out in the Thalinjji cluster (Odakalam) over an area of 1.5 acres. All the agronomic practices were correctly carried out in the fields, but because of heavy rainfall, plants have been affected by wilt disease. There has also been no seed production due to flowers falling down.

On-farm trial (OFT)

The hybrid ICPH-2671 was field-tested on one farmer's field with the local check varieties of VBN-2 and CO-6. The land area for the on-farm trial was about 0.21 acre. Each plot was laid out with an area of about 40 m² and the crop was raised with spacing of about 100 cm x 40 cm. In this trial plot, too, heavy rainfall and water stagnation during flowering days affected the plants, leading to wilt disease and no pods being produced.

Community Learning Centre

Activity has begun for the establishment of a Community Learning Centre at Thalini, in coordination with the PRI and Thalini Village Development Federation. Two women have been selected and they have already completed the census survey and depicted it on maps. CLC managing committee with 18 members has been formed and an account opened in Indian Overseas Bank, Parambur.

Backyard kitchen gardens

Kitchen gardens are essential to enhance the nutritional security of rural households. Seeds of various vegetable crops, like snake gourd, bitter gourd, ridge gourd, field lablab and bottle gourd, were distributed to 55 households at Keela Ennai and Veerangadu villages. Kitchen gardens have been established and maintained in good condition by the village women. In all, the yield of the vegetables obtained by each of the households has been between 1-2 kg of field lablab, 3- 5 kg of bitter gourd, ridge gourd and bottle gourd, and 5-7 kg of snake gourd.

Direct sowing of rice

During the current year, 52 farmers of Thalini panchayat have adopted the drum seeder method of paddy cultivation with different paddy varieties of MDU-5, ADT-39, CO-43 and CO-45 over an area of 52.82 acres.

Animal health camps

Animal rearing is the main occupation of Thalini hamlet. Two animal health camps were conducted here with the assistance of

the Veterinary Assistant Surgeon. 829 cows, 58 work bullocks, 586 goats, 372 sheep were vaccinated and 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.

Awareness creation, mobilisation and group formation

This year we have focused on Keela Ennai cluster and have formed 6 Small Farmers' Groups, 2 Women SHGs (with total savings of Rs. 60,540), one Water Users' Association, 4 Water Users' Groups and one Community Learning Centre Management Committee.

Creation of thematic maps (GIS)

GIS was used to create thematic maps that serve as ready reference for users interested in any of the stored information: land capability classification, crop classification, farm holdings, irrigated areas, education status, pests and diseases, and livestock.

Mini Observatory

In Thalini panchayat, we have established a Mini Observatory for weather data collection using various meteorological instruments. The Single Stevenson Screen holds maximum and minimum thermometers (hung horizontally) for measuring maximum and minimum temperatures daily. The wet and dry bulb thermometers (hung vertically) measure atmospheric humidity, while the rain gauge provides rainfall data and the cup anemometer measures wind speed. The grass minimum

thermometer calculates the temperature at the ground level (grass level). The weather information will be diffused to farmers through CLCs.

Enterprises development

To promote enterprises development and sustainable livelihoods, farming and non-farming families were encouraged to rear milch animals. Loans were facilitated through Indian Overseas Bank, Illuppur, for purchase of 24 milch animals. Farmers have earned on average Rs. 3600 per month by selling of milk whereas non-farming families earned Rs. 2400 / month.

Training

Totally 273 man days were spent on training on soil, water, and crop management and capacity building for grass-root institutions.

Sub Programme Area 403

Hill Regions

403.1 Thonimalai

Farmers in Thonimalai are largely small and marginal landholders predominantly cultivating plantation crops such as coffee and pepper with lemon and banana under a multi-tier cropping system. Efforts have been initiated to shift and strengthen the traditional method of cultivation into professionally managed and certified organic farming methods. Last year inspection and organic certification was completed by IMO for 220 ha under 'small holder certification system'. Simultaneously,

training and capacity building programmes were undertaken to improve the quality and productivity of the products. Two tonnes of pepper were collectively sold to two marketing agencies. Agreements have been entered into with Linz Foods as well as Arogyam Organics, Chennai. The farmers were organised into 3 groups and linked to the producer company at Kannivadi.

Quality is the crucial issue in obtaining premium prices for organic products in niche markets. Interventions to enhance skills and knowledge through the Field Schools have helped to evolve a cadre of 70 men and women farmers as local resource persons. Methods such as hands-on training, learning-by-doing, demonstration plots, training materials, learning from practice, etc. helped them to adopt the different nutrient and pest management techniques on their own in their respective fields. Integrated pest management practices carried out on a community basis (whole village within the particular period) have aided in the effective control of pest populations, especially coffee berry borer, pepper wilt and stem weevil in banana. The Focus Group discussion and field survey indicate that there has been nearly 60 % reduction in pepper wilt, 80 % reduction in coffee berry borer and 65 % reduction in banana stem weevil. Around 60 farmers are regularly making EM compost and so far about 15 tonnes of the product have been produced and used. All the farmers practise pruning and prophylactic measures to control pests and diseases. Community-based initiative such as shade tree planting is being continued and during the year, around

1200 seedlings were planted. Discussions are being held with the Coffee Board, Murukkadi, Coffee Growers' Associations and an NGO who promotes organic farming for assistance in scaling up the initiatives.

During this period training and capacity building programmes covered 1278 trainee days in three hamlets. Ten training materials were prepared and shared with farmers, and these are available in the Village Knowledge Centre for the use of other farmers in the region.

Village Knowledge Centres

The Village Knowledge Centres (VKCs) located both at Thonimalai and Pulayar Colony supply need-based information (especially market prices for the primary agricultural products), maintain database of farmers on organic farming, facilitate functional literacy and furnish information on entitlement schemes. The Centres continue to provide linkages between local farmers and the Coffee Board and the Horticulture Department in order to access various schemes. Awareness programmes have been organised with the support of the Coffee Board on the importance of crop insurance, and nearly 20 % of the farmers have subscribed to insurance under the National Agricultural Insurance Scheme. The Pulayar Colony VKC has attained 100 % functional literacy and Thonimalai, 90 %. Around 5768 trainee days were facilitated in both the Centres for functional literacy. Temporary migration and remote location of houses (due to this, women's mobility is restricted in the late evening hours) are the main constraints. Last year the Centres

organised training and awareness on crop insurance, community-based pest and disease management practices, water conservation systems, etc., and 408 persons accessed the VKCs for information.

In order to strengthen the livelihood of the Pulayar community who are forest dwellers anthropologically, traditional skill-based income-generating enterprises have been initiated along with organic agricultural development programmes. The basic objective is to enhance their resilience through the multiple livelihoods approach. Though they are traditional forest honey collectors, the scientific method of honeybee rearing introduced during 2005-06 enhanced their skills and knowledge on the domestication process. The technology, brought in with the technical support of the Keystone Foundation, Kotagiri, has taken over three years to reach the carrying capacity level of 45 boxes. In addition to apiculture, stall-fed goat rearing was taken up as an additional income-generating activity. Training and capacity building programmes were focused on nutrition and disease management and the planting of forage tree species has been facilitated.

403.2 Koraput

Activities carried out this year concentrated on checking the run off and water harvesting. These interventions have helped to reduce soil erosion, enhance cropping area and pattern and increase the income of the farmers. 270 training days were organised in various aspects of SHGs and watershed management as well as awareness on SHG concepts.

Social mobilisation

Base line data covering all the households (186) of the watershed area were collected. Participatory rural appraisal was conducted at individual hamlets including all the households. To create awareness among villagers regarding the implementation of the bio-industrial watershed, and to streamline them into the project and gain their confidence, 5 awareness programmes were conducted on social mobilisation, agriculture and other topics. Twenty-six meetings have been conducted at village level for smooth running of the watershed. Wall painting and slogans have been put up, focusing on different components of the watershed. Street plays have been performed to draw attention to issues of malnutrition and child care. Mosquito nets have been distributed to all the households by the Health Department. An awareness camp on dehydration was conducted. An animal health camp was conducted during July 2008 and more than 556 animals were treated and vaccinated. Nine SHGs have been revived.

Land and water management

A farm pond at Tolla was renovated at a cost of Rs 42,680 and the flow of water has been controlled and connected to a well to provide supportive irrigation to 16 ha. One check dam is under construction at Bebartaguda at a cost of Rs 94,000 and will be completed by November 2009. This will help 12 farmers and irrigate 8 ha and during good monsoon time will help more than 24 ha with supportive irrigation. Five rock-fill check dams and three brushwood check dams have been constructed in Tolla

village to check soil and water erosion and formation of gullies. These structures help in harvesting 3 tonnes / ha / year of topsoil. On an average, 100 m of field bunds have been completed along with turving and vetiver plantation on 1 ha unbunded cultivable agricultural land. Avenue plantations (5.8 km) have been taken up and trees like mango (over an area of 8 ha) and cashew (12 ha) have been planted on wastelands to check erosion and as crop cover.

Water samples were collected from 12 different water bodies with GPS reading and are being tested. 250 soil samples have been collected to facilitate the issue of soil health cards, which will help to assess the exact need of major nutrients on individual fields of the watershed area.

On-farm interventions

Groundnut cultivation by 32 farmers has been carried out on a single patch of 18 ha of land. Pumps sets have been provided for ensuring irrigation in groundnut cultivation and the yield was between 15-25 qtl per ha. An area of 22.5 ha has been brought under vegetable cultivation in the *rabi* season. This year onion cultivation has been introduced in 1 ha in backyard land. Ginger seed multiplication has also been initiated. Plantation of mango saplings (812 nos) in 8.5 ha and cashew in 6.8 ha (1150 nos) has been taken up with the help of the Horticulture Department. Twenty-five vermicompost units have been constructed at Rs. 2000 per unit. Twelve poor families of the watershed area were supplied with 8 kg of bean seeds to plant in their kitchen gardens

for nutritional support. 13 ha of upland area have been covered by redgram as intercrop with ragi or paddy, at specific line intervals. The objective is to conserve topsoil, make soil more fertile, provide additional nutritional support and additional farm family income and insure against risk factors due to erratic monsoons. Three demonstrations on maize + biri (1.5 acre), ragi + arhar (1 acre) and paddy + arhar (0.4 ha) have been conducted in the watershed area. Demonstration of maize + biri on 0.4 ha has been conducted with farmers' participation. Four ha of lowland under paddy cultivation by 8 farmers have been identified for conducting IPM during *kharif* 2008.

Livelihoods

Two SHGs in the watershed area are involved in managing mid-day meal schemes as well as cultivating vegetables. A community-level central nursery has been developed over 6 ha for providing healthy vegetable seedlings during *rabi*. A total of 4,000 Simaruaba seedlings have been raised for fostering the plantation activities. Single unit oyster mushroom cultivation has been started by Maa Hundi Thakurani SHG at Bebertaguda hamlet. Forty-three vulnerable people have been identified for IG activities in various aspects of animal husbandry as livelihood support. The re-activation of the dormant Community Seed Grain Bank initiated by MSSRF in 2001 has been successful. Effort has been taken to revive water tanks and pipelines to provide safe drinking water to villagers, thereby reducing the drudgery of carrying water over long distances for women.

Sub Programme Area 404

Land-Lab-Land Linkages

The two labs that come under the JRD Tata Centre at Chennai — the INM (microbiology) lab and the IPM lab — provide support for ecotechnology development and the adoption of biological software (biofertiliser, biocontrols, etc) in the farmers' fields. They also conduct soil testing to provide data to develop soil health cards for the farmers at the sites where on-farm interventions are being carried out. Details of the INM lab can be found under Programme Area 301 (Sub Programme Area 305) and details of the IPM lab are reported below.

The IPM-related activities at Chennai focused on the biological control of American bollworm, *Helicoverpa armigera*, using entomopathogens *Beauveria bassiana*, *Lecanicillium lecanii* and *Metarhizium anisopliae*. Mass multiplication of biologicals (egg parasitoid, entomopathogens) and spawn was continued. Training programmes for farmers on pest management were conducted. Pest surveillance in *Morinda citrifolia* and *M. pubescens* in Kerala and Karnataka was documented. Isolation of cellulolytic microbes for bioethanol production was initiated. The physical, chemical and biological properties of soil from different sites were studied and soil health cards were prepared based on soil analysis.

Biological control of different stages of *Helicoverpa armigera* using *Lecanicillium*

lecanii, *Metarhizium anisopliae* and *Beauveria bassiana*

a. Larvae

The insecticidal activity of *L. lecanii*, *M. anisopliae* and *B. bassiana* at different spore concentrations was assessed for larval length, larval weight, larval duration and pupation.

Lecanicillium lecanii: Least pupation was noticed in 2.4×10^7 (53.3%) followed by 2.4×10^6 and 2.4×10^5 (60.0 %). In control it was 100 %. In addition, the fungal growth was observed on the larvae, which confirmed the efficacy of the biocontrol agent. The larval length was more or less similar in all the treatments, which ranged from 2.1 cm to 2.5 cm except for neem and cypermethrin (0.3 cm and 0.4 cm), whereas the larval weight was least (261.8 mg) in 2.4×10^4 treatment compared to control 389.8 mg. The larval duration was 5.4 days in 2.4×10^7 as against the untreated (12.6 days).

Metarhizium anisopliae: The percent pupation varied from 13 to 83 in different treatments, the least with cypermethrin and neem (13.3 %), and the highest with 2.4×10^4 and 2.4×10^5 (83.3 %). In control it was 100% . The larval mortality was less in the fungal treatments.

Incomplete metamorphosis and larval pupal intermediates were evident in the highest concentrations, while larval duration was prolonged by 2.4×10^4 and 2.4×10^5 (6.4-6.9 days). The least larval length was observed in 2.4×10^6 (1.9 cm) as against healthy larvae

(2.9 cm), while the larval weight was similar on all the treatments (330-389 mg), except for cypermethrin and neem (25.4 and 26.3 mg).

Beauveria bassiana: The larvae treated with *B. bassiana* showed least pupation (13.33 %) at a concentration of 2.4×10^7 conidia/ml. In general, the larval length and weight were found to have decreased in comparison with the untreated larvae, with least length (1.67 cm) and least weight (302.8 mg) observed in the treatments with 2.4×10^7 conidia/ml. Larval pupal intermediates were also observed. The results obtained in the treatment of larvae with *B. bassiana* show mortality in the initial stages. The highest mortality (86.66 %) was observed in the treatment with the highest concentration of 2.4×10^7 conidia/ml.

b. Pupal growth

The pupal weight ranged from 22.3 mg to 310.6 mg when treated. Comparison among the different concentrations of *L. lecanii* revealed that least pupal weight (154.9 mg) was recorded in 2.4×10^7 . In other treatments, nearly 59 % and above reduction was observed when compared to control.

In general, the pupal size was reduced in many treatments (0.1 – 1.1 cm) compared to control (normal diet –1.8 cm). The trend was similar to pupal weight in which the least (0.9 cm) pupal length was observed in 2.4×10^7 . The pupal duration was 1.6 days in 2.4×10^4 as against the untreated (10.2 days). Healthy moth emergence was severely affected in larvae treated with neem (0 %) followed by *L. lecanii* at 2.4×10^4 (11.1 %).

Among *M. anisopliae* treatments, reduction in pupal weight was recorded with 2.4×10^7 (206 mg), compared to control (310 mg). The pupal length showed a significant difference between the treatments. It ranged from 0.1 cm to 1.8 cm, with 2.4×10^7 superior among the fungal treatments (1.1 cm). In addition, pupal discolouration, damage and larval-pupal intermediates were observed. The pupal duration was 0.4 days in 2.4×10^6 as against the untreated (10.2 days). This was on par with neem and cypermethrin. More number of malformed moths emerged from neem (100 %) followed by 2.4×10^6 (96.3 %) and 2.4×10^5 (95.8 %) as against highest healthy moth emergence in control (93.3 %).

In the further treatment of the pupa with *B. bassiana*, no healthy adults were found to emerge from the treatment with highest spore concentration 2.4×10^7 conidia/ml in correlation with the controls, neem and cypermethrin. An obvious malformation was observed in the emerged moths after treatment of the pupae. Comparable results were obtained in the current study where the decrease in adult emergence was also from 93.3 % in control to 0 % at 2.4×10^7 conidia/ml.

c. Adults

In general, the longevity of the adults varied from 0 to 12 days between treatments. In the normal, the adults lived longer (12 days) except for neem in which they died immediately. In *L. lecanii* treatments, an early adult mortality (0.0 days) was observed with 2.4×10^7 , followed by cypermethrin (2.0 days). A few treatments, viz., 2.4×10^7 , cypermethrin and neem, arrested

the fecundity completely. The egg hatchability was suppressed in most of the treatments. The highest percentage 93.3 was recorded with normal, whereas it was nil in 2.4×10^7 , cypermethrin and neem.

The adults emerging from *H. armigera* larvae treated with *M. anisopliae* were meagre and did not survive even for a short period of time. Hence, the experiment on adults was not conducted.

In adults treated with *B. bassiana*, the life span was lowest (6.7 days) in treatments with 2.4×10^6 conidia/ml as against 10 days in the untreated. The fecundity was found to be the least (605) at 2.4×10^5 conidia/ml. The hatchability was observed to decrease with increasing spore concentration. Maximum hatchability (71.3%) was observed in the untreated adults.

Mass multiplication of biopesticides

The multiplication of three species of *Trichogramma* — *T. chilonis*, *T. japonicum* and *T. brassicae* — has been standardised for crop-specific problems. Low cost technology has been developed for mass multiplication of entomopathogens, *Beauveria bassiana*, *Metarhizium anisopliae*, *Verticillium lecanii*, *Nomureae rileyi* and fungus *Paecilomyces lilacinus*. Based on a previous study, rice supplemented with 1 %YE was chosen for the multiplication. Based on the requirement from the fields, 200 packets of 250 gm of *B. bassiana* were produced. It was sent to Thonimalai for field trials.

In addition, liquid formulations of biofertilisers, namely, *Azospirillum*, *Phosphobacteria*, *Pseudomonas*, have been multiplied in the laboratory. 15 litres of the liquid biofertilisers were checked for quality and sent to the Biocentre for a field trial on ADT 37 rice.

Mushroom spawn production

Production of healthy spawn to support mushroom cultivation was carried out in the Biocentre. 50 packets of 250 gm each of oyster mushroom spawn were supplied to the Biocentre. In addition to mother spawn, pure cultures and bed spawn of *Pleurotus florida* are maintained in the laboratory.

Field trials

Support to organic farming at Thonimalai by way of field survey, identification of pests and diseases were provided with guidance to application of IPM packages suitable to the cropping system. The major pests and diseases observed and the IPM practices followed at Thonimalai are described below.

Coffee berry borer: Ethanol : Methanol (1:1) traps were installed in 25 acres to manage the coffee berry borer. It showed a positive impact and about 10,000 adults were trapped in Robusta fields.

Banana pseudostem weevil: Based on the previous year findings, continuous monitoring of the insect by placing bait traps was carried out. Removal of sheaths and infected pseudostems, prophylactic injections of neem oil and soil application of neem cake were carried out to prevent the incidence of banana pseudostem weevil. 146 pseudostem traps

with 2.6 kg of *B. bassiana* pasted traps were installed.

Pepper quick wilt: 71 kg of *T. viride* were applied, covering nearly 95 acres in 34 farms.

The series of trainings and demonstration/field trials have facilitated the regular usage of berry borer traps, removal of dried twigs to manage citrus leaf miner, destruction of banana leaf sheaths and stem injection of neem oil to combat banana pseudostem weevil by Thonimalai farmers/SHGs.

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

Seventeen field visits have been covered from May 2008 to January 2009. Two species, *Morinda citrifolia* and *M. tinctoria*, were included in the pest surveillance. Six districts in the coastal belt of Kerala and 5 districts of Karnataka were covered during the study period.

Natural vegetation as well as the trees raised in the farms was selected for the pest surveillance exercise during different seasons. Kasargod, Kannur and Alleppey were visited twice, while Calicut, Ernakulam and Thrissur were visited once. Mandya, Hassan, Bangalore, Mysore and Kolar (farms) districts in Karnataka were visited once.

Overall results proved that plants in natural habitats are highly resistant to pests, whereas those grown in farms are more susceptible to insect attack. From the findings, the

major pests noticed have been membracid bugs, *Leptocentrus tarus*, grasshoppers, *Poecilocerus pictus*, white flies, *Dialeurodes kirkaldyi*, green plant bugs, *Nezara viridula*, leaf folder, *Cnaphalocrosis medinalis*, fruit flies, *Drosophila melanogaster*, *Bactrocera correcta*, unidentified stem girdlers, Sphinx moths, *Macroglossum spp.* black flies, *Aleurocanthus woglumi*, *Psara sp.*, *Dolycoris indicus*, Coreid bugs, *Cletus sp.*, short-horned grasshoppers, *Orthacris maindroni*, *Phaneroptera gracilis*, green hoppers, *Flata ocellata*, *Hylamorpha hyala*, *Heliethrips sp.*, Noni scale, unidentified cicada and Eriophyid mites.

