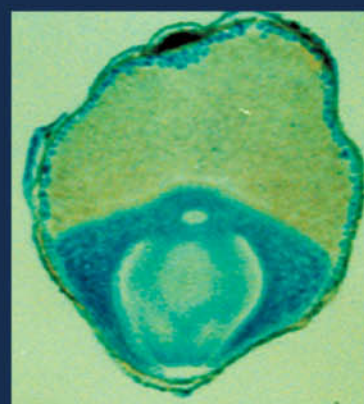




2005-2006 SIXTEENTH ANNUAL REPORT

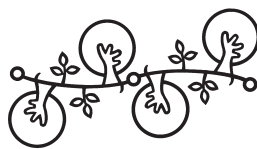
CENTRE FOR RESEARCH ON
SUSTAINABLE AGRICULTURAL
AND RURAL DEVELOPMENT,
CHENNAI

M. S. SWAMINATHAN RESEARCH FOUNDATION



Sixteenth Annual Report

2005-2006



M S Swaminathan Research Foundation

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and Rural Development
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Contents

Chairman’s Introduction	004
<i>Programme Area 100</i>	
Coastal Systems Research	021
<i>Programme Area 200</i>	
Biotechnology	040
<i>Programme Area 300</i>	
Biodiversity	060
<i>Programme Area 400</i>	
Ecotechnology	074
<i>Programme Area 500</i>	
Food Security	099
<i>Programme Area 600</i>	
Education, Communication, Training and Capacity Building	110
<i>Programme Area 700</i>	
Special Projects	136
Publications	150
About the Foundation	160
The Foundation Staff	165
List of Donors	176
Sources of Project Support	179
List of Acronyms	183

Chairman's Introduction

The M S Swaminathan Research Foundation started its work 16 years ago in the thematic areas of coastal systems, biotechnology, biodiversity, ecotechnology, food security and information, education and communication. The approach was based on strategic and participatory research, capacity building, networking and partnership building, based on the principles of social inclusion in access to technologies which help to enhance income and environment. Research and outreach strategies were devised to bridge the rich-poor and gender divides in the areas of information, knowledge and skill empowerment.

Details of the work done during the agricultural year of 2005-06 (ie, 1 June, 2005 to 31 May 2006) are given in this Report. Hence, only a few highlights of the progress made during the year in shaping MSSRF's future directions are mentioned in this introduction.

Strategic Planning

The work carried out by MSSRF's scientists and scholars during 1990-2006 has validated the following assumptions, which led to the choice of programme priorities in 1989-90.

- The poor are poor as they have no physical assets such as land and, livestock, fishponds, and often, education. They hence remain, as unskilled labour and women labour invariably do not get even the prescribed minimum wage. By compulsion

of household economic circumstances, they remain under-nourished. The feminization of poverty and hunger as well as diseases like HIV/AIDS are facts of life and should be confronted with an appropriate response.

- If technology has been a major factor so far in the rich-poor and north-south economic divides, we should now enlist technology as an ally in the movement for gender and social equity. Appropriate technologies which can help to reduce drudgery and add economic value to the time and labour of the poor need to be identified, tested and popularized. While the redistribution of land, livestock and other productive assets comes under the political domain, asset building in the form of market-driven skills is within the competence of technically oriented NGOs. The aims should be to bridge the gap between scientific know-how and field level do-how, and bring about a paradigm shift from unskilled to skilled work in the case of assetless poor.
- When cooperation fails, the only hope of rural India for economic and social progress vanishes. Hence, the organization of SHGs or other groups for technological empowerment and skill building should be based on the principle of social inclusion and a "win-win" situation for all, irrespective of religion, caste, class or gender.

- Even in institutions devoted primarily to the cause of technology incubation and dissemination, there is need for a research back-up, both in social and bio-physical sciences. To quote the Royal Commission on Agriculture (1925), "However efficient the organization which is built up for agricultural demonstration and extension may be, unless that organization is based on the solid foundation provided by research, it is merely a house built on sand". It was therefore decided in 1990, that MSSRF should concentrate on strategic and anticipatory research in relation to its programme in coastal areas, and participatory research in relation to its work with tribal and rural families in the conservation and sustainable and equitable use of biodiversity.

'Science for an Inclusive Society' thus became the motto of MSSRF. Obviously, the concept of society should begin with children and women, and hence MSSRF integrated early childhood care and education services and the gender perspective in its programmes from its early beginning at a rented house in Kotturpuram. Economic replicability, environmental sustainability and social and gender equity became the three pillars of MSSRF's programmes. Thus began the pro-nature, pro-poor, pro-women and pro-sustainable livelihoods paradigm of technology development and dissemination. Since inadequate purchasing power is the most important cause of under- and mal-nutrition at the household level, the emphasis was on

job-led economic growth. This resulted in ecotechnologies, based on five E's (Ecology, Economics, Equity, Employment and Energy) leading to the establishment of the JRD Tata Ecotechnology Centre with the generous support of Tata Trusts. The emphasis on food and nutrition security and gender mainstreaming led to the establishment of the B V Rao Centre for Sustainable Food Security, the Uttara Devi Centre for Gender and Development, and later the Ford Chair on Women and Food Security and the MSSRF-WFP Technical Resource Centre on Food Security. The B R Barwale Chair in the area of biodiversity provided an opportunity to work on the rights of farmers and primary conservers engaged in the conservation of plant genetic resources. The principles of social inclusion in access to technologies, both in gender and economic terms, as well as the conservation and enhancement of nature and natural resources became sacred to MSSRF's approach to harnessing science and technology for fostering agrarian and rural prosperity.

Among technologies, it was decided on the basis of inter-disciplinary dialogues to accord priority to Biotechnology, Information Communication Technologies (ICT), Space Technologies (Remote Sensing, GIS), Nuclear Technologies (mutants of groundnut and pulses) and Ecotechnologies (i.e. appropriate blend of traditional wisdom and ecological prudence with frontier technologies). Technology blending is the pathway to integrate the classic and contemporary in scientific strategies. A great challenge in rural

India is the development of management tools, which can help to confer the power and economy of scale to farm families with small land holdings and to landless labour families. This led to institutional devices like the Bio-village, Village Knowledge Centres (VKC), Sustainable Self-Help Groups (SSHG) and Community Food and Water Security systems designed to convert concepts into field level accomplishments. Rural Knowledge Connectivity was considered an essential prerequisite for rural upliftment. This led to the establishment of the Jamsetji Tata National Virtual Academy for Rural Prosperity and the organization of the National Alliance for *Mission 2007: Every Village a Knowledge Centre*. At the request of MSSRF and the National Alliance, the Government of India has included knowledge connectivity as a component of *Bharat Nirman or a New Deal for Rural India*.

As MSSRF's human-centred development programmes and pro-poor and pro-nature biotechnology and ICT initiatives made progress, it became evident that the basic problems of rural societies like poverty-induced under-nutrition, gender discrimination, and income, work and health insecurity will have to be addressed, if the ultimate goal of hunger and poverty-free villages is to be achieved. This led to the launch of *Mission 2007: A Hunger-free India* initiative. Thus, MSSRF's capacity to address the issues of nutrition and education was built-up.

Most external reviews carried out by the Sir Dorabji Tata Trust, UNDP, SDC, IDRC, CIDA,

India-Canada Environment Facility and other donor agencies have been in general complimentary, but have invariably emphasized the need for greater inter-programme cooperation within MSSRF. Also, the original idea of MSSRF developing into an NGO's NGO, i.e. a resource centre for NGOs who are dedicated to the cause of serving society, but are weak in science, is yet to fructify. Measurement tools to quantify the impact of the work done on the economic and nutritional well being of rural families are yet to be formalized. An in-house strategic planning exercise, titled, "Re-engineering of MSSRF" was therefore undertaken during 2005-06. This exercise led to the concept of Pan-MSSRF programmes, which can help to provide a horizontal dimension to vertically structured activities.

The first of the PAN-MSSRF projects is being initiated during 2006 with generous support from SDC. It will bring together in a mutually reinforcing manner work relating to food, livelihood and ecological security in the Koraput region of Orissa, the Kolli Hills area of Tamil Nadu and the Wayanad region of Kerala. The Village Knowledge Centre or *Gyan Chaupaul* programme will provide the ICT infrastructure needed for the knowledge and skill empowerment of the rural and tribal families. Based on benchmark surveys, the impact of the programme will be measured in relation to the UN Millennium Development Goals for sustainable human security. The PAN-MSSRF approach will also be extended to other areas in due course. During the year,

an internal planning exercise was held with all professional staff to facilitate greater inter-disciplinary interaction, inter-programme and inter-personal communication and collaboration needed to make the approach a reality.

Integrated Coastal Zone Management (ICZM)

The tsunami of 26 December, 2004 underlined the urgency of introducing an integrated development-cum-disaster management programme in coastal areas comprising Bio-shields, Bio-villages and Village Knowledge Centres. Seawater farming and development and cultivation of salt-tolerant crops will also have to be promoted. In the light of these considerations the following core programmes have been identified for inter-disciplinary action research.

Resource Centre for Integrated Coastal Zone Management

This Resource Centre will assist the Government, civil society organizations and Panchayati Raj Institutions in building capacity for conserving and rehabilitating degraded mangrove ecosystems, developing non-mangrove bioshields comprising plantations of casuarina, cashewnut and appropriate halophytes, supporting agronomic rehabilitation of farm fields subjected to sea-water inundation, and managing of disasters.

The Resource Centre will assist local communities and Forest and Fisheries Department officials to work together in Joint Mangrove Forest Management. In addition, it will host in collaboration with the JRD Tata

Ecotechnology Centre and the Jamsetji Tata National Virtual Academy, a "Fish for All" Training Centre as well as a Village Resource Centre, which can provide up-to-date information on wave heights, location of fish, shoals and potential disasters like cyclones, sea water ingress and tsunami. The "Fish for All" Training Centre will function like a Krishi Vigyan Kendra in terms of pedagogic methodology (i.e., learning by doing) and will provide training in all aspects of fish capture, culture, consumption and commerce. The "Fish for All" Training Centre will serve as a Trainers' Training Centre and will have a "Fish Pre-Processing Centre" attached to it.

Mangrove Wetlands Research

The Coastal System Research (CSR) carried out during the last 15 years has provided the scientific basis needed for fostering a community-centred approach to conserve, restore, and sustain mangrove wetlands. All mangrove wetlands, irrespective of ownership, along the coasts of Tamil Nadu, Pondicherry, Andhra Pradesh and Orissa are receiving attention. Community restoration techniques, such as raising community nurseries, have been standardized. Systems of raising agro-aqua farms through integrated production of prawns and fish and the raising of mangrove plantations are currently under development. Monitoring of the status of mangrove wetlands through remote sensing is an ongoing activity. A quarterly 'Mangrove Watch' newsletter is available on the MSSRF website. Mangrove Atlases have already been published for Tamil Nadu, Andhra Pradesh and Orissa.

Generating opportunities for sustainable livelihoods

Population pressure is increasing in coastal areas. Hotels and resorts to promote tourism are also growing in numbers. Ultimately, the fate of coastal ecology will depend upon the opportunities created for sustainable livelihoods for the fisher, farm and non-farm communities living within 10 kms of the shoreline. Coastal Bio-villages, will be promoted on the basis of the experience gained in the Gulf of Mannar, Pondicherry, Pichavaram and Muthupet areas, as well as in Andhra Pradesh, Orissa and West Bengal. Using the Bio-village Tool-Kit already prepared, capacity building programmes will be organized at the Resource Centre for ICZM for NGOs, Panchayat leaders and CBOs to address concurrently issues relating to natural resources conservation and enhancement, and the generation of new market-driven enterprises. Spearhead teams capable of preparing business plans in consultation with rural families will be organized before introducing the bio-village paradigm of sustainable human development. A Gender Code will be introduced in the Bio-village programme, coupled with a gender audit procedure for assessing the impact of the programme on women and men. The Bio-village activities will be managed by a local Bio-village Council comprising equal numbers of women and men on the model already in operation in Pondicherry. The council will have a few representatives of relevant scientific and financial institutions.

Thus, the ICZM programme will give specific scientific attention to the conservation and regeneration of mangrove wetlands and to the strengthening of the work and income security of coastal communities through market-driven eco-enterprises including pro-poor eco-tourism like the proposed Bird Park in the Gulf of Mannar area. Initiatives like the artificial coral reef to rejuvenate fisheries will be replicated, where appropriate.

Biotechnology to Shape our Agricultural Future

The scientifically innovative and socially relevant work carried out during the last 13 years by the young Biotechnology team of staff and scholars has led to MSSRF being designated as a “Centre of Excellence” by the Department of Biotechnology. In the area of biotechnology, MSSRF’s policy is to bring about appropriate combinations of Mendelian, Molecular and Participatory Breeding. The areas chosen for attention 13 years ago, namely tolerance to salinity and drought, have gained further in relevance since the prospects of sea-level rise and reduced precipitation envisaged in 1990 are proving to be real. The progress made in the salinity and drought tolerance areas are given in the Report.

Construction of Genetic Shields for Sustainable Food Security

Salinity Tolerance: This work, involving the transfer of sea water tolerant genes from *Avicennia marina* to rice and other crops of importance to coastal agriculture will be taken

to its logical conclusions in partnership, with farm families resulting in location-specific and agronomically superior strains. Defensive patenting is being done, so that the critical genes are not exploited by commercial organizations for private profit.

Drought Tolerance: The work in progress with *Prosopis juliflora* will be intensified with such additional inputs of human and other resources that may be needed. Transgenic material for stress tolerance will be developed in crops of importance such as pulses and oilseeds in dry-farming areas.

Hidden Hunger: Genetic enhancement of micronutrient content with particular reference to iron will be combined at the stage of field intervention with biofortification and cultivation and consumption of vegetables and fruits. Finding horticultural remedies to nutritional maladies will be an important component of the strategy to eradicate hidden hunger.

Resource Centre for Genetic Literacy

This programme includes the formation of *Genome Clubs* in rural and urban schools. Panchayat level *Rural Science Managers* (one woman and one male member of each Panchayat) will be trained in the handling of BT, ICT and other frontier technologies by organizing 'Trainers' training programmes. The *Every Child a Scientist* programme also lays stress on genetic literacy including the importance of genetic resources conservation. Suitable educational material on the social risks and social benefits involved in the

cultivation of GM crops will be prepared for dissemination through the Village Knowledge Centres.

Thus, the long-term programmes in the area of Biotechnology in an era of climate change and sea level rise, will relate to safeguarding food and nutritional security through appropriate genetic shields involving novel genetic combinations, and to promoting a genetic literacy movement both in rural schools and Panchayats. Other programmes like bio-prospecting, bio-remediation and micro-propagation also made good progress during the year. In addition, the production and demonstration of high quality planting material of *Jatropha Curcas* is paving the way for launching science-based bio-fuel programmes. The Lichen group made excellent progress in the study of lichen diversity and distribution pattern and has identified several lichen species which can serve as bioindicators to monitor environmental pollution. Novel salt tolerant beneficial bacterial species have been identified and developed into potential biological softwares for promoting sustainable good agriculture practices in the study areas.

Biodiversity and Food, Nutrition and Livelihood Security

Biodiversity conservation, sustainable use and equitable sharing of benefits have been major areas of research from the very inception of MSSRF. The significant contributions made so far have been at the policy level. The initial drafts of both the Protection of Plant Varieties and Farmers' Rights Act and the Biodiversity Act were prepared at MSSRF. The very concept

that India should have an integrated legislation to cover both breeders' and farmers' rights was proposed by MSSRF. Getting an integrated Act covering both farmers' and breeders' rights has been a major policy achievement, since there is no parallel for this in the world.

At the field level, the major contributions have been the following:

- Development of an integrated gene management strategy, consisting of *in-situ*, *ex-situ* and community conservation (*in-situ* on-farm and *ex-situ* on-farm, eg Sacred Groves)
- Promotion of a participatory method of biosphere management through the establishment of a Biosphere Trust (eg. Gulf of Mannar Biosphere Trust)
- Revitalization of community conservation traditions through the field gene bank, seed bank and grain bank (conservation – cultivation – consumption – commerce chain)
- Generation of an economic stake in conservation through participatory breeding and linkage with markets
- Enlarging the food security basket by including in the diet under-utilized crops like millets, tubers, grain legumes and leafy vegetables (the 2005 Chennai Declaration on under-utilized crops captures the important points relating to 'orphan' but life-saving and life-giving crops)

The infrastructure of the Community Agrobiodiversity Centre at Kalpetta is being

strengthened, following the donation to MSSRF of about 11 acres of prime farm land by Prof M S Swaminathan, Mina, Soumya, Madhura and Nitya Swaminathan. At Koraput, a new eco-friendly building is being constructed in land kindly made available by the Orissa Government on a 99-year lease. The building for the Biju Patnaik Medicinal Plants Garden Research Centre incorporates rainwater harvesting and solar energy utilization procedures. "A Genetic Paradise Park" depicting the bioresources conservation ethos and heritage of tribal communities like Paroja, Bonda, Kandha, Kutia Kandha, Dongaria Kandha, Koya, Saura, Langia Saura, Gadaba, Bhumia and Bhatra is being developed, highlighting the symbiotic relationship between cultural and biological diversity.

Participatory Plant Breeding (PPB) and Knowledge Management:

This work was started in 1998 in the Koraput region of Orissa in collaboration with tribal families. Koraput is an important centre of genetic diversity in rice. There were 3,500 land races of rice in this region in 1950. In 1998, this number came down to 300, indicating acute genetic erosion. The PPB programme has helped to reverse the decline in genetic diversity and provide opportunities for productivity and income enhancement. The local *Kalajeera* strains of rice were improved through PPB in both yield and quality. Because of the rising demand, nationally and internationally, a *Kalajeera Farmers' Association* is being promoted for production and market planning. The specific identity of the Koraput *Kalajeera* will

be protected through DNA finger printing in collaboration with a leading specialty rice export firm. Thus, the partnership will be tripartite – farmer – scientist – marketing company. PPB thus helps both genetic conservation and enhancement and promotes synergy between traditional wisdom and modern science. These are the essential ingredients of a strategy for sustainable agriculture.

A unique programme initiated during 2006 with generous support from the Sir Dorabji Tata Trust relates to the development of a *Scientists' Corps* for saving endangered plant species. Many species listed in the Indian Red Data Books and the IUCN Red Lists are known only from one or a few collections that give an insufficient picture of their variation, population structure and distribution. In order to foster the conservation of rare, endemic and threatened flowering plant species of the Western Ghats, eight research fellowships have been created for three years to facilitate committed and skilled students to work on the systematics and conservation of 80 rare, endemic and threatened species. This also represents an attempt to revitalize the dying science of taxonomy. Each Fellow will take up an integrated conservation approach (both *in-situ* and *ex-situ*) and deal with a group of 10 species within a period of three years by studying the taxonomy, ecology and distribution and conservation status of each species. They will be made responsible for all aspects of conservation of the selected 80 species. This programme will help to create a cadre of trained taxonomists committed to the

cause of saving vanishing species and dying wisdom.

Rural System Research (RSR): the Bio-village Paradigm of Sustainable Human Development

Unlike Farming Systems Research (FSR), RSR takes a holistic view of rural livelihoods, both on-farm, off- and non-farm. Since most rural livelihoods relate to crop and animal husbandry, fisheries, agro-forestry and farm forestry, agro-processing, priority in agro-based livelihoods goes to enhancing the productivity and profitability of the major farming systems of the village on an environmentally sustainable basis. In other words, JRD Tata Ecotechnology Centre's major goal is to enhance productivity in perpetuity without ecological harm, leading to an evergreen revolution. The Biovillage is RSR in action and on-going programmes like precision farming are being integrated to achieve the following three goals:

- Enhance the ecological foundations essential for sustainable agriculture, particularly soil, water and biodiversity
- Enhance productivity and reduce the cost of production through higher factor productivity. Techniques will include precision farming and organic farming
- Examine opportunities for agro-processing and value addition to the biomass through initiatives like the establishment of Rice Bio Parks

From Micro-finance to Livelihood Finance : Sustainable Self Help Groups (SSHG):

Resource poor families will not be able to come out of the poverty trap, unless they gain the power and economy of scale at the production and post-production phases of their principal source of livelihood. The SHG model of group power is now being promoted on a large scale, since cooperatives are not doing well except in some states and sectors. It is clear that for SHGs to be economically and socially sustainable over a period of time, they will

need not only micro-finance, but also appropriate technologies and access to assured and remunerative markets. Thus, there is need for a paradigm shift from micro- to livelihood finance as emphasized by Dr Vijay Mahajan. The JRD Tata Ecotechnology Centre will set up and operate a “SHG Capacity Building and Mentoring Centre”, at the Biocentre campus at Pondicherry in order to ensure that this socially relevant movement does not collapse. Equal attention will be given to the organization of men’s Self-Help Groups and mixed groups.

From Green to an Ever-green Revolution

The pathways involved in bringing about this transition are given below:

Green Revolution	Evergreen Revolution
Commodity-centred increase in productivity	Increasing productivity in perpetuity without associated ecological harm
Change in the physiological rhythm insensitivity to photoperiodism	Organic agriculture: cultivation without use of any chemical inputs like mineral fertilizers and chemical pesticides
Lodging resistance	Green Agriculture: cultivation with the help of integrated pest management, integrated nutrient supply and integrated natural resource management systems
High harvest index	Ecoagriculture: Based on conservation of soil, water and biodiversity and the application of traditional knowledge and ecological prudence EM Agriculture: system of farming using Effective Microorganisms (EM) White agriculture: System of agriculture based on substantial use of microorganisms, particularly fungi One-straw Revolution: system of natural farming without ploughing, chemical fertilizers, weeding and chemical pesticides and herbicides

They will be particularly relevant in promoting IPM, INM and other eco-farming techniques. The production and marketing of the biological software essential for sustainable agriculture such as bio-pesticides and bio-fertilizers have been chosen for promoting SSHGs, through microenterprise activity.

Climate Management

This important activity of the JRD Ecotechnology Centre was started this year with support from SDC. All aspects of climate management – vulnerability, prevention, mitigation and adaptation – are receiving attention. The Rural Farm Science Managers will also be trained in climate management. In coastal areas, this work will be done through the ICZM Team.

The future of Indian agriculture depends upon our ability to enhance the productivity of small-holdings without damage to their long-term production potential. Transforming the green revolution into an evergreen revolution using one or more of the several pathways described here will usher in a win-win situation for both farmers and ecosystems. Crop-livestock integration and introduction of stem-nodulating legumes or pulse crops in the rotation will facilitate the building up of soil fertility. Instead of placing the above-mentioned six approaches to sustainable agriculture in different compartments, it will be prudent to develop for each farm an evergreen revolution plan based on an appropriate mix of the different approaches, which can ensure both ecological and economic sustainability.

Gender, Hunger and Poverty

This core programme is supported by endowment funds as well as project support. The work is being carried out under three separate endowments – B V Rao, Uttara Devi and Ford Foundation, and also receives generous support from the World Food Programme. Developing the data essential for policy advocacy has been the major activity so far. The three Atlases of Food Insecurity in Rural and Urban India and Sustainability of Food Security, produced in association with WFP have been widely acclaimed as valuable inputs in priority setting and policy formulation. This led to MSSRF being invited to prepare a similar Atlas for Cambodia.

The work on Gender and Development has also resulted in significant initiatives like the preparation of curriculum for engendering the curriculum of agricultural colleges and Universities and the publication of the situation of women in agriculture in the last decade. The gender dimensions of food security have been highlighted and some influence has been brought to bear on providing support services to working mothers. The engendering of the National Rural Employment Guarantee Act is another important contribution.

The work of the B V Rao Centre on Sustainable Food Security led to designing the *Mission 2007: A Hunger-free India* movement. The major components of Mission 2007 are:

- Enlarge the food basket by including in PDS grains like, *ragi, jowar, bajra*, other millets,

pulses and oilseeds, so that these nutritious cereals / food crops are also purchased at a minimum support price. This will help to enhance the income security of farm families in dry farming areas.

- Reform and restructure nutrition delivery systems on the basis of a whole life cycle approach, giving special emphasis to pregnant women, and children in the 0-2 age group with special reference to ICDS.
- Foster community managed sustainable food and water security systems involving the establishment of Community Seed, Grain and Water Banks, in every village.
- Fight hidden hunger through a food-cum-fortification approach.
- Enhance economic access to food through multiple livelihood opportunities and non-farm livelihood initiative.
- Promote convergence and synergy among large ongoing government programmes such as NREG, *Bharat Nirman*, *National Horticulture Mission* and *National Rural Health Mission*.

Another long-term initiative will be the organization of *National Action Research Network on Women and Agriculture*. Such a network could involve appropriate institutions and individuals in the major agro-ecological regions of the country, such as the arid, semi-arid, hill, coastal and irrigated zones and islands.

It can help to undertake longitudinal studies on all aspects of women and agriculture, and

can influence both policy formulation and programme implementation relating to legislation in areas such as land rights to women, Right to Information and Tribal Land Rights.

Information, Education and Communication

Information communication, capacity building and educational programmes are carried out in every Programme Area. *The Hindu* Media Resource Centre provides website and documentation facilities, particularly audio-visual forms and also organizes media briefing and discussion sessions. Besides *THMRC*, the major platform for mobilizing information technology for sustainable development is the Jamsetji Tata National Virtual Academy for Rural Prosperity (NVA). NVA serves as the umbrella organization for content creation, capacity building and coordination with agencies like hospitals which can help to convert knowledge into application. MSSRF now operates with the help of ISRO eight Village Resource Centres and forty Village Knowledge Centre in the States of Tamil Nadu and Pondicherry. In addition, 5 VRCs have been established jointly with ISRO in Rajasthan, Maharashtra, Orissa and Andhra Pradesh.

NVA is creating a cadre of Master Trainers who, after a peer review process, are inducted as Fellows of the Academy. They are the torch bearers of the rural knowledge revolution. In the words of President Dr A P J Abdul Kalam, "the Fellows of NVA represent a celebration of the core competence of rural India".

The aim of NVA is to induct 5,00,000 Fellows by 2010 about – one woman and one man from every one of the about 2,40,000 Panchayats/ local bodies, who can become managers of the Village Knowledge Centres (VKCs). VKCs will be linked at the block/ district level with Village Resource Centres (VRCs) established with the support of ISRO. The internet – FM radio / cellphone combination will ensure last mile and last person connectivity.

In addition to capacity building for creating a critical mass of rural knowledge managers, NVA also hosts the secretariat for the National Alliance for *Mission 2007: Every Village a Knowledge Centre*.

The strength of NVA is its partnership with ISRO, NASSCOM, TCS, Microsoft, IDRC, CIDA, SDC, UNESCO, FAO and other national, bilateral and multi-lateral organization. When fully developed, NVA will be the largest Academy of its kind in the world and will be the flagship of the movement to bridge the growing urban-rural digital divide. So far, 293 rural women and men have been inducted as Fellows of NVA. NVA is developing linkages with all the ongoing Missions of the Government of India like *Bharat Nirman*, *National Rural Health Mission*, *Sarva Shiksha Abhiyan*, *National Rural Employment Guarantee Programme* and the *National Horticulture Mission*. To quote a rural woman in Pondicherry, “The green revolution helped to enhance the productivity of rice and wheat and thereby erase the begging bowl picture of our country; the knowledge revolution spearheaded by the Jamsetji Tata National

Virtual Academy will enhance human capacity and creativity in all its dimensions and thereby help in enabling every child, woman and man to lead a healthy and happy life”. This sums up beautifully the power and purpose of a Rural Knowledge Revolution.