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

Training and capacity building

In-depth training to women and men on IPM as well as eco-friendly management of pests and diseases in plantation crops at Thonimalai (81 trainee days) was organised. Training on management of secondary pest infestation in *Corcyra* production (20 trainee days) was conducted at Kannivadi and BIWS project area. The major pests and diseases of paddy, its life cycle, damage symptoms and integrated management practices for such problems were explained to the Karasanur farmers. This was followed by a field visit where the pests and diseases as well as beneficial insects were shown to the farmers to help them in taking decisions on plant protection (25 trainee days).

Training on management of pests and disease of onion, maize, bhendi and finger millet for Karasanur farmers (25 trainee days) was carried out. Training for pest management in forestry trees and groundnut were completed for Meyagoundanpatti farmers (65 trainee days).

Soil analysis for sustainable agricultural practices

Forty-nine soil samples from Nagapattinam were analysed for pH, and electrical conductivity. 18 soil samples from NONI project (Chennai) were analysed for pH, electrical conductivity and macro nutrients (N, P & K). 40 soil samples from SRI and non-SRI fields of Thalinji village in Pudukottai district were analysed for pH, electrical conductivity, available nutrients, organic carbon and exchangeable cations.

Soil analysis and preparation of 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 a soil health card was developed to list the complete profile of the nutrient status of the soil, based on which the fertiliser recommendations were made. The recommendations took into account the results of the soil testing as well as up-to-date agronomic research on the crop. In all 400 samples from Pudukottai, Puducherry and Koraput 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. The farmers were given advisories based on the results.

Sub Programme Area 405

Climate Change and Bioenergy Initiatives

405.1 Vulnerability assessment and enhancing the adaptive capacity to climate change in semi-arid India

Various adaptation-related interventions, such as lining of irrigation channels, revival of traditional systems of irrigation, weather-based farming, promotion of energy efficient stoves, establishment of fodder banks and development of common pastures continued to be implemented in the respective project sites. The adaptation interventions helped the farmers and the local communities to get better income and enhanced livelihoods. For example, by upgrading the traditional irrigation system (Harren) through a simple intervention like cement lining around 30 % more area was brought under irrigation in the project site in Rajasthan and in total 41 farm families were benefited.

The monitoring framework designed for each of the activities under the Vulnerability & Adaptability (V&A) project enabled us to assess the outputs more effectively and document the results. The establishment of mini agro-meteorology observatories at the village level

and the training of Climate Risk Managers (one woman and one man) at the local level on recording and interpreting locally-generated weather data have greatly helped in farmers taking sound farming decisions. Farmers avoid weather-related risks and make use of the weather parameters more intelligently. This activity has paid rich dividends and more and more farmers have started using the local weather information in their farming practices in all the project villages. A publication titled *A Practical Hand Manual on Village Level Mini Agro-Meteorology Observatory and Processing Data for Farm Decision Making* was prepared and circulated to intended audience in the existing research locations as well as potential future audience/ research sites. Development of the manual in different regional languages is under way.

As a follow-up to the National Consultation on an Interdisciplinary Dialogue on the theme 'Community Management of Climate Change: Role of Panchayats & Nagarpalikas', held in April 2008, a task force created to look into the local level Climate Risk Management Draft Act has been working on the various elements of the envisaged Act. To this effect, a series of consultations with panchayat leaders from various districts was initiated during the course of the year.

To achieve the goals and objectives of any development initiative, community participation and social cohesion are very important. As part of an effort to strengthen local institutions, the concept of Smart Farmers Club (SFC) was introduced in the project sites. The members

of the SFC serve as conduits in implementing adaptation measures as well as experimenting with new ideas to manage climate risks at the local level. Various capacity-building training sessions were provided to SFC members.

A wide range of publicity and education campaigns was undertaken to promote public/community awareness and knowledge of the risks associated with climate change, with the explicit objective of enhancing the adaptive capacities of the local communities. A scoping exercise was undertaken to understand the existing curriculum; new modules on climate change were developed and are now ready for induction into the existing curriculum extended by the National Institute for Agricultural Extension Management (MANAGE), Hyderabad.

A National Policy Dialogue on Adaptation to Climate Change was held in collaboration with project partners in Delhi in November 2008. The objective of the dialogue was to share the V&A project experience with a wider community. Cabinet ministers, the Prime Minister's special envoy, Planning Commission members, Secretaries from various departments, senior bureaucrats, academics and NGOs, and representatives from the donor community participated in this dialogue and deliberations.

As we know, India's National Action Plan on Climate Change (NAPCC) which lays emphasis on eight national missions was unveiled in June 2008. The publication *Community Level Adaptation to Climate Change and its*

Relevance to National Action Plan — A Road Map for Policy Development brought out under the V&A project initiatives as a background document for the National Dialogue was the first ever document to look at the relevance of field level knowledge generated on adaptation options in the context of the spelt out missions. Some of the pointers from the V&A project experience to the National Missions include:

1. Risk management in agriculture by promoting drought-resistant and water conservation practices in dry lands as well as by providing incentives to promote water-saving technologies
2. Stakeholder consultations to share action learning by promoting agro-met stations
3. Upgrading water storage structures to cope with extreme weather events such as droughts and floods
4. Enhancing efficiency of energy use and improving habitats in rural households by promoting improved stoves and compensating the use of high greenhouse gas emitting fuels
5. Improving the livelihoods of the rural poor through farm diversification by rearing livestock, using biotechnology to prevent nutrient deficiency in livestock and also by breed improvement in small ruminants

Based on the assessments and achievements of the V&A project activities thus far, an extension for another year has been obtained to further consolidate the initiatives and bring the project to a logical end with clear-cut exit strategies in place.

405.2 PISCES Project

PISCES — Policy Innovation Systems for Clean Energy Security — a DFID-sponsored research programme, 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. With consortium partners in the U.K, Sri Lanka, Tanzania and Kenya, the project covers the changing contexts and issues of energy, water and food security, bioenergy being in the intersection of these three factors. In the context of soaring geopolitics on fossil-fuel-based energy sources and the resulting emission trade-offs in various international negotiations, the PISCES consortium emphasises research on improving energy access and livelihoods for the poor based on the huge natural resource base without disturbing the ecological integrity of the ecosystem. It is even more necessary than ever to take a holistic perspective of the potential and trade-offs of all forms of bioenergy to deliver the objectives of carbon emission reduction, maintenance of water balance and alleviation of chronic poverty.

PISCES conducted its second annual meeting in September 2008 in Chennai where the Joint Implementation Group (JIG) meeting was held. PISCES has completed a collaborative case study research with FAO, which includes 15 case studies from 12 countries in Africa, Asia and Latin America. It establishes linkages between energy security and livelihood impacts of small- scale bioenergy initiatives. The Indian case studies were the rural

electrification initiative of Winrock International India (WII) in Ranidehra, Chhattisgarh, and village-level biodiesel production for irrigation and sanitation project of CTxGreEn in Mohuda, Orissa.

Climate and Environment is the central theme around which the research activities at MSSRF have commenced. The dynamics of the interrelationship between climate and biofuel-yielding crops is the focal theme for intense research. Several agro-ecological zones have been earmarked where crops can be grown ecologically and economically, based on the biophysical attributes. The growth parameters, pest infestation, oil content, etc. of biofuel crops like Sweet sorghum, *Jatropha*, *Pongamia*, etc. are being studied in selected agro-ecological zones.

Field visits were undertaken to concerned organisations and stakeholder discussions were held to capture all possible perspectives of bioenergy. Organisations implementing Central Government sponsored programmes like the National Rural Employment Guarantee Scheme, and watershed development programmes promoting *Pongamia* and *Jatropha* plantations were consulted.

Alternative feedstock other than molasses for bioethanol production is yet to be established, though Sweet sorghum is emerging as a promising substrate. Sweet sorghum research at ICRISAT and bioethanol production from the same and from sugar beet at Tata Chemical's factory at Nanded are some of the case studies explored under PISCES.

The inherent complexity of bioenergy as a potential alternative, isolated research efforts, multiple technology options and a wide stakeholder base have made bioenergy research very challenging. The situation is aggravated by the absence of a clear-cut policy for bioenergy as an alternative in India. It is a challenge to comprehensively study and draw a decisive conclusion pertaining to the bioenergy scenario in India and this would be focus of future research in the project.

Sub Programme Area 406

Designing Rural Technology Delivery Systems for Mitigating Agrarian Distress

Designing Rural Technology Delivery Systems for Mitigating Agrarian Distress is a research study that focuses on the technological dimension of the agricultural crisis that is currently gripping the Indian economy. Factors underlying the crisis in Indian agriculture are complex and manifold. The major factors relate to the nature of economic strategy pursued by the state as well as several institutional, technological, ecological, and weather-related factors. In this study, the concern has been to analyse one dimension of the problem facing Indian agriculture, namely, the technological dimension. This dimension has been defined in very broad terms to cover an entire bundle of techniques and steps that are required to improve and stabilise crop yields. Factors that

have a bearing on agricultural production and productivity — the physical environment, the extent and nature of agricultural inputs used, the nature of crop protection practices followed, the overall management practices adopted in cultivation including irrigation practices and aspects relating to technology delivery — are all concerns addressed in the study. The technological issues related to the agrarian crisis in two districts — Wardha in Maharashtra and Anantapur in Andhra Pradesh — from among the agriculture-related-suicide-prone ‘distress’ districts identified by the Government of India in the states of Maharashtra and Andhra Pradesh have been examined..

The methodology adopted in the study combines secondary data analysis with primary surveys, interviews and consultations with a cross-section of key persons. Two villages were surveyed in each district: In Anantapur, Thopudurthi village in Atmakur mandal and Tirumaldevarpalli village in Kothacheruvu mandal (that fall in two different rainfall zones) and Lonsawali village in Wardha taluk and Kosurla village in Hinganghat taluk in Wardha. The attempt here was essentially to understand the constraints faced by farmers with regard to adoption of technology and general problems encountered by them with regard to cultivation. Apart from detailed interviews with farmers, discussions were had with a large number of experts in various fields. Scientists from the state Agricultural University, national and international research institutes, agricultural officers and village extension workers from the Department of Agriculture, officers from the Departments of Irrigation, Watershed, and

Seed Corporations, etc., and experts from other non-governmental organisations working in the districts were all consulted.

Over the last year research was carried out in the districts of Wardha and Anantapur. While the report on Wardha district has been completed and finalised, that on Anantapur district is in the process of being put together. The investigation into the technological dimension of agricultural distress has revealed a number of contributing factors. It has been found that both districts have very high degrees of vulnerability with regard to the prevailing agro-climatic condition. Some of the factors that accentuate the widespread instability are the following:

- Incorrect and inappropriate cultivation practices among farmers
- Inadequate soil and water conservation measures
- Inadequate irrigation facilities

- Ineffective agricultural extension services in the public domain
- Lack of availability of quality inputs at appropriate time

The study was initiated in July 2007 and will be completed in 2009. It has been funded by the Office of the Principal Scientific Adviser to the Government of India and is closely monitored by a Project Review and Monitoring Committee (PRMC), comprising the following distinguished members: Dr. C.R. Bhatia, Former Secretary, Department of Biotechnology, as Chairman; Dr. S.F. D'Souza, Associate Director, Bio-Medical Group and Head, Nuclear Agriculture and Biotechnology Division, BARC, Mumbai and Dr R P Sharma, INSA Sr Scientist, National Research Centre on Plant Biotechnology, IARI, New Delhi as Members; and Dr. R.P.Gupta of the Office of the Principal Scientific Adviser to the Government of India as Member Secretary.

FOOD SECURITY

The Report on the State of Food Insecurity in Rural India was released in February 2009. A study was initiated on institutional feeding programmes and their possible linkages with small holder farmers. An enhanced nutrition course curriculum developed for undergraduate students was formally released. The effort to increase production and sale of millet-based products has started leading to greater market visibility. Women farmers' groups are being formed in villages in Vidarbha and their capacity building and training is in progress.

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Programme Area 500

Food Security

Ongoing research and field level initiatives focused on understanding the situation and attempting to improve the food and nutrition security status of communities. Among initiatives in Vidarbha, women farmers are being trained in sustainable agriculture practices.

Sub Programme Area 501

B. V. Rao Centre for Sustainable Food Security

501.1 Report on the State of Food Insecurity in Rural India

The *Report on the State of Food Insecurity in Rural India* prepared by MSSRF with support from the United Nation's World Food Programme (UNWFP) was formally released at a function in New Delhi on Friday, 20 February 2009 by Professor M S Swaminathan and Ms Mihoko Tamamura, WFP Representative in India and Country Director. Ms Mabel Rebello, MP, Rajya Sabha, senior government of India officials, UN and civil society organisation representatives, and media were present. Professor Athreya presented the highlights of the Report.

The Report is in two parts. The first part examines the status of food and nutrition security in rural India. Seven indicators have

been used to rank the states. Of these, 3 are *input* indicators: percentage of population consuming less than 1890 Kcal per day; percentage of households with access to safe drinking water; and percentage of households with access to a toilet inside the premises. The remaining 4 are *outcome* indicators: percentage of women with anemia; percentage of women with chronic energy deficiency; percentage of children under three years of age who are underweight for age; and percentage of children under three years of age who are anaemic. The rankings of the states have been worked out for two time periods — 1998 to 2000 and 2004 to 2006. The maps obtained using the selected 7 indicators between the two time points are given in the inside back cover. The results suggest that despite high rates of economic growth, levels of food insecurity remain elevated across most states in both periods. The reduction of food and nutrition insecurity remains a daunting challenge in rural India and requires policies that improve availability, access and absorption. The government needs to play a key role.

The second part of the Report examines the major public food delivery systems — Public Distribution System (PDS), Integrated Child Development Services (ICDS) and Mid-Day Meals Scheme (MDMS). It is established that the Targeted Public Distribution System (TPDS) has led to the exclusion of a large number of needy poor. It is also emphasised that if PDS is to address the issue of food security at the household level, the ration must be on a per capita basis and not a per

household basis. There must be effective dissemination of all information to the users, including various entitlements pertaining to the PDS and other food schemes. The elected local bodies should be actively involved in monitoring these schemes. It is also pointed out that, from the view point of food and nutrition security, there needs to be a much greater degree of integration between MDMS and government interventions in health and nutrition.

The Report recommends a return to the 'universal PDS' that existed till 1997. It also recommends universalisation of ICDS and MDMS with quality and equity. It stresses the need for effective implementation of ICDS, MDMS and NREGS. Greater involvement of Panchayat Raj Institutions (PRIs) in food delivery at the grass-roots level and integration of food and nutrition security objectives in ongoing government initiatives like the National Food Security Mission and National Horticulture Mission are crucial. The Report points out that global food price volatility and climate change will impact on food insecurity in rural India.

501.2 Community Foodgrain Banks (CFBs)

Monitoring of grain banks already set up in Orissa and Kalrayan Hills in Tamil Nadu continued over the year. The CFB training manual was translated into Tamil and printed. The household entitlement card listing health, food and nutrition-related welfare schemes of both Central and State Governments was also

compiled and printed in Tamil. The evaluation report of the CFB experience in Tamil Nadu and Orissa was finalised.

Kalrayan Hills, Tamil Nadu

Since January 2008, MSSRF has been conducting monthly meetings with the CFB management committee and members, in the two villages where CFBs were facilitated — Melvazhapadi and Talvellar. A joint meeting with the local-partner NGO, World Vision India (WVI) was held in both the villages in September 2008. MSSRF also had separate discussions with WVI on future action plans of CFBs in Kalrayan Hills. Based on the discussions, MSSRF appointed an animator in each village and focused on training members to maintain the CFB. This follow-up activity saw an increase in CFB members from 44 to 57 households in Melvazhapadi and from 49 to 54 households in Talvellar. New bank accounts were opened in a branch in Vellimalai, a new records register was introduced and the rate of interest for lending grains under CFB was revised by the committee. MSSRF proposes to withdraw from the two villages later this year and is working on strategies to ensure sustainability of operations and management by the villagers. Both the entitlement card and Tamil version of the CFB training manual were released at a workshop in Vellimalai on in March 2009. The release-cum-dissemination workshop was attended by government officials, including both Deputy and Assistant Block Development Officers and the Medical Officer. There were around 60 participants from the Kalrayan Hills villages. A similar workshop

was held in Kolli Hills on 29 May 2009. Block level officials from the Agriculture, Horticulture and Health departments, Secretary, Large Area Multipurpose (LAMP) Cooperative Society, SHG members and farmers participated.

Orissa

The renovation of Grain Bank storehouses in 9 villages in Koraput District were completed, with the villagers contributing labour. The functioning of the Grain Banks set up earlier is being monitored and the management committees have been facilitated for smooth operations. Twelve existing SHGs in these villages were also assisted in their operations.

Strengthening Community Foodgrain Banks and Village Development Committees

Under the PAN-MSSRF project on 'Integrated Management of Biodiversity Resources in Partnership with Communities' (see SPA 201.3), the Grain Banks in three project villages (Bologuda, Gunthaguda and Nuaguda) continued to be monitored and reviewed. The focus on strengthening the capacity of the Community Foodgrain Banks and Village Development Committees (VDCs) continued. Technical and input support was extended to promote the cultivation of greengram, finger millet and horsegram. Entitlement cards listing the various food and nutrition schemes of the government were printed and distributed, followed by awareness generation programmes to facilitate information spread and greater access to the extant schemes.

Month-wise loan receiving and repayment status of CFBs are being separately monitored

for every commodity, using a format. Regular meetings are being held with management committees and member households to discuss management of transaction processes and other general problems related to CFB functioning. A series of village-level capacity building programmes were organised to strengthen the management committee members on various management aspects. Awareness programmes were conducted on scientific grain storage at the household level, combining indigenous knowledge and modern methods. Some scientific storage practices have also been highlighted on the walls of the Grain Bank storehouses. A joint one-day management committee review meeting was organised for the 3 Grain Bank management committees to review progress.

One new household joined the CFB in Gunthaguda village with a membership contribution of 20 kg of paddy. The bank supported a member whose house was destroyed by fire, with foodgrains and an interest-free loan of Rs 600 from the village development fund. In Nuaguda, an extension store room (150 sq. ft) is under construction for grain storage. The land and labour for this purpose were contributed by member households. 250 kg of good quality paddy was transferred to the Seed Bank. 16 kg of ragi was transferred from the Seed Bank to the Grain Bank. In Gunthaguda, 50 kg of greengram was transferred to the Grain Bank. Members in both villages contributed to increasing the grain corpus.

Village Development Committee and Development Funds

Village Development funds in 3 project villages are being managed by the concerned VDCs. These funds are used by member households in times of need as well as for developmental activities. The monthly contribution, decided by the villagers, is Rs. 2 in Gunthaguda and Rs. 20 in Nuaguda. Income from common activities like community farming also goes into the funds.

Cultivation of greengram, finger millet and horsegram

Following the initiative to support cultivation of pulses begun last year, 47 farmers have placed 50 acres under greengram (37 acres) and horsegram (13 acres). Farmers were trained on package of practices and application of biofertilisers, Rhizobium culture and Phosphobactor. No seed support was given this year. They now have their own seed and some have also availed loans from the Seed Bank. In addition, during the year, 46 farmers have covered about 40 acres under finger millet, following orientation on package of cultivation practices and initial seed support.

Establishment of model kitchen garden and wild food garden in BMPGRC campus

A model kitchen garden (250 sq.m) was set up in the BMPGRC campus in January 2009. About 21 vegetables — a combination of green leafy vegetables, roots and tubers and others — are being cultivated. The garden is used as a demonstration plot for villagers who visit

BMPGRC, to expose them to the concept and maintenance of backyard kitchen gardens. About 200 farmers were given orientation last year.

A wild food garden (500 sq.m) has also been started in the campus from January 2009 to conserve the valuable wild food species consumed by the tribes of this region. So far 21 species have been collected and are conserved in this garden. Documentation of 86 wild food species used by the tribes has been completed.

Efforts are on in the project villages to make mothers aware of feeding practices of their infants below three years of age. The role of kitchen gardens, which were initiated last year, in contributing to household nutrition security is being monitored.

501.3 Nutrition security initiatives

The community-based nutrition security intervention in 3 villages under the PAN-MSSRF project in Orissa was strengthened, with focus on infant feeding practices and promotion of kitchen gardens.

Research-based interventions in Orissa

Improving infant feeding practices

An interesting outcome of the first workshop on infant feeding practices held in May last year was a play, highlighting the six key messages identified, developed by the street theatre artists belonging to the group *Loka Chetana Natya Parisada* of Phukiaguda village, who participated in the workshop. They staged it

in 11 villages, including the 3 project villages, to sensitise the people on appropriate infant feeding practices.

However, growth monitoring of children by the ICDS has remained weak and the community members have not been able to succeed in their efforts to get the ICDS functionaries to initiate growth monitoring of children on a regular basis. In order to empower mothers on using the growth chart to see how their children grew, MSSRF began growth monitoring of children in September 2008. A staff member, trained initially at the Paediatric Clinic of Voluntary Health Services Hospital in Chennai, has been specially appointed for this task.

In each project village, one specific day — called the Mother-Child Day — has been fixed for growth monitoring of children below three years of age. On this day, weights of children are taken and plotted on the growth chart. The nutritional status of the child is discussed with the mother and suggestions for enhancing the practices are given. The morbidity profile of the children as well as their food intake is recorded on the growth chart. A total of 52 children have been registered in the programme — 14 in Boliguda, 10 in Nuaguda and 28 in Gunthaguda.

Following this and as a continuation of the first workshop, a two-day residential workshop was organised in December 2008, to find out in depth the existing feeding practices of young children in the community. Thirty-seven participants (mothers, fathers, village committee members, traditional birth attendants, street players, Accredited Social

Health Activist - ASHA), several of whom had attended the first workshop from the 3 project villages, took part.

The objectives of the workshop were to:

- review the messages and outcome of the previous workshop and the growth monitoring interventions in the 3 villages.
- understand traditional knowledge of feeding practices of children from birth to two years, with specific reference to complementary feeding.
- help compare and discuss traditional and modern messages, as also the rationale for the same, and arrive at a consensus on messages regarding feeding of young children.
- understand management of feeding in specific conditions, such as low birth weight and illness of the mother and child.
- help participants chalk out an action plan for promoting and supporting appropriate feeding practices in the community.

The workshop generated a lot of discussion on the merits and lacunae in the existing practices. Village-wise action plans were prepared to promote appropriate feeding practices in the communities. A special two-hour workshop was held in all the 3 project villages to help mothers support and learn from each other by discussing feeding problems, the psycho-social aspects of feeding and 'the how' of overcoming malnutrition.

Health committees were formed in Nuaguda (3 female + 2 male members) and Gunthaguda

(4 female + 1 male) villages, to link up with the Primary Health Care system of the State. The purpose is to empower the committees to monitor the health and nutrition security in their villages and to facilitate linkages with entitlement schemes on food and nutrition meant for mothers and children. A one-day capacity building programme on mother-child health care was organised for 35 participants from the two villages. The content touched on the following aspects: food, nutrition and health care for pregnant and lactating mothers; hygiene, sanitation and child care; breast feeding (0-6 months child) and complementary feeding (7 months onwards); and immunisation for pregnant mothers and children. An external evaluation of the impact of the whole exercise is shortly to be undertaken.

Kitchen gardens: utilisation and consumption of produce

The objective of the kitchen garden activity is to cater to the nutritional needs at the household level in the project villages and to facilitate households to promote good quality nutritious vegetables rich in iron and vitamin A.

During the year, activities were generated in this regard. The first step was awareness generation on the importance and contribution of kitchen gardens. A survey was conducted on the availability of space, water, and human resources for kitchen gardens in each participating household, and training was given on package of practices on vegetable cultivation. Data on the yield and utilisation of the produce were collected through individual household kitchen garden cards. A workshop

was organised to help the participants critically look at their existing practices in managing kitchen gardens and there were also group discussions on gender roles in the management of such gardens. Monthly meetings take place on sharing of knowledge and experience.

A one-year monitoring-cum-intervention programme has been planned to study management aspects of kitchen gardens and their contribution to the household nutrition security. Collection of consumption and utilisation data through the kitchen garden card was started in May 2008 in one village and extended to the other two in June. The data collected from 147 kitchen gardens every month (Nuaguda 32, Boliguda 66, and Gunthaguda 49) are being analysed. During this period no support was given from the project in terms of any seeds or seedlings to the farmers, but most farmers were growing vegetables in their backyard with their own resources. Most of the kitchen gardens have some perennial species like papaya, drumstick, guava, lime and banana as well as some seasonal vegetables and greens.

Two training programmes on package of practices on vegetable cultivation were organised in October 2008, in collaboration with the Bio-Village and the Bio-Industrial Watershed project staff to train the farmers on *rabi* vegetable cultivation. There were 84 participants (32 male + 52 female) in the first training programme and 144 participants (78 male + 56 female) in the second.

Overall, it is now encouraging to see farmers growing a combination of green leafy vegetables, root and tubers and other vegetables in their backyards, without any external support. Greater awareness is also observed about the importance of consuming vegetables with about 80 % of the total produce from the kitchen gardens being used by the households. Vegetables like papaya, pumpkin, kunduri and broad beans are found to be popular.

Fruit and vegetable gardens have also been promoted in the garden space in schools in the 3 villages and are being maintained by the school children. The objectives of the gardens are to support the nutritional needs of the schools.

Enhancement of the nutrition curriculum

The exercise for enhancing the undergraduate nutrition curriculum being offered in government and private colleges in Tamil Nadu came to an end in August 2008, with 26 senior nutrition faculty and professionals evaluating the re-worked nutrition syllabus. Constructive suggestions were offered to make the curriculum up-to-date and deliverable. Members of the three committees, namely, Food Science & Quality Control, Dietetics, and Community Nutrition, carried out the necessary changes and were ready with the re-worked curriculum by October. The enhanced curriculum was formally released on 15 November 2008 at a workshop on Current Nutrition Challenges and the Role of Academic Institutions. The first copy was received by the Vice Chancellor of Madras University, Dr.

S Ramachandran, who promised to have the same examined by the concerned bodies. The participants of the workshop were members from the academic boards of universities, deputed by the respective Vice Chancellors. The participants discussed in detail the problems concerning the delivery of the nutrition syllabus and identified possible ways of action. Ten copies of the curriculum were also disseminated to academic institutions at the Annual Conference of the Nutrition Society of India held in Chennai the same month. How far the curriculum has been utilised by the institutions is to be assessed during the academic year of 2009-2010.

501.4 Study of institutional feeding programmes and their linkages with smallholder farmers

A short-term research study on institutional feeding programmes and their linkages with smallholder farmers was undertaken in August 2009. Since India is home to a number of large-scale feeding programmes reaching out to millions of people in different phases of the lifecycle, an opportunity exists to link up smallholder farmers with the feeding programmes at the local level. The study area includes 6 states of India — Maharashtra, Madhya Pradesh, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. MSSRF is the coordinating agency and is also handling the study in Tamil Nadu. The other participating institutes are Jan Sanskriti (West Bengal), Savitri Jyotirao Phule College of Social Work (Maharashtra), Samaj Pragati Sahayog (Madhya Pradesh), Centre

for Environmental Studies (Andhra Pradesh) and Nyasadri (Orissa).

The study includes field work in about 42 villages to understand the current mode of procurement of foodstuffs under ICDS and Mid Day Meal Scheme, as well as to explore the existence of small farmers' groups and their current marketing strategies. It will also examine food procurement in hospitals, prisons and private sector employee meal schemes. The villages selected include both tribal and non-tribal belts. The study sites have varied ecological, socio-political and economic characteristics offering a diversity of contexts in which the implementation of the scheme and role of the farmers could be studied.

A meeting was held with the identified partners from other States to discuss the broad framework of the study. In Tamil Nadu, a preliminary meeting with the officials from ICDS and the state Social Welfare Department helped to identify Theni district as the area for the field study.

The study is being carried out in three phases:

Phase I, the study of school feeding programmes involving literature review of MDMS and fieldwork for MDMS and ICDS has been completed.

Phase II, involving literature review for maternal and child nutrition programmes and data analysis and report writing on ICDS is under way.

Phase III, the study of other large institutional feeding programmes (antiretroviral - ARV and

TB treatment, hospitals, prisons, private sector employee meal schemes)

501.5 Empowering the rural poor by strengthening their identity, income opportunities and nutritional security through the improved use and marketing of neglected and under-utilised nutritious millets in India

The major objectives of this IFAD-assisted project are to promote the cultivation, conservation and consumption of neglected and under-utilised species (NUS) of crops, to enhance income-generation opportunities by cost-effective productivity increase and produce value addition, and to strengthen the cultural identity associated with the cultivation and use of these crops. The project, initiated in 2007, focuses on 5 under-utilised grain crop species, which have variable importance in the food and nutritional security and income generation of farmers in the project villages. These crops are 4 small (or nutritious) millets — finger millet (*Elusine coracana*), little millet (*Panicum sumatrense*), Italian or foxtail millet (*Setaria italica*), and barnyard millet (*Echinochloa crusgalli*) — and grain amaranth (*Amaranthus sp.*).

Project locations, partners and coordination

The project, which is expected to directly or indirectly influence over 750 households, is located in 31 villages in 7 different regions in the southern, eastern and northern parts covering four States in the country. These

regions represent vast diversity in agro-ecological, economic, ethnic and cultural aspects. The agricultural lands are marginal in fertility, rain-fed with low precipitation, and also constitute highly fragile tropical and sub-tropical hilly areas. MSSRF is directly implementing this project at two locations, in Kolli Hills (Namakkal district, Tamil Nadu) and Kundura (Koraput district, Orissa), and is also coordinating the implementation of this project by four partners — the University of Agricultural Sciences, Bengaluru (UAS-B), the University of Agricultural Sciences, Dharwad (UAS-D), the Hill Campus of the G.B. Pant University of Agriculture and Technology, Ranichauri (GBPUAT) and the Central Food Technology Research Institute, Mysore (CFTRI).

Bioversity International, Rome, is the global coordinator for this project, also being implemented in 3 other countries.

Benchmark survey in project villages

Benchmark survey (BMS) using a structured questionnaire developed by MSSRF was undertaken on a sample of farm households prior to the initiation of project work in all the project villages. Socio-economic aspects of

farm families, relevant base information on farmer-practised methods of cultivation of these crops, technologies accessed, practices of post-harvest storage, processing, value addition, consumption and marketing, and the cost-benefit aspects of pure and inter/mixed crop systems, etc., were collated. Details of project villages and sample size of BMS are presented in **Table 5.1**, while those on the socio-economic aspects of households and base information on NUS crops are summarised in **Table 5.2**.

In project villages, farmers offer different reasons for cultivating nutritious millets on variable portions of their landholdings. While farmers in Northern Karnataka viewed them as commercial crops, many from elsewhere consider these crops as important traditional food crops having better food value than rice and wheat. The suitability of these crops for cultivation in marginal soil and management conditions and their importance in providing dependable quality fodder under extreme arid conditions and hilly terrains have also been frequently cited.

The major constraints experienced in the cultivation of these crops are low productivity,

Table 5.1 **Details of project locations, villages and households**

| Project location | No of villages | Total households | Households sampled | Type of community |
|-----------------------------|----------------|------------------|--------------------|---------------------|
| Kolli Hills, Tamil Nadu | 6 | 375 | 148 | Tribal |
| Kundura, Koraput Dt, Orissa | 6 | 279 | 105 | Tribal |
| South Karnataka | 4 | 455 | 120 | Tribal & non-tribal |
| North Karnataka | 5 | 570 | 90 | Non-tribal |
| Tehri Garhwal, Uttarakhand | 10 | 474 | 104 | Non-tribal |

Table 5.2 *Socio-economic background of respondents as emerged from BMS*

| | Kolli Hills | Kundura, Koraput | South Karnataka | North Karnataka | Tehri Garhwal, Uttarakhand |
|--|-------------|------------------|-----------------------|-----------------------|----------------------------|
| Av. Family size, No | 4.2 | 3.8 | 5.6 | 6.1 | 6.1 |
| Literacy, % | 47.3 | 11.2 | 54.0 | NA | 96.1 |
| Engaged in Agric, % | 98.7 | 100.0 | 100.0 | 100.0 | 100.0 |
| HHs with Non-Agril income, % | 33.1 | 1.0 | 66.5 | 25.6 | 63.4 |
| Av holding size, ha | 1.06 | 2.3 | 1.0 | 3.1 | NA |
| Land irrigated, % | 11.1 | 13.6 | 25.5 | 11.0 | NA |
| HHs with livestock, % | 77.7 | 72.4 | 90.8 | 56.8 | 80.7 |
| Farmers growing millet, % | 35.8 | 97.9 | 100.0 ¹ | 100.0 | 100.0 |
| Area grown under millet, % | 15.0 | 55.0 | 56.0 | 26.0 ³ | NA |
| HHs with own seed source, % | 11.5 | 83.6 | 24.5 | 35.0 | 85.0 |
| Seeds sourced from village market/private company, % | Nil | 2.0 | 68.5 | 55.6 | 25.0 |
| Seed from Agri dept, % | Nil | Nil | 6.5 | 9.0 | 6.8 |
| Seed from seed bank, % | 24.3 | 29.5 | Nil | Nil | Nil |
| Average yield of millet, kg/ha | 326.0 | 330.0 | 1736.0 | 1359.0 | NA |
| Average net income, Rs/ha | 1934.0 | 377.0 | 2867.0 | 8193.0 | NA |
| Knowledge on HYVs, HH % | Nil | 5.5 | 7.5 | 9.0 | 46.1 |
| HHs marketing millets, % | 2.7 | 25.5 | 28.5 | 89.4 | Nil |
| HHs aware of value addition, % | Nil | Nil | 11.5 | 13.6 | 16.5 |
| Average total annual HH income, Rs | 32,720.0 | 11,489.0 | 84,902.0 ² | 97,500.0 ⁴ | 68,557.0 |

1. All grow finger millet with one or more intercrop, such as maize, field bean, groundnut, fodder/grain sorghum, pigeon pea, horsegram, coriander and mulberry. Additional intercrops in other locations included little/foxtail millets, black/green gram, mustard and niger.
2. Out of the total annual income/HH, 9 % is from millet cultivation, 70 % from other agri and non-agri sources and 21 % from agri wages.
3. 50 % of millet growing area is on an average used for pure crop and rest for intercrop with pigeon pea and horsegram as the follow crop.
4. Out of total annual income/HH, 46 % is from crop husbandry, 2.6 % from animal husbandry, 14 % from agri wages and 36 % from non-agri sources.

lack of suitable production technology including seeds of high-yielding varieties, lack of remunerative prices, low profitability, lack of value-addition technology to realise better income, erratic rainfall and poor soil fertility. Some villagers felt that these crops are labour intensive, leading to labour shortage, particularly where labour use is on exchange. Non-availability of credit to grow millets and lack of machinery to process grain for consumption have also been pointed out.

Improving production and profitability of NUS

Target NUS crops are traditionally grown either as pure crops or as mixed or intercrops. Mixed crop is broadcasted using a seed mixture of main crop (one of the millets) and companion crops, which vary across project locations (please see legend for **Table5.2**). Farmer participatory yield / income enhancement trials were organised in twin plots, each with size varying from 10 cents to one acre in different project locations. While larger plot sizes are possible in the plains, only small plots are available in terraced hills. The trials were either with pure or intercrop, following the traditional method of cultivation in one plot and improved method in the other. The traditional method is essentially the farmer-practised method. The improved method is innovative in the use of high-yielding local or improved variety identified after participatory variety selection, in the planting of the main and intercrops in scientifically appropriate row spacing and row ratios, in the use of organic manure or/and fertilisers at or near recommended rates,

and in the carrying out of intercultivation and weeding and other good management practices. The data on cost of production, including family labour, grain and straw yield and local farmgate prices, were used to compute cost-benefit aspects of traditional and improved methods of cultivation. A total of 528 trials, occupying an area of 120 ha in 24 villages, were laid out. This included 244 trials in 10.5 ha with pure millet crops and 284 trials in 109.5 ha with intercrops. On the basis of these trials conducted by MSSRF and the three Agricultural University partners, the additional income was found to be higher from inter crops than from pure crops and the income additionally generated by the improved method of cultivation varied from Rs. 1605 to Rs. 13,578 / ha in different regions. The net income from the traditional method in some of the villages was negative when family labour was factored in.

Increasing income from value addition of NUS and market linkages

The second major approach for enhancing farm household incomes from NUS cultivation is grain value addition and marketing value-added products. This is also totally new to the community and required extensive training and building the capacity of farm women and men on the processes of grain value addition, packaging and marketing the value-added products. Capacity building also required provision of simple machinery, which is essential for processing the grain. Lack of such machinery and the dependence of communities on traditional processing

methods, which used manually operated stone grinders to make flour from grain and the more cumbersome mortar and pestle to de-husk the grain, are important reasons for the shift from these millets to alternate grains such as rice. With the help of a small support grant provided by McGill University, Canada, 10 flour mills with grain de-stoners were provided to 10 villages in Kolli Hills in Tamil Nadu and BR Hills in South Karnataka. At Jekinkatti village under UAS-Dharwad, the SHGs were provided with other equipment and facilities from this project fund. Farm women and men from these villages were organised into a number of SHGs and Farmers' Clubs (FCs). More women and fewer men members of these groups were identified for training in value addition and sent to the Rural Home Science Colleges under UAS-B and UAS-D for extensive residential training. During 2008, 16 members of seven SHGs and FCs from Kolli Hills (5 members) and Kundura (11 members) were trained at the Rural Home Science College, UAS-B. This training, designed for 3 days, provided practical skill development on value-added products of millets suited to domestic consumption as well as commercialisation. These trained persons were used to train more members of SHGs and FCs in their villages on the new skills. In Kolli Hills and Kundura alone, 128 members of the local SHGs were trained on value addition.

This training and processing infrastructure helped village women in enlarging millet-based recipes for household consumption and initiating commercialisation of value-added products. With the help of project staff,

members of the SHGs identified products suitable for commercialisation, keeping production logistics and market demand in view. The formulation of such products was networked across SHGs for ensuring quality standards and regular supplies to markets. During the mentoring period, the SHGs were guided by project scientists in commercial production, designing and providing better product packaging to promote consumer acceptability, facilitating market linkages and distribution systems, setting terms of trade, etc.

Such production and marketing groups are established in Kolli Hills and Kundura under MSSRF, Doddabommanahalli and Panasachowdanahalli in Chikkaballapur district under UAS-B, and Jekinkatti village of Yellapur district under UAS-D. The value-added products more frequently commercialised are finger millet malt, millet *laddu*, and finger millet *chakkli (murukku)* in Kolli Hills and Kundura, finger millet malt, millet-based diabetics mix, *nere happala*, *mudde happala*, hand-pounded little millet rice, *chakkli*, millet-based *papads*, *nippattu*, *paddu*, and *savi akki* in Jekinkatti village, and finger millet malt and *hurihittu* in Doddabommanahalli village. At Kolli Hills, the value-added products are marketed by the Kolli Hills Agrobiodiversity Conservers' Federation. Some of the SGHs and FCs under this Federation are engaged in commercial production of finger millet malt, *chakkli*, millet *laddu* and finger millet flour, with different SHGs specialising in specific products. During the year, the commercial production

in Kolli Hills exceeded 1.4 tonnes of finger millet malt, 500 kg millet laddu, 50 kg chakkli, totally valuing more than Rs 1,60,000. The additional income generated by such grain value-addition is nearly ten-fold of the income possible from sale of grain. The ultra poor tribal farm families of Kundura, the majority of them falling below poverty line, were initiated into commercial production of malt and hurihittu. In Jekinkati village of North Karnataka, farm women, marketing about 7 millet products, could earn a net profit of over Rs 30 for every kg sold by them.

The increasing demand for millet-based food products are bringing new challenges to the SHGs, such as consistently maintaining high quality standards across every batch of production, gearing up production to cope with increasing market demand, building up raw material stock, increasing working capital, improving the image of the products by better packaging, creating a market identity by establishing trademark, establishing dealer-retailer network, etc. Project scientists assist the SHGs to successfully meet these challenges by enhancing their capacity and know-how. In Kolli Hills, the SHGs were helped in establishing a trademark for the millet products. A new packaging carton for ragi malt was released by Professor M.S. Swaminathan in an event held at MSSRF in May 2009. All these have substantially enhanced the market visibility and market demand of the millet products. The Kolli Hill ragi (finger millet) malt is now being marketed in packs of 250 g at the retail price of Rs. 100 / kg.