Measuring the Impact of Science and Technology on Agriculture and Rural Development

With support from the Principal Scientific Adviser to the Government of India, Dr R Chidambaram, MSSRF undertook the task of developing indicators for measuring the impact of science and technology on agriculture and rural development. This study led to the identification of catalytic technologies which could lead to increasing the value of output per hectare. A Technology Achievement Index is currently under development, which can provide a yardstick for measuring the impact of public good research on crop and animal husbandry, fisheries and forestry as well as water and energy.

International Collaboration

The partnership with the Ohio State University, USA, the Punjab Agricultural University and the Jawaharlal Nehru Krishi Viswavidyalaya in developing technologies for sustainable soil health and natural resources management has yielded valuable results and is now nearing the final stages. Collaboration has also been developed with the Open Knowledge Network, Commonwealth of Learning and Microsoft in the area of ICT for sustainable development. With support from CIDA and IDRC,

partnership has been developed with the Sarvodaya Organisation headed by the great humanist and visionary, Dr A T Ariyaratne of Sri Lanka. Assistance was rendered to the Government of Cambodia in preparing a Food Security Atlas.

Converting calamities into opportunities for progress

Every natural calamity brings forth an opportunity for progress both for strengthening human security, and for being better prepared to face similar calamities in future. The tsunami of 26 December, 2004 was one such natural calamity which brought out the best in humankind. The spontaneous outpouring of help was inspiring. MSSRF scientists and scholars concentrated on developing a "Beyond Tsunami" strategy aimed at strengthening ecological and livelihood security. This involved integrated attention to bioshields, coastal biovillages and Village Knowledge Centers. It also involved concurrent attention to the problems of fisher and farming communities. Agricultural rehabilitation in sea water-inundated soils became urgent. The best available scientific expertise was mobilized for this purpose. Above all, the education of orphan children received priority attention, since otherwise they would remain blossoms in the dust. In view of the importance of this programme in human terms, a whole time position of Programme Director was created to coordinate the activities.

At the request of the Andaman and Nicobar Administration, MSSRF team headed by

Prof P C Kesavan helped to prepare a strategy for "Post-Tsunami New Andamans". The team was particularly inspired by the traditional wisdom of the tribal communities of Nicobar Islands in dealing with calamities like tsunami. MSSRF's approach to integrating traditional wisdom with modern science thus received further impetus.

While natural tragedies like tsunami, cyclones and earthquakes do occur periodically, avoidable man-made tragedies are a matter of shame and sorrow. One such is the agrarian crisis leading to farmers' suicides in several States, particularly Maharashtra, Andhra Pradesh, Karnataka and Kerala. Punjab is also witnessing such an unfortunate tragedy. Government relief programmes generally concentrate on re-starting agriculture. The human dimensions of the tragedy like the plight of young widows and the future of the children do not receive as much attention as they need. MSSRF therefore initiated on 1 May 2006, a widows' psychological and livelihood rehabilitation and children's' education programme in the distress hotspots of the Vidharbha region of Maharashtra. 78 children (45 boys and 33 girls) ranging from primary school to junior college level from 37 families across 36 villages in 8 talukas of Wardha district have been covered under the education programme, which is being expanded in a well-planned manner. The widows' rehabilitation programme includes introduction to sustainable livelihoods and training in running *Gyan Chaupals*. Based on the action taken by the Central and State Governments,

this programme is designed to ensure opportunities for a productive life for the unfortunate victims of the agrarian crisis. Credit and market are two key factors in the agrarian dilemma. The *Gyan Chaupals* operated by the widows or children affected by the crisis will provide all the needed information on credit, insurance, market and technology to farmers at the right time and place. The State Bank of India and MSSRF plan to develop in the Wardha district a strategy for financial inclusion based on the *antyyodaya* principle, so as to cover every family by 15 August, 2007 with the needed and timely credit. If implemented successfully, Wardha will be the first district in India where the concept of financial inclusion becomes a reality.

As regards market, MSSRF strategy aims to link nutrition security and income security in a mutually reinforcing manner. For this purpose, locally adapted cereals, millets, oilseeds, vegetables, fruits and tuber crops will be promoted based on market tie-ups. Drought tolerant local millets and cereals like ragi, jowar, bajra and kodo and other millets will be recommended for inclusion in the Public Distribution System, based on a minimum support price. In addition, local SHGs can operate Community Grain and Feed Banks. Jowar fodder and cottonseed cake can help the families affected by the agrarian crisis in Vidharbha to broadbase their sources of income through integrated crop-livestock farming systems. Once more a human tragedy can be converted into an opportunity for launching a farm revolution in rainfed areas.

During the year several major national and international seminars, workshops and consultations were held which have been included in detail in the Report. Among these, a notably holistic and comprehensive one was the International Conference on "Human-Centred Sustainable Development Paradigm," held from 8 – 10 August, 2005. The thematic areas discussed included evergreen revolution, sustainable livelihoods, natural resource management, food and nutrition security, knowledge–empowered communities, gender and development, effective delivery mechanism for sustainable livelihood options for rural communities and policy issues. In addition, ongoing activities of the Foundation in relation to developments in the relevant fields were showcased. More than 600 participants representing researchers, development planners, policy makers, various stakeholder representatives and students attended the conference. On the pre-conference day, two sessions were dedicated to highlight contributions of Prof. Swaminathan to science and technology and public policy.

Human Resource Development continued to receive high priority in the mission of MSSRF. The efforts in capacity building ranged from providing opportunities to visually impaired children to experience the beauty and diversity of life, to train rural women and men to master modern ICT and become Fellows of the Jamsetji Tata National Virtual Academy for Rural Prosperity. During the year five scholars took their Ph.D degrees based on the thesis work done at MSSRF. Dr Ajay Parida received the B M Birla Science Prize in Biology of the Birla

Science Foundation, while Dr Sudha Nair was chosen for the B D Tilak Award of the Indian National Science Academy.

The new initiatives in human capacity building included steps for establishing a "Fish for All" Training Centre at Poompukar near Nagapattinam in Tamil Nadu, and a SHG Capacity Building and Mentoring Centre at Pillayarkuppam in Pondicherry.

Management and Policy Oversight

During the year, MSSRF lost one of its valuable Trustees, Dr K N Shyamasundaran Nair, whose commitment to improving the quality of life of the underprivileged and to ensuring gender equity in development, were sources of great inspiration and guidance. Another loss was the demise of Dr A Sankaram, who was the first Secretary of the Centre for Sustainable Agriculture and Rural Development. Dr Sankaram was a role model for the younger researchers by virtue of his thoroughness in the collection, analysis and interpretation of scientific data. He developed the first Soil Health Card, to empower farmers with information on the Chemistry, Physics and Microbiology of the Soil. MSSRF will carry forward the legacy of Drs KNNS Nair and A Sankaram by intensifying work in the areas initiated by them.

Pain and pleasure are integral parts of life. While we lost some of our valued colleagues, the Board of Trustees of MSSRF will be enriched by the addition of Dr Vijay Mahajan and Smt Mina Swaminathan. We are indebted to past

and present Trustees for their invaluable contributions to the growth and effectiveness of the organization. Particular thanks go to Shri N Ram, Chief Editor, *The Hindu*, who chairs the Audit Committee, Dr T Ramasami, Secretary to the Government of India, Department of Science and Technology, who chairs the Personnel Committee, and to Dr Usha Barwale, Director, Mahyco Research Foundation, who chairs the Programme Committee, for sparing their valuable time to guide the growth of MSSRF in a scientifically and socially meaningful direction. The other Trustees of MSSRF, Mr Russi M Lala, Smt Anuradha Desai, Dr Soumya Swaminathan, Dr Suman Sahai, Shri V Namasivayam and Dr Madhura Swaminathan are all pillars of strength. Our sincere gratitude goes to all of them for their dedication to the growth of a unique organization determined to demonstrate that inclusive economic growth and human development can be accomplished through a fusion of professional skill, public action and community involvement. MSSRF is also committed to showing that seemingly impossible tasks can be achieved by mobilizing the power of partnership, as for example, *Mission 2007: Every Village a Knowledge Centre*.

The work reported in this as well as the earlier reports would obviously not have been possible, but for the generous financial and technical support of a wide range of national and international agencies listed are also listed in the Report. Particular thanks go to our corpus and endowment donors whose generosity and help has imparted stability and

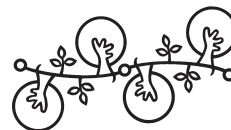
continuity to the core activities of the Foundation. We were particularly moved by the spontaneous support from individuals and institutions, far and near, to the cause of bringing comfort and confidence in the lives of the families affected by natural tragedies like tsunami, and man-made tragedies like the agrarian crisis resulting in farmers' suicides. Participating in the meetings of Friends of MSSRF in Japan and Australia brought home the eternal truth of the ancient words, "Vasudeiva Kutumbakam" (the world is one family).

The Trustees wish to express their gratitude to all the scientists, scholars and administrative and support staff for their continuous efforts to give their best. They adhere to Mahatma Gandhi's dictum, "Be the change you wish to bring about". Particular thanks go to Dr M Velayutham, Executive Director, all Programme Directors, Homi Bhabha and Ford

Foundation Chairs, Distinguished Fellows, and other senior staff members for their dedicated work and leadership. Thanks also go to Dr S Rajagopalan and Dr Malavika Vinodkumar as well as to the Members of the Governing Council of CRSARD, for their contributions to the growth of the sustainable agriculture movement.

Finally, I wish to record my sincere appreciation of the painstaking efforts of Prof Venkatesh Athreya, Dr Ajay Parida and Dr Sudha Nair for bringing out this Report in a timely and reader-friendly manner. Thanks also go to Dr Nandhini Iyengar for her continued help in editing this Report and to AMM Screens for ensuring a high quality of printing.

M S Swaminathan
Chairman, MSSRF



Coastal Systems Research

Promotion of coastal bioshield has been initiated in 71 ha in 7 villages where tsunami rehabilitation programmes of MSSRF are being implemented. An Indo-Srilankan project has been launched covering bioshield, livelihoods and Village Knowledge Centres. Micro water shed development activities have been initiated at Kudankulum.

101	Coastal Wetlands: Mangrove Conservation and Management -----	22
102	Coastal Bioshields -----	24
103	Seawater farming -----	31
104	Nuclear and Biotechnological Tools for Coastal Systems Research -----	32
105	Remote Sensing and Geographical Information System -----	37

Sub Programme Area 101

Coastal Wetlands: Mangrove Conservation and Management

Coastal Systems Research

Being the year after the tsunami, activities of Programme Area 100: Coastal Systems Research during this year focused on i) scientifically establishing the role of mangroves and non-mangroves in mitigating the impact of tsunami, ii) ecological rehabilitation of the coastal areas with mangrove and non-mangrove bioshields and iii) building the capacity of the stakeholders including the community, grassroot NGOs, funding agencies and government institutions in bioshield development and management through training.

101.1 Role of mangroves and other coastal vegetation in mitigating the impact of tsunami

There have been reports in the media after the tsunami that hit the Indian coast in December 2004, that mangroves and other coastal vegetation played a role in reducing its impact on the lives and property of coastal communities. Last year, a micro level study was conducted on how mangroves mitigated the impact of the tsunami. This year, scientific evaluation was carried out in collaboration with Nordic Agency for Development and Ecology, Copenhagen and University of Copenhagen, Denmark, to assess the role of mangroves and

other coastal vegetation as a protective barrier against possible tsunami at the macro level.

Method: The study was conducted in the southern part of Cuddalore district and northern part of Nagapattinam district, which were severely affected by the tsunami. The coastal vegetation of Cuddalore consists mainly of mangroves (Pichavaram) whereas Nagapattinam is characterized by the presence of large casuarina shelterbelt plantations raised by the Tamil Nadu Forest Department (TNFD) since the 1970s. The total length of the coast covered in this study was about 20 km and the land up to 1 km from the shoreline was taken up for the assessment. The topography of the study area is smooth and the elevation of the land is generally between 1 and 3 m above mean sea level. The height of the waves that hit these coastal areas was about 4.5 m. In this study, high resolution pre-tsunami and post-tsunami satellite images were used to find the correlation between vegetation cover and damage caused by the tsunami. Using Quick Bird satellite imagery of May 2003 (pre-tsunami) to study the vegetation cover, including mangroves and non-mangroves, the study area was divided into three categories namely, i) dense tree vegetation, ii) open tree vegetation and iii) no tree vegetation. Mangrove forest with dense trees and thick casuarina shelterbelt areas were included in the dense tree vegetation category. All other woody vegetation, including degraded mangroves and gaps in plantations, were considered open vegetation. For post-tsunami damage assessment, IKONOS satellite imageries of December 29, 2004 (3 days after the tsunami) were used and the

damages were divided into three categories namely, i) damaged (areas where all or most of the physical structures had been destroyed, removed or damaged), ii) partially damaged (some damage but most of the physical structures remain intact) and iii) undamaged (no damage visible on the ground or in the satellite imageries). A comparison was then made between the tree vegetation categories and the tsunami damage using chi-square tests.

Results: The results showed that within 1,000 m from the shore, there was statistically significant correlation between tsunami-caused damage categories and different tree vegetation densities: ($c_4^2 = 5.15 \times 10^2$, $P < 0.01$), in particular, dense tree vegetation associated with undamaged areas and dissociated with damaged areas (Table 1.1).

The results have been published in *Science* (310: 643) with online support materials. However, the results from the present study are only a preliminary finding from a single case study and more detailed studies involving more sites and using different statistical methods such as multivariate analysis and modelling are needed, to fully understand the protective role of coastal tree vegetation against tsunami.

101.2 Restoration of Mangroves in Andhra Pradesh

During the year, activities relating to the Joint Mangrove Management (JMM) programme were initiated in Chollangipetta hamlet of the Chollangipetta Panchayat of East Godavari district. Chollangipetta is a farming hamlet with a total population of 1,800. A few of these farming families own feral cattle, which live in the mangrove forest throughout the year and graze heavily on the mangroves. These families also utilize the mangrove wood for house construction. Degraded mangrove area of about 10 ha in the Coringa Reserve Forest has been identified as the mangrove management unit of this village. The Andhra Pradesh Forest Department (APFD) has already formed an Eco Development Committee (EDC) in this hamlet, with 844 members and a 16 member Executive Committee (EC). This EDC is actively participating in the planning, implementation and monitoring of the restoration activities as well as in nursery development. The biophysical survey indicates that the canal method of restoration can be followed to restore the degraded areas. Technical and financial support has been given to the EDC to establish a mangrove nursery near the restoration site. It

Table 1.1 *Distribution of tsunami damaged area with reference to tree vegetation cover (numbers in parenthesis indicate % in the study area)*

Damage category/ tree cover	Damaged area (ha)	Partially damaged area (ha)	Undamaged area (ha)	Total area (ha)
Dense tree vegetation	2.2 (0.5)	15.7 (3.5)	437.1 (96.1)	455.0
Open tree vegetation	30.9 (15.4)	84.4 (41.9)	86 (42.7)	201.3
No tree vegetation	502.9 (35.1)	384.2 (26.8)	547.0 (38.1)	1,434.1

now has about 54,000 seedlings of *Avicennia marina*. These seedlings will be planted in the restoration sites. As part of the community mobilization processes, an awareness rally was organized in the village and student members of the Green Corps of the nearby high school actively participated in the rally.

The experiences of the community during the tsunami and anecdotal evidences published in the media about the role of mangroves and non-mangrove coastal vegetation in reducing the impact of the tsunami caused changes in the mindset of coastal communities and the attitude of government agencies towards raising mangrove and non-mangrove vegetation as bioshields along coastal areas. The fishing community, which is normally reluctant to participate in restoring, conserving and raising mangrove and other coastal vegetation programmes, now shows a lot of interest in

coastal areas as a part of disaster mitigation initiatives. The plan of action for the rehabilitation of tsunami affected communities and areas, published by the National Commission on Farmers (NCF), also strongly recommended that strengthening the ecological foundation of the coastal areas should be taken up immediately as a long term measure to manage natural disasters in the coastal zone. Considering all these, the coastal bioshield movement was initiated during the year and the following activities were completed: i) assessment of current practices in establishing non-mangrove plantations along the coastal areas, ii) initiating development of mangrove bioshields, iii) initiating development of non-mangrove bioshields, and iv) establishment of mangrove and non-mangrove nurseries.

102.1 Assessment of current practices in establishing non-mangrove coastal plantation

Sub Programme Area 102

Coastal Bioshields

restoring degraded coastal vegetation as well as raising plantations in new areas. This is indicated by the demands of the fishing community to government agencies and non-governmental organizations for raising mangrove or other tree vegetation in suitable places around their villages. Similarly, administrators and planners are willing to allot large plots of wastelands to the coastal community to raise plantations, of either mangroves or non-mangroves, as a protective cover along the

In addition to mangroves, other coastal vegetation such as casuarina plantations, raised by government agencies and individual farmers as crops, and sand dunes, associated sand binders and tree vegetation, also played a role in reducing the impact of the tsunami. In order to understand the various practices followed to raise and manage these plantations, a study was conducted in randomly selected areas covering the entire coast of TN. The study covered i) the species used to raise coastal shelterbelts, ii) the techniques followed, iii) the level of community participation in raising shelterbelts, and of iv) the community initiatives in conserving sand dunes and associated

coastal vegetations. The following are the major findings of this study.

- Almost all the shelterbelts raised by the government agencies consist of only one species, namely *Casuarina equisetifolia*. The ecological impact of such single shelterbelts is not known, but such single species shelterbelts do not address the issue of linking livelihood security of the coastal communities with ecological security of the coastal areas. Hence, in order to achieve better results, multispecies shelterbelts with tree vegetation that provide economic incentives to the local community should be raised. The local community can be encouraged to cultivate suitable intercrops within shelterbelts to increase their stake in shelterbelt development and management.
- There has been only token participation of Panchayati Raj Institutions (PRI) and local communities in planning and monitoring the shelterbelts. Local NGOs can be involved as facilitating agencies to bring genuine partnership between PRI, the local community and government agencies so that long-term management of shelterbelts can be ensured.
- Small sand dunes with various kinds of vegetation are present all along the coast. A few of them are owned by individuals but a majority of them are common property, belonging to either the Panchayat or other government agencies. However, there is no system in place for the management of these coastal sand dunes. Conservation of these sand dunes with suitable sand binding and tree vegetation, with the participation of the local community, should be taken up as a priority issue because these dunes act as barriers against cyclones and tsunami and play a dominant role in water conservation in coastal areas where water scarcity is a recurrent feature during the summer season.
- Currently, plants in shelterbelts are raised following the square method which can be changed to the V shape method to create more effective barriers.
- In casuarina shelterbelts which are 2 to 3 years old, suitable species can be grown as understory species so that the gaps created due to increase in the height of casuarina trees can be compensated. This would also improve the ecological condition of the plantation.
- Starting casuarina plantations right from the high tide line is one of the serious concerns relating to shelterbelt plantation along the coastal areas. This may have serious implications on the ecology of the coastal areas such as destroying the nesting sites of turtles and the habitats of shore crabs. Shelterbelt plantations close to the shore may also trigger soil erosion by reducing or preventing supply of sand to littoral drift. Hence, shelterbelt plantations should start at least 50 to 60 m away from the high tide line.

102.2 Bioshield development and management

The coastal bioshield programme has been initiated in the villages where tsunami

rehabilitation programmes of MSSRF are being implemented. The following procedure is being followed in initiating the bioshield programmes. During the initial phase of the programme, discussions are held with the villagers about the role played by mangrove and non-mangrove coastal vegetation in protecting the lives and livelihood of the coastal communities during tsunami. The importance of the vegetation as a barrier against cyclone and storm surges and its role in preventing soil erosion and in ameliorating micro climate are also discussed. The advantages of multispecies bioshields as a source of income are explained in detail. Following this, the interest of the community in participating in the development and management of mangrove and non-mangrove bioshields is ascertained. After this, lands suitable for the development of mangrove and non-mangrove bioshields are identified and quantified, followed by the assessment of ownership of the land. If the land belongs to the community, permission from the traditional panchayat is obtained. In case the land belongs to government departments, permission is obtained, mostly through the concerned elected panchayat with the concurrence of the traditional panchayat. So far, no attempt has been made to develop bioshields in private lands.

After permission is obtained, biophysical data, particularly, soil character, nutrient status and source of water, are collected. Biophysical data provide an opportunity to determine various kinds of technical interventions to be taken up in bioshield development. These data also help in determining the species to be planted.

However, the community mostly decides the tree species for the bioshield. Following this, village level micro plans are prepared with the help of the traditional panchayat. In some cases, a separate village level committee is formed for the preparation and implementation of the micro plans at the request of the traditional panchayat. These micro plans contain details of technical interventions and management activities to be taken up. As per the micro plan, funds for bioshield development and management are being provided to the traditional panchayat where it directly implements the programme, whereas in other villages, funds are being provided to village level committees that have been formed exclusively for the purpose of bioshield development and management.

102.3 Development and management of mangrove bioshields

Raising mangrove vegetation in areas other than reserve land (otherwise called afforestation of mangroves) with the participation of the local elected government and community is the major activity of the current mangrove bioshield development and management programmes. Table 1.2 shows the villages involved in mangrove bioshield programmes, the area where mangrove plantations are being raised and village institutions that implement the programmes.

The project villages, Muzhukkuthurai, MGR Thittu and Mudasalodai of Cuddalore District, are located north of the Pichavaram mangrove reserve forest. Extensive mud flats are present

Table 1.2 *Villages and village level institutions involved in the development of mangrove bioshields in tsunami affected areas*

Name of the village	District	Area (ha)	Village level institution
<i>Muzhukkuthurai</i>	Cuddalore	20	<i>Grama Nala Sangham</i>
<i>MGR Thittu</i>	Cuddalore	35	<i>Grama Nala Sangham</i>
<i>Mudasalodai</i>	Cuddalore	12	<i>Grama Nala Sangham</i>
<i>Chandrapadi</i>	Nagapattinam	1	Traditional panchayat
<i>Pazhayar</i>	Nagapattinam	to be decided	<i>Grama Nala Sangham</i>
<i>Sadraskuppam</i>	Kanchipuram	2	Traditional panchayat
<i>Pattinamcherry</i>	Pondicherry	1	Traditional panchayat

between the villages and sea. Degraded mangroves are present in some areas of these mud flats and other areas are almost barren. These areas are suitable for raising mangrove bioshields. The canal method, which was tested successfully in other areas, is being followed to raise mangrove plantations here. These mud flats are classified as revenue *poramboke* lands and permission from the District Administration, Cuddalore District, has been obtained through the traditional panchayats of these villages and the elected panchayat of Killai, in which these project hamlets are located. Demarcation of these areas into management units of three villages has been completed. Canal digging work has been completed in about 20 ha. In the case of Pattinamcherry of Pondicherry, the identified land for the mangrove bioshield belongs to the FD and it has given permission to the traditional panchayat to raise a mangrove plantation. In all these areas three species of mangrove plants namely, *Rhizophora apiculata*, *Rhizophora mucronata* and *Avicennia marina*, have been selected by the local fishing community for plantation.

102.4 Development and management of non-mangrove bioshields

Raising of multispecies shelterbelts that take care of both ecological and livelihood needs with the participation of the local community is the major activity currently being implemented in the non-mangrove bioshield programmes. The following are the villages involved in the development and management of non-mangrove bioshields (Table 1.3).

Table 1.3 *Villages and village level institutions involved in the development of non-mangrove bioshields*

Name of the village	District	Village level institution
<i>Chandrapadi</i>	Nagapattinam	Traditional panchayat
<i>Poompuhar</i>	Nagapattinam	Elected panchayat
<i>Madavamedu</i>	Nagapattinam	<i>Grama Nala Sangam</i>
<i>Muzhukkuthurai</i>	Cuddalore	<i>Grama Nala Sangam</i>
<i>MGR Thittu</i>	Cuddalore	<i>Grama Nala Sangam</i>
<i>Mudasalodai</i>	Cuddalore	<i>Grama Nala Sangam</i>
<i>Sadraskuppam</i>	Kanchipuram	Traditional panchayat

A non-mangrove bioshield is normally developed in linear patches between the village and the sea. Currently two different models of non-mangrove bioshield are being developed. The structure of Model 1 is shown in Figure 1.1. As shown in the figure the first component of this bioshield is a small sand dune that starts about 50 to 60 m away from the high tide line. In some cases, sand dunes that are in degraded condition due to social causes or flattened due to tsunami waves are restored and considered the first component of the Model 1 bioshield. In some other cases, new sand dunes are created using either the traditional method or by piling up sand manually. In the traditional method, palm fronds are arranged like a fence in the sandy area located between the sea and the village to facilitate deposition of sand in that area, leading to the formation of small dunes. These dunes are then covered with various sand binding creepers such as *Ipomoea pes-capare*, *Spinifex* sp and bushes like *Vitex* sp. In some areas tree species such as *Thespesia* sp are grown on these dunes to stabilize them.

The multispecies non-mangrove bioshield starts next to these restored or created sand dunes. The length and breadth of this bioshield is determined by available land. In the first few rows, ecologically valuable tree species such as *Pongamia pinnata*, *Thespesia populenoides*, *Callophyllum inophyllum*, neem and casuarina, are planted as per the choice of the local community. Following this, several rows of coconut trees are planted, as it is the primary choice of the local community for economically valuable trees. Behind the coconut trees, rows

of other ecologically valuable trees are planted. Traditional practices such as mulching using coconut husk and casuarina needles are followed as measures to increase the water holding capacity of the soil. In some cases, linear ditches are created along the length of the sand dunes, which not only act as a rain water harvesting structure but also aid in the recharge of ground water. In addition, new practices such as the application of biofungicide such as *Trichoderma* and biofertilizer such as VAM are introduced in the development of the non-mangrove bioshield. Plants that yield green fodder and green manure are not normally preferred by the fishing community as they maintain very low livestock and also possess limited or no agriculture land. In Model 2, (Fig. 1.2) no sand dune is present between the beach and the bioshield and the first few rows consist of bushy vegetation. Otherwise,

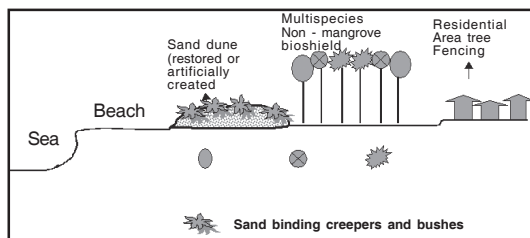


Figure 1.1 Non-mangrove bioshield ~ Model 1

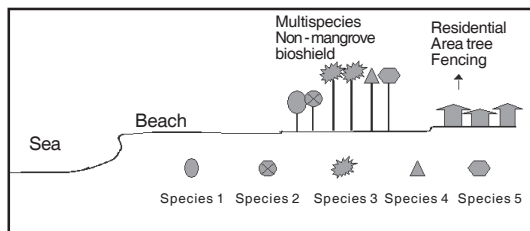


Figure 1.2 Non-mangrove bioshield ~ Model 2

bioshield components and methods of raising plantations are more or less similar to Model 1.