Conservation and quality seed supply

Enhancing income generation from millets is a means to promote their conservation, cultivation and consumption. Poor availability of seed is found to be a very critical component in limiting the capacity of farmers in the conservation of local varieties. The benchmark survey across project locations clearly brought out that 11 % - 85 % of farmers use their own seed. Therefore, there is need to strengthen farm-saved seed systems with quality seed to preserve variety identities and to harvest better yields. In some of the project villages, particularly those directly managed by MSSRF, Village Gene-Seed Banks (VGSB) managed by local SHGs or FCs serve as additional sources of seed. Seed quality is also important for ensuring yield stability, irrespective of whether the variety is the improved or the traditional one. Therefore, building local capacity for quality seed production and safe storage is an important component of sustainable seed systems of farmer-preferred varieties. During the year, large quantities of seeds of different varieties of all millet species were produced in participation with farmers (**Table 5.3**). While part of this seed was distributed free to farmers involved in participatory production enhancement trials, the rest was distributed through VGSBs. In Kolli Hills and Kundura, special seed production programmes were taken up during off-season (January-May) to augment the seed supply. In locations receiving heavy rain during the harvesting and threshing seasons, the seed quality deteriorates and this requires fresh supply of seed during crop season, either from external sources or from off-season seed production.

Demonstration of intercropping finger millet with tapioca

This new approach is being evaluated with farmer participation in Kolli Hills, where nearly 90 % of the traditional millet area had been diverted to tapioca (cassava) during the last 30 to 35 years. Tapioca is being promoted as a cash crop by the sago industry around Salem under a kind of contract farming. Because of better profitability from tapioca and ready availability of rice at a very low price from the local PDS outlets, farmers are under no pressure to grow foodgrains. Therefore, only less than 10 % of the cultivated area is used for millets. Nevertheless, the local community, whose traditional food was millets, still values these grains for their health and nutritional benefits over rice. However, there is no land to cultivate millets as tapioca has taken over. This project assessed the early growth pattern of tapioca and found it is possible to introduce finger millet as an intercrop, if the latter has a maturity period not exceeding 3 months. New varieties were identified to suit this growth period, and participatory trials of finger millet intercrop with tapioca were

organised. Comparison of growth of tapioca in intercropped and non-intercropped plots showed that tapioca growth, as measured by plant height, number of leaves and canopy size, was impacted by the finger millet. However, this impact at early growth stage was found to have no significant influence on the yield of tapioca in the intercropped area. Intercropped finger millet, on the other hand, offers a yield of about 700 kg / ha with a favourable cost-benefit relationship. This has been verified with repeated trials in more farmers' fields.

Studies to assess the possibility and economics of including millets in infant diets

The millets greatly contribute to the nutritional security of local communities in all the project areas, particularly in those with ultra-poor tribal people. The tribal people of Kundura and BR Hills to a larger extent and those in the Kolli Hills, Haveri and Tehri Garhwal regions to a lesser extent are dependent on these grains for their food security (**Table 5.4**). In addition to millets, the grain amaranth also

Table 5.3 *Details of quality seeds produced under the project in 2008*

| Crop | Variety | Seed quantity, kg | | | | | Total |
|-----------------|---------------------------------|----------------------|------------------|-------|-------|--------|-------|
| | | MSSRF Kolli Hills | MSSRF Kundura | UAS-B | UAS-D | GBPUAT | |
| Finger Millet | 17 varieties, including 4 local | 314 | 166 | 1050 | | | 1530 |
| Foxtail Millet | 3 varieties, including 2 local | 39 | | | 800 | | 839 |
| Little Millet | 5 varieties, including 3 local | 66 | 17 | | 270 | | 353 |
| Barnyard Millet | 2 improved varieties | | | | | 400 | 400 |
| Grain Amaranth | 2 improved varieties | | | | | 250 | 250 |
| | Total | 419 | 183 | 1050 | 1070 | 650 | 3372 |

contributes to income generation and nutrition of communities, particularly in BR Hills and Tehri Garhwal. Nonetheless, the school-feeding or ICDS programmes in these regions do not include the millets in any substantial scale, despite their advantages in nutrition and cost-effectiveness.

On a request from the Department of Women and Child Welfare, Government of India, to develop low cost nutritional meals from local cereals/millets to be included in school feeding programmes, the project staff from UAS-Dharwad developed 4 low cost recipes using millets — *Bisibelebath*, *Vangibath*, *Kichadi* and *Pudina* rice. It is estimated that these preparations made from one kg millet and other ingredients offer 39-50 servings, each serving weighing 110-170 g and providing 123-188 kCal and 3.3-6.8 g protein, at a cost of Rs 1.40- 2.50.

Major approaches emerging from these studies are the need for policy interventions to:

- promote NUS cultivation with enhanced yields and income generation through value addition of primary produce at farm level and linkages with markets.
- enhance the consumption of these grains by vulnerable groups like school-going children (inclusion in mid-day meal or menu of residential schools) and BPL families through inclusion of these grains in PDS at the regional level and in the ICDS food mix. This may concurrently contribute to combat malnutrition and hidden hunger by virtue of the nutritional superiority of these grains in micronutrients, vitamins, certain essential amino acids and fiber.
- promote these grains as health foods, particularly for combating metabolic disorders.

Table 5.4 *Grain consumption pattern of farm households in project villages*

| Project locations | Grain consumption/HH/month, kg | | | | |
|------------------------------------|--------------------------------|-------|-------|--------|-------|
| | Millet | Rice | Wheat | Others | Total |
| S.Karnataka (incl BR Hills), kg | 47.5 | 38.0 | 6.0 | 5.0 | 96.5 |
| % HH consuming | 100.0 | 100.0 | 61.5 | 16.0 | -- |
| N.Karnataka (Haveri & Bellary), kg | 4.0 | 24.0 | 10.0 | 50.0 | 88.0 |
| % HH consuming | 10.0 | 100.0 | 100.0 | *100.0 | -- |
| Kolli Hills, kg | 6.5 | 44.4 | 2.0 | Nil | 51.9 |
| % HH consuming | 30.0 | 100.0 | 0.7 | -- | -- |
| Kundura, Orissa, kg | 20.6 | 15.5 | 22.5 | Nil | 58.6 |
| % HH consuming | 99.0 | 84.6 | 14.0 | -- | -- |
| Tehri Garhwal, kg | 5.7 | 28.5 | 68.2 | Nil | 102.4 |
| % HH consuming | 89.4 | 90.3 | 8.6 | -- | -- |

* Sorghum

Enhancing human and social capital for better benefits from NUS

The project aims to build the human and social capital of farmers and the public in the project villages through training and awareness programmes, exhibitions, use of media, etc. The theme of every training programme is chosen for improving sustainable management of millet production and utilisation, including participatory variety selection, production of quality seed, intercropping systems, soil health management, vermicompost production, value addition of millet grains, development of different value added products, packaging and marketing of products, management of accounts of the SHGs, nutritional value of millet grains, operation and management of processing machineries, etc. Some of these were on-farm training, with practical demonstrations. Other programmes deployed village animators and group discussion among villagers as well as travel of trainees to outside villages on exposure visits, etc. A training programme on value addition of millets took selected farm women and men from each SHG and FC to the Rural Home Science Colleges at Bangalore and Dharwad, where instruction was provided by the senior faculty. All these contributed substantially to the knowledge level of the farmers, changing their outlook on agricultural practices and enhancing their self-confidence and self-prestige, in particular that of farm women. The role of youth in these processes deserves special mention. In all the project locations they were in the forefront and showed great interest in learning new technologies, capturing new opportunities

and changing for the better. During 2008, 75 training days were organised, involving 1397 trainees, comprising 875 women, with 95 % of the trainees from farm families. The details of training programmes at each of the five project locations are presented in Table 5.5.

Table 5.5 ***Training details at project locations***

| Project location | Training days | Men trainees | Women trainees | Total |
|-------------------------|----------------------|---------------------|-----------------------|--------------|
| MSSRF, Kolli Hills | 8 | 28 | 71 | 99 |
| MSSRF, Jeypore | 32 | 215 | 282 | 497 |
| UAS, Bengaluru | 6 | 30 | 168 | 198 |
| UAS, Dharwad | 10 | 89 | 147 | 236 |
| GBPUAT, Ranichauri | 19 | 160 | 207 | 367 |
| Total | 75 | 522 | 875 | 1397 |

As in December 2008, there were 35 SHGs and FCs with a total membership exceeding 386 with more than 214 women (membership details of 12 SHGs established by UAS-Bangalore and GBPUAT-Ranichauri are not available). Savings of these SHGs varied from Rs 1,200 to Rs 1,00,000 and many of them are availing bank loans for enterprises, with good repayment record.

Public awareness on millets and their dietary importance

Generating public awareness on the importance of nutritious millets in local food and nutritional security as well as their special importance in mitigating metabolic disorders is an important project activity. World Food Day was celebrated on 16 October 2008 in KLE Hospital, Belgaum, involving hospital

doctors, nurses and the public. Similar events were organised by the project scientists of Rural Home Science College, Dharwad on Osteoporosis Day on 27 October 2006 and on Diabetic Day on 14 November 2008, along with exhibition-cum-sale of various millet products. GBPUAT-Ranichauri organised 3 food fairs at Churer Dhar, Chopriyal Gaon and Jaripani villages, where the farm women and members of local SHGs presented different traditional and modern food products prepared from millets. The best preparations adjudged by a panel of judges were given prizes. In Kundura, a 'clean village campaign' and a sports competition for the village children was organised with participation of 3 villages and the winners of the sports events were presented with value-added products of millets produced by the local SHGs. A millet awareness camp was conducted at Tiruchengode in August 2008 in conjunction with a programme organised by the Tamil Nadu Government to award revolving funds for SHGs. About 2500 SHGs participated. Another awareness camp was organised for college and school students at Namakkal in December 2008. Finger millet malt drink was served to the participants by the Kolli Hills SHGs on both occasions.

Promoting on-farm conservation

Conservation of traditional varieties is an important component of the project activities. While no specific efforts other than quality seed production are made in the case of improved varieties, special care is taken to identify traditional varieties or landraces in the areas of their popular cultivation and promote their

conservation through linking with the local Village Gene-Seed Bank. It has been assessed that there is only one local variety in each of the project areas in Ranichauri, Bellary, Yellapur, Chikkaballapura and BR Hills. MSSRF has estimated the existence of 21 landraces of three millets in Kolli Hills, out of which 7 are cultivated in the project villages, while there are 9 landraces of finger millet and little millet in Kundura. Some of these varieties are regularly grown by farmers in all the locations and brought into the value addition chain. The VGSB serves as an important local institution for the sharing of these seeds and their sustainable conservation. SHGs organised by GBPUAT-Ranichauri were introduced to the VGSB concept and supported to establish mini seed banks by providing common facilities for safe storage of seeds.

Appropriate policy frameworks for promoting cultivation and consumption of millets

Exposing policy makers to the merits of millets as an important component of local food security systems is being undertaken under this project. The Chief Minister of Orissa, during a visit to MSSRF, Jeypore, was introduced to the value-added products of millets developed by the SHGs of Kundura. The Chief Minister who tasted some of these food products was very appreciative of the MSSRF work on promotion of these crops, which are the principal staple of local tribal communities.

Sub Programme Area 502

Initiatives in Vidarbha

Under the Education Support programme, a week-long residential coaching camp for children in classes VIII to XII was held in November 2009. Formation of women farmers' groups and their capacity building and training is in progress. A VRC was started in Washim district. Work of the VRC-VKC network is reported under SPA 601.

502.1 Education Support Programme for children of families affected by farmers' suicides

121 children of 59 families in Wardha district and Ralegaon (in Yavatmal district) are being supported under the ongoing programme. There will not be further expansion in numbers and the focus is on seeing to it that the needs of these 121 children are addressed effectively. It is also planned to target school dropouts in these 59 families, many of whom had stopped studying after the parent committed suicide and are now engaged in farm work.

The distribution of the 121 children is given in **Table 5.6** below:

Table 5.6 *Class profile of children*

| | Primary School up to class V | | Middle School classes VI – VIII | | Secondary School classes IX – X | | High School classes XI - XII | | Total |
|--------------|------------------------------|-----------|---------------------------------|-----------|---------------------------------|-----------|------------------------------|-----------|------------|
| | M | F | M | F | M | F | M | F | |
| Wardha | 10 | 7 | 13 | 8 | 12 | 6 | 7 | 10 | 73 |
| Ralegaon | 16 | 9 | 10 | 4 | 2 | 4 | 3 | - | 48 |
| Total | 26 | 16 | 23 | 12 | 14 | 10 | 10 | 10 | 121 |

The majority of the 121 children currently being supported are at the primary (43 %) and middle school (29 %) levels; the focus will be to see them all through the higher secondary level and then be equipped with some skill / vocational training. The current choice of some of the girls who will be completing classes X-XII in the near future is to join courses in nursing, following the completion of which they hope to get jobs immediately. One girl, who completed class X in 2008, with 74 % marks, has enrolled in a two-year diploma course in agriculture.

Given that most of the children are found to fail in English and Maths at the Board examinations, a one-week residential camp for special coaching in English, Science and Maths was held for the children from classes VIII-XII at Sewagram, Wardha, in November 2008. Thirty-four children (20 boys and 14 girls) participated. Member teachers of Wardha District Science, Maths and English Teachers' Associations voluntarily gave their time for coaching the students.

MSSRF sees this as a pilot initiative that other agencies could take on and replicate in other areas of distress.

502.2 Mahila Kisan Sasakthikaran Pariyojana (Women Farmers' Empowerment Initiative)

A two-day camp was held at Sewagram in December 2008 for the members of the Mahila Kisan Samitis. About 140 women from 14 Samitis participated. This was the first time that the groups met each other. The objective was to explain to them the purpose behind the formation of these groups in the villages and the difference from self-help groups, as also to find out from them their needs and expectations, and together plan the way forward. The capacity building of the groups is in progress on the following fronts:

- Organisational capacity building on Samiti operation and management
- Legal literacy on rights, governance issues, rights under panchayati raj (allocation of 10 % funds for women, representation in Panchayat sub-committees like those for health, education, vigilance), awareness about RTI, NREGS, issues of health and sanitation. This is being done through a series of workshops.
- Exposure to, and training in, sustainable agriculture practices

Six cluster meetings on Samiti operation and management have been held and 158 members given orientation since January 2009. The process is continuing as new Samitis are being formed. Three workshops have been conducted on Panchayati Raj, with 89 participants including 15 men. Also planned are awareness and strategies to improve

the health and nutrition status of women, and training in on-farm and non-farm-based income-earning activities.

Up until 15 May 2009, Jagrut Mahila Shetkari Samitis have been formed in 28 villages covering 344 women. It is planned to have 60 Samitis in place by the end of the year.

Training in sustainable farming under rainfed agriculture

Following the training in 2008, contour bunding was completed on the fields of 5 women farmers from 5 villages, covering 15 acres. Eight women from 7 villages practised mixed cropping of cash crops and food crops — soybean, cotton, wheat, jowar, mung, rajgira, vegetables, and turmeric — covering 23 acres of land. Overall, the feedback has been positive.

Continuing on the same lines for the current year, a camp for training on sustainable agriculture practices was held at Dharamitra, a local NGO, in February 2009. Twenty-eight women farmers from 14 villages participated. The women were trained in organic farming practices, seed selection, seed treatment, compost preparation, setting up kitchen gardens, and pest management. The approach included a mix of theory, demonstration and hands-on trials. A kitchen garden calendar of vegetables has been prepared and all the participants plan to start such gardens in their backyards or on part of their farmlands. All of them also plan to practise organic farming on one acre, do seed treatment, test seed germination and prepare green manure. Seeds

of straight-line variety of cotton and jowar will be made available for cultivation.

A two-day training programme on contour bunding was held in April 2009 at the Dharamitra farm. Five women farmers and 19 male farmers participated. The trained farmers will carry out contour bunding on about 50 acres of land.

International Women's Day, organised through the initiative of women farmers' groups, was observed in 3 villages.

A week-long NSS camp for students of Ramkrishna Bajaj Institute of Agriculture, Pipari Meghe, was held in Wabgaon village. It was organised in collaboration with the Mahila Kisan Samiti of the village. Thirty-five students camped in the village. The activities undertaken included soakpit construction (11), improved chullah construction (9), soil testing (5 farms), cattle vaccination (383), demonstration of charcoal manufacture from cotton stalk and dal processing. Following this, the villagers have been enthused to make their village a 100 % total sanitation village.

In collaboration with the NVA team, Samitis in 9 villages organised eye check-up camps in their villages using the mobile eye testing van facility, with 561 patients being treated. The process is continuing. The work is now partly supported by the Uttara Devi Resource Centre for Gender and Development at the Foundation, as highlighted under SPA 602.

502.3 Financial inclusion

A meeting was organised in February 2009 by the State Bank of India, the coordinating

bank for financial inclusion, in Wardha, to mark the completion of the first phase of financial inclusion. It was reported that 95 % of all households had been covered with a bank account. The lead Bank in the district, Bank of India, described the plans for taking the initiative forward. The District Collector, Wardha, and the CEO of the Zilla Parishad, Wardha, expressed their full support for the effort. Professor M S Swaminathan lauded the banks and stressed the importance of taking the measure forward in terms of ensuring access to schemes of the banks and having a dynamic relationship with the customers.

502.4 Coalition for the Elimination of Agrarian Distress in Vidarbha

A multi-stakeholder meeting to discuss the way out of the agrarian crisis in Vidarbha was jointly convened by the Sir Dorabji Tata Trust, Tata Institute of Social Sciences and MSSRF at Nagpur on 10 February 2009. Members of academia, government, research institutes, industry, civil society organisations, farmer leaders and the media participated. The need for a multi-dimensional approach to the problem was emphasised.

It was decided to form a Coalition for Elimination of Agrarian Distress in Vidarbha with all the participants and other organisations actively working in the region, with MSSRF servicing it. The Coalition will be an informal network to bring a life of hope and cheer to the unfortunate victims of the agrarian crisis, namely, small and marginal farmers and landless labour families (see SPA 606 for more details).

INFORMATION, EDUCATION AND COMMUNICATION

The Informatics (Research & Development) division initiated the setting up of web-based knowledge management systems for the Foundation. A new set of 227 NVA Fellows were selected from 18 states. Several electronic communication networks have been established for disseminating locale-specific demand-driven information. The Jamsetji Tata Training School organised several capacity building programmes for Gyan Choupal staff. Knowledge Workers have created social blogging using Orkut for sharing information on VKC activities and exchanging views. The Hindu Media Resource Centre was a joint recipient of the Jawaharlal Nehru Prize for the year 2008-09 conferred by the Indian Science Congress Association for Propagating Science. The Foundation took the lead in organising the first Indian Youth Science Congress.

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Sub Programme Area 601

Jamsetji Tata National Virtual Academy for Rural Prosperity

Since 1992, MSSRF has been implementing Village Resource Centres (VRCs) and Village Knowledge Centres (VKCs). Generally, the Village Resource Centre is located at block, commune or mandal level or at the centre of a cluster of villages. In 2003, the VRC and VKC programmes were strengthened with the creation of the Jamsetji Tata National Virtual Academy (NVA) and the ISRO-VRC programme, which involve collaboration with national and international partners for developing content and capacity building structures to promote sustainable rural development. VRCs are connected to one another through ISRO's uplink and downlink satellite facilities, whereby users located at one node of this network can fully interact with those located at another node through video and audio links.

NVA's main objectives are to provide need-based locale-specific, demand-driven information content (both dynamic and static) based on secondary data and well-planned need assessments; to organise training and awareness programmes; and to create linkages with leading institutions / organisations for translating the content into field-based applications.

A year-long evaluation of NVA, undertaken from May 2008 to May 2009, by reviewers

appointed by the Tata Trusts and MSSRF provided several valuable suggestions to improve the on-going programmes.

Based on the recommendations in their report, NVA has been re-structured into four divisions, each to be looked after by one or two coordinators:

1. ***The Informatics (Research & Development) Division*** primarily looks into MSSRF's intranet and internet activities, develops databases related to sustainable development, tests and diffuses ICT-based rural applications and develops ICT-based training materials. In the long run, this division will devise appropriate technology forecasting in relation to content, capacity building and connectivity.
2. ***Village Resource Centres (VRCs) and Village Knowledge Centres (VKCs)*** set up and manage VRCs and VKCs and maintain the existing three-tier knowledge system (Informatics division, VRCs and VKCs) to strengthen the four-way information linkage system (lab-to-lab, lab-to-land, land-to-lab and land-to-land). The VRCs and VKCs develop locale-specific demand-driven content based on primary and secondary data analysis and well-planned need assessment, organise training and awareness generation programmes and network with relevant agencies for transforming the content into action/application.
3. ***The Jamsetji Tata Training School (JTTS)*** selects grass-root academicians — NVA Fellows. The selection of NVA Fellows

is in three categories, namely, staff of Gyan Chaupals (Village Knowledge Centres, Village Resource Centres, Community Service Centres, Community Technology Learning Centres, Community Information Centres, etc.), social workers, and holders of traditional knowledge and innovative practices. JTTS identifies their needs, provides necessary capacity building, documents their expertise, and shares these with other rural communities. JTTS also provides necessary capacity building and training to Gyan Chaupal staff who are not NVA Fellows.