102.5 Training in mangrove and non-mangrove bioshield management

Orientation and training programmes on the development and management of mangrove and non-mangrove bioshields were conducted for various stakeholders. The objectives of these orientation trainings were i) to raise awareness among stakeholders (community, NGOs, government agencies, Panchayati Raj representatives etc.) about the role of mangrove and other coastal vegetation in reducing the impact of tsunami and other natural disasters, ii) to provide orientation in technical aspects of raising mangrove and other coastal vegetation as bioshields and of iii) to provide orientation in the participatory process of developing and managing coastal bioshields.

Participants: Orientation / training programmes were conducted in response to demands from stakeholders. There is an increased interest among the community leaders and Panchayati Raj representatives in establishing coastal bioshields around their villages. Hence, orientation programmes were organized for community leaders and Panchayati Raj representatives on how to motivate others in their villages in bioshield development and management as well as on technical know-how and participatory processes. A number of grassroot NGOs, who are working on rehabilitation of tsunami affected villages, wanted to involve themselves in establishing coastal bioshields as part of their rehabilitation

efforts. Requests were also received from funding agencies to organize training for their staff. Therefore, orientation programmes were organized for them to enhance their capacity to evaluate the project proposals submitted by grassroot NGOs. Table 1.4 shows the number of training programmes conducted for different stakeholders and the participants who attended the programmes. Table 1.5 gives details of the funding agencies, grassroot NGOs and villages from which community and Panchayati Raj leaders attended the training.

Table 1.4 *Training programmes conducted for different stakeholders and the number of participants*

<i>Stakeholder</i>	<i>No. of programmes</i>	<i>No. of participants</i>
Community and Panchayati Raj leaders	4	140
Grassroot NGOs (middle level managers and field workers)	2	40
Funding agencies, grassroot NGOs (top level managers) and government agencies	2	65

Topics covered: The following topics were covered in these training programmes: i) identification of suitable lands for mangrove and non-mangrove bioshields, including analysis of environmental conditions, assessment of ownership, getting permission from the government agencies through Panchayati Raj ii) technical aspects of mangrove and non-

Table 1.5 *Participation in the orientation programmes*

Funding and other agencies	Grassroot NGOs	Community, SHG and Panchayat Raj leaders
Care India	CREED, Chidambaram	16 villages in Ramnad district
CASA	CSSR, Cuddalore	4 villages in Tuticorin district
World Vision	MNTN, Cuddalore	4 villages in Nagapattinam and Cuddalore districts
German Agro Action	PAD, Vembar	1 village in Karaikkal
Centre for Environmental Education, Karaikkal	CCD, Madurai SEED, Madurai, SEVAI, SMSS, Sivagangai, PMSSS, Pondicherry CODE, Radhapuram	

mangrove bioshield development, including analysis of biophysical conditions, species suitable to meet the ecological requirement of the bioshield and economic requirement of the community, technical intervention to create tidal flushing in the case of mangroves, planting methods, and after care and iii) participatory and management aspects of bioshields such as group formation in the village, partnership with other agencies, joint planning, implementation and monitoring. The orientation programmes for funding agencies and NGOs were conducted for three days, whereas for the community, SHGs and Panchayati Raj leaders, they were conducted for two days.

102.6 Development of projects for Andhra Pradesh Forest Department

A study of the development of tsunami sensitive areas of Andhra Pradesh (AP) was conducted at the request of the APFD. The objectives of this study were:

- to study and evaluate the existing ecosystem management in the coastal areas of AP, with special reference to mangrove and non-mangrove shelterbelts,
- to study the existing institutional framework that is implementing the mangrove restoration and shelterbelt establishment,
- to identify the various stakeholders involved in the management of coastal zone ecosystems,
- to suggest suitable strategies and practices for the management of coastal zone ecosystems and
- to suggest suitable institutional arrangements and roles for stakeholders for the management of coastal ecosystems of AP

The study was conducted by reviewing available information, including remotely sensed data, collecting primary data in the field and interacting with various stakeholders such as the

community, community-based organizations, NGOs, panchayat representatives, research institutions and government agencies. A workshop was conducted separately for each stakeholder to assess their strengths, weaknesses, opportunities and threats relating to the development and management of mangrove and non-mangrove bioshields. The Report includes details of technical, social and developmental interventions that can be taken up for better management of the coastal ecosystems of AP. The Report was developed into a project proposal and submitted to World Bank for support by the APFD which is now approved and MSSRF has been selected as one of the partners to implement this project.

102.7 Indo-Sri Lanka Project

A project titled “Strengthening Resilience of Tsunami affected Communities: Bioshield, Livelihood Development and Village Knowledge Centres in India and Sri Lanka” has been developed based on the concept papers submitted by MSSRF, a grassroot NGO of Sri Lanka namely, Lanka Jatika Sarvodaya Sharamadhana Sangam (*Sarvodaya*), which has its headquarters in Moratuwa and an international NGO namely Practical Actions (formerly ITDG) with its headquarters in Colombo. The aim of the project is to reduce the vulnerability of the rural poor in coastal areas of Sri Lanka and India to natural disasters and enhance the capacity, resources and collective action of the coastal communities, grassroot organizations and government agencies to reduce the impact of natural disasters through integrating environmental rehabilitation,

livelihood enhancement and knowledge empowerment. In Sri Lanka, this project will be implemented in the eastern districts of Ampara, Hambantota and Batticaloa. In India, it is being implemented in the states of TN and AP. The following are the expected outcome of this project in India:

- Establishment of mangrove and non-mangrove bioshields in about 210 ha and 50 ha in TN and AP respectively,
- Establishment of 4 Village Resource Centres (VRCs) and 10 Village Knowledge Centres (VKCs),
- Livelihood opportunities created for about 20 % of the people of the project villages, who are below the poverty level.

The activities of bioshield development, village resource and knowledge centres and livelihood programmes will be implemented in an integrated manner.

Sub programme area 103

Seawater farming

103.1 Integrating mangrove afforestation with the cultivation of halophytes and fish and crab culture

A seawater farm uses untreated seawater instead of freshwater to raise crops. An integrated seawater farm combines the growing of salt tolerant field and orchard crops with the husbandry of animals, mainly fish, crab and shrimp. Diminishing freshwater sources,

shrinking arable land, rising sea level, intrusion of saline water and depleting capture fishery resources necessitate the development and demonstration of an ecologically suitable, economically viable and socially equitable system of seawater farming for the prosperity of coastal communities. Currently, a seawater farming system is being developed in partnership with a private entrepreneur and the local community in the Coleroon estuarine region in Nagapattinam district. In this system, attempts are being made to integrate raising of mangrove plantation, halophyte cultivation and crab and fish culture. It is being developed in a farm of about 0.70 ha. Normally, aquaculture ponds have four bunds to hold the water where fish and shrimp are cultured. In this farm, in addition to the four side bunds, the ponds have inner bunds; such an arrangement does not restrict the flow of tidal water in and out of the pond and at the same time, provides space for mangrove plants as well as halophyte crops. At present, mangrove species *Rhizophora apiculata* and *R. mucronata* are being grown in the lower edge of the inner and outer bunds and *Avicennia marina* is being grown in the middle portion of the bunds. A halophytic crop namely, *Sesuvium portulacastrum* will be grown at the top of the bunds. The area between the inner bunds has standing water of about 1.5 feet, which is suitable for fish and crab culture. Fish will be cultured during the first year. Once the *Rhizophora* species have started producing still roots, crab fattening or culture will be started. In this extensive system of seawater farming, water is not pumped from the sea into the farms, but seawater entering the saline

coastal tracts through tidal creeks and channels is tapped and utilized for farming. No artificial feed or chemicals will be used for fish or crab culture or halophyte cultivation. A community based Seawater Farming Monitoring Committee is being formed with 20 members. Four members, 2 men and 2 women, from the villages of Muzhukkuthurai, MGR Thittu, Mudasalodai, Madavamedu and Pazhayar will constitute the committee, which will visit the farm at regular intervals, and monitor the progress and evaluate results. Modifications and interventions suggested by this committee will be analyzed and incorporated.

Sub Programme Area 104

Nuclear and Biotechnological Tools for Coastal Systems Research

The project *Nuclear and Biotechnological Tools for Coastal Systems Research*, supported by the Department of Atomic Energy (DAE), has been primarily designed to integrate conservation of natural resources and sustainable development in the rural areas adjoining the Nuclear Power Plants through strengthening livelihood security, by blending frontier science and technology with traditional knowledge systems of rural coastal communities. The primary activity of the programme undertaken in Kalpakkam, Chidambaram and Kudankulam regions of TN was to introduce new tools and technologies for sustainable development in agriculture,

fisheries and animal husbandry through the development of grassroot level institutions, and strengthening local communities through capacity building and knowledge empowerment. In the first five years, the project focused on developing suitable models for adoption by the people, in the fields of agriculture, water management, animal husbandry, fisheries and allied activities. Last year the programme had a broader focus and concentrated on the demonstration of models developed jointly with the communities and their adoption by farmers.

104.1: Location specific performance and yield evaluation

In coastal dryland agriculture as practised in Kudankulam, the amount and distribution of rainfall during the NE monsoon governs the quality and length of the growing season. The monsoon rains occur at infrequent intervals and are interspersed with drought-like periods, when crops are exposed to moisture deficits.

Mutant varieties of pulses and oil seeds developed by BARC were evaluated and tested by farmers. They were found superior and drought-tolerant compared to the locally used ones. Table 1.6 shows the mutant varieties multiplied during the years, involving more than 150 farmers, under different soil conditions, in

three villages in and around Kudankulam. Similar activities were also initiated in Chidambaram (See PA 401.1.1) and Kalpakkam regions. The net area covered under various mutant crop varieties of pulses and groundnut in these regions has gone up substantially. Last year, more than 200 ha of land was under these crops, involving as many farmers.

Performance test for the millet species *Samai* was carried out as per the recommendation of the soil survey report, in the demo-plot under rainfed condition. Seeds obtained from TNAU and the All India Coordinated Project on millets were sown in one acre of land, and the yield obtained was 85 kg. Seeds produced in the demo-plot were distributed to farmers for further trials in their fields in the coming year.

Redgram (CO₅) variety obtained from the Department of Pulses, TNAU, Coimbatore, was sown in one acre of land and performance and yield parameters were recorded. The yield was found to be satisfactory at 135 kg/ac under rainfed condition. The trial also showed the production of a large amount of biomass which could be used as fodder and fuel. During the next season, most of the farmers with assured irrigation facilities will be cultivating these crops in their fields.

Jatropha (bio-diesel crop) is another promising crop to increase the productivity of the dry wasteland available in and around Kudankulam. In the MSSRF demo-plot, 135 different elite accessions were planted to identify the location specific genotypes in relation to oil content and yield. This will serve as a gene bank of *Jatropha*

Table 1.6 **BARC seed multiplication during the year in all the study sites**

Crops	Seed (kg)	Area (ha)
Greengram	3,940	67
Blackgram	2,569	40
Groundnut	12,292	38

germplasm. Four farmers' groups from nearby villages were trained on the techniques of large-scale plantation and production of bio-diesel crops. Four hectares of land with different soil characteristics were covered by growing *Jatropha* for demonstration purpose. Three nurseries have been established with a capacity of more than 10,000 plants, based on the interest shown by the farmers. Many of them are interested in quality seed production. Table 1.7 shows the area covered by different crops at Kudankulam.

Table 1.7 Area covered by different crops at Kudankulam

Crops	Area (ha)
Pulses	12
Groundnut	7
Jatropha	4
Fodder grass	30
Fruit crops	14
Total	67

104.2: Micro-watershed development

The yield of crops is affected during the dry period, especially during the flowering stage. Improving the soil moisture status and providing for lifesaving supplemental irrigation from local water resources is, thus, of primary importance for raising the productivity of rain-fed lands to their optimum potential. The local farmers adopted *in situ* conservation methods for securing the length of the growing period to meet crop water needs.

In a semi-arid region like Kudankulam, seasonal rainfall is less than 400 mm and soils have

medium to low water holding capacity. Shaping the land surface and grading it in such a way that excess water received during rainfall is safely conducted to water storage reservoirs (or tanks) or watershed unit to augment groundwater recharge is necessary to ensure sustainable availability of water.

The various activities undertaken in previous years at Vijyapathy panchayat with the participation of local people, such as earthwork and contour trench making, were completed and different local plant species, mainly fodder based trees, were planted, covering 10 ha of land. The group responsible for watershed development took up stall fed goat rearing as one of the income generating activities. Safe drinking water, sanitation and health awareness were included as various developmental activities around the watershed development area.

A few SC farmers applied for subsidized loan from NABARD for the construction of water harvesting structures in their fields, with technical support from MSSRF. MSSRF has taken the initiative to select farmers from nearby villages to recommend them for available loan schemes.

104.3: Fodder production practices

The importance given to nutritious perennial grass has created a good impact in and around Kudankulam region. About 50 farmers were supplied fodder slips directly from the demo plot. (Table 1.8) This has become an income generation activity as many farmers have started to sell the fodder slips @ Rs. 30/100 slips. MSSRF is helping NARDEP Kalluvilai

Table 1.8 Fodder crop varieties adopted by the farmers

Fodder varieties	No. of farmers
Hybrid fodder grass var. KKM1	30
Hybrid fodder grass var. CO3	10
Lablab	5
<i>Azolla</i>	3

centre to establish a fodder bank by providing all fodder slips/seeds available at the demo-plot. NARDEP is one of the technology resource centres under Vivekananda Kendra, Kanyakumari.

Azolla has been introduced as nutritious fodder in farmers' fields. Two demonstration plots have been established with help of NARDEP and *azolla* was distributed to a few farmers for

growing in their fields. *Azolla* is useful in dryland agriculture and can be used as manure.

104.4: Capacity Building

Regular training programmes, covering various topics, were conducted for SHG members at Kudankulam involving 1,480 training days as shown in Table 1.9.

During the year 14 new SHGs were formed in four different villages, taking the total number of SHGs to 60. Five SHGs were formed in Ovary village under Radhapuram Taluk, northeast of Kudankulam at the request of the local panchayat groups. The SHGs have saved about Rs 19 lakhs and received about Rs 50 lakhs from local financial institutions as soft loans for various activities.

An ADB sponsored and DRDA supported training programme on "Tsunami-Rehabilitation

Table 1.9: Details of the training programmes conducted during the year

Topic	Participants Men / Women	Training days
Concept of SHG / Leadership development	100 / 100	200
Micro-enterprises development	10 / 40	50
Fodder production practices	120 / 60	180
Vermicomposting	100 / 100	200
Dryland agriculture	100 / 100	200
Livestock management	80 / 40	120
Microwatershed	20 / 20	40
Sanitation/health programme	100 / 100	200
Computer and IT uses	100 / 160	260
<i>Azolla</i> production	10 / 20	30
Total	740 / 740	1,480

and Implementation”, covering almost 180 SHGs in Vijayapathy panchayat was implemented by MSSRF. The training module covered overall skill upgradation. Under total sanitation campaign for villages with 70 % SC population, 50 families benefited through MSSRF initiatives. Another 20 applications from these villages have been forwarded to the district authority for being covered under the sanitation scheme.

104.5: Eco-Enterprises

Horticultural species have been found to be a profitable investment by the farmers. They have started raising horticultural crop species under rainfed conditions through lateral exchange of ideas from neighbouring farmers, especially those trained by MSSRF.

The following interventions have also helped the farmers:

- Sale of fodder slips @Rs.30/100 slips of three internodal lengths.
- Sale of OYSTER mushroom at a cost of Rs.20/200 gm.
- Vermi-compost which is sold in eco packs @Rs.10/kg. One SHG has been issued PAN card by the income tax department for starting another compost unit at NPCIL township as per the mandatory requirement. More pits have been started by the farmers and the total strength is now 30.
- Strengthening the dairy unit. The dairy society at Kudankulam has added another 20 milch animals to increase their milk production. Milk distribution has gone up to 500 l/day. They are also receiving milk from other SHGs. MSSRF has helped in

training educated unemployed youth in animal husbandry with the support of the District Administration. These groups have now obtained financial support from the local bank for starting dairy units. The dairy society plans to establish a small packing unit for selling either milk or curd. The newly formed group of milkmen in Radhapuram has undergone training on value addition of milk. Due to the development of a cosmopolitan society in and around Kudankulam the demand for milk and milk based, value added products has gone up.

- Poultry units started by Kudankulam farmers have proved successful and fetch an average profit of Rs 1,500 to Rs 2,000 per month.
- Goat rearing started by an SC group at Olagachargarpuram is giving good returns.
- Fish based, value added products, mainly fish pickles, dry fish and masala fish sold by the fisherwomen groups have provided a profit of Rs 500 to 1,000 on 5 kg to 10 kg sales, adding to their regular source of income.
- Three groups in Kudankulam area have signed an MOU with Hindustan Lever Limited (HLL) to take up dealership and distribution of consumer products among the SHGs in nearby villages. The groups have realized a profit of Rs 1,500 to 1,800 per month in the first two sales.

104.6: Village Knowledge Centre (VKC)

The Village Knowledge Centre, with the support of students trained earlier, started a computer literacy campaign to reach out to every house

in the village to participate in the process initiated by MSSRF. The campaign has resulted in more than 200 girls and boys enrolled for computer classes. The VKC also conducts summer courses for fishermen and quiz and essay competitions. It receives various inputs from *The Hindu* Media Resource Centre, Informatics and *Every Child a Scientist* Programme of MSSRF, to improve the working model.

104.7: Genome Club

Kuthankuzhy village has been included in genome club activities. Twenty-five students joined this year, taking the total strength to 90. They were taken on a one - day exposure visit to the demo-plot and KKNPP. With the support of the Environmental Survey Laboratory and Science Centre, they have been involved in the “learning by doing programme”. Through this programme they learn basic facts of science. They were involved in raising a kitchen garden of seasonal vegetables. Two villages were chosen for this programme under the banner of “Promotion of kitchen garden for nutritional security”.

Sub Programme Area: 105

Remote Sensing and Geographical Information System

105.1: Coastal Zone Studies

During the year, the project “Coastal Zone Studies” was initiated with the support of the Space Application Centre (SAC), Ministry of

Environment and Forests, Government of India and the Forest Department, Government of Tamil Nadu. The main objectives of this study are:

- Mapping and monitoring of Marine Protected Areas (MPAs) and Marine Biosphere Reserve and Ramsar Coastal Wetlands using high resolution remote sensing data,
- Generation of a database indicating previous and current conditions and assessing the ecological status,
- Verifying the suitability of present boundaries, and if not suitable, to define the management boundaries based on the sensitivity of the coastal habitats with adequate buffer both seaward as well as landward.

The study is being conducted in the regions of Pichavaram, Vedaranyam, Ramanathapuram, Point Calimere and Pulicat Lake. Mangrove wetlands of Pichavaram and Muthupet are also being mapped at the plant community level. Assessment of the health of the mangrove wetland of Pichavaram is also a part of this project. Apparent reflectance of the mangrove vegetation from Indian Remote sensing Satellite (IRS) 1D Linear Imaging Self Scanning system (LISS 3) satellite data was used to map Pichavaram mangroves at the community level. Analysis of the reflectance of mangrove vegetation and non-mangrove vegetation from Landsat 5 TM (Thematic Mapper), Landsat 7 ETM data and IKONOS Multispectral data was initiated. Baseline data such as existing boundaries of MPAs and wetland maps of previous periods will be given by SAC to support current mapping and assessment activities.

105.2: Mapping indicators of Food Security Atlas of Cambodia

For the Food Security Atlas of Cambodia, thematic maps were prepared for three major groups: Food Availability, Food Access and Food Absorption. Natural break classification in Arc View GIS was used for these mapping. About 15 maps were prepared for Food Availability. Of these, 9 maps were prepared as thematic maps of provinces: They were rice production, rice production instability, per-capita deficit of food production, flood prone communes, drought prone communes, rainfall, water bodies, irrigated area and forest cover. Other maps such as soil types, land use and land cover, mangroves and rice types of Cambodia were prepared by over analysis of maps from secondary data and province maps. Paddy spread vs yield map and soil ranking map were prepared based on the GIS analysis of rice production, yield, land use/ land cover, rice types, soil and province maps.

There are 6 maps under the section Access: poverty rate, total literacy, female literacy, unemployment rate, incomplete education and primary education attainment. Indicators such as access to safe drinking water, toilet, infant mortality rate, sex ratio, juvenile sex ratio and percentage of stunted and underweight children are mapped in the section Absorption. Index maps of each section and the final Food Security Index map were also produced based on composite indices derived.

A commune-wise Food Security Index map was also produced as a composite of commune-

wise thematic maps such as per-capita production of food grains, population below poverty, adult literacy, percentage of underweight children, children enrolled and stunted children. These thematic maps were used in the preparation of the Food Security Atlas of Cambodia (Details in PA 403.1).

105.3: Database integration with Geographic Information System

Self Help Groups database of JRD Ecotechnology center was integrated with the spatial database of Reddiyarchatram block and Pondicherry. In Pondicherry, commune, road, river network, landuse, irrigation and other maps from secondary sources were digitized and integrated with the SHG database. Farmers and animators of Reddiyarchatram block were provided training on “Basics of Remote Sensing and Geographic Information System and their applications in the field” on 2 and 3 March 2006. As a follow up of this training programme, 9 animators (5 women and 4 men) of the VKCs of Kannivadi project site were given hands on training on using Remote Sensing data, entering data and digitizing maps into GIS and handling Global Positioning System from 22 to 24 May 2006.

105.4: Mapping and monitoring of water spread areas of Reddiyarchatram block

This was carried out as a part of the GIS development of Reddiyarchatram block of Dindigul district. Mapping and monitoring were done using satellite data of Landsat TM, Landsat ETM and IRS 1C LISS 3 and 1: 25,000 scale

maps of the Survey of India toposheets. This study showed that between 1970 and 1990 there was a great reduction in the water-spread areas when compared to the area reduction between 1990 and 2001 (Table 1.10). During this exercise water bodies that were formed after 1970 were also mapped using 2001 satellite data.

105.5 Assessment of soil and land use/ land cover of Mehbubnagar district

This study was carried out as an initial step to mapping assistance to the project on vulnerability and adaptation to climatic change. The objectives of the study are to prepare the first level land use land cover map of Mehbubnagar district using remote sensing data and derive mandal-wise extent of soil types and land use/ land cover. Landsat ETM data of 2001 was used to prepare landuse/land cover map. The soil map of AP prepared by the National Bureau of Soil Survey and Landuse Board of 1: 250,000 scale was used to separate the soils of Mehbubnagar district. The mandal map of the district was overlaid with soil and landuse/

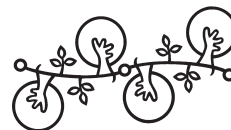
land cover maps to derive mandal-wise soil and landuse / land cover. Similarly, different soil types present under agricultural areas were also identified by overlay analysis, which shows that clayey calcareous soil has maximum agricultural coverage of about 3,72,313 ha followed by cracking clay calcareous soil covering an area of 1,39,452 ha.

105.6: Mapping Coastal Geomorphology of Cauvery delta

This study involved the mapping of geomorphological features of the Nagapattinam coast, starting from the Coleroon estuary in the north to Nagapattinam town in the south. Shoreline changes and sedimentation along the coast through fluvial discharge over a period from 1930 to 2005 were assessed. The shoreline changes show that there occur both erosion and accretion. Maximum erosion was mapped in Chinnavaikkal mouth region for about 0.73 km and maximum accretion in the region south of Vellar mouth to about 0.55 km. It also shows the southerly shift of Chinnavaikkal mouth for about 2.5 km.

Table.1.10 *Change in water spread areas of Reddiyarchatram block in hectares*

Period	No change	Other areas into water storage area	Waterspread area into other landuse
1970 – 1990	115	92	413
1990 – 2001	67	116	141
2001 – 2005	120	79	64



BIOTECHNOLOGY

Progress made during the last few years in the area of abiotic stress tolerance has resulted in MSSRF receiving support under the “Centre for Excellence” programme of the Department of Biotechnology, Govt. of India. Compounds exhibiting antimicrobial properties have been characterized. A few leads on new microbial isolates from mangrove rhizosphere have been established.

201	Ecological Restoration and Ecosystem Monitoring -----	41
202	Molecular Mapping -----	45
203	Bioprospecting for Novel Genes -----	46
204	Bioprospecting for Novel Compounds -----	53
205	Bioprospecting for Novel Microorganisms -----	55

Programme Area 200

BIOTECHNOLOGY

Advances in Biotechnology and Molecular Genetics have opened up new avenues of research and have enormous promise and implications for food, agriculture and nutrition security. Developments in the field of bioprospecting of plants, microbes and other organisms during the last few years have opened up new prospects for developing abiotic stress tolerant genetic material that are of immense utility in addressing the issues of water scarcity, increased salinization and associated problems.

The programmes of the Biotechnology group at MSSRF are designed to harness advanced molecular tools and technology in developing reproducible *in vitro* propagation methods for species of importance in dry areas; document diversity among economically important plant species using molecular marker technology; assess ecosystem health using microbes and lichen species; generate, catalogue and utilize characterized novel genetic combinations from target species and develop transformation systems for generation of location specific crop varieties with enhanced nutritional qualities and increased tolerance to abiotic stress.

The programme objectives have remained unchanged over the years with new interventions and initiatives being undertaken to add value to genetic resources and ensure their sustainable utilization for the ecological and economic security of the farming communities.

Progress made during the last few years has resulted in the award of long-term funding support for development of location specific crop varieties for abiotic stress tolerance by the Department of Biotechnology (DBT) under its competitive programme of *Centre for Excellence*.

Sub Programme Area 201

Ecological Restoration and Ecosystem Monitoring

201.1 Production and demonstration of high quality planting material of *Jatropha curcas*

Jatropha curcas is well known for its oil yield for biodiesel production and is a good crop for cultivation in the dry lands. The potential of *Jatropha* cultivation has been recognised by the Government of India. Technology development plans for *Jatropha* have been developed by organizations like Indian Oil Corporation, Indian Railways, universities and private institutions. In TN, the government has introduced schemes to encourage investment in *Jatropha* plantations and several individuals and organizations have already started cultivating *Jatropha* in a big way.

Collection of *Jatropha* germplasm accessions

Under the micro mission programme of DBT, "Production and demonstration of high quality planting material of *Jatropha curcas*," exploration of elite, high yielding accessions from TN was carried out. A total of 315 accessions were collected during the year from

various districts of TN (Table 2.1), based on yield and other parameters. The first 50 accessions were submitted to The Energy Resource Institute (TERI) for oil parameters analysis. A number of high oil-yielding accessions suggested by TERI are being maintained in the field nurseries of MSSRF at Kudankulam, Chidambaram, Jeypore and Karaikal.

Table 2.1. Details of the elite high oil yielding accessions of *Jatropha* collected from TN

Districts	Number of Accessions
Coimbatore	57
Erode	68
Salem	22
Namakkal	17
Karur	62
Trichy	41
Dindigul	13
Madurai	11
Virudunagar	24
Total	315

Clonal propagation of *Jatropha curcas*

Seed: Seeds were collected from respective elite germplasm and were sown directly in nursery bags containing garden soil and farmyard manure (1:1). Three-to four-month old saplings were kept under nursery conditions and transferred to selected sites for plantation. After plantation the saplings were irrigated once a week till the plants were well established.

Vegetative propagation: Soft wood cuttings were collected from selected accessions for rapid

uniform sapling propagation. After treatment with IBA and NAA, these cuttings were successfully rooted at field mist chambers.

Micropropagation

Direct organogenesis: Explants were selected from superior saplings. Uninodal explants were used for induction of shoots. Single shoots were first observed in MS medium in combination with BA. Additional supplementation with GA₃ and PVP gave better shoot development and elongation after 35 days. Second subculture was carried out in the same medium along with growth promoting endophytic bacteria isolated from *Jatropha*, and the cultures showed better multiplication and shoot development. The maximum number of shoots (2-5) was obtained after 40 days. Further sub-culture was initiated for root induction in ½ MS combination with NAA. Rooting was obtained after 30 days from the date of inoculation. Hardening process is ongoing.

Indirect organogenesis: Callus initiation was done in MS medium in combination with 2-4 D, NAA, KN, and PVP on 35 - day old callus transferred to multiplication medium. Callus differentiation was achieved in MS medium containing 0.5 mg/l TDZ and shoot elongation is in progress.

Nursery development

Selected elite germplasm were used for large scale nursery development in TN (2 nurseries with 15,000 saplings each), Pondicherry (1 nursery with 5,000 saplings) and Orissa (1 nursery with 10,000 saplings) where saplings are ready for plantation. These nurseries are

being maintained by the SHGs. About 50,000 *Jatropha* saplings will be taken for second phase plantation.

Plantation and maintenance

Jatropha gene pool gardens are being maintained in TN (5 ha), Pondicherry (2 ha) and Orissa (3 ha). Plantations have been carried out in Kudankulam (3 ha), Chidambaram (2ha), Pondicherry (2 ha) and Jeypore, Orissa (3 ha). Out of 10 ha of land available for *Jatropha* cultivation, 6 ha of gene pool garden and 4 ha of plantation are being maintained in the three states. Fifteen SHGs have been trained in nursery establishment and plantation in these states. Wastelands have already been identified by the Panchayats in TN, Karaikal region of Pondicherry and Jeypore in Orissa for *Jatropha* cultivation.

201.2 Demonstration of efficient energy plantation in coastal regions of TN with community participation

Bioenergy plantation and nursery management

Both field and bioenergy nurseries of *Rhizophora*, *Avicennia*, *Ceriops* and *Excoecaria* species are being maintained by Women Self Help Group (WSHG) members. Three lakh plants are being maintained at the bioenergy nursery for the coming year and these saplings will be supplied to the Pondicherry Government. A total area of 5 ha of two-year-old *Salicornia* and mangrove plantation is under maintenance in Pondicherry and a 2 ha three-year-old plantation is being maintained in Karaikal.

Salicornia brachiata cultivation and yield analysis

Four acres of *Salicornia* cultivation from selected high yielding clones was undertaken in Karaikal. The yield parameters were analyzed (edible shoot 4,046 kg/acre, oil yield from seeds 8 l/acre, herbal salt 1,400 kg/acre and animal feed seed meal 45 kg/acre; husk 1,500 kg/acre). These results are encouraging for seawater farming technology for saline coastal wasted lands, to provide a productive and promising economic source for resource-poor coastal people. Preliminary analysis of the results would be carried out, for cultivation during the current year in other coastal locations to confirm yield analysis.

Agro-technology for selected mangrove species

A complete agro technology package was developed for selected mangrove plants (*Ceriops decandra*, *Excoecaria agallocha*, *Salicornia brachiata* and *Avicennia marina*) for effective cultivation from managed mangrove forests in saline coastal land. MSSRF in collaboration with DBT is developing a monograph on energy plantations.

Micropropagation of Excoecaria agallocha

Rapid multiplied *Excoecaria* saplings were supplied to Kalpakkam and Karaikal for planting in tsunami affected coastal areas. About 3,500 tissue culture raised plants of *Excoecaria* were sent to SHG nurseries at Karaikal and Kalpakkam for hardening. After hardening, the saplings were planted at 2.5 x 2.5 meter spacing at both places and are growing well.

Planting of mangrove tree species at Chunnambar and Thengaithittu by women SHGs

Six WSHGs were trained in mangrove nursery techniques, mist propagation, plantation and plantation maintenance practices. All six of them were incorporated as a management unit (*Kizhavanjur Magalir Sathuppu Nila Kaadu Valarppu Kuzhu- KMSNKVK*). Its main activities include providing jobs from various sources, managing the income generation activities on a sustainable basis, and implementing projects on mangrove afforestation under Government Departments and NGOs. SHGs have signed an MoU with the Government of Pondicherry for the scheme “Implementation of Integrated Afforestation and Eco-Development Project (Coastal Shelter Belt Plantation) for the year 2005-2006. This programme would be focussing on supply of mangrove saplings, identification of suitable coastal sites for mangrove plantation, and aftercare plantation practices. KMSNKVK have received the first instalment of Rs. 1,08,000 (total grant Rs. 4.32 lakhs) from the Government of Pondicherry.

201.3 Lichen Diversity and distribution pattern in the Madukkarai region of the Western Ghats and their correlation with the disturbance regime

It has been established that lichens (symbiotic fungi with algae or cyanobacteria for nutritional requirements), due to the absence of protective and conductive tissues, are the first indicators of air pollution. The large-scale quantitative data on lichen diversity and their distribution pattern

can provide vital information on the levels of ecosystem health. The impact of cement dust on lichen diversity and their distribution in Madukkarai-Walayar region (E 76° 45'30" N 10° 49' 50" to E 76° 54' 10", N 10°54'10") was studied using large scale quantitative ecological sampling protocols. In the Madukkarai region of the Western Ghats, the sources of pollution (cement factory and limestone mining) are present close to the biodiversity “hot spot” areas.

Macroplot surveys were carried out in the moist and dry deciduous forest types of the Walayar reserve forest range, Kerala, which are geographically adjacent to the cement factory and the mining area. The Global Positioning System (GPS) assisted dust sampling using gravimetric method, indicated intense pollution in the forest sites within the radius of 0 km to 1.5 km and moderate pollution within a distance of 1.7 km to 5.6 km. Beyond 5.6 km the pollution levels were very low. The dust particles are predominantly calcium and silicon.

In addition to quantifying the lichen diversity and distribution, lichen species selected on the basis of distribution pattern from polluted and unpolluted sites, were analyzed for the composition of accumulated elements, distribution of trace elements within lichen layers, quantitative elemental deposition per unit area and ultra structural details, using Scanning Electron Microscopy (SEM) associated with Energy Dispersive X ray Microanalysis (EDX) (PHILIPS XL 30 ESEM at IGCAR, Kalpakam).

A total of nine trace elements were quantified through EDX (Energy dispersive X ray

microanalysis). The element Sulphur was found to be absent among samples collected from the polluted sites. The salient findings of the study are listed below.

- The lichen species *Bacidia sp.*, *Heterodermia dissecta* var. *koyana* Kurok., *Physcia tribacoides* Nyl., *Parmotrema grayanum* (Hue) Hale and *P. planatilobatum* Hale were identified as species that can indicate environmental contamination by the pollutant in the discontinuous thickets to low scattered shrub vegetation types of the Madukkarai - Walayar region located between Longitude 76° 45' 30" E - 76° 54' 10" E and Latitude 10° 49' 50" N - 10° 54' 10" N in TN state.
- The morphological, ultra structural and physiological studies indicated that lichen species from the polluted sites showed higher levels of tissue damage.
- *Bacidia sp.* that has to be described as a new species is the only lichen tolerating higher levels of pollutants.
- SEM-EDX studies indicated that the ascomata of this lichen accumulates high levels of Calcium and shows vigorous growth, whereas other lichens show lethal symptoms even at 50 % of Ca accumulation.
- Membrane integrity response in lichen species analyzed in terms of electrolyte leakage indicated that the cell membranes of the lichens from polluted areas have undergone damage. The *Bacidia sp.* showed a lower level of electrolyte leakage.

The lichen species *Bacidia sp.*, *Heterodermia dissecta* var. *koyana*, *Physcia tribacoides*, *Parmotrema grayanum* and *Parmotrema planatilobatum*, based on their distribution within the polluted and unpolluted areas, explicated differences with respect to distribution pattern, external and internal morphology, elemental accumulation, membrane integrity and pigment composition. These species can be used as indicators of the cement dust contamination in the forest types in the Madukkarai - Walayar region.

Sub Programme Area 202

Molecular Mapping

Molecular Profiling of Kewda genotypes

Kewda (*Pandanus* species) extract is one of the most popular perfumes used in India since ancient times. It blends with all types of perfumes used for scenting cloth, lotions, soaps, cosmetics, hair oils, tobacco and incense sticks. It is also used for flavouring various foods and soft drinks and is popular for use in bath waters. A study was conducted on the identification of elite genotypes, assessment of diversity among the genotypes of *Pandanus fascicularis* and other wild species of *Pandanus*. These genotypes and cultivars are being analysed for genetic fingerprinting, with the help of molecular markers such as RAPD, AFLP and ISSR. Collection of leaf samples of different genotypes of *Pandanus sp.* has been initiated from various locations in Orissa and TN. Protocol for DNA isolation has been standardized using the CTAB method. Isolated

DNA would be used for RAPD analysis with Random Operon primers. AFLP analysis is being performed using the Invitrogen AFLP kit. Genetic relationships among the genotypes will be assessed using the presence or absence of fragments or banding patterns between various genotypes of *Pandanus* with RAPD and AFLP and ISSR. These bands would be scored and analyzed using the NTSYS software package.

Molecular Profiling of *Cajanus*

Pigeon pea (*Cajanus cajan* (L.) Millspaugh) is one of the major legumes of the tropics and sub-tropics. It belongs to the family Leguminosae, subfamily Papilionideae, tribe Phaseolae and subtribe Cajaninae. A study has been initiated to collect and study the nature and extent of diversity among the traditional landraces of *Cajanus sp* and *Vigna sp* regarding which there is little or no information. The study is being undertaken through extensive collections of landraces from tribal regions of Orissa (Jeypore and adjoining areas), TN (Kolli Hills) and AP (Vishakapatnam and adjoining areas). Isolated DNA from different accessions is being used for AFLP analysis using the Invitrogen AFLP kit. Genetic relationship assessments will be carried out taking into account the presence or absence of fragments between and among wild relatives and landraces. The objectives of this study are to evaluate the extent of resistance to *Fusarium* disease, *Helicoverpa* pest attack and one of the most important abiotic stress tolerance traits, drought. The study ultimately aims to identify elite populations and landraces for conservation.

Sub Programme Area 203

Bioprospecting for Novel Genes

203.1 Analysis of gene expression under various environmental stress conditions

Plant growth and development are influenced by the presence of a variety of environmental factors. These abiotic stress factors, including salinity, high light intensity, high temperature, and heavy metals, lead to oxidative stress with the formation of Reactive Oxygen Species (ROS) causing extensive cellular damage and inhibition of photosynthesis. The antioxidant enzymatic pathway consists of different enzymes such as Super Oxide Dismutase (SOD), catalase (CAT) and ferritin (FER), which effectively remove these reactive oxygen species. As a first step towards studying the role of individual genes in *A. marina*, the antioxidant response to salt, iron, light and mannitol stress was analysed by monitoring the mRNA levels of Cu-Zn SOD, catalase and ferritin. *Cat1* and *Fer1* showed short-term induction while *Sod1* transcript was found to be unaltered in response to NaCl stress. A decrease in mRNA levels was observed for *Sod1* and *Cat1* while *Fer1* mRNA levels remained unaltered with mannitol stress treatment. *Sod1*, *Cat1* and *Fer1* mRNA levels were induced by iron, light stress and by direct H₂O₂ stress treatment, thus confirming their role in oxidative stress response. Mangroves face many environmental stress factors, especially salt stress and light. The response of *Cat1* and *Fer1* can be categorized as a short-term response

while *Sod1* performs a constitutive role in NaCl stress. This particular isoform, *Sod1*, may not have a contributory role in salt stress response of *A. marina*. This study confirmed that relative mRNA expression levels could be used as indicators to study the role of individual genes of a multigene family in each of these stresses. In conclusion, our data confirms that oxidative stress positively regulates the functioning of *Sod1*, *Cat1* and *Fer1*.

Introgression of AmSOD1 from transgenic PBI to local varieties

The generation of transgenic lines with the gene superoxide dismutase from the mangrove species *Avicennia marina* has been described in earlier reports. These lines have been tested for their tolerance to salinity stress as well as water stress conditions. In order to integrate the transgenes into other local varieties, introgression experiments were carried out. ADT43, white ponni, IR64 and IR20 were crossed with transgenic PBI and F_1 was obtained. The F_1 were uniform for the respective crosses with 50 % genome of the local variety. The F_1 were backcrossed with the parent (local variety) to obtain the BC_1F_1 seeds. An average of 200-300 BC_1F_1 plants were raised and analysed for the presence of the AmSOD1 gene. The segregation ratio for the transgene was in the ratio of 1:1 as expected. The plants which were positive for the transgene and had maximum resemblance to respective parents, were selected and backcrossed to obtain BC_2F_1 seeds. The backcross was repeated to obtain the BC_3 generation. The plants positive for phenotypically 100 % resemblance to the parent

and with transgene were forwarded to the BC_3 F_2 and BC_3 F_3 generation to develop homozygous populations.

Field trial of transgenic rice plants at Kalpakkam overexpressing AmCu/ZnSOD

Transgenic rice plants in four varieties ADT-43, IR20, white ponni and IR64 were generated with a gene homologous to cytosolic Cu/Zn SOD from the Mangrove species *Avicennia marina*. Based on the results obtained from the tests done in the laboratory it was decided to take up a field trial. The laboratory results were examined and the permission for the field trial was given by the RCGM for the four varieties. The field trials undertaken at Kalpakkam, using RBD design, are being assessed for the efficacy of the inserted gene for salinity tolerance and to assess the safety aspects of the inserted gene.

Isolation, characterization and overexpression of MnSOD

Full-length cDNA encoding MnSOD was isolated from *Avicennia marina* cDNA library. The cDNA was of 925 bp in length. The cDNA had an open reading frame of 680 bp from 90 bp to 770 bp. The MnSOD cDNA was cloned in the prokaryotic expression vector pET32a. The vector was transformed into *E. coli* BL-21 cells and the expression of the recombinant protein was studied. The BL-21 cells were grown to an O.D of 0.5. Recombinant protein expression was induced by adding 1mM IPTG. Expression of the recombinant protein was studied by resolving the total protein from the IPTG - induced *E. coli* cells. The recombinant

MnSOD protein was of 45 kDa in size. Studies are under way to purify the recombinant protein from the *E.coli*. Studies on the expression pattern of MnSOD in *A. marina* during stress conditions are also ongoing.

Analysis of ferritin gene expression in transgenic rice plants

Micronutrient deficiency is among the most challenging problems of global concern. With an overall objective of fortification of staple crops, an attempt was made to develop transgenic rice varieties incorporating the ferritin gene with improved iron content.

Earlier Reports have described the results of transformation of rice with iron storage protein ferritin gene for iron fortification and the presence and integration of T-DNA in the rice genome. These were corroborated by PCR and Southern blot analysis. During the last year, further improvements in functional analysis confirmed the expression of the ferritin gene in a tissue specific manner by iron specific histochemical analysis and western blot analysis.

Perl's Prussian blue staining method has been recommended for locating Fe (III) in animal tissues since it is quick and highly reproducible and the reagent can penetrate into bulky tissues to give a distinctive blue colour reaction. This technique has been used in non-transgenic rice to find the localization of iron in seed materials. Perl's Prussian blue staining of ferritin transgenic rice grain sections showed the distribution of iron accumulation (blue coloured compound of ferric ferrocyanide) throughout the aleurone and sub-aleurone layers and also in

the central region of starchy endosperm. However, in non-transgenic grains, blue colour formation of iron accumulation was restricted to the aleurone layer and the intensity of the colour development was also very low.

Transverse section of mature transgenic rice grains passing through the embryo region showed high iron accumulation in the embryo as well as in the endosperm. However, in non-transgenic rice grains, iron was restricted to the embryo and aleurone layer. Further, when compared to transgenic grains, the intensity of colour development in embryo region was very low. This histochemical analysis of iron in rice specifically showed temporal and spatial deposition of storage iron. This finding showed correlation with the Western blot analysis of expression of exogenous ferritin gene. In all the transgenic southern positive plants (seeds), a 28-kda-ferritin protein was detected, confirming that ferritin protein accumulates in rice seeds.

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

As part of the ongoing investigation of anti-oxidant systems and their role in stress, two cDNA clones from the cDNA library (salt stressed *Avicennia marina*), AmAPX1 (Ascorbate peroxidase) and AmMDAR1 (Monodehydroascorbate reductase), were chosen for investigation. These are the genes coding for key enzymes involved in scavenging of the reactive oxygen species during oxidative stress. AmAPX1 is 1179 bp in length while AmMDAR1 is 1916 bp in length. Both genes

were cloned simultaneously in pCAMBIA 1301, either alone or in combination. The constructs, pAmAPX, pAm-MDAR and pAmMDAR+AmAPX were used to transform tobacco. pAmMDAR+AmAPX was also transformed into the Indica rice variety IR-20. GUS positive AmAPX (18), AmMDAR (21) plants were checked by PCR. For tobacco plants transformed with AmAPX+AmMDAR, only PCR was used to confirm the presence of the transgene as the T_DNA did not carry the GUS gene. Among the thirty-three regenerant plants obtained, eighteen plants showed the presence of both AmAPX and AmMDAR genes.

A cultivated variety of Indica rice, IR-20, was used for rice transformation. Transformation of rice calli was performed by using *Agrobacterium* strain LBA 4404 transformed with pAmAPX+AmMDAR. Rice calli transformed with the double constructs are in various stages of regeneration. Gene expression studies were carried out with two-month-old *A. marina* seedlings to analyze the expression pattern of AmAPX1 in the presence of various abiotic stresses such as salt, hydrogen peroxide, excessive light and iron, using a gene specific probe. With 500 mM salt stress, the AmAPX1 transcript levels increased at 12 hrs in leaves, decreasing thereafter at 24 and 48 hrs of salt stress. Upon withdrawal from salt stress, AmAPX1 expression returned to basal levels. AmAPX1 transcript level increased when *Avicennia* seedlings were exposed to dark for 7 days and were transferred to high light intensity for 24hr. With excessive iron, AmAPX1 mRNA was induced within 30 minutes of transfer of the seedlings to iron excess medium and on

withdrawal of the iron stress, the Am-APX transcript levels decreased. The promoter for AmAPX1 has been isolated from TAIL PCR and is 1.67 Kb.

203.2 Gene expression studies with AmDHN and localization of the AmDHN-GFP fusion protein in the nucleus

Dehydrins from many plant species are known to express under circadian and/or diurnal rhythms. In order to see if such a pattern exists for AmDHN, gene expression studies were carried out. To check for the presence of a possible circadian oscillation in AmDHN expression, two sets of plants were acclimatized in half strength MS. One was kept at constant light while the other was kept in total dark conditions for 72 hours. The dark-acclimatized set was moved to light and the light-acclimatized set to dark for 12 hours. The samples were shifted from a dark to light or light to dark regime every twelve hours for 48 hours. Northern hybridization analysis revealed a clear profile of sequential waves. The transcript levels oscillate and peak at dawn (3 am) and confirmed that the transcript for AmDHN did not exhibit circadian behaviour. To check for a possible diurnal regulation of AmDHN expression, *A. marina* seedlings were kept in a 16 h/8h photoperiod (light/dark) for 72 hours and leaf tissue was frozen at 6 hourly intervals. A total of 13 time points were taken. The Northern hybridization signals were quantified by densitometric analysis using BioRad Quantity One software. The results are yet to be analyzed. Using TAIL-PCR, an 843 bp promoter fragment was obtained in two

steps. PLACE analysis revealed the presence of 4 ACGT sequences at -316, -409, -470 and -644 bp respectively. ACGT forms the core of sequences reported to function as ABA-responsive elements (ABREs) in many ABA-responsive genes. GFP was fused with the C-terminus of the AmDHN ORF and cloned in pCAMBIA 1301 under the control of the 2x35S Cauliflower mosaic promoter. The construct has been named pAmDHN-GFP. It was mobilized into *Agrobacterium tumefaciens* strain EHA105 by the freeze-thaw method. *Agrobacterium* – mediated transformation of tobacco (*Nicotiana tabacum*) cv. Petite Havana was carried out by the standard protocol. Epidermal leaf peels mounted in water were prepared from GUS positive tobacco plants and examined under the Nikon Optiphot-2 phase contrast microscope fitted with an Episcopic fluorescence attachment (100W Hg lamp). Fluorescence imaging of guard cells was carried out using the Nikon B2A filter set. Guard cell imaging of pAmDHN-GFP transformed tobacco plants showed localization of the green fluorescence in the nuclei of the guard cells and the nucleus of the trichome and was confirmed by DAPI staining of the nucleus. Bright field images and fluorescence images of the same guard cell have been taken. Tobacco explants (shoot) expressing AmDHN-GFP were placed in half strength MS medium containing 200mM NaCl and kept for 10 days. These plants produced roots readily and were shown to grow better as compared to the control (constructs transformed with GFP alone) which did not survive and underwent chlorosis.

203.3 Analysis of transgenic tobacco plants expressing the *Porteresia coarctata* Na⁺/H⁺ antiporter (PcNHX) and localization of PcNHX-GFP fusion in vacuoles

It has been reported that tobacco plants were transformed with PcNHX via *Agrobacterium*-mediated transformation and PCR and GUS positive plants used for further Southern analysis. For determining the copy number of the Na⁺/H⁺ antiporter gene in transgenic tobacco plants transformed with the PcNHX, tobacco genomic DNA of the PCR and GUS positive plants were subjected to Southern blot analysis. Out of the seven plants analysed, four were found to be single integration events. Northern-blot analysis was also carried out to determine whether the PcNHX gene was successfully expressed in these transgenic lines. Total RNA was isolated from 4 independent transgenic plants with single copy insertion of the gene and full length PcNHX gene was used as a probe. The transcript level was very high in transgenic plants, whereas no signal was obtained from untransformed control. Southern analysis was also carried out to identify transgenic plants with single copy integration of the PcNHX promoter fused to the GUS gene. Of the eight plants analysed, a single hybridization signal was observed in lines 1 and 7. In all the other lines two or more bands were visible, corresponding to multiple integration events.

The green fluorescent protein (GFP) fusions have been successfully used to determine protein localization. Expression of GFP fusion proteins offers an opportunity to introduce specific markers for subcellular structures that can be

directly visualized in live cells. The mGFP6 gene fused to the N-terminus of the PcNHX gene through an (alanine)₁₀ linker was cloned in PCAMBIA 1301 under the control of the double strength Cauliflower Mosaic promoter (2X 35S). This construct, pGFP-Ala-PcNHX, was used to transform tobacco. The plants were screened for the presence of the gene by both PCR and GUS assay. Four plants, which showed intense GUS staining, were then used for further analysis. 7-day-old suspension culture derived from the PCR and GUS positive plants was screened for GFP fluorescence using the Nikon Epifluorescence microscope. The imaging of pGFP-Ala-PcNHX transformed tobacco suspension cells showed localization of the green fluorescence at the vacuolar membrane. No detectable signal was present in non-transgenic tobacco cells. The vacuolar localization of the fusion protein was confirmed by using the fluorescent styryl dye FM 4-64.

For the isolation of genomic clone for PcNHX, primers were designed based on the cDNA sequence and used to amplify the entire gene from the *Porteresia* DNA by PCR. The genomic clone for PcNHX was 4740 bp in length with a total of 13 introns in the gene. The largest intron was 735 bp in length. The position and distribution of introns along PcNHX was similar to that of the OsNHX gene from *Oryza sativa*, a closely related species.

203.4 Characterization of stress induced genes from the *Prosopis juliflora* library

From the *Prosopis juliflora* cDNA library, 1,467 ESTs were deposited in the public database

(NCBI, dbEST). One of the genes from the *P. juliflora* library, Glutathione-S-Transferase (PjGST), was chosen for further study. Northern experiments were done for PjGST for PEG, salt, mannitol, cadmium, heat stresses, water withdrawal and 2,4 D, GSH, methyl viologen, H₂O₂ application. PjGST was transformed into tobacco (Wisconsin 38) and the presence of the integrated gene was confirmed by PCR Southern. Transformed tobacco plantlets were tested for survival under stress conditions. PjGST transformed plants were found to survive better under conditions of 150 mM NaCl, 100 mM mannitol, 25 mM cadmium or 10 % PEG. PjGST was also transformed into Indica rice variety ADT 43 and the presence of the transgene in the T2 generation was confirmed with PCR southern. Stress tolerance studies (ability to germinate in medium containing 150 mM NaCl, 100 mM mannitol or 25 mM cadmium) was carried out with the transgenic rice plants and they showed faster germination as compared to control (untransformed) plants. Three isoforms of Type II GSTs found in the *P. juliflora* cDNA library were fully sequenced. Genomic clones for all three GSTs were also isolated and the intron number, sequence and position determined.

As reported earlier, Type II metallothionein (Pj MTII) was isolated from *P. juliflora* cDNA library. It was cloned in pCAMBIA 1301, transformed into *A. tumefaciens* strain (LBA 4404) and used to infect tobacco (Petit Havana) leaf discs. Thirteen hygromycin resistant plants were regenerated on MS medium containing BAP

and NAA. Genomic DNA was isolated from these plants and PCR was performed with 5' and 3' UTR specific primers. PCR products were blotted on a nylon membrane and Southern hybridization was done with 3' UTR specific probe. Twelve out of thirteen plants were found to be positive. Total RNA was isolated from these plants and Northern hybridization was done to study the expression level of the transformed PjMTII gene. Lines 1, 4 and 6 showed higher mRNA expression level than the other plants. These three lines were further analyzed for their heavy metal tolerance. Sixty-day-old untransformed and transformed (PjMTII) tobacco plants (Lines 1, 4 and 6) were kept in half strength MS for 4 days and then transferred to fresh MS containing 100 μM CdSO_4 . Comparison revealed that transgenic plants were healthier and did not show any necrotic lesions even after ten days of treatment when compared to control untransformed plants. To test the ability of *E. coli* cells expressing PjMTII to survive under conditions of metal stress, type PjMTII cDNA was cloned in the thioredoxin fusion vector pET32a and transformed into *E. coli* BL21(DE3) cells. Control (vector alone) and transformed (PjMTII) cells were grown in different concentrations of CdSO_4 (0.3 mM, 0.6 mM, 0.9 mM) for 7 hours (as measured by an increase in the absorbance OD_{600} using a spectrophotometer). At the seventh hour, cells containing PjMTII showed higher absorbance compared to the control untransformed *E. coli* cells. This shows that PjMTII expressing *E. coli* cells could tolerate heavy metal and grow better than the control cells. The fusion protein was purified for raising polyclonal antibody.