4. **The Outreach, Extension and Partnership Wing** focuses on strengthening the *Grameen Gyan Abhiyan* (Rural Knowledge Movement – Mission 2007: Every Village a Knowledge Centre) secretariat’s networking capacities for engaging stakeholders, including researchers, policy makers and development practitioners. It facilitates researchers study different ICT-models, test various technologies and develop applications for VRCs and VKCs. It works to get corporate support under Corporate Social Responsibility programmes, for VKCs and capacity building of Gyan Chaupal staff. Another effort is to sensitise policy makers in the implementation of ICT4D activities (e.g., members of Parliament in the allocation of funds under MPLAD programme). “Bharat Jodo through ICT” is the maxim of this wing

601.1 Informatics (Research & Development) Division

Rural communication

This year, MSSRF’s internet line has been upgraded from 512 kbps to 2 mbps. To the already available servers — Proxy, Domain Name, FireWall, Mail, Domain Controller, Anti Virus, E-print server in Library, Tally and Payroll — some more have been added. One is the SMS server for sending text messages to farmers, fisherfolk and field staff regarding important alerts related to early weather warnings, livelihood training programmes, work plan reminders, etc. Another is the Internet-based Radio server that broadcasts audio content in the internet through the Radio Destiny Broadcaster.

Region-specific accounting software for SHGs has been developed with the help of bank officials, the District Rural Development Agency, SHGs Federations, and NGOs.

With the help of Tata Consultancy Services, the village knowledge portal has been refined and customised. Through this portal, VRCs and VKCs store and share their content in the web mode, using languages such as Bengali, Marathi, Tamil, Telugu, Gujarathi, Gurmukhi, Oriya, Malayalam, Nepali, Kannada and Hindi.

The Informatics Division has also introduced a GSM-based public address system to disseminate locale-specific demand-driven information from all over the country to the farming, fishing and tribal communities in VKC villages.

In April-May 2009, the Reliance Fixed Wireless Phone – Closed User Group (CUG) network was set up, covering 8 VRCs and 43 VKCs in Tamil Nadu and Puducherry, to conduct audio conferences between experts and rural communities (lab-to-land and land-to-lab) and also among different rural communities (land-to-land). The network also covers MSSRF, Chennai. The CUG network has considerably increased the information flow between VRCs and VKCs and vice versa. Dissemination of daily news, effective cluster coordination to plan and follow up activities, immediate provision of guidance / solutions to problems, sharing of knowledge by NVA Fellows and experts — all these have become easy and efficient operations. Discussions on several issues pertaining to horticulture, hygienic handling of fish, career guidance, examination results, VKC management, sustainable fisheries, etc., are regularly conducted. A welcome outcome has been that village level meetings can be managed even late in the day, and remote villages can be contacted without being physically visited.

Infrastructure development

An external server for storing all MSSRF e-mails for 5 days as a safeguard against loss by disaster (internet line damage, server breakdown, and router, modem and firewall problems) has been established.

The Indira Gandhi National Open University (IGNOU) Virtual Counseling Centre for addressing issues related to sustainable development has been created.

Training

The following training programmes were conducted:

- *11-12 June 2008*: Knowledge Workers were taught social blogging using Orkut.
- *17-18 July 2008*: Training on HTML, Dreamweaver and Photoshop for the MSSRF staff.
- *16-17 December 2008*: Programme organised by ISRO and Informatics Division on how to effectively handle the ISRO-VRC equipment such as Very Small Aperture Terminals (VSATs), Unlimited Power Supply (UPS) devices, outdoor units (antenna, block up converter, data transmitter to satellite, low noise block converter, data receiver from satellite), indoor units [Return Channel Satellite Terminal (RCST), rear view with port connections, tool bar buttons, classroom equipment, students' software], electrical grounding (earthing, purpose of earthing, earth pit maintenance), etc. The implementation of "ghost" software, which provides complete back-ups of disks, partitions, system files and other programme files, was introduced.

Knowledge management

Informatics (Research & Development) division is developing a web-based knowledge management system with different layers of password protection. This system has four parts:

- *Intranet*: Brief profiles of each staff member along with key words covering location,

expertise and experience; brief write up of each project along with sources of project, contract number, amount sanctioned, amount received, amount spent and sources returned; MOU of the project proposals; MSSRF activities calendar (both headquarters and field sites) including the announcements of various workshops, seminars, discourses, visitors, field-based training programmes, etc.; library of Power Point presentations, technical and financial reports of projects, important correspondence / contact persons details, details of outcomes of each discourse; Personal Policy Book, Minutes of Staff Council meetings, COD, etc.; blog facility / discussion corner for each Programme Area for staff (including field) and peer-to-peer group discussions; library services (availability of books – index, status of staff book loan facility, new arrivals, etc.)

- *Internet*: Dissemination of MSSRF activities and experience to the outside world
- *Village Resource Centre (VRC) and Village Knowledge Centre (VKC)*: Content collection / generation / dissemination and the availability of expertise of different institutions, including Grameen Gyan Abhiyan (GGA) partners. This is basically to strengthen the networking / partnerships of different stakeholders
- *Networking of Grameen Gyan Abhiyan partners*: Strengthening the alliance of the Rural Knowledge Movement

The main aim of the knowledge management system is to strengthen four linkages: lab-to-lab, lab-to-land, land-to-lab and land-to-land.

ICT-based curricula

Three ICT-based curricula — Microsoft Unlimited Potential Programme (MUPP), Computer-Aided Learning Programme (CALP) and Intel Learn Programme (ILP) — are regularly conducted for rural youth (both women and men) and children, through VRCs and VKCs. Under MUPP, 4294 rural communities covering 705 villages were trained in MS Office, Digital Media and Web Development. In the Computer-Aided Learning Programme, 7285 children (male: 4071; female: 3214) in 369 schools were taught arithmetic, English vocabulary, health aspects, flora and fauna of India, etc. In the Intel Learn Programme, 538 children (male: 278; female: 260) in 81 schools undertook projects on various developmental issues.

601.2 Village Resource Centres (VRCs) and Village Knowledge Centres (VKCs)

As on date, there are 8 Village Resource Centres in Tamil Nadu (Chidambaram, Nagapattinam, Thiruvaiyaru, Annavasal, Sempatti, Thangachimadam, Nagercoil and Poompuhar), one VRC in Puducherry (Pillayarkuppam), 4 VRCs in Vidarbha (Waifad, Yavatmal, Jasapur and Karda) and one in Orissa (Jeypore). MSSRF, Chennai acts as the expert / coordinating centre. All the VRCs are connected through ISRO uplink / downlink satellite to share the local-specific demand-driven content. Other than the above, there are two VRCs, one at the Community Agro-Biodiversity Centre, Kalpetta, Wayanad and the other at the Coastal Systems Research

Field Office, Kakinada, but these do not have satellite connectivity.

MSSRF had also organised VRC connectivity for partner organisations – ICRISAT and Aadarsha Mahila Sahakara Samaikya Ltd, Addakal, in Andhra Pradesh. The VRCs are now maintained by ICRISAT and have joined the Andhra Pradesh cluster. Two more organisations, Urmul Trust – Pokran and Vikas Sansthan, Jadhola, both in Rajasthan were similarly facilitated. MSSRF is now in the process of shifting these VRCs elsewhere. The VRC set up at Arya Vaidyashala, Kottakal, has been shifted to the MSSRF Fish for All Training Centre, Poompuhar, Tamil Nadu and the VRC at Maharogi Sewa Samiti, Anandwan, has been shifted to the MSSRF Karda VRC in Washim district, Maharashtra.

Apart from these VRCs, 101 VKCs have been set up in the rural areas of Tamil Nadu, Puducherry, Maharashtra (Vidarbha), Orissa (Koraput), Andhra Pradesh (Machilipatnam and Kakinada) and Kerala (Wayanad).

Users and dissemination

Since May 2008, 17,212 (male: 10,378 - 60.2 %; female: 6831 – 39.8 %) rural women and men have been to these VRCs and VKCs for personal contact and information. Similarly, 288 community newspaper issues (12 VRCs), published in three local languages, namely, Tamil, Marathi and Malayalam, reach 663 villages.

VRCs and VKCs disseminate information through multiple modes such as notice boards, pamphlets, public address systems (wired

/ wireless / GSM), community newspapers (vernacular), press releases, cable TV, audio / video conferencing through wireless, land-lines and mobile phones, SMS servers, internet radio servers, CUG, pen drives and CDs, through bus drivers, K YAN-PC (PC, projector, TV tuner card, DVD player, amplified speakers and modem), intranet websites, etc. Thus the coverage is quite substantial. Apart from VRC and VKC villages, 552 other villages are also covered.

Partners

NVA works with 112 boundary partners who have rendered support in the setting up of VKCs by providing rent-free space and electricity, helping to select village knowledge workers (KWs) to maintain the Centres, giving feedback regarding the training and awareness programmes, taking steps for sustainability of VKCs, monitoring day-to-day activities of VKCs and providing necessary inputs and support for strengthening VKC activities. The 389 strategic partners have supported VRC and VKC activities by providing locale-specific, demand-driven (information / knowledge) content as well as resource persons for conducting the training and awareness programmes, and by establishing linkages for addressing several developmental issues. 163 (male: 27; female: 136) knowledge workers are involved in the maintenance of the VKCs.

Digital library / audio programmes

A digital library containing photographs and videos taken during different occasions has been developed and properly indexed.

Several audio programmes — on new technologies in fishing, government schemes related to agriculture and fisheries, sustainable fishing practices, traditional fishing methods, fisheries-related micro enterprises, organic farming for sustainable agriculture, fodder crops cultivation and management, horticulture crops, soil health management, rainwater harvesting, climate change in the context of rural development, water management, health issues such as nutrition for adolescent girls and children, awareness of HIV/AIDS, and so on — are relayed through All India Radio and converted into Internet Radio Format.

Learning Modules / Power Points / Videos

Each VRC also produces several learning modules / Power Point presentations / videos on a great many topics, ranging from health, agriculture, computer trouble shooting and disseminating weather information, to micro enterprises like producing value-added marine products, livestock management, and the Right to Information Act and the National Rural Employment Guarantee Scheme.

Training and awareness

NVA conducted 393 training and awareness programmes, based on the needs of the communities, reaching out to 21,619 (male: 10, 317; female: 11, 302) participants. The training programmes covered a vast canvas and included awareness on entitlements, health issues, soil testing, hygiene and sanitation, micro enterprise activities, cultivation practices, pest management and livestock management.

Staff capacity building programmes

To strengthen the capacity of the NVA staff, several training programmes are regularly conducted on a variety of areas, such as decentralised data processing, content management systems, TrainNet software setting up and operations for ISRO VRC connectivity, creation and deployment system image using ghost software, monitoring and evaluation procedures, MUPP training, Statistical Package for the Social Sciences (SPSS) training, as well as on issues like gender training and community organisation and mobilisation.

Other activities to strengthen the sustainability of VRCs and VKCs

With regard to the reviewers' suggestion to give more focussed information on what minimum services should be provided by VKCs, based on local context and local culture, NVA has documented the need assessment of each of the VRC and VKC network villages, and listed the popular services as also the output and outcomes of the different arms of NVA.

To strengthen partnerships with different stakeholders, share VKC activities and identify expertise, NVA organises Knowledge Fairs at each of the VRCs. Meetings with boundary and strategic partners are also regularly arranged.

Village Knowledge Centre Management Committee

In all VKC villages, management committees have been set up to plan, organise, implement,

monitor and evaluate activities. The village knowledge centre management committees (VMC) comprise boundary partners of VKC, knowledge workers, traditional and innovative farmers, village health nurses, retired teachers, Anganwadi workers, potential and knowledgeable farmers, representatives from youth groups, SHG women representatives, etc.

Roles and responsibilities of the committee are as follows:

- Facilitating and guiding KWs and boundary partners to implement VKC activities in an effective manner
- Helping to identify the common issues and needs of the community
- Evolving strategies to sustain VKCs, like resource mobilisation, content generation, linkages, etc.
- Helping to establish partnership with different organisations, including government departments, for fulfilling appropriate content and capacity building needs
- Monitoring and evaluation of activities carried out by VKCs and suggesting improvements

Case Studies

Under the title *Human Dimensions of ICT in Rural India – Reflections by Rural Women and Men*, NVA has collected 314 case studies from the Annavasal VRC, Sempatti VRC, Thangachimadam VRC and Thiruvaiyaru VRC. The case studies describe how the

rural communities use different dissemination technologies to address issues in the areas of agriculture, animal husbandry, education, health, ICT-based curricula, micro enterprises and employment.

Monitoring and evaluation

A monitoring and evaluation framework, incorporating qualitative and quantitative indicators, and data collection and compilation plans, has been in use in VRCs and VKCs. However, it was observed that there were some differences in implementing the system from one VRC to another. Hence, a series of initiatives to streamline the implementation process as well as to institutionalise the system were taken up. Mr. Munish Kaushik of the Association for Stimulating Know How (ASK), a Delhi-based NGO, was hired as a consultant to assess the monitoring and evaluation practices of VRCs. Certain areas for improvement were identified, such as planning for targets to be reached, analysing and systematic reporting of data / information collected. A three-tier monitoring and reporting system was evolved in a participatory manner, covering different levels, i.e., village level VKCs, block / district VRCs and the Chennai headquarters at monthly, quarterly and half-yearly intervals, respectively. For operational purposes, the VRCs have been clustered as Coastal VRCs, Agriculture VRCs and Vidarbha VRCs.

To enhance staff capacity, hands-on training was provided at two locations to make it more region-specific. The staff of VRCs and VKCs in Tamil Nadu, Puducherry and Kerala attended

the training at Thangachimadam VRC, Rameswaram, from 27 to 30 April 2009. For the Vidarbha team, including staff from Orissa, the training was conducted from 24 to 27 May 2009 at Amaravathi. As a follow up of these training programmes, monthly monitoring at village level has already been initiated. The cluster-wise quarterly monitoring meetings will take place in the first week of July 2009 for the second quarter, April-June 2009; first week of October 2009, for the third quarter, July-September 2009; first week of January 2010, for the fourth quarter in 2009, October-December 2009; and first week of April 2010, for the first quarter in 2010, January-March.

The reporting system will capture both the status of the activities planned and implemented as well as results planned and achieved. More importantly, the internal and external reasons for non-accomplishment of activities and results will be analysed and incorporated. Strategies and decisions to overcome the gap will be evolved. Major challenges, learning and requirements will be ascertained. Quarterly reports of each VRC will be compiled and communicated to the head office. The head office will compile the reports and conduct half-yearly review meetings.

601.3 The Jamsetji Tata Training School (JTTS)

The Jamsetji Tata Training School (JTTS) has been established to provide necessary capacity building and to document the expertise of NVA Fellows. The process of identifying NVA Fellows has been through nominations from a

large number of institutions and organisations. Partners of NVA, alliances of Mission 2007, Grameen Gyan Abhiyan partners, academic and scientific institutions, government agencies, private sector companies as well as NGOs working in the field of sustainable development participate in a nation-wide search for such grass-root academicians. A special effort is made to establish contact with people living and working in farmers' distress hotspots, drought or flood-prone areas and geographically remote regions.

Through 21 regional committees in 18 states, a new set of 227 (male: 154; female: 73) NVA Fellows for 2008-2009 have been selected from 13 states and 1 Union Territory. These Fellows have been divided into three categories:

- 46 Knowledge Workers / Gyan Chaupal Operators / CICs Operators / e-Chaupal Operators / Entrepreneur Kiosk Operators / etc.
- 167 Social Workers
- 14 Holders of Traditional Knowledge / Innovative Practices

JTTS has developed tool kits and materials to be used by the Gyan Chaupal staff, as follows:

- *VKC Management Committee*: Definition of institution, aspects and approaches of development, need for institution building, types of institution building, appointment of suitable and appropriate members and staff, state-specific requirement of groups

taking into account local social and cultural ethos

- *Monitoring and Evaluation (M&E)*: Definition, purpose and key functions of monitoring and evaluation, difference and similarity between approaches, M&E plan and methods, data collection and analysis, internal and external M&E, Participatory M&E (PM&E), difference between conventional and PM&E, key challenges of, and approaches to, PM&E
- *Gender Analysis*: Gender introduction, difference between sex and gender, gender roles, gender needs, gender analysis, gender problems and issues, and women's empowerment
- *Development*: Introduction, aspects and pre-requisites, approaches to development, processes of development, stages of group development
- *Micro Planning*: Micro planning- introduction and need, process of preparing a plan, steps involved in micro planning, format of micro plans, tips for facilitators to conduct micro planning and golden rules before, during and after preparation of micro plans

Assessing the need for capacity building of CSC operators

JTTS is planning to conduct a capacity-building need assessment for operators of Community Service Centres with the help of the Association for Stimulating Know How (ASK). This was a suggestion that was mooted during the training programme on *Community*

Participation and Facilitation Skill in December 2008.

At the state level, the implementing agencies will form a team to look into the management, administration, coordination and reporting of CSCs. At district level, the block level staff (paid) or block level operators (volunteers) will be in charge. The village-level entrepreneur is the last link in the chain, responsible for the operation and management of CSCs at the panchayat level. Three types of service delivery models are envisaged — Government to Citizen (G to C), Business to Citizen (B to C) and Citizen to Citizen (C to C).

Based on the need assessment survey and extensive interactive discussions with block coordinators, block operators, village-level entrepreneurs and staff, it has been decided that:

- the village level entrepreneurs need training in community participation and facilitation skills (through master trainers) as well as skills required to carry out need assessments, practical exposure to different software, entrepreneurship development (building linkages and relationship with potential users), networking, communication skills, IPR and documentation skills.
- the block level operators need clarity to be developed on their roles and their responsibility in coordinating the activities of village-level entrepreneurs, and training in carrying out need assessments, hardware / software / internet usage as

well as entrepreneurship development and networking skills.

The Training School has conducted several workshops, including one on identifying and addressing the needs of the telecentre managers / staff. Another has been on

Module Development on Bringing Community Closer to the CSCs, at Jharkhand in April 2009. Currently, modules on Training on Needs Assessment for Business Development, and Training of Trainers are being developed.

601.4 Outreach, Extension and Partnership

Tele-ophthalmology

NVA provides tele-ophthalmology services to the rural communities through the Sankara Nethralaya Medical Research Foundation. The mobile eye-care unit has all the necessary ophthalmic equipment for diagnosis of eye problems. It is also equipped with spectacle-grinding and frame-fitting facilities, to provide spectacles on the spot at reasonable and affordable costs to the rural community. In the period from January 2008 to May 2009, 127 camps were conducted in the Vidarbha region, and 7010 patients (male: 4008; female: 3002) screened through the mobile tele-ophthalmology van (including some cases referred through video-conferencing). This service covers 151 villages in the districts of Wardha, Yavatmal, Amaravati and Washim. From April 2007 to July 2008, 190 camps were conducted in Tamil Nadu covering 178 villages and 14685 patients.

Soil and water testing mobile unit

NVA provides soil health advisories through the mobile soil and water testing unit, which is equipped to test different soil parameters in farmers' fields, identify deficiencies and provide remedial measures. During the period under reporting, the soil and water testing van covered 73 villages and provided the necessary advisories to the 729 farmers (soil samples). This programme is supported by IFFCO-IKSL.

Since May 2009, NVA has also been providing audio advisories (5 messages per day) to IKSL-AirTel Green SIM Card subscribers, as also detailed answers for the queries raised by farmers through the toll-free number.