Understanding salinity tolerance mechanism in Sesuvium portulacastrum

S. portulacastrum is a halophyte belonging to the Aizoaceae family. It is found to be associated with mangrove plants and also grows along the coasts in the tropics. Since it can be easily propagated through stem cuttings and can tolerate a wide range of stresses that include drought, salinity and high light intensities, understanding the mechanism of salinity tolerance in this plant would be useful for redesigning salt-sensitive crop plants. It is well appreciated in recent times that salinity stress tolerance is a complex trait and it requires a proper understanding of both whole plant and cellular responses to salinity stress. Therefore, experiments were designed to understand cellular and whole plant level responses of *S. portulacastrum* to salt stress.

Results from the past year indicate that at least one response might be common both at the cellular and whole plant levels. *S. portulacastrum* plants responded to salt stress by accumulating pink to red coloured pigments, which could probably be anthocyanins. It was interesting that at the cellular level the pigmentation response was at low concentrations of sodium chloride or salt in the growth medium while at the whole plant level it required higher concentrations of salt. Moreover, it was observed that optimal cell growth was possible only when a small amount of sodium chloride was present in the growth medium, suggesting salt to be a requirement for optimal growth in halophytes like *S. portulacastrum*.

203.5 Gene mining from Lichens

Lichens are eukaryotic microbes having the flexibility of a microorganism to be handled comfortably under controlled lab environments, and genetic stability because of their eukaryotic nature. The insights into the capabilities or adaptations by these natural microbial communities could be well understood by sequencing the genomic DNA of these organisms. Lichen genomic DNA are yet to be screened in a detailed manner, and the novel genetic information could throw valuable information on the mechanisms of adaptation of these organisms, which can be mined and utilized for crop improvement and nutritional schemes for the protection of sustainable livelihoods as well as fragile environments. The existing genomic DNA studies with specific reference to genes responsible for Polyketide Biosynthesis (PKS), protein expression enabling desiccation tolerance (hydrophobins) etc. have demonstrated that lichens are the potential future novel sources of genetic material.

The ongoing study on *Dirinaria consimilis* and *Pyxine cocoes*, such as germplasm characterization, cDNA library construction, large scale EST sequencing, Gene annotation and standardization of growth conditions are the prerequisites for mining novel genetic combinations from these species. Protocols were standardized for genomic DNA isolation from *Dirinaria consimilis* and *Pyxine cocoes*. Genomic DNA was isolated and digested with restriction enzymes and genes below 1kb were cloned in *E.coli*. Further sequencing and

molecular analysis of the cloned genomic DNA of these species are ongoing. Protocols of RNA isolation from the above selected species were standardized. mRNA were isolated from total RNA for further construction of cDNA library.

Sub Programme Area 204

Bioprospecting for Novel Compounds

204.1 Lichens

This program aims at harnessing the antimicrobial potentials of the secondary compounds of selected lichen species (symbiotic fungi with algae or cyanobacteria for nutritional requirements) viz. *Roccella montagnei*, *Parmotrema praesorediosum*, *Dirinaria consimilis*, *Ramalina celastri* and *Usnea sp.* The secondary compounds of these lichen species were extracted in organic solvent gradients and screened for their antimicrobial properties against human bacterial and fungal pathogens. The compounds which exhibited antimicrobial properties were further chemically characterized in collaboration with the Organic Chemistry Laboratory and Sophisticated Analytical Instrumentation Facility (SAIF), Indian Institute of Technology, Chennai. As a prerequisite for drug development, these potential compounds were subjected to cytotoxic and genotoxic studies on Swiss Albino mice and Wister rats in collaboration with the Department of Pharmacology & Environmental Toxicology and Genetics, PGIBMS, University of Madras.

Qualitative and quantitative extraction of lichen secondary metabolites and subsequent antimicrobial screening provided the basis for the identification of two novel compounds from *Roccella montagnei* and *Parmotrema praesorediosum*. Patent applications for these compounds have been filed.

Crude hexane extract of *D. consimilis* exhibited antimicrobial activity and this extract was subjected to further fractionation and subsequent bioassays. Out of the five fractions of the above lichen, two fractions (Fraction 1 and 5) showed antimicrobial activity against five human bacterial pathogens. Hence these fractions were subjected to further purification and structure elucidation of these fractions is being carried out. Similarly, crude acetone extracts of *Ramalina celastri* and *Usnea sp.* were found to be bioactive.

Lichen culture for secondary compound production is considered a vital component of the conservation of the lichen species in their habitat and sustainable utilization of these novel resources industrially. On these lines, the protocols for *in vitro* culture for the production of secondary compounds through lichen whole thallus, fungal and photosynthetic partners for *Roccella montagnei*, *Parmotrema praesorediosum*, *Dirinaria consimilis* and *Usnea sp.* were standardised.

204.2 *Excoecaria agallocha*

Excoecaria agallocha, also called the milky mangrove, is widely distributed across Africa, Asia, Australia and the Pacific Islands. The tree grows further inland, usually at the high water

mark. It can grow in both stony and muddy soils and tolerate dry and salty conditions. It is used to treat sores and stings from marine creatures. Smoke from the bark is used to treat leprosy. The plant is being tested for modern medical uses. Preliminary screening at MSSRF showed that the plant may have anti-HIV, anti-cancer, anti-bacterial, anti-pest and anti-viral properties.

Hexane and aqueous extracts of *E. agallocha* were found to be active against the third instar larvae and the moth of *H. armigera* in laboratory assays. Fractionation and subsequent purification of the hexane extract yielded bioactive compounds that were confirmed as terpenoid by spray reagents.

Field trials were carried out in cotton, okra, pigeon pea and chickpea. The pigeon pea and chickpea trials are ongoing in CBSH, University of Pantnagar, Uttaranchal. The results from okra and cotton indicate a comparable performance of the *E. agallocha* formulation with positive, Neem Gold. Results from the field trial indicate that the hexane extract in ethanol formulation is comparable with Neem Gold while the extract in traditional formulation gave better results (yield 1.8 kg/ plot in the former and 2.4 kg/ plot in the latter in the cotton trial).

In pigeon pea, three replications were maintained for each treatment. Five spray doses with 1-week time intervals were administered using a hand sprayer. Effective reduction in the larval count and subsequent crop protection were observed. The percent pod infestation in T₂ (Polygonum + Reetha), T₆ (Nimbecidine) and T₇ (MSSRF) was significantly lower than control

(4.43 %). The lowest % infestation was obtained in T₂ (2.21 %) followed by T₆ (2.35 %) and T₇ (2.42 %), respectively. However, average yield data showed that it was statistically insignificant due to a high variation within treatments on account of a heterogenous seed. Chickpea data is being analyzed and the tomato field trial is continuing.

Four hexane fractions that show high anti-feedant activity against *H. armigera* were found. With respect to X-ray crystallography studies, data H5 is complete; fraction H4 has been crystallized and is being characterized for compound structure. Crystallization of Fractions H1 and H2 are underway. Column chromatography of a partially purified bioactive component H-5 in SiO₂ (60-120) using Pet Ether: Ethyl acetate yielded crystals (Colorless needles in CHCl₃). They were analyzed by X-Ray Crystallography, ENRAF NONIUS CD-4 model with molybdenum probe (Goniometer Geometry- Kappa). For structure refinement, Full Matrix Least Square on F² method was used. The resolved structure suggested that the lattice arrangement obeys monoclinic symmetry with C₂ spacer group. The molecular formula was assigned as C₃₀H₅₁O. ChemFinderä database search with the unit cell parameter values revealed that the compound was novel. Assignment of the IUPAC nomenclature and the class of compound are underway. For further confirmation, ¹³C and H⁺ NMR analysis with decoupling was performed. Column purification of fraction H-4 yielded crystals that are under XRD analysis. Column fraction H-1 (amorphous waxy material) was subjected to ¹³C and H⁺

NMR. Crystallization, Mass Spectroscopy and FT-IR are underway to confirm the molecular structure.

Sub Programme Area 205

Bioprospecting for Novel Microorganisms

205.1 Microbial diversity in coastal agri-ecosystem

Field testing and product development of Plant Growth Promoting Bacteria in the Coastal agri-ecosystem

An extensive field trial on a participatory mode was carried out in a coastal area (Chidambaram) for 200 acres of paddy, using efficient strains of biofertilizers, identified through multi-location field trials, which showed interesting results in the increase in number of tillers and significantly increased yield in paddy. The demonstration plots for biofertilizers have convinced the farming community on the effectiveness of this technology, for which there is presently an increasing demand. The promising strains were formulated in a vermiculite based carrier medium in collaboration with a private entrepreneur. Liquid formulations have been prepared for the best performing strains *Azospirillum* MSA-148 and Phosphobacteria PS-5.

Out of the short listed 20 strains, 4 were selected on the basis of their antagonistic potential. Using the selected strains of *Pseudomonas*, further field trials, mandatory for the registration process of the efficient strains,

were conducted at the Tirur Rice Research Station in three different seasons. Based on the antagonistic potential of the strains and their salt tolerance potential, MSP-393 has been selected for toxicological analysis in an accredited institution, as this is mandatory for formulation and release. Preliminary discussions are on for the toxicological analysis of the primary culture as per Central Insecticide Board (CIB) standards. Once this is through, the strains will be handed over to entrepreneurs for formulations and large-scale production and release.

Mechanism of salt tolerance in Pseudomonas

The FAME analysis was carried out to study the change in the fatty acid profile of the bacterium upon increasing osmolarity and it showed the absence of C7:1, C8:1, C10:1, C12:1 and C16:0 in MSP-393 grown at high osmolarity. The percentage of total acids in the normal culture and in the stressed culture had significant difference. Fatty acids C14:1, C19:0, C20:1, C22:1 were found only in the stressed culture; they were identified as Methyl myristate, Methyl nonadecanoate, Methyl arachidate and Methyl erucate respectively. Analysis of the lipid composition of cells grown in minimal medium containing 300 mM NaCl revealed a 7.61 % increase in cellular unsaturated fatty acids with respect to cells grown in the absence of NaCl. The percentage of unsaturated fatty acids was more in the stressed cells compared to the one grown in a medium without NaCl stress. This phenomenon gives an indirect evidence for the altered expression of genes involved in osmoregulation.

As a means to understand the role of K^+ in osmotolerance, cells of *P. fluorescens* MSP-393, exponentially growing in minimal medium (with 0, 300 and 600 mM of NaCl) were analyzed for the cellular K^+ . The study showed that the K^+ concentration inside the cell increased with increasing concentration of NaCl (300 mM & 600 mM).

Plant growth promoting rhizobacteria from Mangroves

Last year, initial screening was carried for the functional population of rhizosphere microorganisms with respect to nitrogen fixation, phosphate solubilisation and biocontrol of plant pathogens. As a result, some strains have been identified, which are presumed to be novel. A total of 45 marine red-pigmented vibrio were isolated from *Portersia coarctata* and *Avicennia marina*. Based on the Rep-PCR analysis these 45 isolates have been grouped into four clusters, depending on their banding pattern and these isolates show very good biocontrol activity against bacterial phytopathogens, for example *Xanthomonas oryzae* (rice sheath blight disease) and its 16SrRNA gene sequence was submitted in NCBI Database (accession no- DQ273663). Taxonomic characterization is being carried out to place this strain at species level. Three yellow-pigmented bacteria were identified from *Avicennia marina*, which are positive for nitrogen fixation, confirmed by *nifH* primers. Its 16SrRNA gene sequence does not form a close relationship with any genus in the family *Sphingomonadaceae* and its 16SrRNA gene sequence was submitted in NCBI Database

(accession no- DQ399262). Similarly red-orange pigmented bacteria isolated from all mangrove plants and Rep-PCR analysis of them revealed that all had similar banding patterns thereby indicating that all the isolates belong to a single taxon. All are positive for nitrogen fixation, confirmed by *nifH* primers and its 16S rRNA gene sequence formed close relationship with *Bacillus firmus* and its 16S rRNA gene sequence was submitted in NCBI Database (Accession no- DQ399261). Likewise, the studies also establish other novel strains which are associated with mangrove rhizospheres and the outcome of these studies shows that there are quite a number of bacteria other than *Pseudomonas* and *Bacillus*, like *Novosphingobium sp*, *Erythrobacter sp*, *Vibrio sp* which can colonize the mangrove rhizosphere. Detailed studies have to be carried out to understand the ecological role of these microbes in mangrove rhizosphere.

205.2 Genetic diversity of soil DNA from mangrove forests (16S rRNA genes) using PCR-SSCP.

A comparative study was carried out to examine the structure of the bacterial community in different mangrove rhizosphere samples collected from intra and inter sites, by using cultured-independent method. The universal primers, Com1 and Com2 (positions 519 to 536 and 907 to 926, *Escherichia coli* numbering), were used for the amplification of V4 and V5 regions in the rhizosphere soil DNA. To gain a better understanding of the dynamics of the bacterial community, Single-Strand Conformation Polymorphism (SSCP) was used

for analyzing 16S rRNA genes of PCR products. Prominent SSCP bands were excised and sequenced to gain insight into the identities of predominantly present bacterial populations. The majority of SSCP band sequences were related to bacterial genera of root-free soil environments, such *Bacillus*, *Planococcus*, *Planomicrobium*, low G+C Gram-positive bacterium, glacial ice bacterium and uncultured bacteria. The sequences detected by SSCP approach were derived from a wide taxonomic range, suggesting that presence in the rhizosphere was not determined at broad taxonomic levels but rather was a strain- or species-specific phenomenon.

The PCR-SSCP profiles of rhizosphere samples showed somewhat distinguishable variations between different mangrove species. SSCP of recovered PCR products based on amplified soil DNA from five different rhizosphere samples produced between 11 to 17 bands in *P. coarctata*, 11 to 13 bands in *R. mucronata*, 6 to 10 bands in *A. marina*, 4 to 6 bands in *S. apetala* and 6 to 10 bands in *E. agallocha* ranging in mobility from non denaturant gel.

Sequencing of SSCP bands revealed that the majority of the dominant populations detected had 16S rRNA gene sequences that were most closely related to those of previously described soil bacteria (i.e., *Planococcus*, *Planomicrobium*, *Bacillus*, low G+C Gram-positive bacterium, and Glacial ice bacterium) or unidentified bacteria detected as environmental clones. Moreover, one sequence recovered was an exact match with a previously recovered sequence of *Planomicrobium sp*.

(AY730709). Results suggest that the activity of bacteria within the rhizosphere is rather strain or ecotype specific, instead of determined at the genus level or a higher taxonomic level. Band sequences determined in this study have been deposited in the NCBI database under accession numbers DQ 322699 and DQ 322700; DQ 336196 to DQ 336202 and DQ 356474 to DQ 356479.

205.3 Low cost biofertiliser unit as an enterprise

As a first step to understand the distribution of the plant growth promoting rhizobacteria in the Kannivadi region, soil samples were collected for major cultivated crops (paddy, maize, cotton, sugarcane, cluster bean, brinjal, banana, chili, crosandra, bitter gourd and jasmine). The plant growth promoting bacteria (*Azospirillum* and *Phosphobacteria*) were isolated and characterized. The most efficient strains were short-listed and growth studies were carried out. Of the *Azospirillum* strains isolated, Kaz1, Kaz12, Kaz25, Kaz29, Kaz38, Kaz52, Kaz55, Kaz83, Kaz85, and Kaz91 were found to be efficient and the strains Kaz29 and Kaz83 were short-listed for production, based on their activity and growth rate. Out of the phosphate solubilizing bacteria isolated, KPA and KPB were found to be efficient and KPA was short-listed for production as these native strains would already be well adapted to the soil conditions and would have a cutting edge in the colonization of root surface and establishment in the rhizosphere and thus perform better.

The representatives of the Jhansirani SHG were trained on biofertilizer production technology at the Microbiology lab at MSSRF for three days (See PA 401.3.1).

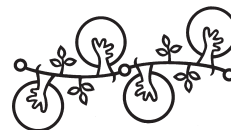
205.4 Biological control of finger millet blast

Finger millet, *Eleusine coracana* L., (Ragi) is an important staple food in India and in the eastern and central parts of Africa. Even though finger millet is known to be one of the hardiest crops, it is affected by many diseases such as blast, foot rot, smut, streak and mottling virus. Among these, blast, caused by the fungus *Pyricularia grisea* sacc., is the most devastating disease, affecting different aerial parts of the plant at all stages of its growth, starting from seedling to grain formation. Yield loss due to blast may be around 28 %, and sometimes it may go as high as high as 80 to 90 %. Since finger millet is predominantly grown as a rain fed crop by small farmers, the disease management by chemical means is found to be economically unaffordable. Hence, it would be useful for the disease to be managed by natural and low cost methods. Biological control using bacteria is not only economical for minimizing the losses caused by the disease, but it is also an environmentally friendly method.

Preliminary work has been initiated towards biological control of blast in finger millets. The samples of rhizosphere of finger millet and blast affected leaf and neck lesions were collected from different regions of Villupuram district and Kolli Hills. Monoconidial isolates of *Magnaporthe grisea* were isolated from the lesions by moist chamber method and the

isolates were subjected to conidiation for confirmation. The finger millet rhizosphere soil samples were serially diluted and plated on Kings B and Nutrient agar plates. The individual colonies were isolated and streaked to purity. The isolated rhizobacteria isolated were screened for their antagonistic potential by dual plate assay against *Magnaporthe grisea*, the causal organism of Blast disease. The plates were incubated at room temperature ($28 \pm 2^\circ\text{C}$) for four days and the radial growth (cm) of the pathogen mycelium was recorded and percent inhibition of the mycelial growth was then calculated. Of 180 Rhizobacteria tested, only 19 showed antagonistic activity, of which 5 strains showing 60-64 % were short-listed and subjected to further characterization. The shortlisted strain was then observed microscopically and standard biochemical characterization was carried out putatively,

identifying the isolates to belong to *Pseudomonas*. The DNA was isolated from the putative *Pseudomonas* isolate and was subjected to PCR analysis of genus specific primers, the forward primer Ps-F (5'GGTCTGAGAGGATGATCAGT) and the reverse primer Ps-R (5'TTAGCTCACCTC-GCGGC). The products were run on agarose gels along with 1Kb ladder and a 1Kb fragment was amplified confirming the isolate to belong to the genus *Pseudomonas*. The isolates were further characterized to deduce their mechanism of action. They were found to produce iron chelating compounds, siderophores both by spectrophotometric method and CAS chemical assay. The isolates also produced hydrogen cyanide, which exerts a cytotoxic effect. They did not produce hydrolytic enzymes like pectinase, cellulase, lipase or chitinase.



BIODIVERSITY

The year 2006 marks a decade of CABIC efforts in addressing the issues of strengthening community conservation practice at Wayanad, Kerala. During the year kalajeera was produced on a large scale and fetched a price equivalent to the procurement of basmati rice in the export market. Characterization of the rice germplasm collected from the tsunami areas was initiated at Nagapattinam.

301	Kolli Hills and Namakkal -----	61
302	Wayanad -----	64
303	Jeypore -----	68
304	Community Gene Bank -----	73

Sub Programme Area 300

Community Based Agro-biodiversity Conservation and Management

There was a dynamic progress in community-led agro-biodiversity management in all the three intervention sites. Training and capacity building programmes of SHGs, farmers groups and grassroot institutions were continued with a focus on income generation, strengthening homestead agro-biodiversity with traditional crops in Wayanad and quality millet seed production, processing and marketing of value added products in Kolli Hills. A Biodiversity Conservation Corp (BCC) consisting of women SHG members has emerged in Kolli Hills for the purpose of monitoring and managing the millet based activities. A “Save Millet Seed Campaign” helped in creating an awareness of the importance of conserving the millet genetic variability of the region. A tribal leaders’ support group has emerged to advice and steer the activities of the community agro-biodiversity Centre at Wayanad.

The Gene Bank accessions marked 1,037 during the reporting period. Altogether 500 accessions of paddy and millets were subjected under the characterization trial in the field sites of Jeypore, Orissa and Puthoorvayal village in Wayanad. With the special support from the Italian Government a detailed study on characterization of the rice germplasm collected from tsunami affected areas was initiated at Nagapattinam.

Sub Programme Area 301

Kolli Hills and Namakkal

The community-led developmental activities were merged with the core action in Kolli Hills, and some notable research attempts on millet crop production and region specific landraces were made.

Awareness, Training and Capacity Building

Training and Capacity Building: Four clusters of SHGs, each with four groups consisting of four members each, were formed and organized into a *Biodiversity Conservation Corp (BCC)* to monitor and manage activities in conservation, cultivation, input and marketing (processing and value addition).

With the help of CCD, an NGO from Madurai, a 12 -day training programme was extended to 40 SHGs including the BCC from the villages of Valavandhi, Selur, Devanur, Valappur, Ariyur, Gundur, Alathur, Thirupuli, Chithur, Bail, Perakarai and Edapuli. The members have taken up enterprises such as minor millet processing, vermicompost preparation, petty shop, ragimalt preparation, minor millet marketing and organic pineapple export marketing. The training programme included topics such as conservation of resources, sustainable harvesting, identifying available resources, improved agronomic and cultivation practices, agri input and organic farming. Details of the various training and capacity building programmes are given in Table 3.1.

Table 3.1: **Consolidated details of Training, Networking and Capacity Building**

Training	Male	Female	Trainee Days
Value addition of minor millet instant mixture preparation at Namakkal for SHGs	2	2	8
SHG members participated in the exhibition at an international consultation on Role of Biodiversity	2	2	12
The SHG members attended SC- ST Interface meeting on Biodiversity	1	1	6
Networking meeting organized for the SHGs	9	36	45
Interactive session organized with the farmers of Kolli Hills, Veerabayangaram and Namakkal region and National Commission on Farmers	68	34	102
National Integration Camp and NYK Awareness Camp	52	6	116
Basic training and introduction to computers	50	230	280
Animal health camp organized at Kolli Hills Panacattupatti	10	8	18
Barefoot taxonomist training organized by the FRLHT	5		15
SHG capacity building	9	90	396
Training on millet value addition and SHG capacity building organized at KK Trust, Namakkal	12	38	50
Total	220	447	1,048

A group of farmers from Kolli Hills were given training on seed selection, seed treatment, improved agronomic techniques and organic manuring. Field demonstrations on differential performance of millets under traditional broadcasting and line sowing, millet intercropping with tapioca and seed multiplication were conducted in Devanur, Valavandhi, Valappur and Edapuli panchayats. In this effort several participatory demonstration plots were identified in all the four clusters (Table 3.2). A livestock health camp was organized at Sengarai and Panacattupatti for livestock

development and several training programmes conducted on fodder development and cattle management.

Save Millet Seed Campaign: A "Save Millet Seed Campaign" was organized in four districts around Namakkal and 28 places in Kolli Hills to create an awareness of the importance of millets and the existing genetic variability in the region. Mass media and a travelling workshop with public addressing system were the means used to reach the people. An audio CD on the importance of millets was prepared, shown and

Table 3.2: *Participatory demonstration of improved agronomic techniques*

Place	Crop Mixture	Trial
Senkarai, Edapuli	<i>Sadansamai</i> (Little Millet), <i>Kurinkelvaragu</i> (Ragi), Red gram, Mustard, <i>Senthinai</i> (Foxtail Millet), Maize	Broad casting Vs Line Sowing with out treatment. Broad casting Vs Line Sowing treatment with Vermicompost/ <i>Azospirillum</i> / Phosphobacteria
Peria Kovilur, Valapur	<i>Kurunkelvaragu</i> (Ragi), <i>Mallisamai</i> , <i>Palanthinai</i> (Little Millet) <i>Kadugu</i> (Mustard)	Broad casting Vs Line Sowing Line sowing through Seed drill/ Line sowing manually
Aripalapatti, Devanur	Ragi (<i>Kurunkelvaragu</i>)	Ragi with Tapioca with Rows; Ragi inter crop with Tapioca
Kuchakiraipatti, Valavandhi	<i>Thinai</i>	Seed multiplication

distributed. A short film on biodiversity conservation, natural resource management, poverty reduction and food security was produced based on the activities in Namakkal and is being used as an educational material in various platforms. An awareness camp on nature and natural resources was jointly conducted with NYK from 1 to 7 August, 2005. The “M. S. Swaminathan Nature Club” was inaugurated on 5 December, 2005 at the Tribal Residential School in Senkarai to create an awareness among students and teachers about medicinal plant conservation and their sustainable utilization.

Village Knowledge Centres: Computer infrastructure has been set up at four villages namely, Aripalapatti, Padasolai, Nariankadu and Chinnamangalam in Kolli Hills. Subsequently preliminary training was organized for SHGs in different clusters on the basics and management of computers.

Millet seed production, multiplication and distribution

Quality seed multiplication: As a part of the participatory conservation system, land races of little millet such as *Vellaperunsamai*, *Sadansamai*, *Thirikulasamai*, finger millet such as *Satai Kelvaragu*, *Karunsurutai Kelvaragu*, Italian millet *Senthinai*, *Palanthinai*, *Cinna palanthinai*, *Karuvaragu*, and *Panivaragu* have been raised in Kondichettipatty seed multiplication plot. During the season, 714 kg of millets were multiplied for distribution during the sowing season.

In addition, seeds of little millet landraces were collected and kept in the seed bank at Aripalapatti for distribution during Kharif season.

Seed Distribution: Millet seeds were raised in the Kondichettipatty plot and distributed to the farmers through seed banks managed by SHGs (Table 3.3).

Table 3.3: **Seed supplied to Seed Bank of Kolli Hills**

Millet	Local Name	Quantity (kg)
Barn yard Millet	<i>Panivaragu</i>	27
Finger Millet	<i>Perung Kelvaragu</i>	62
	<i>Sundangi Kelvaragu</i>	75
	<i>Sattai Kelvaragu</i>	35
Little Millet	<i>Thirukulasamai</i>	19.5
	<i>Kottapattisamai</i>	15
	<i>Malliyasamai</i>	15
	<i>Sandansamai</i>	15
	<i>Karuperansamai</i>	18
	<i>Chinna Malliyasamai</i>	12
Italian Millet	<i>Mokkaanthinai</i>	17
	<i>Cheenapalanthinai</i>	49
	<i>Palathinai</i>	35
	<i>Perunthinai</i>	62
	<i>Kellanthinai</i>	45
	<i>Mochanganthinai</i>	35
	<i>Koranganthinai</i>	29
	<i>Chennaperunthinai</i>	3
	<i>Chenthinai</i>	3
<i>Karunthinai</i>	70	
Kodo Millet	<i>Peruvaragu</i>	43
Total		684.5

In addition, vegetable seeds were distributed to SHG members. About 15 kg of Italian millet and 10 kg of little millet were distributed in Kalrayan Hills in Salem.

Millet based value-added product development

Many women SHGs were trained in product development from millets that resulted in the

production of seven products: *Thinai Payasam* mix, *Samai Uppuma* mix, *Samai Bajji* mix, *Samai Thinai* health beverage mix, *Ragi fortified flour*, *Samai Thinai omapodi*, *Samai rava dosai* mix). These products were sold at Vanigavalam-Commercial Complex at Namakkal and also at various exhibitions organized at district and state headquarters. The SHGs got a net profit of Rs 14, 492.

Men SHGs which own millet processing mills processed about 940 kg of little millets and produced 545 kg of samai rice, 894 kg of Italian millets and 580 kg rice with the support of millet growing farmers. This group has decided to operate the mill by nominating two members each year by rotation. In November 2005, they received Rs 50,000 as a bank loan for internal circulation. This effort has resulted in generating interest among the SHGs in cultivating traditional millets. Another highlight of the year was the Ion Exchange Enviro Farm Private Limited procuring about 80 tonnes of organic pineapple worth Rs 4,00,000 from the farmers, for which the SHGs have got an additional incentive of Rs 20,000.

Sub Programme Area 302

Wayanad

The year 2006 marks a decade of the Community Agro-biodiversity Centre's efforts in addressing the issue of strengthening community conservation practices in Wayanad district of Kerala. Two new projects on organic farming

inputs and plant taxonomy were launched. The Centre also got formal approval from the Japanese Consulate to build training infrastructure, and from DBT for establishing a Bio-Resource Complex for herbal production and marketing. The organization that came into being with 2 staff members in 1997 now has 30 members with diverse expertise in community agro-biodiversity conservation.

Biodiversity conservation, utilization and genetic enhancement

The activities of the SDC project were focused largely on capacity building of the farmers and other stakeholders in Panthippoyil bio-village and increasing the crop yield by proposing changes in agronomic methods, technologies, soil and water conservation approaches, value addition and employment generation.

- *Solution to the water problems of the village:* Water for agriculture and drinking was a scarce resource in the village. This problem has almost been solved by building five loose boulder check dams, one Gabion check dam and one water tank.
- *Agro-biodiversity strengthened:* Pepper, rice, and fruit species were conserved *in situ* on farm by promoting cultivation. Livestock population has increased after the intervention because organic farming necessitated the increased application of cow dung and manure. Women SHGs took up cattle or goat rearing as a profitable enterprise. Two model farms with integrated soil and water management, crop diversity and organic cultivation practices were set up. Seeds of tubers, vegetables, ginger, turmeric, taros, and fruit plant seedlings were supplied to the tribal and low-income families as a part of the home garden diversification programme. Seed exchange programmes were conducted for ensuring the availability of vegetable seeds. Now the villagers depend on their own vegetable seed source and market the same through the outlet initiated in the village.
- *Knowledge Centre strengthened:* The VKC, provides a common platform to the villagers to acquire knowledge and share experiences. The content created during the year is reflected in the titles such as Importance of paddy cultivation (video); Pest and disease management of pepper (video); Mushroom cultivation and *Panchakavya* preparation (text with photos); Soil and water management practices and pest control in vegetables (text with photos); CD on Dioscorea cultivation; Organic farming and nutrient literacy (power point) and SHG activities and bookkeeping practices.
- *Area increased for organic pepper:* Organic pepper cultivation is being continued in order to increase the income of the farmers and conserve the pepper varieties. So far 250 ha have been brought under organic farming. Since pepper is raised under mixed farming, organic pepper cultivation means organic cultivation of other crops as well.
- *Income generating activities:* Four more SHGs have been formed adding up to 18 SHGs in the village and linked with PRIs and Community Banking for taking up

income generating activities like vegetable cultivation, sericulture, goat rearing, cattle rearing, herbal medicine preparation and pottery. The total savings of all members put together during the year was Rs 4,44,240. The internal loan circulated was Rs 43,12,500. A total of Rs 13 lakhs has been mobilized from different sources by SHGs for starting various micro enterprises. The National Network on Bio-villages and Community Banking supported four SHGs to start cattle and goat rearing units.

- *Tribal leaders support group:* A separate platform has been formed to empower selected tribal leaders of Wayanad to make them familiar with biodiversity related legislation. The purpose of this platform is to provide training for tribal leaders in various aspects of biodiversity and TK related legislation, and provide them orientation in sustainable agricultural and rural development. This platform is also intended to advise MSSRF in its intervention in tribal areas of Wayanad.
- *Malayalam version of Biodiversity Act and Farmers Rights Manual:* The Biodiversity Act 2002 and Biodiversity Rule 2004 and Farmers' Rights Manual based on PPVFR Act 2001 were translated into Malayalam and published.
- Water conservation;
- On-farm genetic diversity conservation and a case study of the Kurichiya of Wayanad
- Ecological and environmental impacts of bio-village model development.

Medicinal and Special Varieties of Rice: Validation, Value Addition, Organic Cultivation and Market Development

The project started in early 2005 is intended to promote cultivation, validation, value addition and market development of rice varieties such as *Navara* and *Chennellu* (medicinal) and *Gandhakasala* and *Mullanchanna* (scented). The process involves collection and documentation, genetic purification (to establish distinct types of cultivars, if any), clinical validation and bio-chemical analysis of *Navara* rice, and studies on value addition of the other three varieties with a view to taking the commodities developed to non traditional markets as a medicinal or nutraceutical package. It is aimed at promoting wider cultivation of all the promising varieties.

The results achieved during the year include:

- Special varieties of rice cultivation brought under an area of 23 ha, involving 76 new farmers constituting 5 farmer clusters
- Genetic purification of *Navara* rice started at on-farm level
- Six value added products developed from *Navara* rice under trial marketing through women's initiative and
- Characterization of *Navara* golden yellow and black varieties.

The project helped to check the pace of paddy field conversion in selected cluster areas, which in turn helped to enhance employment opportunities for women. The last one year

contributed 2,846 women labour days and 1,562 men labour days under this initiative.

Livelihood and Food security programme for the most marginalised tribal groups

A collaborative programme has been initiated in 10 tribal colonies with the help of CTCRI in the area of household food security. Under this programme, each family in the 10 colonies was supplied with seedlings of 8 species of fruit trees, 4 species of fruit yielding climbers, 5 species/ varieties of traditional *Dioscorea* (15 kg), two varieties of sweet potato (25 cuttings), 2 varieties of colocassia (5 kg) and seeds of 5 traditional vegetable species. The Centre in collaboration with Vanamoolika, a local NGO, implemented an apiary programme for 245 selected families scattered over the district by providing them with 2 honey boxes each. The families harvested and marketed about 1,200 kg of wild honey at a price of Rs 100/litre.

The results show that the home garden diversification programme helped the marginalized tribal families to diversify their diet with various food crops, which served as a buffer stock to meet emergency food needs. The honey boxes placed in the vicinity of tribal hamlets helped tribal women to harvest wild honey, an activity that was earlier practised only by men. The tribal department has selected this initiative as a model for their interventions in poverty reduction in tribal areas of Kerala.

Training was extended to 30 tribal women in value addition of wild edibles like bamboo shoot and gooseberry. Two publications in the local language have been prepared on wild edible

mushrooms and leafy greens. These field guides would be of help to those who are interested in learning about and conserving such diversity.

Bio-health programme for conservation and sustainable use of medicinal plants

The activities of this initiative are aimed at community level development of bio-health products and conservation of medicinal plants, with the involvement of underprivileged women, traditional doctors/herbalists and conservation experts.

Awareness campaign: Awareness classes were conducted for students, farmers, the general public and kudumbashree members and a total of about 2,000 people were benefited in various ways. The other notable activities included raising 3,000 medicinal plant seedlings belonging to 25 species and distributing them to traditional medical practitioners, farmers and school children. A checklist of campus as well as shade house plants was prepared as a part of documenting the flora of CAbC campus. Internship of students was encouraged. The registration of 3 innovations on conversion of vegetable wastes of tropical countries to tincture alcohol was facilitated.

Bio-health campaign: An evaluation survey was carried out among 15 WSHGs engaged in the preparation of bio-health products, to understand the effect of bio-health training on the health status of the SHG members. Attempts were made to market 3 bio-health products (fairness oil, hair oil and thali powder) through the Biotech Park, Chennai.

Database on medicinal plants: The medicinal plant database was strengthened with basic information on 125 plants of high potential.

Promotion of cultivation of traditional varieties of yam

The aim of the programme supported by the GEF small grant programme, is to identify all domesticated *Dioscorea* varieties grown in the Malabar eco-region and enhance their availability through field level multiplication of promising varieties. Extensive field surveys were undertaken which resulted in the identification of 18 varieties of *Dioscorea*, currently grown in the Malabar region. Specimens of 15 varieties were collected and a central demonstration plot was maintained in the CAbC campus. Nutritional analysis of the varieties was done in collaboration with CTCRI, Thiruvananthapuram. The promising varieties were distributed to tribal and marginal farmers' groups for addressing malnutrition and poverty. Now more than 250 tribal families and 300 non-tribal families are involved in this project. More farmers have shown interest in cultivating tubers as they perceive it as a safe food which is free from chemical fertilizers and pesticides.

Conserving 10 RET plant species for tribal and rural livelihood security

Funded by the Invest in Nature (IIN) initiative of the Botanic Garden Conservation Network (BGCN) through NBRI, Lucknow, this project came to an end in March 2006. An intensive systematic survey was undertaken to study the population of the species in 10 selected pockets (1,000 sq.m each and a total of 10,000 sq.m) of different types of forests, using the Quadrant

method and traditional knowledge related to 7 target species was documented. A total of 6,900 seedlings of target plants at 3 levels – CAbC nursery, tribal/rural community nursery and KFRI, Nilambur nursery were raised successfully. A sacred grove was augmented with 80 species of plants commonly grown in sacred groves.

An important outcome of this project was the recognition of CAbC-MSSRF Garden as a member in the Botanic Garden Conservation Network.

Every Child A Scientist programme

Twenty-two children who had regularly attended this programme for a period of three years and gained knowledge on biodiversity have formed a *Biodiversity Conservation Corps*. These children are taking up environmental issues including water scarcity and use of chemicals in agriculture (See SPA 604).

Linkages have been established with Information Kerala Mission and C-Dit for expanding the activities and content development. A detailed curriculum with step by step instructions to the trainers has been developed from our past learnings and is ready to be published.

Sub Programme Area 303

Jeypore

Biodiversity conservation, utilization and genetic enhancement

Participatory plant breeding - the rising economy of poor tribal communities: During the year,

Kalajeera was produced on a large scale. Farmers took pains to maintain a good crop despite erratic rainfall and incidence of stem borer. Out of the 377q of *Kalajeera* produced, 293 q were available for sale, the remaining being kept by the farmers for their own consumption. Marketing such a large quantity of paddy locally at a remunerative price was found difficult. Therefore, much before the harvest, the Government was informed of the problem and their help sought to get the paddy procured using their tribal development avenues. In response, the Government of Orissa arranged for procurement through NAFED (National Agricultural Cooperative Marketing Federation of India Ltd.). Based on the good quality, NAFED set a price of Rs 10 per kg which is equivalent to the procurement price of Basmati rice in the export market.

Farmers realized the value of Village Seed Banks (VSB) and the need for their efficient management when quality seeds of *Kalajeera* produced by them were stored there for distribution the next year. In all 75 q of pure seeds were selected during *Kharif* 2005, which is sufficient to cover an area of about 160 ha.

To support farm families producing seed and grain, FYM at the rate of 6 cartloads/acre was provided. VSBs of respective villages supplied pure seeds @ 20 kg/acre. The farm families also signed a utilization certificate for the material supplied to them in the presence of the Community Seed Bank members.

Many of the farm families adopted formal methods of cultivation by raising a nursery and

transplanting seedlings. The initial dry spell reduced the germination of seeds by 23 %, inhibited seedling growth and delayed transplanting, leading to pest infestations of blast, brown spot, leaf folder, bacterial leaf blight and stem borer. The use of biopesticides controlled the infestation in all but one village. After field observation, training on IPM and water management was given in all the villages. Erratic rainfall during flowering reduced production by about 40 %. In spite of this drop in production, the yield ranged on an average from 8 – 16 q / acre.

Production of Kalajeera- cost - benefit: To get an idea of benefit in relation to cost information was gathered from 13 farmers belonging to 4 hamlets who raised a good crop (Table 3.4).

Table 3.4: Cost benefit analysis of Production of Kalajeera by Jeypore farmers

Parameters	Range	Average
Area sown (ha)	0.18 – 1.07	-
Yield (q / ha)	16 - 34	25
Cost (Rs / ha)	6,000 – 9,000	7,100
Profit (Rs / ha)	6,700 – 21,100	13,300
B : C	1.177 - 3.36	1,904

Farmers:13: Nuaguda 4; Jhalaguda 2; Taliaguda 3; Kundura 4

It is significant that the benefit was about 1.2 to 3.4 times the cost of production of *Kalajeera*, in general with an average B:C of ~2. Despite this, there was a farmer who could not raise a good crop resulting in a poor B:C ratio of 0.203. Such farmers would need a few more seasons

to gain practical knowledge of improved cultivation methods.

Characterization of Kalajeera variants and similar varieties: Preliminary chronicling and collection of variants of *Kalajeera* have been completed to get basic information for benefit sharing. Eighteen variants of *Kalajeera* were collected from 10 districts of Orissa; they were directly seeded in farmers plots in Patraput village. Only 14 of the collections germinated. A team of scientists from Jeypore explored 50 sources of information (Table 3.5) to identify *Kalajeera* variants and varieties looking like

Table 3.5: **Chronicling of Kalajeera (July ~ August 2005)**

Districts	Bolangir	Nuapara	Kalahandi
Villages	1	10	2
Farmers	2	14	12
Govt. Officials			6
NGOs			3

Kalajeera. The idea is to grow and characterize them and find out how far they resemble the Jeypore *Kalajeera*.

Fourteen variants of *Kalajeera* were collected and raised during Kharif, 2005. However, their purity in the next two generations has to be examined before coming to firm conclusions. In addition, 22 *Kalanamak* collections which have black husk were collected from G.B. Pant University of Agriculture and Technology, Pantnagar (courtesy: Dr US Singh) and planted during Kharif, 2005. Since the seeds arrived late, the sowing was late, affecting germination and expression.

Participatory conservation: Successful Participatory Plant Breeding (PPB) activities helped people to achieve stable economic gains that revived Participatory Conservation Systems (PCS). The PCS technology reached several villages through farmer-to-farmer extension. As in the past, farmers returned a good quantity of seeds after harvest of the PCS plots. This would be redistributed to others for regenerating fresh seeds; this method adopted over the past few years has been found very efficient and has led to a self-sustaining conservation cycle of valuable farmer-germplasm. This year, 33 popular landraces from upland, medium land and lowland were conserved with a few lines of varieties like *Kalajeera*. Some of the landraces in the PCS plots showed a potential for good yield, based on 9 agronomic characters. Details of participating farmers and the progress in the area under PCS are given for Nuaguda hamlet (Table 3.6).

Village Seed Bank: The earlier “community gene-seed-grain bank” initiative has been renamed “Village Seed Bank” (VSB). Designated activities like grain and seed distribution, recovery of interest as seeds on landraces earlier distributed on loan, formation of management committees of seed banks, monitoring of plots growing *Kalajeera*, and re-activating the earlier approved passbook system were carried out this year. Supply of seed and grain on loan benefited several farm families (Table 3.7).

Village gene bank: New Collections: The village gene bank at Jeypore was augmented with 22 new landraces of rice from Nabarangpur district.

Table 3.6: *Varieties and progress of area in Participatory Conservation in Nuaguda hamlet*

Farmer	Variety		Area (acre)	
			2003	2005
Mr.Gobardhan Pujari	Osagathiali	Upland	0.05	1.3
Mr.Hari Pradhani	Dangar basmati	Upland	0.02	0.5
Mr.Laxman Minurbalia	Tulasiganthi	Lowland	0.02	1.5
Mr.Sunadhar Ghiuria	Karkoli	Lowland	0.04	1.0
Mr.Laba Ghiuria	Assamchudi	Lowland	0.04	0.7
Mr.Dhanurjoy Ghiuria	Machhakanta	Lowland	0.05	2.0

Table 3.7: *Details of farm families benefited by VSBs at Jeypore*

Name of the village	No. of beneficiaries		Paddy (kg)	
	Grain	Seed	Grain	Seed
Tolla	55	13	2,920.0	130.5
Boliguda	29	14	2,227.5	45.0
Patraput	13	21	581.0	95.5
Kashiguda	91	98	5,812.5	302.0
Pujariput	38	10	1,831.5	109.0
Nuaguda	28	08	1,425.0	90.0
Santaliaguda	25	12	250.0	400.0
Jhalaguda	25		500.0	
Total	304	176	15,547.5	1,172.0

They were multiplied along with the available 68 landraces in farmers' plots. The VSBs supported 304 needy families from eight villages with 15,547.5 kg of grain. Similarly 6,383.5 kg of seeds of traditional and high yielding varieties were distributed among 174 farm families of seven villages. Twenty percent of seeds were stored in the VSB. This helped some families, whose farms suffered from flash floods, by making available seeds for re-sowing. 75 q of

pure seeds of *Kalajeera*, and seeds of a few other land races were produced. Villages other than the MSSRF demonstration villages also availed of seed loans from the VSBs. As a consequence, the demand is increasing for establishing VSBs in villages adjacent to the demonstration villages.

Natural Resource Management

Cashew cultivation: The plants in the cashew plantation, which was established in 2003 in 12 acres of wasteland at Tolla village have attained a height of one meter and are healthy.

Vermicomposting: The efforts on promoting vermicomposting continued among 54 farm families belonging to 5 villages by getting support from the Spices Board. During the year 60 – 70 q of vermicompost was applied in fields of landraces of rice and millet at Nuaguda, Taliaguda and Jhalaguda. This is reported to have reduced the incidence of weed growth and pest attack. The groups have sold 82 kg of earthworm to GOs and NGOs @ Rs 50/-kg and imparted training to farm families regarding preparation of vermicompost pits.

Fish farming: In the percolation pond of Tolla, SHG members introduced 3.5 kg of fish fingerlings with the approval of the Central Village Committee. In the community ponds the fish mortality rate was less and the fishes were attaining an average size of 4 to 5 inches. The CVC of Taliaguda took the decision to sell 2.5q of fishes of their village in the nearby weekly market @ Rs 35/kg.

Community vegetable garden: The villagers of Nuaguda developed a wasteland covering 2.80 acres into a community vegetable garden. The initiation of community farming of turmeric and ginger at Nuaguda in 2003 had a good impact in nearby villages. The yield of 2003 was preserved as seed and distributed among farm families of Nuaguda for cultivation in their backyard. This process is gaining momentum in the villages.

Networking, training and capacity building of SHGs: A training programme was conducted for 14 SHGs on formal methods of cultivation, setting up of vermicompost units and establishment of VSBs. The same programme was repeated for the benefit of seven NGOs who brought 49 farmers (42 men and 7 women).

Biju Patnaik Medicinal Plant Garden and Research Centre

Last year, the Government of Orissa had allotted 12.5 acres of land to MSSRF for establishing a research, training and capacity building centre at Jeypore for strengthening *in situ* and *ex situ* conservation of medicinal plants and for undertaking validation and identification of active biomolecules as well as for safeguarding the

IPR of tribal families. The garden and research centre is being established as a joint initiative of MSSRF and the State Government to conserve the medicinal plant species being used by local tribal communities. MSSRF has taken possession of the allotted land from the State Government and a basic contour map of the area has been prepared in collaboration with the soil and water conservation research and training centre of ICAR. Detailed soil testing has also been carried out. The layout of the garden has already been established and nine one-acre plots have been assigned to be developed as *in situ* conservation units for the major tribal groups of the region. This will serve as a repository of various genetic stocks of the region and will be of immense utility for present and future generations and will serve as a living gene bank of the tribal families. The design for the research centre, that includes training halls for tribal communities and laboratories for biomolecular studies, has also been finalized and the construction work will be completed by November 2006. As a part of the initiative, two interactive programmes involving the traditional healers and traditional medicinal practitioners of the region were conducted and the information obtained from these traditional health practitioners has been compiled as a database. This database has been of great use in identifying the species and varieties of medicinal plants to be conserved in the centre. A village resource centre has also been established in this centre. It was inaugurated during the first Virtual Congress of Farmers in January 2006, at which a meeting was organized between the President of India and the local tribal communities.

Sub Programme Area 304

Community Gene Bank

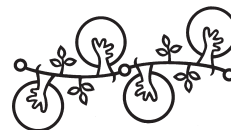
The Gene Bank accessions increased to 1,037 during the reporting period. These collections, many of which are drought tolerant, flood tolerant and salt tolerant, and also have pest and disease resistance features, are largely accessed from different tribal and rural communities, belonging to Orissa, Kerala and Tamil Nadu. Several of these accessions were subjected to characterization based on the international standard descriptors for the target crops. This was done across three field stations. Field trials were conducted in MSSRF field sites in Patraput village in Jeypore, Orissa and Puthoorvayal village in Wayanad, Kerala. In TN, the trials were conducted at the Kattupakkam Livestock Research Centre of the TN Veterinary and Animal Sciences University. All together 500 accessions of paddy and millets were included for the trial.

Interaction meetings were held at Puthoorvayal, Wayanad during the harvest period inviting men and women of the Kuruma tribe. They were interested in seed material for the varieties such as *alliannan*, *theakkan cheera* and *kundipullu*. The requested seed material will be supplied to them after seed multiplication trials. Soon after characterization trials, germplasm accessions received from the field are being processed for storage at the gene bank. Corresponding photographs and herbarium voucher specimens are being prepared and catalogued.

With support from the Italian Government a detailed study on characterization of the germplasm collected from tsunami affected areas was initiated at Nagapattinam, the worst

affected area. A farmer who follows traditional cultivation under rainfed condition was identified near the coastal village, with the help of the Agricultural Department, Nagapattinam. Tests were conducted in both tsunami affected (with soil casting and without soil casting) and non-tsunami affected lands. Varieties such as *kunthali*, *kallurundai*, *kuzhivedichan*, *soorakuruvai*, *katchakombalai*, *vellakudavalai*, *kattukothalai*, *kattuponni* and *kombalai* were included in the trial with the onset of monsoon. In addition to this, varieties collected from Orissa such as *bhalungi*, *kusuma*, *haroimati*, *ratnachudi* and *kuthiru* from Wayanad (those with low to moderate level of salinity tolerance) were also tested in the same field. These varieties withstood the heavy northeast monsoon that hit TN last year. The overall crop stand and performance were found to be good. International standard descriptor was used to record data both on agronomic and morphological traits, including quantitative and qualitative characters. After harvest, considerable amounts of seed material were obtained from tsunami affected areas and will be used for further trials in the forthcoming season.

Soil samples were collected at three different stages i.e. during field preparation, time of sowing and at the time of harvest; analysis was conducted at the IPM lab at MSSRF. Analysis included parameters such as pH, electrical conductivity, available nutrient content, organic carbon and sodium chloride levels. Subsequent germination tests using different salt concentrations were taken up with the help of the biotechnology group at MSSRF. Necessary field photos, individual variety photo and corresponding herbarium voucher specimens are housed at the gene bank.



ECOTECHNOLOGY

*H*undred and one ha of farmland were certified as organic in conversion and therefore the produce can be certified as organic. A low cost biofertilizer unit was established and the production technology was demystified. Approximately 39,000 trainee days were completed during the year. A bulletin documenting the achievements under the OSU supported project was brought out in November.

401	JRD Tata Ecotechnology Centre.	75
402	Sustainable Management of Natural Resources for Food Security and Environmental Quality.	96

Sub Programme Area 401

JRD Tata Ecotechnology Centre

During the year the Centre revisited the approaches and activities for the purpose of strengthening the delivery mechanisms under the human-centred, sustainable development paradigm – the *Biovillage Model*, which aims at optimising the use of natural resources and enhancing the opportunities of the rural poor in terms of sustainable livelihoods. Based on the revised thrust and focus area, strategies were identified for the way forward on a role change in a couple of sites and launching new initiatives at two of the sites, based on the strengths developed over the years. A number of training programmes have also been organized.

The following are the highlights of the activities of the Centre.

401.1 Coastal Region

401.1.1 Chidambaram

This year the focus was on large-scale participatory farm trials in relation to water use efficiency, System of Rice Intensification (SRI), crop diversification (finger millet and cotton), enhanced biological inputs as part of good agricultural practices, promoting a community seed bank for pulses, initiating the documentation of the (on going) Integrated Intensive Farming System (IIFS) and Eco-aquaculture practices and strengthening the SHGs and their income generating activists. The various topics were covered in 773 trainee days.

A major focus has also been on post tsunami-activities, especially in the area of ensuring livelihood security interventions carried out under the PAN-MSSRF work at multiple locations (see PA 702.1).

Participatory on-farm trials - System of Rice Intensification

System of Rice Intensification (SRI) method was adopted as one of the approaches for demonstration and creating awareness among the paddy-cultivating farmers. SRI provides an opportunity among the subsistence farmers to double their yields without increasing existing inputs, an alternative approach to rice production that addresses most of the problems that are being encountered by our farmers such as more water and higher seed rate.

The participatory SRI demonstration was conducted during the samba season with CO-43 and Ponni rice varieties in the Cauvery delta tailend region to compare SRI with conventional methods in relation to growth parameters, yield attributes, cost and economics. This was done with 25 farmers and covered an area of 41 acres. The results of the CO-43 trials are given in Table 4.1. An average 30 % increase in yield was observed, compared with production using conventional practices. The ratio of seed used for transplanting, compared to the paddy harvested was 1:814 for SRI, whereas with conventional practices, the ratio was 1:36. The results of SRI evaluation have shown that with SRI small farmers are able to increase their rice production with less input of seed and water. More farmers are planning to replicate this.

Table 4.1: **Comparison of economics in SRI and conventional method for CO-43**

Particulars	Total cost (Rs)	Gross income (Rs)	Net income (Rs)	CBR	Productivity kg/acre	Production cost/ kg
SRI	7,570	14,531	6,961	1.92	2,442	3.01
Conventional	9,225	10,800	1,575	1.17	1,800	5.13

* data analysis from 41 acres

BARC- Pulse Seeds Multiplication

The *Adhivaraganatham Farmers Welfare Association* took responsibility for distributing BARC pulse seeds to 127 members. Each farmer received 6 kg of either black gram or green gram seed. Totally, 657 kg of pulse seed were distributed to *Adhivaraganatham*, *Suthukuzhli* and *Erataikulam* village farmers. Out of this, 324 kg of blackgram seeds was distributed to 53 farmers with 12.8 ha and 433 kg of green gram seeds were distributed to 74 farmers with 14.4 ha of land. The association has initiated the seed bank concept with a contribution of 30 % harvested pulse seed from every farmer who received initial inputs. A total of 50 farmers received soil health cards from the department of agriculture, Cuddalore. Ten farmers prepared vermi bed for vermi compost production. One of the milestones of *Adhivaraganatham Farmers Welfare Association* was opening of their own office building. (See PA 104.1)

Biological inputs - Mass Field Trial in Rice Cultivation

Mass field trials with biofertilizers and biocontrols were conducted in *samba* rice cultivation. In this trial, all the 4 grassroot institutions participated and applied bio

fertilizers (417 packets each of *azospirillum* and phosphobacteria @ 500 gm per packet) and biocontrol agents (383 litres). Totally 272 farmers participated in an area of 83.2 ha and followed the application through seed treatment, seed dipping, soil application and field application after one month of transplanting. Under this trial, 180 soil health cards were distributed to farmers. The average yield increased by 15 to 20 % through the application of biofertilizer. This mass field trial has resulted in a demand to establish low cost production units in this region with guidance from MSSRF.