Fisher Friend Mobile Application

The Fisher Friend Mobile Application (FFMA), launched in 2007, which disseminates relevant information to fisherfolk through mobile phones, is in the process of being expanded into the entire coastal areas of Tamil Nadu and Puducherry with the support of QUALCOMM, Astute Systems and Tata Teleservices. Vodafone Public Policy Services – 2009 have covered this project under the title "India: The Impact of Mobile Phones". In the pilot stage, NVA has distributed 36 mobile phones to 5 VRCs, namely, Puducherry, Chidambaram, Nagapattinam, Thangachimadam and Nagercoil. These mobile phones are used by fisherfolk on loan basis. The total number of users is 261 (Puducherry – 85, Chidambaram – 40, Nagapattinam – 75, Thangachimadam – 35, Nagercoil – 26). In each location 10

to 12 villages are covered. Feedback from fisherfolk is continuously incorporated into the system such as fisheries-related audio content, predictive wave height and weather information for five days in advance, etc. The development of a low cost mobile-enabled interactive Global Positioning System is on the cards.

Video-conferencing advisories

Several video-conferencing advisories were organised to strengthen outreach, extension and partnership. The video advisories were on orientation and guidelines to VRC staff on soil health issues, health and nutritional concerns, sustainable fishing practices, ornamental fish culture, fodder crops, livestock management, Panchayat Raj institutions, crop insurance schemes for Tamil Nadu farmers, and launching of the digital literacy course of MS Office, among others.

Rural Innovation Fund

Nine rural applications — Village Centric Management System, Patient Logistics Management for Hospitals, Knowledge Kit for Goat Keepers, Application Tool for Bone Mineral Density Scan Analysis, Participatory FisherFolk e-Commerce Project, School Management Software, e-Commerce Web Portal, Primary Eye Care through Rural Vision Centre, and Account Maintenance of Self-Help Groups — have been developed under the Rural Innovation Fund, which is monitored by the GGA secretariat. All the applications were evaluated by Tata Consultancy Services in September 2008, and by February 2009,

the applications were ready for trial runs in the field.

NVA will continue to focus on content and capacity building using different ICT and non-ICT tools for a revolution in rural knowledge.

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 done during the year have been reported under SPA 502.2.

Sub Programme Area 603

The Hindu Media Resource Centre

The Hindu Media Resource Centre (*THMRC*), established in 1998 with the endowment provided by *The Hindu* group of publications, is the primary interface wing of MSSRF. Multimedia options are used as tools to disseminate the research and developmental activities in diverse fields undertaken at the Foundation to a wide audience of media professionals, lay persons, social workers, activists and students, among others. *THMRC* adopts unique approaches to create a platform for interaction and gives scope for

in-depth presentations by scientists and other specialists.

The Centre was a joint recipient of the Jawaharlal Nehru Prize for the year 2008 – 2009, conferred by the Indian Science Congress Association for propagating science.

Events

During the year, *THMRC* organised 13 events, under various categories such as lectures, workshops, seminars and panel discussions, and so on. The **Table** in this section gives details of the various proceedings.

Public forums are generally organised as a panel discussion, during the visit of either experts or eminent scientists invited for a conference. To encourage and create the habit of active participation, colleges are networked. Following the public forum, the floor is open for an interactive session. Two such events were organised in August 2008 and March 2009.

One of the unique methods in *THMRC*'s repertoire of making the larger public aware of key issues of relevance is the Millennium Lecture by distinguished speakers. Both national and international speakers have enlightened our audience on a variety of topics. The audience is given the opportunity to interact with the guest speaker after the session. This year the Millennium Lectures were given by Dr. David Malone and Professor Bruce Alberts.

Public lectures on topics of specific interest are again very well received. This year it was on "Soil Health for Sustainable Food Security".

Seminars and panel discussions / dialogues are organised and designed to find place for developmental stories in the mainstream media.

Based on the theme of the workshop / lecture / seminar, target groups are invited to participate in the event, which is structured to give scope for interaction and dialogue. The consistent efforts in organising events have resulted in establishing a network among Arts, Science and Engineering colleges and media houses.

The media workshop provides a platform for the media to acquire credible and multifaceted information from experts through face-to-face interaction on contemporary themes. In October 2008, the workshop discussed the challenge of climate change on world food security. It was recorded and simultaneously uploaded on the website.

Press interactions are organised to sensitise media professionals to the various activities of MSSRF and media professionals are also taken on tour to VRCs, VKCs and other activity locations. Interaction between the media and the local community brings out new ideas and in-depth understanding of issues.

Ongoing services

Around 40 documentary films have been made on the work undertaken in the different programme areas. *Science and Tsunami-Two Years Later; Agricultural Biodiversity; Mangrove Restoration and Conservation; Power of Partnership* are some of the films that document the initiatives taken by 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 promote the conservation of traditional knowledge and diversity.

All the news features of interest that are published in newspapers / magazines are tracked and made available to the staff, web subscribers, media professionals and internal discussion groups. During the year, around 250 stories that were published, broadcast and telecast were tracked and preserved for research and documentation.

Activities conducted by THMRC in 2008-2009

| Date | Title |
|----------------------------------|--|
| Media Workshops | |
| 16 October 2008 | World Food Security: The Challenge of Climate Change and Bioenergy |
| Public Lectures | |
| 6 April 2009 | Soil Health for Sustainable Food Security: Issues and options by Dr. Amit Roy, President and CEO, IFDC |
| Press Interactions | |
| 29 July 2008 | Enhancing the Focus of Bioenergy Options |
| 23 September 2008 | PISCES: Meeting on the Perspectives on the Bioenergy Scenario |
| 28 March 2009 | Chennai Declaration: Release on Retaining Youth in Farming |
| 5 May 2009 | Launch of Ragimalt: A Nutritive Product from the Kolli Hills |
| Millennium Lectures | |
| 23 January 2009 | Political Economy of Food Security by Dr. David Malone, President of IDRC, Canada |
| 2 March 2009 | Science and the World's Future by Professor Bruce Alberts, Editor-in-Chief, Science |
| Seminars | |
| 15 September 2008 | Soil and Water Management under Changing Climate |
| 9 March 2009 | Fair Trade and Development: Tensions and Possibilities, by Darryl Reed and Ananya Mukherjee Reed, Associate Professors, York University, Toronto |
| Public Forums | |
| 8 August 2008 | Saving and Searching Genes in an Era of Climate Change |
| 15 March 2009 | Attracting and Retaining Youth in Agriculture |
| Panel Discussion/Dialogue | |
| 21 May 2009 | International Day on Biological Diversity: Invasive Alien Species – A Threat to Biodiversity |

Activities and partnership

News and feature stories are being regularly published in the national dailies, regional journals, and private television channels. Gyan Vani, a 53-week training programme was broadcast on community radio stations. THMRC has been partnering with other Programme Areas in creating voiced-over multimedia training packages for rural audiences. A data base of all media professionals is maintained and updated regularly. Press briefs for dissemination are prepared in English and Tamil on events organised.

Public relations

The Foundation receives national and international visitors from all walks of life including government officials, delegates, scientists, research scholars and students from schools and colleges. Last year's distinguished visitors included Her Royal Highness Maha Chakri Sirindhorn, Princess of Thailand; Mr David Mulford, US Ambassador to India; and Her Excellency Dr Michelle Jeria Bachelet, President of the Republic of Chile.

Sub Programme Area 604

Every Child a Scientist Programme – Chennai

The target groups in this programme to promote scientific curiosity and awareness, ongoing since August 2002, are students studying in Corporation schools who belong to the economically challenged sections of

society. With support and formal orders from the Commissioner of Education, the centre has established good rapport with Corporation Middle School headmasters, headmistresses, schoolteachers, orphanage schools and government-aided schools in the neighbouring Zones IX and X. This year, there are 5 additional schools from these zones.

The centre is equipped with 15 computers and multimedia learning material with new content creation every month. Batches of 20 students participate in the programme, which is usually for 15 days from 10.00 a.m. to 4.00 p.m. Each batch of students is exposed to a combination of lectures and some practical experiments. The interactive lectures are mostly on biotechnology, biodiversity, Information Technology, health and hygiene, global warming and greenhouse effects, wild life, value of medicinal plants, science facts, and also cover several other subjects. Students learn to use computers to understand the concepts, principles, and amazing facts in science and are also taught fundamental programmes like MS office. Apart from learning science through multimedia, the students also perform simple science experiments to learn how to observe, collect evidence, and draw conclusions; this helps the students sharpen their thinking about the ideas and events they encounter in everyday life.

This programme has stimulated curiosity among the students while giving them “an opportunity to master some of the concepts in science and environmental issues”, as mentioned by some of them in the feedback

forms. This reporting year, 450 students from the Corporation schools in zones IX and X, Advent Christian Schools in Velachery and Kanagam, and Seva Samajam Home at Pallipattu benefitted from the 'Every Child a Scientist' programme.

In February 2009, a one-day Science Camp was organised, with 120 students participating. This competition provided a wonderful opportunity for the students to apply their skills in essay writing, science quiz and theme drawing. They were encouraged by the prizes and certificates awarded.

A Canadian delegation of 100 navy men visited the Centre in November 2008 and as a goodwill gesture donated computers, binoculars and digital cameras to be used by the students.

Activities under the programme at the Wayanad and Jeypore Centres have been reported under SPA 202.2 and 203.5 respectively.

Touch and Smell Garden

This unique garden has been 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 schools for the Blind, National Institute for the Visually Handicapped (NIVH) (Dehradun and Chennai), visually impaired adults from various NGOs, and private and public school children come to this garden regularly. Recently children from the Clarke School for the Deaf and Mentally Retarded also visited the garden. The garden forms part of the curriculum for

all teachers passing out of NIVH, Chennai. The board in front of each plant helps the students learn its common name, botanical name and the family to which it belongs. A detailed description of all the plants in the Touch and Smell garden has been developed in the form of a small booklet and is available for visitors.

Sub Programme Area 605

Library and Information Services

The well organised library at MSSRF serves and fulfils the needs of the staff as well as research workers and students from other research and educational institutions.

The library has 16,890 books, of which 223 were added during the year. In addition, it also holds 330 CDs, 120 journals, 185 newspaper clippings for the year 2008-2009 and 2225 bound journals. Besides, the Library has a precious collection of technical reports, and annual reports from various institutions. The existing collection of books is further enriched regularly by the addition of more current, important scientific and technical books.

The library also provides digests of information downloaded from the Internet, and provides an alert service tailored to suit individual researchers in the Foundation.

The following Library services are provided to the end users:

- Current Awareness Services (CAS)

- Selective Dissemination of Information (SDI)
- Article Alert Services (AAS)
- Document Delivery
- Publication and Distribution Services
- Reprographic Services
- Newsletter Alert Services

The library provides assistance to research students working in the areas of Biotechnology, Agricultural Sciences and Life Sciences. During the year, it was accessed by around 650 students from universities across the country and abroad.

The web-based MSSRF Open Access Archives (OAA) has been initiated for the benefit of the global research community.

Sub Programme Area 606

Conferences and Workshops

International Forum on Conservation and Stewardship of Agricultural Biodiversity in an Era of Climate Change, 7 –9 August 2008, Chennai

An International Forum was recently organised to discuss and develop a strategy to conserve and mobilise agricultural biodiversity for mitigating and managing adverse changes in temperature, precipitation and sea-level rise leading to severe droughts, floods and coastal seawater intrusion. Forty-five people from seven countries participated in the Forum, representing UN agencies, international

organisations, national government institutions, non-government organisations, academics and civil society organisations.

After considering different aspects of dynamic conservation, improvement and sustainable and equitable use of agricultural biodiversity ranging from global to local issues, such as the challenge of mitigating the adverse impacts of climate change and the enormous socio-economic problem of how to attain food and rural livelihood security, the participants developed a Nine-Point Charter to mobilise the national and international community to enhance the resilience of small farmers and agricultural systems to the impacts of climate change through the stewardship and conservation of agricultural heritage systems and their biodiversity and genetic resources.

The nine-point charter provides a road map for fostering stewardship in the conservation, sustainable use and equitable sharing of the benefits of agricultural biodiversity in an era of climate change. This is the pathway towards ushering in an era of biohappiness, characterised by the sustainable use of bioresources for strengthening and safeguarding harmony between humanity and environment.

Consultative Workshop on Telecentre Networks for Strengthening the Capacity of Telecentre Managers, 1-2 October 2008, National Academy of Agricultural Sciences, New Delhi

The main objectives of this workshop were to bring together different telecentre stakeholders,

study different models of telecentres operating in India, understand the challenges facing them, and to identify key training needs of the telecentre managers and operators. More than 60 telecentre professionals, policymakers, academics, and development and curriculum experts attended. The workshop identified the elements of a good telecentre and the skills of operators and managers.

Telecentre managers / staff were of the view that training modules or training programmes in the areas of technical skills, soft skills, business skills, functional skills and fundamental skills would be needed to improve their capacity in the telecentre movement. Such skill programmes could be conducted in three different formats: certificate course for the beginners, appreciation course for the practitioners, and diploma course for career movement.

Fifth Convention of the National Alliance for Grameen Gyan Abhiyan (Rural Knowledge Movement), 3-5 October 2008, National Academy of Agricultural Sciences, New Delhi

The major theme of the convention was “Architecture of Inclusive Growth: Role of *Grameen Gyan Abhiyan*”. Such aspects as synergy between National Missions (Bharat Nirman, National Rural Employment Guarantee Scheme, Sarva Siksha Abhiyan, National Action Plan on Climate Change, etc.) and different ICT innovations and initiatives (Fisher Friend Mobile Application, m-Krishi, Rural Innovation Fund, Digital Green, IFFCO’s farmer mobile services, etc.), policy

frameworks and recommendations, global partnerships for GGA, etc. were discussed. During the convention different GGA partners displayed their rural communication and content products in the Technology Pavilion — Catalysing Innovations and Initiatives.

Workshop on Networking through e-Forum: Setting up and Moderation Procedures, 27-28 November 2008, MSSRF, Chennai

Dr Joe Thomas, editor, AIDS ASIA and AIDS INDIA e-forums (joe_thomas123@yahoo.com.au) acted as resource person for this workshop. Several aspects such as Internet Mediated Communication (IMC), structure of information of the telecentre practice, methods of assessing the quality and reliability of information, barriers to an effective IMC, setting up an e-Forum, how to moderate and run e-Forums, policies and code of conduct for e-Forums, etc., were elaborated and discussed. The workshop provided hands-on training in Yahoo Groups and Google Groups to the participants.

Officials from Central Institute of Brackishwater Aquaculture (CIBA), Centre for Sustainable Rural Development & Research Studies (CSR&RS) – VIT University, EMPOWER, ERP Foundation, Indian Institute of Technology-Madras, FAO, RIDE, Sree Jayajoti Cements Limited, Sundar Serendipity Foundation, Vadalur Knowledge Centre and Vidiyal participated in the workshop.

Workshop on Demonstration of Different Solar Applications: Tata BP Solar’s Arunodaya Programme, 6 December 2008,

MSSRF, Chennai and 15 December 2008, National Academy of Agricultural Sciences (NAAS), New Delhi

Power is a major problem in running Gyan Choupals, particularly in remote areas. In this scenario, the GGA secretariat organised a workshop to address the power issue in telecentres using alternative energy sources, particularly solar energy whose full potential remains largely unexploited. Both these Arunodaya workshops provided basic information on solar energy harnessing technologies and solar energy related products and applications such as solar panels, home lighting systems, power backup systems, and lanterns running on solar power, for generating livelihood opportunities to Gyan Choupal managers and GGA partners.

Representatives from Aravind Eye Hospital, Centre for Women's Development and Research, VIIT University, Community Action for Rural Development, Digital Equalizer Programme-American India Foundation, ERP Foundation, Gandhigram Trust, Humana People to People India, Dr MGR Engineering College, Nehru Bharathi Educational Institution, PEN INDIA, Polymers Educational Society, ROSI Foundation, Sankara Nethralaya Hospital, South Indian Federation of Fishermen Societies (SIFFS), Swayam Shikshan Prayog and Community Agro-Biodiversity Centre, MSSRF, Kalpetta participated in the Chennai workshop on 6 December 2008.

Executives from ADARASA, Ambuja Cement Foundation, Centre for Environment Education, CABI South Asia, Development

Communication India (DCI), Gram Seva Trust, and SDC participated in the New Delhi workshop on 15 December 2008.

Training Programme on Community Participation and Facilitation Skill, 18-20 December 2008, MSSRF, Chennai

Members from the Central Institute of Brackishwater Aquaculture, IL&FS, NABARD, Vaigai Trust, District Technology Society, Assam, Tharuni, Wainganga Samudaik Vikas Kendra, Family for Health, Rural Development Action Cell, Orissa, ERP Foundation, Hope Foundation, IEC Centre for Health and Family Welfare, Trivandrum, Human Relation Development Agency. Puducherry, National Project on Preventing Torture in India – People Watch, and RCDC. Orissa participated in the three-day training programme.

Aspects such as familiarisation with the concepts of community participation and facilitation, concept of development, comprehending the need and importance of community participation, knowing the different levels of participation and recognising the differences, obtaining knowledge on the advantages and challenges involved in community participation, description of the strategies to increase community participation, acquiring knowledge and skills for facilitation and realising the role of facilitator in the process of community participation were dealt with.

Important points and information were translated into Hindi, Tamil and Telugu, for better understanding by different levels of participants (telecentre managers, operators, NGOs and panchayat presidents).

On 20 December 2008, the participants spent one day in Kalitheerthalkuppam village, Puducherry for hands-on training.

Suggestions put forth by participants included the making of a documentary film along with a few case studies to emphasise community participation, conducting such workshops in regional languages, issuing appreciation certificates to participants, among other ideas.

Stakeholders' Meeting on Agrarian Crisis in Vidarbha, 10 February 2009, Central Institute of Cotton Research, Nagpur

The meeting organised in collaboration with the Sir Dorabji Tata Trust and the Tata Institute of Social Sciences (TISS), Mumbai, was chaired by Professor M.S. Swaminathan. There were about 60 participants in all, from TISS, Government of Maharashtra, various field-based NGOs, Sir Dorabji Tata Trust and Sir Ratan Tata Trust, universities, research institutes and media, as well as farmer leaders. There was wide-ranging discussion on the causes of the agrarian crisis and possible solutions. Professor Swaminathan emphasised that, while every help should be given to the women and children of farmers who have committed suicide, urgent attention to eliminating the causes which lead to farmers' suicides should not be lost sight of.

Four of the areas deserving integrated attention are:

- Conservation and enhancement of the ecological foundations essential for

sustainable agriculture, namely, soil, water, biodiversity, forests and climate

- Improving the productivity and profitability of small holdings
- Creation of opportunities for multiple livelihoods through attention to market-driven non-farm enterprises, including crop-livestock-fish integrated farming, agro-processing and value addition to primary produce
- Special attention to women and youth through *Mahila Kisan* and *Yuva Kisan* skill enhancement programmes and appropriate support systems

Professor Swaminathan called for the formation of a Coalition for Elimination of Agrarian Distress in Vidarbha, an informal network of all concerned, that could emerge as a platform for generating convergence and synergy among ongoing programmes and for filling critical gaps and connectivity in them.

Inter-disciplinary Dialogue on New Technologies: Attracting and Retaining Youth in Farming, 14-16 March 2009, Chennai

The Dialogue was attended by 72 participants representing a wide range of expertise in the field of youth involvement in agriculture. Several students doing post-graduate work in the areas of crop husbandry, animal and veterinary sciences, fisheries, forestry and home science participated. In addition, 4 experts from Transforum and Wageningen International, The Netherlands, as well as the

representative of FAO in India shared their experience.

Based on the discussions, it was felt that while developing strategies for youth involvement in agriculture, it will be necessary to tailor them for the following categories:

- Young women and men operating their own farm (farmers with large and small holdings will need different types of assistance)
- Youth educated in agriculture and allied enterprises, who will be able to organise advisory services as well as provide equipment and implements on a custom-hire basis
- Landless agriculture labour whose children can be trained to manage farms in land taken on lease and as well as in non-farm enterprises
- Educated youth from urban areas who are interested in promoting urban agriculture, including greenhouse horticulture
- Young farmers who will be able to operate Farm Schools in their farms in order to promote farmer-to-farmer learning

In-depth discussions and break-out groups made the Dialogue meaningful and enriching. The Dialogue concluded with the release of the Chennai Declaration which basically drove home the point that we should enable our farm youth, including farm graduates, to help in imparting an income and employment orientation to farming. Agriculture should yield more food, more jobs and more income if we are to achieve the goals of food and work for all.

Technology Day Celebrations, 11 May 2009, Chennai

Since 1998, Government of India has been celebrating 11 May as National Technology Day to commemorate India's technological achievements. It is also a day when laboratories are open to the public at large.

On 11 May 2009, NVA launched a Digital Literacy Campaign and a sample digital literacy presentation on "Hygienic Handling of Fish", with the help of Indiss Infotech Solutions Pvt. Ltd and the Rotary Club of Madras Midtown. This self e-learning module consists of basic concepts of computers, Microsoft Windows, Word, Excel, PowerPoint and the internet, with Tamil voice-over and script. The e-learning content has a SHOW mode using which the learners can play video-like simulations; with the GUIDE mode the learners can practise at their own pace, and the TEST mode allows the users to evaluate themselves by taking a self-test.