Thenkoodu Federation

The Thenkoodu Federation has currently 44 SHGs in 14 villages, including 41 women SHGs and 3 men SHGs, grouped into five clusters. Among the clusters in the *B. Manavelli* cluster, the individual average borrowing was Rs 15,859/ head (8.85 fold of their savings), followed by *Senthirakillai* with Rs 9,680/ head (4.91 fold), *Boothavarayanpettai* with Rs 6,766/ head (3.66 fold), *Vandurayanpattu* cluster Rs 4,615/ head (2.26 fold) and *Keelamanakudy* with Rs 1,088 head (1.10 fold). Totally 228 women SHG members have availed of bank loans worth Rs 29,86,000 (@ 28 times their savings) and 74 % of women (164 members) utilized bank loans for agriculture and livestock purposes.

Manikollai Lift Irrigation

The lift irrigation model has been replicated by the DRDA in one village from Cuddalore Taluk and BLESS NGO replicated this model with 20 marginal farmers. In addition, the farmers from this federation developed a community paddy nursery for optimum utilization of available water and cost of cultivation. This nursery serviced about 20 acres. Because of lift irrigation, 43 acres of cotton and 12 acres of finger millet are being cultivated by 15 farmers as part of their crop diversification process. The cost of lifting water from *Paravanaru* is about 20 to 25 % of the total cost of cultivation. So this federation has approached the electricity department for power supply and in addition, the option for tapping renewable energy to lift water is also being looked into. Lift irrigation farmers, agricultural labourers and others could not reach the land for irrigation and other agricultural operations. MSSRF worked with DRDA to provide access and 1,700 m of road costing Rs 6 lakhs, has been laid. Documentation of the experience in the last three years of the Manikollai Lift Irrigation implementation has been initiated.

IIFS Replication

What started of as a participatory demonstration of Integrated Intensive Farming Systems (IIFS) has resulted in its replication in three blocks viz Portnova, MelBhuvanagiri and Keerapalayam by nearly 172 farmers. The documentation of the process, replication and key learning have begun. These replications have been mapped at the Chidambaram taluk level. In addition, the information related to resource recycling, input

and purchase cost have been documented along with the IIFS directory of all practising farmers.

Aquaculture activities - Community pond aquaculture by SHGs

Composite fish culture techniques are being used for aquaculture activities. In all, 27 members were involved in the demonstration. The culture duration was 10 months. The water-spread area of the pond was about 0.6 ha. The species used were both Indian and Chinese carps. The total sale from the pond was Rs 47,638 and the net profit was Rs 793/head, apart from the regular income. The low income was because the pond belongs to the village Panchayat and fertilization is not allowed in the pond.

Backyard ornamental fish breeding

Backyard ornamental aquaculture is one of the activities, in which about 30 women are involved. Due to the lack of infrastructure, the income from the pond is not much. This issue is being addressed. Livebearers like the mollies and guppies are the candidates. Goldfish culture is also being planned. A total of 376 training days have been organized, based on the needs of the SHGs, including pond culture techniques, controlling and addressing carp diseases and ornamental fish breeding and weed management in open waters.

Aquatic weed management - Hydrilla verticillata (Hydrilla)

A pilot initiative to test the efficiency of the biological management of the submerged weed

Hydrilla verticillata by the grass carp, *Ctenopharyngodon idella* revealed that the biomass decreased to 0 kg/m² in the treated pond at the end of the experimental period of approximately one year. This experiment established that the grass carp was one of the efficient biological methods to manage the aquatic weeds. The pond is being monitored for any reappearance of weeds. Currently about 20 farm ponds have this weed management in place and over 4 ha of water surface area is covered under this management. More farm ponds will be covered in the coming year.

Giant duckweed (*Spirodella polyrhiza*) management by grass carp (*Ctenopharyngodon idella*)

The sacred temple pond is one of the biggest ponds (5115.00 m²) in the town where the sub-soil aquifer is recharged through water

harvesting and the hand pumps work when the pond is recharged with rainwater. Due to lack of water in the pond, the water quality/quantity in the hand pumps is affected. Duckweed is one of the floating weeds in this water body. The weed has been a menace in the pond over the last 15 years and it deteriorates the water quality, which is detrimental to the fish. At the request of the temple authorities, grass carp was stocked in the pond early this year as part of the weed management practices. The biomass of weed in the pond was estimated by the quadrangle method. As per the random sampling, the biomass was about 2,980g/m². The weed density was lowered partially before stocking the fish (116 numbers at a total biomass of 66 kg). The basic parameters like dissolved oxygen (3.4 ppm – early morning) and pH (7.5) were taken initially. On the 40th day the weed density came down to nil.

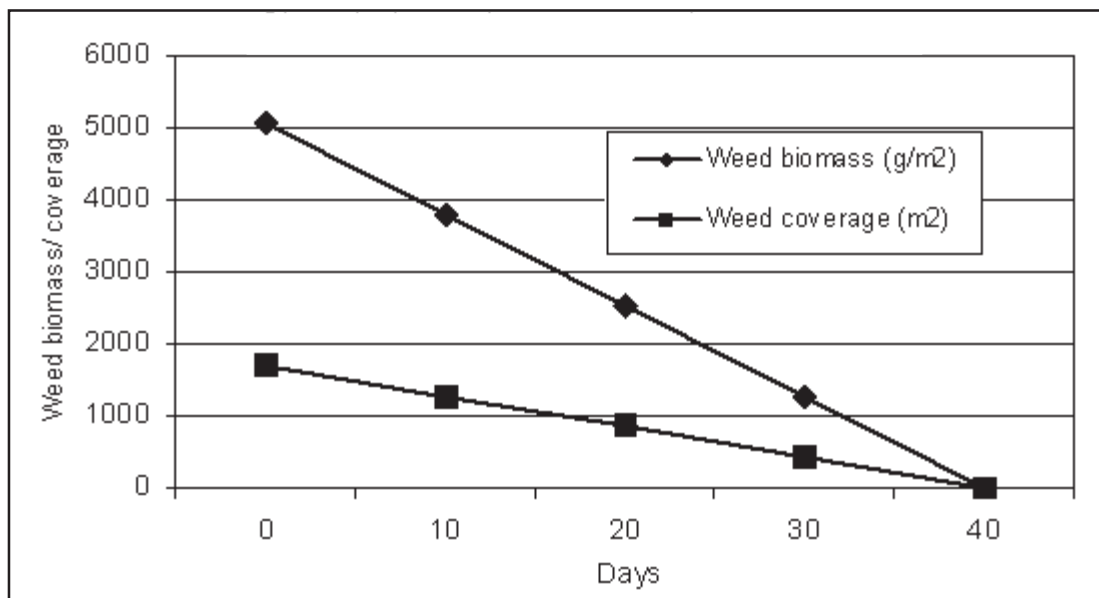


Fig. 4.1 *Giant duckweed management by grass carp*

Fish for All Centre: The proposed centre will function as a training and demonstration centre for the fisher men/women on a KVK model (learning by doing) to help in strengthening and diversifying the existing livelihoods and identifying alternative livelihoods for the resource poor to add value to the chain from “Capture/culture – Consumption”. The Centre will also house a Knowledge Centre to enhance the training through ICT based options and a fish pre-processing centre. Preliminary discussions are under way for the choice of land and discussions with the local community to ascertain their acceptance and needs for planning the activities of the centre.

401.1.2 Pondicherry

The Biocentre was established at Pillayarkuppam Village as the hub of the Biovillage programme for horizontal transfer of knowledge and to offer a single window system of extension. Over the years, with the support of the farmers and SHGs, the programme has been replicated in 40 villages. The focus of the Biocentre is training and demonstration on various income generating activities for the resource poor, networking with stakeholders, linking the SHGs to get credit facility from the financial institutions, and helping the farmers to sustain the agricultural activities with available natural resources.

This year the demonstration area around the centre was rejuvenated by increasing the integration of various activities around the IIFS model, diversifying the crops, redoing the low cost green house and using it optimally for raising crossandra and jasmine saplings

(15,000). The saplings were supplied to about 200 biovillage members, each of whom is replicating floriculture cultivation in about 10-15 cents in their backyard. Dairying activities were integrated and fodder cultivation increased. Vermicompost pits were established and azolla was cultivated. The mushroom and biopesticide units were strengthened. About 700 cc of corcyra eggs were produced and marketed to cover about 650 acres of paddy and sugarcane fields in and around the bio-villages. The nutritional garden was also redone. About 500 kg of vegetables was produced from the Biocentre and nearly 180 SHG members replicated the concept of nutritional garden through the subsidized vegetable minikit (seed package) from the Agriculture Department.

Biovillage Council

The federated Biovillage Council (BVC), *Innyur Grama Sangam*, currently has 247 SHGs under its umbrella. The focus for this year was strengthening the community banking and putting in place a database of the SHGs. The BVC also liaisons between SHGs and banks, institutions and universities and has started working on Community Banking. The target of more than Rs 1,00,000 in the community bank has been achieved this year.

Training

Training was inculcated in various enterprises such as mushroom cultivation, fodder production, horticulture, floriculture, *Trichogramma*, establishing a biogas plant, vermicompost and biofungicide production. Other areas included Accounts and

Bookkeeping, Software Accounts Training, group management, orientation to new SHGs, credit management and entrepreneur skill development. Totally 3,416 (2,990 women and 426 men) trainee days were covered during this period. Compared with the past years, more men came forward to take training at the Biocentre. Out of 3,416 trainee days, 1,020 trainee days were devoted to women SHGs from other parts of TN and Pondicherry. A total of 720 trainee days were organized on micro enterprises *i.e.* on planning, implementing and monitoring. As a new venture, 10 men groups were trained on forming SHGs and income generating activities.

This year, 43 new SHGs were formed. More than Rs 62, 58,000 have been mobilized from various sources to start income generating activities in the villages. During the year, group internal credit was raised up to Rs 95,00,000. Thirteen SHG members purchased housing plots in Uruvaiuar, Mangalam, Melsathamangalam and Ulavaikal villages. Fodder plots were developed in 1 ha to support the dairy activity in Mangalam village. Expanded floriculture activity (jasmine, crossandra, marigold) was carried out in 2.8 ha. Rs 49,000 was mobilized as a subsidy for marigold/acre. Thirty-eight members from 7 villages are involved in vermicomposting activity, while 420 SHG members were brought under the fold of dairy activity. The SHGs of Mangalam village helped Indian Bank to start banking services to all; Mangalam is the first village to do this.

Other activities included the celebration of *Aadiperukku vizha* and International Women's

Day. About 1,300 SHG women participated in these programmes. The Biocentre is acting as a common platform for NGOs, Govt Depts and Research Institutions to share their updated knowledge with SHG members and the farmers of this region. More than 1,500 school children from different schools had a one-day exposure programme at the Biocentre.

Kodathur Biovillage - in partnership with SBI, ADB Pondicherry

A couple of steering committee meetings were conducted this year. An impact analysis was carried out on the work done in the last two years. Currently, under the Integrated Dairy Management Programme (IDM) 180 members own cattle and supply milk to Hatsun and Ponlait. Fifteen members have constructed a biogas plant, 15 members have developed fodder cultivation in 10 ha and 9 members have started vermicompost pits. A subsidy of Rs 42,000 has been facilitated for fodder and biogas plants through government departments. About 250 households (HH) have been relieved of debt from moneylenders. Twenty-nine SHGs consisting of 19 women, 9 men and 1 mixed have been mobilized. Additional calves, milch animals and goats have been observed.

The SHGs are now able to identify the needs of the community and help themselves through group activities. Their mobility has increased and they have developed their skills tremendously in networking with stakeholders like banks, DRDA, Block Development Office, District Industries of Commerce, Department of Animal Husbandry, Veterinary College, Fodder Research Station, Federation, Ponlait,

Hatsun, Deepaoli and MSSRF. The net increase in income through dairy activity is Rs 10,56,000. An additional 140 labour days have accrued through *Pseudomonas* production with an income of Rs 8,77,000 which was mobilized to start micro enterprises in the villages. During the year group internal credit was raised up to Rs 5,33,750 and 687 trainee days were organized for women SHGs, clean milk production and *Pseudomonas* production. Other activities initiated include mat weaving and vegetable vending.

401.1.3 Kendrapara, Orissa

During the year, the emphasis was on strengthening the ongoing activities and forming a federation of the SHGs and Farmer's Groups, which would enable the continuation and replication of the ongoing activities by the grassroot institutions during and post role change, in the 10 villages, namely Manitiri, Niyamatpur, Padagayaspur and Patana of Rajagarh Zilla Parishad (ZP); Anduli, Basaghara and Ghantiapalli of Balipala ZP of Mahakalapara block and Nembera, Narendrapur and Balia villages of Kuhudi ZP in Marsaghai block.

Participatory Demonstration and Replication

The project activities at Kendrapara were focused towards demonstrating and strengthening the available livelihood options at the individual household level and community based group activities that would be manageable and sustainable, and integrated into the existing lifestyle of the community. All on-farm activities were carried out in a

participatory mode with SHGs and Farmer's Groups (both men and women groups).

During the last 2 years, the Centre has been demonstrating and studying the impact of Aquaculture based Integrated Intensive Farming System (AqIIIFS), as a group activity. The first AqIIIFS model was established in the common community land at Manitiri village in June 2004, covering an area of 0.6 ha. Currently there are 2 such model farms at Manitiri and Niyamatpur. These activities were developed to facilitate the effective utilization of community ponds for water harvesting and cultivation of horticultural crops on the bunds, and enhance fish productivity (carp culture/ carp nursery). This group activity is being taken up by 165 individuals, of whom 109 belong to Scheduled Castes. The ponds have been stocked with composite fish culture viz. *Rohu*, *Catla*, *Mirigal* and *Grass carp*.

Besides the cultivation of fish, the pond water is used for irrigating seasonal horticultural and floricultural crops cultivated on the bunds and adjacent to the pond, to maximise production per unit area, throughout the year. For vine crops roof gardening with nylon net was constructed inside the periphery of the pond for optimum use of space. Cultivation of fodder crop (hybrid Napier) and hybrid marigold flower cultivation show promise for upscaling in the project area.

Cultivation of commercial crops as a group activity is being continued by the members of the Farmer's Club at Niyamatpur, under irrigated condition. These crops were grown with assured irrigation in Rabi season after paddy. This

cropping system convinced the members of the club and other farmers. It is seen from Table 4.2 that the farmers' club, consisting of 10 male members, earned Rs 1,23,886 in 5 months from 11.10 ha of land and each member got a share of Rs 12,388.

harvested by some of the SHGs for compost preparation.

Vermicompost: During the year, 10 qtls. of vermicompost, rich in organic carbon (12.5 %) and high nitrogen content (0.5 – 1.2 %), worth Rs 8,000 has been harvested by SHGs and

Table 4.2 : *Commercial crops grown by Farmers Club, Niyamatpur, during Rabi, 2005-2006*

Crops	Area (ha)	Production in Quintal	Actual sale price (Rs)	Expenditure (Rs)	Net profit (Rs)
Sunflower	0.48	7.0	15,924	5,250	10,674
Summer paddy	6.00	247.50	1,18,800	48,500	70,300
Green gram	4.00	35.0	50,000	16,780	33,220
Chilli (Green)	0.20	2.25	2,700	1,025	1,675
Spinach	0.06	1.36	340	185	155
Brinjal	0.20	5.12	3,032	1,130	1,902
Ladies finger	0.16	13.00	7,800	1,840	5,960
Total	11.10	311.23	1,98,596	74,710	1,23,886

Other Activities

As the confidence and skill of the SHG members in the smooth functioning of the activities related to upkeep and running of the community AqIIFS pond increases, newer components are also being introduced, such as NADAP composting, vermicomposting, *Azolla* nursery and apiculture. These new elements not only serve the purpose of demonstrating and training but are also being integrated into the local cultural practices. For the purpose of NADAP compost, locally available biomass are used, especially water weeds (water hyacinth, pistia etc). This has indirectly benefited and encouraged the use of ponds for fish culture, as the water weeds are

used at the AqIIFS demonstration area at Manitiri. The use of vermicompost, and other organic manure like oil cakes instead of chemical fertilizers or pesticides yielded satisfactory results and could lead to the promotion of organic farming in the region.

Azolla: Training on *Azolla* production has been initiated to replace the requirement of FYM which is not available as a major amount of cow dung is used for fuel. One *Azolla* tank is maintained at the demonstration plot of Manitiri village. During the period under report 55 farmers have taken up *Azolla* culture for *in situ* production in rice fields at the beginning of Kharif 2005 and covered 17 acre. In addition, 12 SHG

members maintained *Azolla* in ponds for incorporation into their kitchen gardens as compost before vegetable cultivation. This is being practised by the people of this locality for vegetable production.

Apiculture: Apiculture as an activity is being encouraged at the project site, especially with the introduction of sunflower. Currently apiculture has been taken up by the SHGs of Manitiri, Padagayaspur and Niyamatpur for pollination of crops and securing honey. During the year about 4 kg of honey worth Rs 600 was harvested.

Sunflower cultivation: The cultivation of sunflower for edible oil was introduced last year at the project site for the first time in the region. This year 8 SHGs have cultivated sunflower Var MFSH-8 in 2.5 acre. and received up to 6.0 quintals seed yield per acre from which they extracted about 300 kg of oil. Sunflower oil cake is used as fish feed and manure at the project site. Large-scale sunflower cultivation at the project site appears promising and could be suggested as an alternate crop to paddy under conditions unfavourable for paddy cultivation. As the sunflower is slightly salt tolerant, it is well suited for this region. After observing the results of sunflower demonstration of 2004-05, farmers are ready to grow this crop. In the Rabi season of 2005-06, the area under sunflower after Kharif paddy has multiplied covering 25 acre and involving 73 farmers.

Mushroom cultivation: Mushroom yields recorded during the year per bed were in the order of 2 kg for oyster and 1 kg for straw

mushroom. The mushrooms were sold at Rs 40 – 60 per kg in the market, getting a net profit of Rs 13,000 during the season. The SHGs members have also been given training in making mushroom pickle, soup, and other products.

Poultry: Maintaining poultry birds is gaining momentum as within a period of 2 – 3 months they get a net profit of Rs 55,000. This year 1,500 chicks have been procured by the members and 5-15 chicks per family are being reared as per our recommendations. Altogether 126 SHG and farmers' club members have reared these birds and sold them within 3 months @ Rs 40-45 per kg body weight.

Kitchen garden: Kitchen garden activities at the household level are continuing, with quality seeds being used as inputs. The produce is mostly used for their own consumption although the excess is sold. Some of them are growing vegetables as a group; for instance, 18 members in Ghantiapalli and 5 gardens in Padagayaspur maintained by 5 members of a group.

System of Rice Intensification: SRI technique was taken up for demonstration. Trials were conducted in the Rabi season of 2005 in two farmers' plots in Niyamatpur. In this trial, 15 - day and 30 - day seedlings of the rice variety 'Lalata' were transplanted in 20 x 20 cm and 25 x 25 cm spacing and farmers' practice (not line planting) of each spacing was maintained for comparison. The highest grain yield *i.e.* 66.24 q/ha was from 15 - day old seedlings planted in 20 x 20 cm. space, followed by 30 - day old

seedlings at the same spacing. Satisfactory grain yield was also obtained from 30 - day old seedlings at 25 x 25 cm spacing. It is concluded that 20 x 20 cm spacing with two seedlings per hill recorded higher grain yield and there was not much difference in 15 or 30 - day - old and one or two seedling / hill. The trial has also been conducted in 15 farmers' fields with the rice variety "Swarna" during Kharif 2005. Observations showed that the height of the crop was maximum in one seedling / hill whereas maximum tillers and productive tillers were recorded in 15 - day - old plants at one seedling/hill. Lowest stem borer infestation, healthy and heavier grains and grain yield were recorded where one seedling was transplanted per hill followed by two seedlings.

In the Rabi season trial, two seedlings / hill showed best performance. This may be due to congenial atmospheric moisture and moderate temperature. Therefore, to save the cost of seed, one or two seedlings / hill can be recommended to the farmers. The SRI technique is becoming popular in this area as 27 farmers followed this practice in Narendrapur, Nembera and other villages and received 10-15 % extra yield with less seed and labour.

New initiatives taken up during the year included the cultivation of green manure crops (sunhemp and dhaincha) before transplanting of paddy seedlings and planting fruit and agro-forestry trees. Saplings of *Accacia mangium* (Australian Teak) (250), Areca nut (50), Coconut (250), Drumstick (200), Guava (75), Lemon (450) and Papaya (255) were distributed.

Need based training and capacity building

Other than strengthening the existing ongoing activities with new inputs, specialised need based training such as rodent control was also conducted. During the training, use of rodenticides like Roban, Zinc Phosphide and sticky traps were demonstrated.

To create an awareness of the activities undertaken by research institutions and on the technologies they have developed, two exposure visits were organized to institutes at Cuttack and Bhubaneswar. These exposure visits have helped the farmers in having direct interaction with the scientists and clearing their doubts and the exposure is helping them in undertaking income generating activities in an organised manner. One hundred individuals participated in this programme (69 women and 31 men).

The beneficiaries have given their options for income generating activities as follows: 45 % for poultry, apiary, mushroom and vegetable cultivation (small holding groups); 30 % for vegetable and flower cultivation, dairy, poultry, mushroom, rice parboiling and processing; 15 % for rice, vegetable cultivation, dairy and poultry and 10 % for rearing ducks, fish and coloured fish production, rice and vegetable cultivation. These are now being initiated by them.

During the reporting period 510 farmers, both men and women, were trained and 5,100 trainee days were completed under the Commonwealth of Learning (COL) project activities. The topics covered ranged from general agricultural

practices in crop production, post harvest techniques, processing and value addition and marketing, along with ecofriendly techniques, and included field visits and demonstration. Training was imparted in allied activities such as pisciculture, backyard poultry rearing, bee keeping, goat rearing, mushroom cultivation and nursery for plantation crops. The impact of Farmer's Training initiated in June 2003, was studied/ surveyed, covering 15 villages and the salient features of the study show that most of the farmers are illiterate, though they may have more than 4 acre. of land. They felt topics such as soil testing, biofertilizers, cultivation of oilseeds, vegetables and fruit were helpful. They felt that activities such as bee keeping, mushroom cultivation, and floriculture would help them in getting extra income and the training in dairy, poultry and fisheries is helping them. Training on food preservation, apiary, mushroom cultivation and poultry were found to be preferred by the women trainees.

Biological Software

The Centre is also making a conscious effort to introduce good agricultural practices at the project site. During the year, as part of integrating biological pest management at the project site, training and demonstration in the use of *Trichogramma*, *Bracon*, water and pheromone traps were taken up. *Trichogramma* (egg parasite) were introduced for control of paddy stem borer, covering an area of 2 ha. Cocoons of *Bracon brevicornis* were released 3 times in 42 coconut trees, showing pest attack by leaf eating caterpillars. Water traps and funnel pheromone traps were demonstrated for control

of brinjal shoot and fruit borers. These pest control methods are new to the area and have elicited a positive response from the farmers. Based on their feedback, an appropriate integrated package of practices (such as IPM) is being developed.

Currently, there is one Computer Training Centre functioning in Nembera village; 25 members of the local SHGs are making use of this facility along with the nearby college and school going children. There is good scope and demand for setting up of such Computer Training Centres at the project site and in upgrading these Centres into VKC.

Strengthening the grassroot institutions

During the year, grassroot institutions worked to define the path of development through managing development programmes, conducting participatory research, introducing innovative practices, and being involved in networking, negotiation and policy advances. All the members of SHGs are participating actively in the group activities like participatory research, community banking management, kitchen gardening, poultry, mushroom cultivation, apiary, flower cultivation and small business.

Under the various training programmes, 1,699 individuals (503 men and 1,196 women) were trained on different aspects. In the farmer to farmers learning programme, 210 men and women were trained in a 10 day course on agriculture.

Some of the training materials published include booklets on cultivation of rice and control of pests

and diseases; floriculture; fruit cultivation; oil seed cultivation; mushroom cultivation; apiary and application of biofertilizers for increasing crop yield. These materials are in the local language (Oriya). Video material on mushroom, apiary and vermicompost were prepared along with audio material on vegetables, paddy cultivation and bee-keeping.

Networking and Partnership

The project has established a good rapport with all district and block functionaries, PRIs, local bodies, Agricultural University functionaries, NGOs, banks and other projects of MSSRF.

The activities at the project site have also encouraged individuals from other institutions to visit the site for gaining first hand information. The project activities also received media attention during this period. ETV-Oriya broadcast a feature on AqIIIFS model at Manitiri and Prasar Bharati (DD) broadcast a feature on loan fair and the impact of training.

401.2.Hill Region

401.2.1 Thonimalai

Thonimalai and Pulayar Colony are remote villages in the forests on the western slopes of Lower Palani hills. *Pulayars* and *Mannadiyars* are the inhabitants of the region. The multi-tiered cropping system of coffee-lemon-pepper along with a few trees of jack/sweet orange/sour orange/banana/pomegranate, is their primary source of livelihood. The VKC located at the school building teaches functional literacy to adult learners as well as school children and continues to cater to the information needs of

the local people. Records pertaining to small holders, organic certification and Internal Control System (ICS) are being managed by the VKC.

Organic farming: Considering the market advantage and traditional management systems, organic farming has been promoted as a value addition strategy to enhance the income of small and marginal land holders. An agreement has been made among the International Institute for Market Ecology (IMO), certification agency, farmers' group and MSSRF, and after an internal inspection, 101 ha of land was certified as organic in conversion from November 2003 and therefore the produce can be certified as organic from November 2006; the remaining 119 ha were certified from November 2005. The products include coffee – *Arabica* and *Robusta*, parchment and cherry, black pepper dry, lemon fresh and banana green. Potential buyers are being identified and plans to promote multiple market links both at the regional and foreign markets is underway. Steps have been taken to further strengthen the ICS and facilitate the IMO certification process.

Good Agricultural Practices: Efforts have been taken to disseminate Good Agricultural Practices (GAP), especially on agronomic management and pest and disease management, particularly for citrus bug and twig die back, coffee-berry borer, pepper-wilt and banana-stem weevil and bunchy top with the support of the Coffee Board, Horticultural College and Research Institute and State Horticultural Department. Efforts have been taken to control pests and diseases. To promote the use of organic seedlings, a local nursery was

established by one SHG which produced 600 coffee seedlings. An attempt was made to produce lemon and pepper seedlings for the coming season under organic conditions. To improve soil fertility and nutrient management, an efficient composting system through vermiculture and biodynamic formulations has been initiated. Land has been identified in the Thonimalai village to establish the community based units managed by the SHGs. The farmers were registered as a society as *Thonimalai Thottakkalai Vivasaikal Suyavudhavi Sangam* which manages the organic farming activity at the village level. It has been decided to establish a production facility for biological products like *Beauveria* and *Metarhizium* to cater to the local needs with the technical support of TNAU and Coffee Board.

Apiculture – An Ecoenterprise: The *Pulayars* who are traditional honey collectors, were mobilized into SHGs and trained on improved apiculture techniques with the support of Keystone foundation, Kothagiri, The Nilgiris. The TN Adidravidar Development Corporation (THADCO) extended credit support to establish the infrastructure and training. Each of the group members manages three production units. With the help of traditional knowledge of the movement of bees and the knowledge acquired during the training, the group members identified the wild bee colonies in the forest, collected and filled the hives. The domestication process took a long time. However, this year, the yield increased from 35 to nearly 60 %. Nearly 35 % of the hives have reached the honey extraction stage. The members were trained on hygienic extraction and handling processes.