On the same day, NVA linked many VRCs (Pillayarkuppam, Chidambaram, Nagapattinam, Thiruvaiyaru, Annavasal, Sempatti, Thangachimadam and Nagercoil) to MSSRF, Chennai, through ISRO's video conferencing mode.

Indian Youth Science Congress, 5-7 June 2009, Rajiv Gandhi National Institute for Youth Development (RGNIYD), Sriperumbudur

The First Indian Youth Science Congress was held from 5-7 June 2009 at the Rajiv Gandhi National Institute for Youth Development,

Sriperumbudur, under the joint auspices of MSSRF, SRM University and RGNIYD. It was attended by over 500 delegates from all parts of the country. The focal theme for the Congress was “Youth and Shaping the Future of Innovations in Science for Societal Needs”.

The Congress dealt with the following major topics:

- Innovations in Science for Societal Needs
- Scientific Innovations in relation to Achieving the UN Millennium Development Goals
- Science for Human Security and Well-being
- Scientific Innovations in relation to the National Missions for Climate Change
- Inculcating Scientific Temper among Young Minds
- Young Scientists and Shaping India’s Future

In addition, a National Virtual Congress on *Celebrating Women’s Contributions to Safeguarding and Strengthening Ecological Security* was organised with the participation of women scientists and tribal and rural women from 9 different locations in the country. Also, 5 parallel sessions dealt with issues relating to biotechnology, climate change, biodiversity conservation, medical biotechnology, linking science and society, and entrepreneurship.

A unique feature of the Congress was the free and fearless interaction between young and

senior scientists. Young scientists brought fresh ideas and thoughts into the various discussions. Encouraged by the success of this Congress, the participants decided to form an Indian Youth Science Congress Association. This will be the umbrella organisation for coordinating an Annual or Biannual Youth Science Congress at different locations in the country.

National Virtual Congress on Celebrating Women’s Contributions to Safeguarding and Strengthening Ecological Security, First Indian Youth Science Congress, 6 June 2009, RGNIYD, Sriperumbudur

NVA regularly organises virtual congresses and virtual interactions between policy makers, experts and rural communities to deal with different common issues and bridge the prevailing gap between scientific ‘know how’ and field-level ‘do how’. In this Congress, women participants from Tamil Nadu, Kerala, Maharashtra, Rajasthan, Jharkand, West Bengal, Sikkim and Orissa shared their views on the role of women in the conservation of marine biodiversity, drought and salt tolerant rice varieties, water, mangroves, millets, etc., and exchanged practical experiences in adopting new technologies such as SRI, in promoting organic agriculture, in maintaining home gardens for nutritional security, in spreading scientific inputs to the tribal communities, etc. — all through the ISRO uplink / downlink satellite facility.

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analysis of soil actinomycetes against fungal pathogens." Poster presentation at International Colloquium on Emerging Biotechnologies in Agriculture, Animal Health and Productivity (ICEB'09). Alagappa University, Karaikudi. 23-27 February 2009.

Rajkumar, R. and P. Sivakumar. "Securing community involvement for CTLC sustainability." NGO Connection Day and UP-CTSP Partners Meet, organised by Smile Foundation and Microsoft. New Delhi. 26-27 May 2009.

Ramasubramanian, R. "Joint mangrove restoration in Andhra Pradesh, India." Scientific and Technical Symposium on Sustainable Mangrove Ecosystem Management, Mangroves for Future. Ranong, Thailand. 22-25 November 2008.

Satheesh, K., A.B. Rema Shree, N. Anil Kumar and Indira Balachandran. "Micromorphological studies using scanning electron microscope (SEM) for species de-limitation in the genus *Gymnema* occurring in Kerala." 21st Kerala Science Congress. Kollam. 28-31 January 2009.

Satyan, R. S., V.Sadhasivam, S. Rajalakshmi and Ajay Parida. "*In vitro* and field evaluation of phytochemicals from *Excoecaria agallocha* L. against *Helicoverpa armigera* Hubner." 2nd International Conference on Science and Technology (ICSTIE-08): Applications in Industry and Education. Universiti Teknologi Mara Pulau Pinang, Malaysia. 12-13 December 2008.

Selvam, V. "Participatory management of mangrove wetlands of India." National

Seminar on Mangroves: Biology, Utilisation and Conservation. St. Albert's College, Cochin. 6 November 2008.

Selvam, V. "Halophytes: a new source of crops." Interdisciplinary Dialogue on New Technologies: Attracting and Retaining Youth in Farming. MSSRF, Chennai. 14-16 March 2009.

Selvam, V. "Development of mangrove and non-mangrove bioshield." International Training Programme on Integrating Environmental Management in Disaster Risk Reduction, organised by SEEDS India. Chennai. 23-25 March 2009.

Senthilkumaran, S. "ICT initiatives for rural development: India experience." ASEAN Science and Technology Week 2008 – Techno Gabay Program (TGP). Pasay City, Philippines. 9-10 July 2008.

Senthilkumaran, S. "Community access to ICT skills, tools and infrastructure." Experts Consultative Meeting on Good Practices on Community Media, organised by UNESCO. Paris. 9-11 February 2009.

Shanthakumar, S.P., S. Malarvannan, V. R. Prabavathy and Sudha Nair. "Surveillance of insect pests of *Morinda citrifolia* L. and *Morinda tinctoria* in the west coast of Kerala." Poster session of the Third National Symposium, Noni Search. New Delhi. 18-19 October 2008.

Shanthakumar, S.P., S. Malarvannan, V.R. Prabavathy and Sudha Nair. "Efficacy of green muscardine fungus, *Metarhizium anisopliae* (Metsch.) against red flour beetle,

Tribolium castaneum (Herbst) (Tenebrionidae: Coleoptera).” National Symposium on Non-chemical Insect Pest Management. Entomology Research Institute, Loyola College, Chennai. 5-6 February 2009.

Sridhar, Ravichandran., N. Subathara, V.R. Prabavathy and Sudha Nair. “Isolation of antagonistic actinomycetes from evergreen forest soils of Kodaikanal and Kolli Hills, Tamil Nadu.” AMI Conference. South Campus, University of Delhi, Delhi. 18-20 November 2008.

Srinath, J. “Deeper water crisis, negligence in understanding and increasing water demand: Case of Ahmedabad and Chennai cities, India.” Session No.7, International Conference on World Water Week - 2008. Stockholm International Water Institute (SIWI), Stockholm. 16-22 August 2008.

Sujanapal, P. and N. Sasidharan. “The genus *Atuna* (Chrysobalanaceae) in peninsular India.” XVIIIth Annual Conference of Indian Association of Angiosperm Taxonomy and International Seminar on Multidisciplinary Approaches in Angiosperm Systematics. Kalyani University, West Bengal. 11-13 October 2008.

Swain, S and Akshya Kumar Panda. “Knowledge empowerment of tribal youth on forest-derived food.” Indian Youth Science Congress. RGINYD, Sriperumbudur. 5-7 June 2009.

Swain, S., Ram Ranjan Tripathy, Kartik Charan Lenka, and N. R. Parida. “Bioresource-based

entrepreneurship development for tribal youth.” Indian Youth Science Congress. RGINYD, Sriperumbudur. 5-7 June 2009.

Vedhamoorthy, R., R. Gopinath and R. V. Bhavani. “Ensuring food security among the marginalised section through Community Foodgrains Bank: An assessment survey in Kalrayan Hills, Tamil Nadu.” National Conference on Social Exclusion, Poverty and Livelihood of Marginalised Groups in India – Need for Effective Inclusive Strategies. Centre for Study of Social Exclusion and Inclusive Policy, Mangalore University, Mangalore. 24-25 September 2008.

Velvizhi, S. “Transforming rural communities through ICTs.” Sub Regional Workshop on Community e-Centres for Rural Development, organised by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). New Delhi. 16-18 April 2008.

Participation in Training Programmes / Workshops

Arivudai Nambi, A. Seminar on Kick the Habit! Towards a Low Carbon Economy. US Consulate General and Indo-American Chamber of Commerce – Tamil Nadu Branch, Chennai. 5 June 2008.

Arivudai Nambi, A. Workshop on Climate Change and Energy Project Funding. British High Commission, Chennai. 12 August 2008.

Arivudai Nambi, A. Parliamentary Standing Committee on Agriculture: Examination

of Impact of Global Climate Change on Agriculture Sector in India. Parliament House Annexe, New Delhi. 27 August 2008.

Arivudai Nambi, A. Fifth Meeting of the Expert Committee on Impacts of Climate Change. Government of India, Vigyan Bhavan Annexe, New Delhi. 10 September 2008.

Arivudai Nambi, A. Proposal for a Training Workshop on Climate Change Scenarios. Indian Institute of Tropical Management (IITM), Pune. 13-14 October 2008.

Arivudai Nambi, A. Inaugural Functions of the School and Book Exhibitions on Environment and Climate Change. Lalaji Memorial Omega International School, Chennai. 15 November 2008.

Arivudai Nambi, A. Seminar on 'Does More Information Help to make Better Decisions?' Results from National Health and Nutrition Survey in the US. Madras School of Economics, Chennai. 18 November 2008.

Arivudai Nambi, A. Seminar on Current Global Economic Crisis. Madras School of Economics, Chennai. 3 December 2008.

Arivudai Nambi, A. National Environmental Awareness Campaign 2008-2009 on Climate Change. CPR Foundation, Chennai. 9 December 2008.

Arivudai Nambi, A. Launch of Environmental Sustainability Index for Indian States and Online Interactive Portal. Centre for Development Finance, IFMR, Chennai. 18 December 2008.

Arivudai Nambi, A. Seminar for Thamizh Journalists on the Impact of Climate Change on Tamil Nadu – Focus on Agriculture and Health. Loyola College, Chennai. 19-20 December 2008.

Arivudai Nambi, A. Digital Video Conference on Role of Business Associations to Promote Corporate Social Responsibility Practices. US Consultant General & CII, Chennai. 12 January 2009.

Arivudai Nambi, A. University of Cambridge Alumni Events Meeting. Bangalore. 12-13 January 2009.

Arivudai Nambi, A. World Meteorological Day with the Theme — Weather, Climate and the Air We Breathe. Regional Meteorological Centre, Chennai. 23 March 2009.

Arivudai Nambi, A. Save Energy Now: Workshop on Industrial Technologies Program (ITP). USAID, CII and U S Department of Energy. Chennai. 31 March 2009.

Arivudai Nambi, A. Earth Day. Indo-American Chamber of Commerce and US Consulate General, Olympia Technology Park, Chennai. 23 April 2009.

Arivudai Nambi, A. Independent Expert Delegation Briefing on India and Climate Change. Centre for Social Markets (CSM), Washington DC. 18-19 May 2009.

Bhavani, R.V. Resource Group Meeting of the Food and Nutrition Community of UN Solution Exchange. New Delhi. 27 June 2008.

Bhavani, R.V. Programme Advisory Board Meeting of DFID's Research into Use Programme. Dar-es-Salaam, Tanzania. 26-27 October 2008.

Bhavani, R.V. Women's Leadership Forum. Harvard Business School, Boston, USA. 13-18 April 2009.

Chinnaraja, S. Workshop on Women in Aquaculture Development. Central Institute of Brackishwater Aquaculture, Chennai. 29-30 July 2008.

Gandhi, Tara. India Biodiversity Portal Inauguration. INFOSYS, Bangalore. 15 December 2008.

Gandhi, Tara. International Conference on Conservation in a Globalising India, organised by the Bombay Natural History Society. Indian Institute of Science, Bangalore. 16-19 February 2009.

Girija, D.S. Biodiversity Awareness Programme. National Green Corps. Thondamanatham Higher Secondary School, Puducherry. 22 July 2008.

Girigan, G. and P. Prajeesh. National Seminar on Intellectual Property Rights in the Knowledge Era. Kozhikode. 28-29 November 2008.

Gopinath, R. International Seminar on National Rural Employment Guarantee Act: Impacts and Implementation Experiences, organised by the Institute of Human Development. India International Centre, New Delhi. 16-17 September 2008.

Gopinath, R. National Seminar on Global Financial Crisis and Indian Peasant Position, organised by the All India Kisan Sabha. Kalpetta, Wayanad, Kerala. 31 January-1 February 2009.

Gopinath, R. Regional Consultation Meet on Strategies for Ensuring Food and Nutrition Security of Vulnerable Groups. NIPCCD, Bangalore, 4-6 February 2009.

Isaac Manuel, R. Panel Discussion on Green Genes and Global Warming in Commemoration of International Day for Biological Diversity. MSSRF, Chennai. 21 May 2008.

Isaac Manuel, R. Round Table on Combating Climate Change and Local Responses. CPR Foundation, Chennai. 5 June 2008.

Jeeva, R. Training on Business Planning for Livelihood Promotion. Centre for International Programme, Osmania University, Hyderabad. 23-26 March 2009.

Kishore Kumar, A.T. Training Programme on Processing and Preparation of Value-added Products from Finger Millet (Ragi). University of Agriculture Science, Bangalore. 26-28 June 2008.

Kumar, N. Training Programme on Food and Nutrition Security of Women and Children during Disasters. National Institute of Public Cooperation and Child Development, Southern Regional Centre, Bangalore. 25-29 August 2008.

Kumar, N. State-level Seminar on Usage and Importance of Medicinal Plants. Tamilnadu

Scientific Research Organization, Pudukkottai. 23 November 2008.

Mahapatra, Sushanta Kumar. Workshop on Economic Instruments of Water Resource Management - Recent Developments. Indira Gandhi Institute of Development Research, Mumbai. 9 January 2009.

Mahapatra, Sushanta Kumar. Launch Function for Prof. Malcolm Adiseshiah Centenary Celebration. Madras Institute of Development Studies, Chennai. 4 May 2009.

Mahapatra, Sushanta Kumar. Workshop on Financing for Rural Development. Madras Institute of Development Studies, Chennai. 4 May 2009.

Maity, B.K. Discussion on Challenges and Opportunities for Small and Marginal Farmers in National Trade Policy. NGO - CYSD. Bhubaneswar. 25 June 2008.

Maity, B.K. Training on Biovillage Activities in Organic Farming and Pest Management. NGO - SAMBANDH. Choudwar, Orissa. 12 July 2008.

Maity, B.K. 47th Foundation Day. OUAT, Bhubaneswar. 24 August 2008.

Maity, B.K., National Level Citizen's Summit Workshop on Budget Priorities and Human Developments. Utkal University & CYSD. Bhubaneswar. 29 November 2008.

Maity, B.K. Workshop on Participatory Guarantee Systems in Organic Farming. NGO – SAMBANDH. Bhubaneswar. 16-17 December 2008.

Manjula, M. Soybean cum Livestock-based Farming System Approach for Sustainable Work and Income Security in Vidarbha, organised by MSSRF and The Soybean Processors Association (SOPA). Nagpur. 10 May 2008.

Manjula, M. Statistics Day. The State Planning Commission. Madras University, Chennai. 30 June 2008.

Manjula, M. Workshop on Project Management Cycle. Community Agro-biodiversity Centre, MSSRF, Kalpetta, Wayanad. 15-18 November 2008.

Manjula, M. Workshop on Gender and Migration: Negotiation Rights: Women's Movement Perspective - Southern Region Consultation, organised by the Centre for Women's Development Studies, New Delhi. Chennai. 5-6 January 2009.

Manjula, M. National Seminar on the Global Economic Crisis and the Indian Peasantry. Waynad, Kerala. 31 January- 1 February 2009.

Manoj Kumar, T. and P.A.Rasheed. National Workshop on Current Trends and Future Prospects in Production and Export of Spice Crops with Special Reference to Chillies, organised by CSS- NHM Project Division of Horticulture, MARS University of Agricultural Sciences & Directorate of Arecanut and Spices Development, Ministry of Agriculture, Government of India, Calicut. UAS, Dharwad. 27-28 February 2009.

Mathew, Elsy. Training on Administration and Management. Karl Kubel Institute for Development Education, Coimbatore. 18-19 November 2008.

Mishra, Smita. Training Programme on Contemporary Approaches on Plant Genetic Resources, Conservation and Use: Adaptive Genetic Resource Management. Wageningen International, the Netherlands. 2-3 June 2008.

Mishra, Smita. Training Programme on Contemporary Approaches on Plant Genetic Resources, Conservation and Use: Genetic Resource Policies and Gene Bank Management. Wageningen International, the Netherlands. 16- 27 June 2008.

Nagaraja, C. Workshop on Women in Aquaculture Development. Central Institute of Brackishwater Aquaculture, Chennai. 29-30 July 2008.

Nayak, Geetishree. Training on Achieving Institutional Linkages for Sustainable Nutritional Security and Role of Women. National Institute of Public Cooperation and Child Development, CYSO, Bhubaneswar. 25 – 27 June 2008.

Nayak, T.R. Skill Training on Behaviour Change Communication in Nutrition and Health Education. NIPCCD, Bangalore. 9-13 June 2008.

Pakkialatchomy, P. Opinion Meeting on 33% Women Masooha Amendment. Animal Husbandry Department, Puducherry. 2 August 2008.

Panda, A.K. Training on Market and Marketing for Livelihood Practitioners. PARIVARTAN, New Delhi. 18-20 June 2008.

Parasuraman, N. Design and Development of Rural Transformation Centres in Nellore District, organised by Alterra Wageningen & Yes Bank. Nellore. 29-30 June 2009.

Parida, Ajay. Transforum International Advisory Committee Meeting. San Francisco, USA. 13-15 June 2008.

Parida, Ajay. Harvest Plus Project Management Committee Meeting. Cali, Colombia. 23-25 June 2008.

Parida, Ajay. Harvest Plus Project Management Committee Meeting. Washington DC, USA. 2-5 November 2008.

Parida, Ajay. Transforum International Advisory Committee Meeting. Amsterdam, the Netherlands. 24-25 November 2008.

Parida, Ajay. Capacity Building Workshop on Biotechnology. Colombo, Sri Lanka. 1-5 December 2008.

Parida, Ajay. Sustainable Michigan Summit. MSU, Leising, USA. 29 April -2 May 2009.

Parida, P.K., T. R. Nayak and A. Sahu. Training on Integrating Gender Perspectives in Health and Nutrition Programme. NIPCCD, Guwahati. 23-27 June 2008.

Pradhan, Shishusri. International Conference on Genomics and Society: Reinventing Life? University of Edinburgh, UK. 27 October 2008.

- Pradhan, Shishusri. Launch Function for Prof. Malcolm Adiseshiah Centenary Celebration. Madras Institute of Development Studies, Chennai. 4 May 2009.
- Pradhan, Shishusri. Workshop on Financing for Rural Development. Madras Institute of Development Studies, Chennai. 4 May 2009.
- Prajeesh, P. and T. Raveendran. Workshop on Geographical Indication. Regional Agricultural Research Station. Ambalavayal, Wayanad. 5 September 2008.
- Patnaik, Santosh Kumar. Sixth International Biofuels Conference. WINROCK International India, New Delhi. 4-5 March 2009.
- Rajkumar, R. Orientation Programme on Research Methodology to the Investigators. Centre for Science, Technology and Development Studies, Pudukkottai. 13 June 2009.
- Rajkumar, R. Adolescence Awareness Programme for Girls. ICDS, Pudukkottai. 20 June 2009.
- Ramasubramanian, R. Project Advisory Committee Meeting of Strengthening Resilience of Tsunami-affected Communities of India and Sri Lanka. International Development Research Center (IDRC), Colombo, Sri Lanka. 22-25 February 2009.
- Ratheesh Narayanan, M.K., P. Prajeesh, K.M. Manudev, P.M. Salim and K.Satheesh. ANNAM. The Agrobiodiversity Festival. Thiruvananthapuram. 26-30 December 2008.
- Rosario, D. Training Programme on Watershed Development. NABARD, Nilakottai. 2-3 February 2009.
- Rosario, D., G. Meenakshi, S.Sudarkodi and P.Santhamurthy. Training of Trainers on Planning and Implementation of SGSY at Puducherry. NIRD & DRDA. Puducherry. 16-21 March 2009.
- Sanjeev, R. Training Programme on Remote Sensing and GPS/GIS. MSSRF, Chennai. 10-11 February 2009.
- Senthilkumaran, S. 2nd Global Stakeholders Meeting for the Implementation of the Global Telecentre Academy. Fundacion Esplai, Barcelona, Spain. 22-24 September 2008.
- Senthilkumar,V. Training for Aqua Culturists and Food Technologists on Hazard Analysis Critical Control Points (HACCP). Central Institute of Brackishwater Aquaculture, Chennai. 14-17 May 2008.
- Senthilkumar,V. Workshop on Women in Aquaculture Development. Central Institute of Brackishwater Aquaculture, Chennai. 29-30 July 2008.
- Senthilkumar,V. AQUAINDIA – 2008. Society of Aquaculture Professionals, Chennai. 16-17 February 2009.
- Shaji, K.V. and Thejos Piyooosh. Course on Communication and Presentation. Karl Kubel Institute for Development Education, Coimbatore. 16-18 April 2009.

Sivakumar, M.N. State-level Seminar on Phytomedicines for Human Health Care. Pudukkottai. 23 November 2008.

Sivakumar, M.N. Biogas Production: From Kitchen Waste. NARDEP. Vivekananda Kendram, Kanniyakumari. 26 September 2008.

Sivakumar, M.N. International Conference on Invasive Plants in the Tropics, Ecology, Management and Livelihoods. ATREE, Bangalore. 5-6 January 2009.

Sivakumar, A. Training Course on Sustainable Fishing and Fisheries Conservation. Marine Product Export Development Authority - NETFISH. Cochin. 23-31 July 2008.

Sivakumar, A. Exchange Programme between India and Sri Lanka on Monitoring and Evaluation. Colombo, Sri Lanka. 16-20 December 2008.

Sivakumar, A. Project Advisory Committee Meeting of Strengthening Resilience of Tsunami-affected Communities of India and Sri Lanka. International Development Research Centre (IDRC), Colombo, Sri Lanka. 22-25 February 2009.

Sivanesan, V. Inter-Disciplinary Dialogue, New Technologies: Attracting and Retaining Youth in Farming. MSSRF, Chennai. 14-16 March 2009.

Sivanesan, V. A Two-Day Workshop for Young Professionals on Successful Grant Proposals in Agricultural Research, organised by Young Professionals for Agriculture Research and

Development, Germany, and Vellore Institute of Technology. Vellore. 9-10 June 2009.

Shyja, K.N. UGC Workshop on Information Literacy in Higher Education. Department of Library & Information Science, Farook College, Kozhikode. 14-15 January 2009.

Sudarkodi, S. Training Programme on Project Management and Implementation. CaBC, MSSRF, Wayanad. 15-18 November 2008.

Sujana, K.A. and K.M.Manudev. UGC-Sponsored Workshop on Statistical Analysis using Microsoft Excel. Post-graduate Department of Statistics, Madras Christian College, Chennai. 29 March 2009.

Sujanapal, P. Workshop on Taxonomy and Bioprospecting. University of Delhi. Delhi. 16-26 March 2009.

Swain, S. and S. S. Chaudhury. NAIP Interactive Training Workshop on Development of Winning Proposal. NAARM, Hyderabad, Andhra Pradesh. 10-12 September 2008.

Swain, S. International Training on Plant Genetic Resources and Seeds: Policies, Conservation and Use. Mekelle University, Mekelle, Ethiopia. 13-17 October 2008.

Swain, S. Third Workshop of the DBT Project on Quantitative Assessment & Mapping of Plant Resources of Eastern Ghats. S. K. University, Anantapur, Andhra Pradesh. 22-23 December 2008.

Swain, S. Training on Participatory Approaches in Conservation of Agrobiodiversity Conservation in Assam. Assam Agricultural

University, Jorhat, Assam. 24-27 February 2009.

Swain, S. Inception Workshop on Comparative Country Study on Community Empowerment in Conservation in situ of Plant Genetic Resources for Food and Agriculture. Wagenigen, the Netherlands. 16-18 March 2009.

Thiagarajane, A. R. Enhancing Livelihoods of Livestock-dependent Poor People through Increasing Availability of Fodder, organised by International Livestock Research Institute (ILRI) & International Crop Research Institute for Semi Arid Tropics (ICRISAT), Hyderabad. Rajiv Gandhi College of Veterinary and Animal Sciences, Puducherry. 9-10 January 2009.

Vedhamoorthy, A. An Orientation Programme on Food and Nutrition Security of Women and Children during Disasters. National Institute of Public Cooperation and Child Development (NIPCCD) – Southern Regional Centre. Bangalore. 25-29 August 2008.

Vedhamoorthy, A. Training on Project Cycle Management (PCM). Community Agro-biodiversity Centre, MSSRF, Wayanad. 15-18 November 2008.

Vedhamoorthy, A. Inter-Disciplinary Dialogue on New Technologies: Attracting and Retaining Youth in Farming. MSSRF, Chennai. 14-16 March 2009.

Velvizhi, S. Trainers Training Programme on Marine Conservation and Sustainable Fisheries, organised by Marine Product Export Development Authority & Central Marine Fisheries Research Institute. Cochin. 23-31 July 2008.

Awards/Honours

Bhavani, R.V. 2009. Member, Programme Advisory Committee of SEED Division, Department of Science & Technology, Government of India, New Delhi.

Prabavathy, V. R. 2009. Indian National Science Academy (INSA) Award. International Collaboration/Exchange Programme. University of Göttingen, Germany.

Sujanapal, P. 2009. Fast Track Fellowship for Young Scientists. Department of Science and Technology, Government of India, New Delhi.

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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List of Acronyms

| | |
|---------|--|
| AD | Additional Director |
| AqIFS | Aqua Integrated Farming System |
| APX | Ascorbate Peroxidase |
| ATMA | Agricultural Technology Management Agency |
| BARC | Bhabha Atomic Research Centre |
| BCC | Biodiversity Conservation Corps |
| BCUE | Biodiversity Conservation Utilization and Enhancement |
| BDO | Block Development Officer |
| BIWS | Bioindustrial Watershed |
| BPMPGRC | Biju Patnaik Medicinal Plants Garden and Research Centre |
| CABc | Community Agrobiodiversity Centre |
| CALP | Computer Aided Learning Programme |
| CASMB | Centre for Advanced Studies in Marine Biology |
| CBO | Community Based Organisation |
| CC | Concluding and Consolidation |
| CCD | Coast Conservation Department |
| CD | Community Development |
| COD | Council of Directors |
| CFB | Community Foodgrain Bank |
| CGB | Community Gene Bank |
| CIC | Community Information Centre |
| CIDA | Canadian International Development Agency |
| CLC | Community Learning Centre |
| CMFRI. | Central Marine Fisheries Research Institute |
| CSC | Community Service Centre |
| CSIR | Council for Scientific and Industrial Research |
| CST | Central Sales Tax |
| CTC | Community Training Centre |
| CTAB | Cetyl Trimethyl Ammonium Bromide |
| CUG | Closed User Group |
| CVC | Central Village Committee |
| DAE | Department of Atomic Energy |
| DBT | Department of Biotechnology |
| DFID | Department for Funding International Development |
| DGAT | Diacylglycerol Acyltransferase |

| | |
|---------|--|
| DIC | District Industry Centre |
| DM | Disaster Management |
| 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 |
| EC | Executive Committee |
| ECAS | Every Child A Scientist |
| ECT | Education Communication and Training |
| EST | Expressed Sequence Tag |
| FC | Farmers' Club |
| FFS | Farmers' Field School |
| FIG | Farmers' Interest Group |
| FS | Food Security |
| FYM | Farm Yard Manure |
| GAP | Good Agricultural Practice |
| GBPUAT | G.B. Pant University of Agricultural Sciences and Technology |
| GGA | Grameen Gyan Abhiyan |
| GIS | Geographical Information System |
| GSM | Global System Mobile Communication |
| GPS | Global Position System |
| HH | Household |
| ICDS | Integrated Child Development Services |
| 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 |
| ICM | Integrated Crop Management |
| IGA | Income Generating Activities |

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| IGCAR | Indira Gandhi Centre for Atomic Research |
| IGNOU | Indira Gandhi National Open University |
| ILP | Intel Learn Programme |
| IMFFS | Integrated Mangrove Fishery Farming System |
| IMO | Institute of Market Ecology |
| INM | Integrated Nutrient Management |
| IPM | Integrated Pest Management |
| IPR | Intellectual Property Rights |
| ISRO | Indian Space Research Organization |
| ISSR | Inter Simple Sequence Repeat |
| JTTS | Jamsetji Tata Training School |
| KHABCoFED | Kolli Hills Agrobiodiversity Conservers' Federation |
| KKNPP | Kudankulam Nuclear Power Plant |
| KKRGCS | Kalinga Kalajeera Rice Growers' Cooperative Society |
| KVK | Krishi Vigyan Kendra |
| KW | Knowledge Worker |
| LAMP | Large Area Multipurpose Society |
| LEISA | Low External Input Sustainable Agriculture |
| MANAGE | National Institute of Agricultural Extension Management |
| MDMS | Mid Day Meal Scheme |
| MDAR | Monodehydroascorbate Peroxidase |
| M&E | Monitoring and Evaluation |
| MEM | Micro Enterprise Marketplace |
| MIS | Management Information System |
| MOU | Memorandum of Understanding |
| MPA | Marine Protected Areas |
| MPEDA | Marine Products Export Development Authority |
| MPLAD | Member of Parliament Local Area Development |
| 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 |
| NBPGR | National Bureau of Plant Genetic Resources |
| NBRI | National Botanical Research Institute |
| NFHS | National Family Health Survey |

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|----------|---|
| NFM | National Floriculture Mission |
| NHM | National Horticulture Mission |
| NMPB | National Medicinal Plants Board |
| NMDS | Non-Metric Multidimensional Scaling |
| NREGS | National Rural Employment Guarantee Scheme |
| NUS | Neglected and Underutilised Species |
| NVA | National Virtual Academy |
| NET | National Eligibility Test |
| NIVH | National Institute for the Visually Handicapped |
| NPK | Nitrogen – Phosphorus – Potassium |
| NPL | Nicholas Piramal Limited |
| NTFP | Non-Timber Forest Produce |
| PAD | People's Action for Development |
| PAU | Punjab Agricultural University |
| PBR | People's Biodiversity Register |
| PCR | Polymerase Chain Reaction |
| PCS | Participatory Conservation System |
| PDKV | Panjabrao Deshmukh Krishi Vishwa Vidyalaya |
| PDS | Public Distribution System |
| PGUS | Panchabati Grama Unnayan Samiti |
| PISCES | Policy Innovation Systems for Clean Energy Security |
| PM&E | Participatory Monitoring and Evaluation |
| PMCA | Participatory Market Chain Analysis |
| PPB | Participatory Plant Breeding |
| PPV & FR | Protection of Plant Varieties and Farmers' Rights |
| PPV& FRA | Protection of Plant Varieties and Farmers' Rights Authority |
| PPSS | Praja Pragathi Seva Sangham |
| PRA | Participatory Rural Appraisal |
| PRI | Panchayat Raj Institution |
| RET | Rare, Endangered and Threatened |
| RNA | Ribonucleic Acid |
| RAPD | Random Amplified Polymorphic DNA |
| RSGA | Reddiyarchatram Seed Growers' Association |
| RGNIYD | Rajiv Gandhi National Institute of Youth Development |
| RTI | Right to Information |
| SBI | State Bank of India |

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|---------|--|
| SDC | Swiss Agency for Development and Cooperation |
| SFC | Smart Farmers' Club |
| SHG | Self-Help Group |
| SRI | System of Rice Intensification |
| SSA | Sarva Shiksha Abhiyan |
| SSI | Small Scale Industry |
| SSR | Simple Sequence Repeat |
| S&T | Science and Technology |
| TANUVAS | Tamil Nadu Veterinary and Animal Sciences University |
| TBGRI | Tropical Botanic Garden and Research Institute |
| TERI | The Energy Research Institute |
| THMRC | <i>The Hindu</i> Media Resource Centre |
| TIN | Tax Payer's Identification Number |
| TNAU | Tamil Nadu Agricultural University |
| UAS | University of Agricultural Sciences |
| UAS-B | University of Agricultural Sciences, Bengaluru |
| UAS-D | University of Agricultural Sciences, Dharwad |
| UNICEF | United Nations International Children's Emergency Fund |
| UTR | Untranslated Region |
| VAM | Vesicular Arbuscular Mycorrhiza |
| V&A | Vulnerability and Assessment |
| VC | Village Committee |
| VDC | Village Development Committee |
| VDMC | Village Development and Management Council |
| VIC | Village Information Centre |
| VKC | Village Knowledge Centre |
| VMRC | Village Millet Resource Centre |
| VRC | Village Resource Centre |
| VS | Village Seed Bank |
| VSGB | Village Seed Gene Bank |
| VWS | Village Welfare Society |
| WFP | World Food Programme |
| WSHG | Women's Self-Help Group |
| ZnF | Zinc Finger |

M.S.SWAMINATHAN RESEARCH FOUNDATION

NO.6, THIRD CROSS ROAD, TARAMANI INSTITUTIONAL AREA, TARAMANI, CHENNAI 600 113

BALANCE SHEET AS ON 31 MARCH 2009

| Particulars | As on | As on | As on | As on |
|--|----------------|-----------------------|----------------|-----------------------|
| | 31/03/2009 | 31/03/2009 | 31/03/2008 | 31/03/2008 |
| | Rs. | Rs. | Rs. | Rs. |
| I SOURCES OF FUNDS: | | | | |
| CORPUS AND GENERAL FUNDS | | 277,595,335.97 | | 259,056,624.20 |
| ENDOWMENT FUNDS | | 403,637,948.26 | | 335,934,000.00 |
| PROJECT FUND | | 83,738,017.25 | | 142,110,358.51 |
| TOTAL | | 764,971,301.48 | | 737,100,982.71 |
| II APPLICATION OF FUNDS: | | | | |
| 1 FIXED ASSETS | | 65,049,368.80 | | 61,187,221.10 |
| 2 INVESTMENTS | | | | |
| a) LONG TERM | 144,085,275.00 | | 140,264,000.00 | |
| b) ENDOWMENT INVESTMENT | 401,270,000.00 | | 345,550,000.00 | |
| c) TERM DEPOSITS | 45,850,000.00 | 591,205,275.00 | 73,069,466.00 | 558,883,466.00 |
| 3 CURRENT ASSETS, LOANS AND ADVANCES | | | | |
| a) Current Assets | | | | |
| (i) Cash and Bank balances | 98,069,261.20 | | 89,931,257.10 | |
| (ii) Advances and deposits | 28,549,068.43 | | 28,790,776.51 | |
| | 126,618,329.63 | | 118,722,033.61 | |
| Less: Current Liabilities and Provisions | 17,901,671.95 | | 1,691,738.00 | |
| NET CURRENT ASSETS | | 108,716,657.68 | | 117,030,295.61 |
| TOTAL | | 764,971,301.48 | | 737,100,982.71 |

N C RajaGopal & Co
Chartered Accountants

SD/-
M.S.Swaminathan
Chairman

SD/-
V.Namasivayam
Trustee

SD/-
Sumithra Ravichandran
Partner

M.S.SWAMINATHAN RESEARCH FOUNDATION

NO.6, THIRD CROSS ROAD, TARAMANI INSTITUTIONAL AREA, TARAMANI, CHENNAI 600 113

GENERAL INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 MARCH 2009

| PARTICULARS | 2008-09 Rs. | 2007-08 Rs. |
|--|--------------------|--------------------|
| A INCOME: | | |
| INTEREST INCOME | 46,027,169 | 42,943,668 |
| DONATIONS AND OVERHEAD RECOVERIES | 22,725,353 | 7,765,870 |
| PROJECT RECEIPTS ** | 277,365,171 | 306,413,063 |
| TOTAL (A) | 346,117,693 | 357,122,601 |
| B EXPENDITURE: | | |
| INFRASTRUCTURE AND ADMINISTRATIVE EXPENSES | 18,853,923 | 15,084,726 |
| ENDOWMENT EXPENSES | 27,218,398 | 27,379,835 |
| PROJECT EXPENSES | 193,627,153 | 164,302,703 |
| DEPRECIATION | 6,117,282 | 6,139,196 |
| TOTAL (B) | 245,816,756 | 212,906,459 |
| C SURPLUS /(DEFICIT) | 100,300,937 | 144,216,141 |

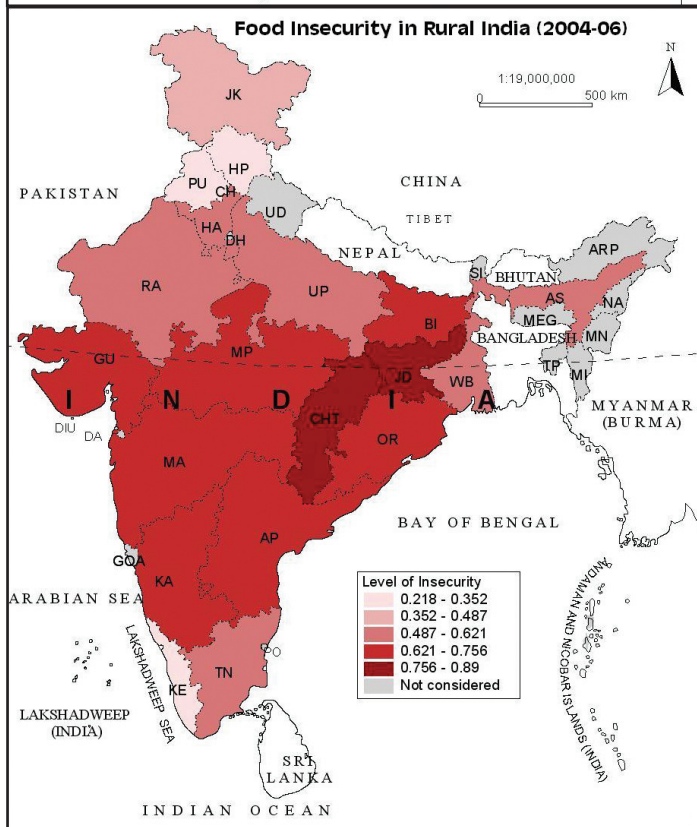
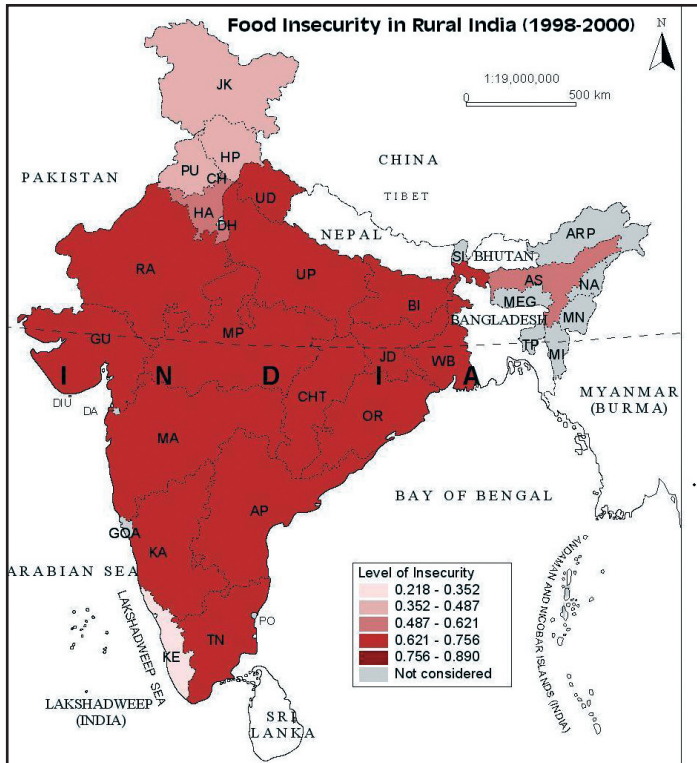
** Project Receipts includes corresponding receipts for the previous years

N C RajaGopal & Co
Chartered Accountants

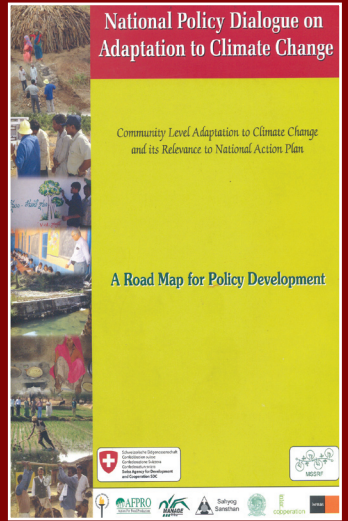
SD/-
M.S.Swaminathan
Chairman

SD/-
V.Namasivayam
Trustee

SD/-
Sumithra Ravichandran
Partner



Maps of Food Insecurity in Rural India at two time points



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