Linkages were established with Keystone Foundation for periodical field visits.

Application of Geographic Information System (GIS) in farm and village level planning: The GIS tool was applied to develop a farm-level map of Thonimalai, covering 99 farmers and an area of 220 ha, to plan for the optimal management of natural resources at the farm level. Initially the GIS layers will be used to plan for field specific water harvesting structures and maintain organic farming certification details. Also, efforts have been made to develop a tool kit on the preparation of field level maps using the GIS tool (See SPA 105.3).

401.3 Semi-Arid Region

401.3.1 Kannivadi

This being the 9th year of operation and association of MSSRF in this region, it was proposed to initiate role change of the on-going activities such as sustainable agriculture, horizontal transfer of knowledge, diversification of livelihoods through promoting ecoenterprises and application of modern ICT for promoting literacy and rural development. It was done by institutionalising the activities through two major grassroot institutions functioning in the site. Much focus was given to increasing the capacity of the grassroot institutions through need based training and capacity building to prepare them for role change. Also, efforts were taken to initiate self-sustainability of the organizations on institutional and financial perspectives.

Grassroot Institutions

Kulumai, a federation of around 145 SHGs, and Reddiyarchatram Seed Growers Association

(RSGA), a farmers' association with 90 members, are the two grassroot level institutions functioning at Kannivadi. During the year two more organizations namely *Thonimalai Thottakkalai Vivasaikal Suyavudhavi Sangam* and Oddanchatram Vegetable Traders Welfare Association were formed and registered under the Societies Act. Need based training and capacity building on institutional and financial management were made available with the support of external agencies.

Farmers Association: The farmers' association continued its efforts to facilitate horizontal transfer of knowledge and carried out 1,200 trainee days. The directory of local resource persons was prepared, indicating their core expertise. The association is slowly emerging as a local resource centre. It has established a cotton Farmers Field School with the collaboration of the Department of Agriculture and National Watershed Development Agency in Rainfed Areas and extended its support for mobilizing around 120 ha under sugarcane contract farming with a processing mill in the region. Small-scale experiments and field demonstrations were carried out on introducing alternative crops for the region such as hybrid castor and coleus. The initial performances of the crops were encouraging. Technologies such as SRI and Bt Cotton varieties, long stapled Suvin cotton species and low cost machines for processing castor were demonstrated by the organization to their members. To strengthen its activities seven thematic groups were proposed of which 4 groups have been formed. Strategies were evolved to bring microcredit facility to the members through these thematic

groups. Three printed materials, four CDs and two audio cassettes were prepared with the technical support of MSSRF which was also involved in facilitating informal Open and Distance Learning among farmer and agricultural labour groups.

The association has been managing the website www.oddanchatrammarket.com in close collaboration with the market commission agents. An export group, has been registered under the Societies Act with the broader objective of strengthening formal farmer-trader forward linkages in the region. The market commission agents were trained in the export logistics and identification of potential buyers. The group received the APEDA registration and is linked with TANSTIA – FNF Service Centre (TFSC) for a six month period. TFSC will provide handholding support on export, especially on the identification of potential buyers, export pricing and logistic consultancy.

With reference to the medium range weather and seasonal climate forecasting, the Centre is recognized as an Agricultural Field Measurement Unit by the Indian Meteorological Department. The Centre started issuing agro advisories through the network of Knowledge Centres twice a week based on the local cropping systems.

For the effective dissemination of locale specific dynamic information, a detailed content analysis was carried out for frequently asked questions. This indicates that more importance was given to pest management practices and season-based agricultural practices focusing on

the crops suitable for that period/ region as well as information on agricultural inputs.

Kulumai- SHG Federation: The Federation continued its efforts to strengthen its community banking operations. Fifteen new groups were formed during the year, taking the total to 145 with an annual turnover of Rs 2.3 crores. The repayment rate is more than 90 % and during the year it mobilized around Rs 41,35,000, of which Rs 29,50,000 was through commercial banks and Rs 11,85,000 from government departments. The composition of the groups indicates that nearly 70.5 % of them belong to Backward Communities. Animators were sensitized to put more effort in targeting the socially disadvantaged groups. The utilization pattern of microcredit shows that nearly 57 % of the members used credit support to strengthen/initiate livelihood activities like agriculture, livestock, petty business and microenterprises; 6.2 % is used for educational purpose; 10.3 % on medical expenses; 9.5 % on festivals and 7.6 % on housing.

Need based training and capacity building programmes were carried out for SHG leaders. Nearly 300 trainee days were organized on SHG management and microcredit. Efforts also continued on the accounts management system using special software and animators were trained on the operation. Micro-insurance programmes were initiated in addition to credit and saving services.

Kulumai facilitates group dairy farming among SHG members and is slowly increasing its strength towards evolving into a local cooperative

dairy. It is in the process of expanding its support services to the group members and has started offering business development services such as technology, credit and market assistance. To achieve institutional and financial sustainability and to support the group members, it has started retail trade in animal feed with the support of a leading animal feed manufacturing company. External auditing has been initiated to establish transparency in financial transactions.

Community Informatics: VRCs continued their efforts in providing need based locale-specific information on commodity-based market trends, government schemes, educational opportunities, simple remedies based on locally available medicinal herbs, agriculture, pest management and weather forecast to the local men and women. Seven VRCs, including a hub centre are functioning in this region. Apart from providing need-based information, five centres are facilitating functional literacy and livelihood training, one centre is involved in managing the weather station and one manages the market website. The hub of the VRCs, located at Kannivadi, continues to be an active point for information access and computer-based training on sustainable agriculture.

Ecoenterprises for livelihood Security

The Reddiarchattram Union is unique in that initiatives in the last few years have seen the establishment of 5 units which cater directly to the promotion of good agricultural practices, waste value addition and introduction of livestock.

Banana paper unit: Special initiatives were taken to revamp the unit by enhancing its infrastructure, especially the hydraulic press and the drying yard. Need based training and capacity building programmes were organized for machinery management, paper and board preparation of various thickness and colour combinations. The group members participated in district, state and national level exhibitions and shared their experiences with bank officials, NGOs, farmers' associations and developmental workers. The unit generated 400 labour days and produced new products like herbarium sheets and water absorbing sheets, based on the market demand. Efforts have been taken to identify market links.

Trichoderma viride unit: The unit stabilized the production technique and generated nearly 470 labour days, produced 2.5 tonnes and distributed nearly 8 % of the production to local farmers. The production and labour days generated were slightly lower than the previous year, mainly due to the difficulty in market links. Efforts have been taken to increase the local trade by contacting the plantation estates in nearby Kodaikanal hills as well as other potential buyers in the region. Now the group has entered into an agreement with two more marketing agencies and created local demand through farmers' network in different villages of the region. Hilly ecosystem based local strains of *Trichoderma* were bought and multiplied to meet the local demand, which increased the farmer's confidence. The unit is acting as a training centre and provided hands-on training to NGO workers both in TN and AP as well as to the trainers of KVK.

Pseudomonas fluorescens unit: The unit refined the production process and reduced the production cost by 35 % of the estimated cost, which is 10 % higher than the previous year. The unit applied for registration under the Central Insecticides Act, 1971. It produced 3 tonnes of the product, which helped to generate 600 days of employment. The group has entered into an agreement with a market dealer and is slowly expanding its local network. The group members trained 24 members of the SHGs from Pondicherry and Kannivadi in the production of other biological products.

Trichogramma biopesticide production: Two SHGs in Kannivadi region are producing and collectively marketing the pesticide both at the local level as well as to a sugarcane factory. The groups generated nearly 750 labour days and produced 6,500 cc, which could cover nearly 450 ha. Selected NGOs in TN and AP received three days intensive hands-on training on the production technology, business plan preparation and marketing strategies from the group members. Constraints in the production process like the incidence of *Tribolium* (an insect pest, which causes damage at the time of web formation of *Corcyra*) and a fungal disease are being managed through integrated methods. This year Bracon, an insect pest attack, was encountered. The members were trained on the identification, precautionary measures and management methods. Efforts have been made to increase the scale of production in each of the units in consultation with the sugarcane industry.

Production of low cost biofertilizers: Kaliyammal women SHG, Kappliyapatti was selected and trained on the production process. But due to the lack of cooperation among the members as well as constraints in identifying a suitable place, it was decided to select another group. Jhansirani women SHG was selected and hands-on training was organized at Chennai for four members. The unit was established in February 2006 and the production process stabilised. The members are landless agricultural labourers belonging to economically disadvantaged groups. Subsequently exposure visits were organized to a low cost pseudomonas production unit, successfully managed by a woman SHG in a nearby village as well as to a production facility based at Chennai. It gave them confidence to take up the enterprise. An orientation workshop was also organized at the group level and a business plan was prepared. Efforts were taken to establish market linkage for the 300 kg produced, using vermicompost as carrier material. Field level intensive training was started on phosphobacteria production. The process of demystification using cost effective chemicals was initiated. (See SPA 205.3)

Low cost decentralized production of Arbuscular Mycorrhiza (AM): Pudukai women SHG of Pudukatti have started the production unit. Market linkage was identified and the group marketed nearly 400 kg of VAM and generated nearly 50 labour days. The group prepared a business plan and production facility of 3 tonnes was established in the leased land. The members entered into an agreement with a market agency and received credit support from the Federation. Based on the success at the

field level, a unit was established by agricultural women labourers in tsunami affected regions of Nagapattinam district.

Credit linked Biovillage – Integrated Scientific Dairy: Sixty-five members came together and 59 of them received credit support to purchase animals. *Kulumai* purchases the milk from the members and has established multiple market links with three agencies in the region. In addition, it arranges need-based training. Programmes on animal identification while buying, insurance, integrated dairy farming and disease management were organized for the members. Efforts were made to introduce improved fodder sources; bio gas and vermicompost units were established at the household level.

Sesame Seed Village

The Sesame Village Project was taken up as an explorative project in August 2004. The project envisages the promotion of an integrated management approach through community participation to create a sesame seed village for the production of quality seeds. Linkages are being established with industries and institutions using appropriate technologies for the improvement of sesame production in the farmers field through a Public-Private Partnership mode with Idhayam Group, Virudhunagar. The mode adopted for the implementation of the project is extension service for the farmers. The project is creating awareness of good cultivation practices and management. The project is also facilitating mechanisms for mitigating the constraints, e.g. availability of quality seeds. The project area is distributed in three districts of TN, namely Namakkal, Erode and Salem,

with an outreach programme extending to Villupuram district. 172 farmers (168 men and 4 women) participated in the programme as core trainees, covering 23 villages and 464 acres under sesame cultivation, of which 89 acres were rainfed. 274 trainee days (270 men and 4 women) have been completed under this programme. The average yield increase among the participating farmers against the district average is estimated as 32 % under irrigated and 65 % under rainfed conditions. The cost-benefit ratios for individual farmers range between 1.26 to 4.09 and as this is market determined, the project is looking into the aspects of reducing the input cost through efficient management practices. To provide quality certified seeds to the farmers, the project has taken up seed multiplication at Poolampatti (Salem district) and Tottipalayam (Namakkal district) field centres, covering an area of 6.5 acres, with an average seed yield of 600 kg/acre. The project is currently evolving strategies to create a better delivery system in reaching out to farmers, extending its operational area and documenting the process of farmer-participatory seed production.

Community Banking, Micro-credit and Enterprise Development

This is a very important component of the activities in enhancing livelihood options. This year, the focus was to understand our SHGs better and so a study was initiated to set up a database. Also, the community-banking component has been strengthened at all the sites. Enterprise development and marketing have received greater focus, leading to streamlining of guiding principles for the SHGs

in initiating and planning income generating activities, minimizing the risk involved, and increasing the marketing linkages.

Database on SHGs formed under Ecotechnology Centre

It was decided that the Centre should have a common database of the institutions set up over the years which should be easily available. A prescribed format was developed in consultation with all the people concerned and desirable parameters for inclusion in the database were prepared.

The broad objective of the exercise was to compile a database on the existing SHGs, with details of their current status in terms of profile, functioning, financial transactions, training, and income generating activities. The methodology adopted included designing the questionnaire, discussing with the staff, BVC and *Kulumai* members, and conducting a pilot study in both sites. The survey was completed in December 2005 and February 2006 and the outcome of the survey shared with BVC members of Pondicherry and *Kulumai*. Similar activities have also been completed at Chidambaram and Kendrapara (Table 4.3).

Microcredit and enterprise development

This year the entire focus has been in three areas: rebuilding lost livelihoods of tsunami affected victims, setting up enterprises in areas where Village Knowledge Centres have been set up by MSSRF, and including other sites where MSSRF has ongoing projects. Thus, 28 income generating activities were started with interest free loans amounting to Rs 26 lakhs. Out of this, Rs 12 lakhs was given to tsunami

Table 4.3 *Progress of SHGs during 2005 ~ 2006*

Site	SHGs formed during 2005-2006	Cumulative no. of SHGs as on March 2006
Pondicherry	43	247
Kannivadi	15	149
Chidambaram	19	35
Kendrapara	5	38
Total	82	469

affected women SHGs for restarting their livelihood activities. Thirty SHGs consisting of 400 families were supported through micro-credit in Nagercoil, Chidambaram and Kakinada; 12 micro credit banks have been initiated by the Friends of MSSRF, Japan and 16 micro credit banks by Friends of MSSRF, Australia.

As part of the withdrawal strategy and role change in Kannivadi and in our endeavour to strengthen the grassroot Federation *Kulumai*, a loan of Rs 5 lakhs was given to the Federation. They, in turn will give loans to SHGs to start small income generating activities.

Training and capacity building on enterprise initiation and development for SHGs and local NGOs forms an important component for each enterprise that is being initiated. To ensure that the SHGs starting new enterprises have sufficient exposure and knowledge on all the four components – technology, credit, market and management, a two-day training programme on how to develop a micro-plan and to write a bankable proposal was given to SHG members at different project sites.

Training

MSSRF conducted for the first time, on request, a 12-day training program for graduate students of Temple University, Tokyo on “The role of NGOs in Rural Development”. This was made possible through the facilitation provided by the Friends of MSSRF, Japan. The objectives of the training were to expose students to science based approach to rural development; to prepare the students to work for NGOs; to critically examine the development structure and role of NGOs and to introduce students to field work. The methodology adopted was a travelling workshop mode. The course content comprised classroom lectures and discussions, field visits, guest lectures by experts/NGOs in the field, interaction with communities and grassroot institutions and preparation of a case study. On the final day of the program the students made a presentation with valuable suggestions on what these programs meant for the rural poor as they saw it.

State Development Report of Pondicherry

MSSRF has been involved in the preparation of a State Development Report of Pondicherry for the Planning Commission, Government of India. The other partners in the effort are Madras Institute of Development Studies (MIDS) and Institute for Financial Management and Research (IFMR). MSSRF is preparing chapters on Agriculture and Rural Development; Health and Social Security. Trend analysis is being carried out, based on the data collected (from 1980s onwards) from different published sources covering the four regions Mahe, Yanam, Karaikal and Pondicherry. Regionwise meetings were organized and discussions held with the line

department heads. The draft report was submitted to the Planning Commission and comments were received. The process of improving the chapters is going on. It is planned to get expert opinions for each of the chapters and submit them shortly.

401.4 Chennai

The Centre at Chennai concentrates on research in exploring less utilised indigenous plants, conducts frequent training for SHGs and harnesses beneficial organisms for IPM and increasing crop productivity.

The major activities carried out by the laboratory were in the area of bioassay of a few botanicals (crude extracts and fractions) against *Helicoverpa armigera* and determination of antimicrobial properties against human pathogens, biodegradation of endosulfan, field trials, training and support.

Fractions of *Argemone mexicana*, *Cipadessa baccifera* and *Melia dubia* were tested against *Helicoverpa armigera* for determining distinct bioassay properties. Fractions (1 and 4) from *A. mexicana*, were able to reduce the pupation to the maximum (nil pupation) as against 100 % pupation in untreated larvae. The larval duration was prolonged in fraction 2 (14.7 days) compared to untreated larvae (6.6 days) and nearly 8 % were malformed.

Fractions of petroleum ether extract of *C. baccifera*, were able to inhibit larval growth particularly in the first fraction. Except fraction 3, all other treatments resulted in less than 50 % pupation as against 100 % pupation in untreated larvae. Further, a drastic reduction in pupal weight from 251 mg to 150 mg (normal control was 306 mg) was recorded in all the treatments, which subsequently resulted in

malformed moths (83-100 %). Exposure of *H. armigera* to all fractions from *M. dubia* resulted in 100 % larval mortality.

Another serious agricultural pest *Spodoptera litura* was also tested. Maximum inhibition of *S. litura* growth was observed in *A. mexicana* fraction 1, hence there was no pupation. However, 13 % pupation was recorded in fraction 2, compared to control (96 % pupation). The larval duration was extended in fraction 4 treated larvae (6.3 days) compared to untreated larvae (4.6 days). Further, a drastic reduction in pupal weight was recorded in all the treatments. It ranged from 129-284 mg (normal control was 304 mg), with 248 mg in fraction 5. Maximum malformed moth emergence was recorded in fraction 3 (92 %), followed by fraction 5 (89 %) as against the untreated ones (3 %).

Antimicrobial activity was studied against 6 human pathogens using different plants viz., *A. mexicana*, *C. baccifera*, *C. dentata*, *D. angustifolia* and *M. dubia*. The results revealed that test pathogens were highly susceptible to hexane and chloroform extracts of *D. angustifolia* and *C. baccifera*. Among all the extracts of *A. mexicana*, chloroform extract was found to be effective against most human pathogens. The crude extracts were further fractionated and tested against pathogens. Fraction 1 of *A. mexicana* chloroform extract showed maximum growth inhibition of *Micrococcus sp.* and *Vibrio cholerae* (6 mm). *D. angustifolia* hexane fraction 2 at 10 % concentration inhibited the growth of *Vibrio cholerae* and *Salmonella typhi* (7 mm). *Shigella flexineri* was highly susceptible to 5 % and 10 % of *Clausena* hexane fraction 2 (8 mm).

Among the fractions of *Cipedessa* (chloroform), fraction 4 had more inhibitory activity against *Pseudomonas aeruginosa*, *Micrococcus*, *Vibrio cholerae*, *Salmonella* and *Shigella*.

Biodegradation of endosulfan using tolerant bacteria was carried out. Seven different bacterial colonies were isolated from the soil amended with pesticides; these strains were tested for their tolerance to different concentrations of insecticide, (endosulfan, quinalphos, cypermethrin, carbofuran, acephate) herbicides (butachlor, metsulfron metyl and chlorimuron ethyl) and fungicides (kasugamycin, carbendazim). P1, P2 and P6 strains were tolerant to endosulfan and quinalphos up to 200 ml. P1 and P6 were able to tolerate 200 ml of butachlor and P1 alone was able to resist 200 ml of carbendazim. The tolerant strains were characterised and identified using biochemical tests. The tolerant strain P1 was identified as *Pseudomonas sp*, P2 as

Pseudomonas flouresence and P6 as *Xanthomonas sp*.

Field Trials

Two field trials against *H. armigera* on chickpea and pigeonpea were conducted at Samiyarpatti and Palaniyur. Plant extract was effective in controlling the insect population. *Dodonaea* alone, and when combined with *Trichogramma* or NPV had the similar effect.

Training and Technical Support

Need-based technical support to already established *Trichogramma* units in the field sites and in-depth training to newly formed SHGs on IPM, and *Trichogramma* (314 trainee days) and oyster mushroom (360 trainee days) were organized in the coastal villages of Pondicherry.

The training programmes conducted by the centre are listed in Table 4.4

Table 4.4 **Training programmes held at the JRD Tata Ecotechnology Centre during 2005 - 2006**

Sl. No.	Details	Trainee Days		
		Men	Women	Total
1.	Functional literacy	10,130	13,774	23,904
2.	Farmer to farmer training	3,875	1,465	5,340
3.	Skill enhancement for income generating activities	553	3,007	3,560
4.	Capacity building, leadership & management of grassroot institutions	788	2,558	3,346
5.	Integrated cultivation and farm management	881	615	1,496
6.	Post harvest & value addition	0	110	110
7.	Computer literacy and GIS application	100	378	478
8.	Health and hygiene	50	143	193
9.	Sponsored exposure visits from other organizations to the field sites *	225	312	537
Total		16,602	22,362	38,964

* In addition, 1,530 school students also visited the field sites.

Sub Programme Area 402

Sustainable Management of Natural Resources for Food Security and Environmental Quality

This project was initiated in technical collaboration with Ohio State University, Ohio, USA from 2001-2002 with generous financial assistance from Sir Dorabji Tata Trust in three major soil sites of India: the red soils of Pudukottai and Dindigul districts in TN, the alluvial soils of Nawashahr and Faridkot districts in the Punjab, and the black soils of Narsinghpur and Hoshangabad districts of Madhya Pradesh. This year (2005-2006) being the last year of the project, the results are summarized for the project period as a whole.

402.1 Pudukottai, TN

Water: Channels were formed from the participating farmers' fields to carry the excess rainwater received during the monsoon season to the village tank for storage, and use. This year, due to the high rainfall of 1,323 mm, the excess run off water was effectively harvested and the farmers were able to bring about 15 acres of additional land under irrigation and cultivate short duration vegetables and greens. This also improved the water level in the open wells in the area. Summer ploughing opened up the soil and facilitated infiltration of rainwater. Formation of tied ridges or ridges and furrows before the start of the rains helped in early sowing and conserving rainwater in the fields.

A zero energy gravitational ground level drip irrigation system was introduced to promote cultivation of vegetables. This saved about 40 % irrigation water, besides improving the productivity and quality of the vegetables.

Soil: Surface hardening and inadequate phosphorus availability due to excessive presence of iron and aluminium oxides were identified as major constraints in red soils. A low-cost, fast-composting technique was introduced, using locally available crop residues and press mud from the nearby sugar factory as the base. The compost was enriched with rock phosphate and bio-fertilizers. Application of this biocompost in the last ploughing improved the crop productivity significantly without increasing the cost of inputs too much. Water conservation in the soil profile has also improved.

During the year, the application of rice bran to the soil at the rate of 1 mt per acre was tried in the farmers' fields at Maringipatti and Ariyamuthupatti. The yield of groundnut was 423 kg per acre in the control plot as against 708 kg per acre in the experimental plot.

Cropping Patterns: In the red soil regions of TN, single cropping is the normal practice under rainfed conditions. Double cropping is possible in the years of normal rainfall, with short-duration pulses like green gram/cowpea in the southwest monsoon season and millets in the northeast monsoon season. Intercropping of green gram/cowpea/groundnut in the long-duration red gram is a viable alternative, with high economic returns. New varieties both of

red gram and green gram performed very well under rainfed conditions and are gaining popularity among the farmers. As a long-term measure, dryland horticulture was taken up and saplings of fruit trees such as mango and sapota have been planted; intercropping of annual crops is being taken up until the canopies of the fruit trees cover the ground area.

Enhancement of Livelihood Opportunities: Women in the project villages were organized into SHGs. Production of the biopesticide *Trichogramma* was identified as a viable micro enterprise for the area as the nearby sugar factory was prepared to buy the entire production. Five SHGs comprising 76 women were able to produce 26,993 Tricho cards and earned Rs 5.19 lakhs. Other micro enterprises such as vermicompost production and turkey rearing are also being taken up by some SHG members.

402.2 Punjab Agricultural University, Ludhiana

Water: The intensive rice-wheat cropping system followed by the Punjab farmers consumes large amounts of water, energy and nutrients. The system is becoming unsustainable due to excessive exploitation of water. Hence attempts were made to test alternate cropping systems that would use less water. Upland crops such as cotton and maize in the place of lowland rice in the kharif season saved substantial quantities of water and gave high productivity. Drip irrigation was introduced for vegetable crops, considerably increasing the efficient use of water.

Soil: Due to intensive cultivation, organic matter content has been declining and multiple nutrient deficiencies are becoming common in the alluvial soils. Burning of rice straw before wheat sowing is a common practice. This not only deprives the soil of the much-needed organic matter but also causes environmental pollution. To mitigate this problem, incorporation of rice straw before wheat sowing was attempted. Though there was increase in organic matter, it is too early to come to a conclusion. There was no perceptible increase in wheat yield. This practice has to be continued to assess any significant improvement in soil fertility and crop productivity. The main constraint in adopting the practice seems to be the non-availability of suitable machinery for incorporation of rice straw.

Cropping Patterns: To replace the unsustainable rice-wheat cropping system, demonstrations with various alternate cropping systems were laid out in farmers' fields. Cotton-wheat, cotton-chickpea, maize-wheat, and maize-gobi/sarson performed well, with much less demand on water and nutrients. Intercropping of gobi/sarson in sugarcane proved to be economical. Agro-forestry with poplar was attempted with wheat as intercrop, and initial results show promise. Alternate cropping system studies have to be continued to demonstrate their economic viability and to observe their effect on soil fertility.

Nineteen training sessions were organized for farmers in agriculture and related activities. They were taken to the university centres, production units, and marketing yards.

402.3 Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur

Water: In the State of Madhya Pradesh in central India, water-logging is common in the kharif season due to high rainfall and poor infiltration rate of the heavy black soil. As a result, many farmers leave the lands fallow during kharif and raise one crop in the rabi season with the residual moisture in the soil profile. In the Narsinghpur project site, the system of raised and sunken beds drained the excess water and reduced water-logging. Farmers could raise two crops in a year. In Hoshangabad, ridges and furrows provided adequate drainage, facilitating farmers to raise a crop in kharif. Wherever water stagnated, fish culture was introduced. In areas where rice is grown, irrigation only at critical stages of crop growth reduced the water requirement substantially without reducing the yield.

Soil: Integrated plant nutrient supply, involving the use of locally made compost (farm yard manure), bio fertilizers improved the productivity of the crops and maintained the soil fertility at fairly high levels.

This year's trials on wheat in three villages namely, Dangidhana, Murlipondi and Karakbel of Narsinghpur district, also demonstrated the increased yield of 6 tons/ha from the combined

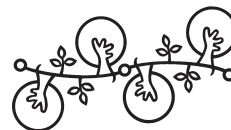
application of the recommended fertilizers and farmyard manure.

Cropping Patterns: With good land management systems such as raised and sunken beds, and ridges and furrows, double cropping such as paddy and soybean-gram/wheat was found to be profitable as water-logging could be minimized and excess water could be stored for future use. Wheat and gram were sown in the rabi season after the fish harvest. Fish culture was introduced during kharif and three species of fish were stocked in the field.

Enhancement of Livelihood Opportunities: Many farmers have started production of simple chulas, low cost latrines, and biopesticides and compost, thus enhancing their income.

Twenty-eight training programmes, 14 fairs and 10 field days were organized. Various land management systems, compost making and crop management activities formed the major themes of training. Field visits were arranged for farmers to exchange information on their experiences.

A bulletin explaining the natural resource management problems, the interventions made and the achievements during the project period at the three sites was brought out in November 2005.



Food Security

The corpus stock of grain in the community grain bank at Jeypore has gone up to 15,410 kg. The TRC on Food Security supported by WFP was formally inaugurated in Jan 2005. The Food Security Atlas of Cambodia has been completed. A three credit course on 'Hunger, Famine and Food Security' for the UN University of Peace in Costa Rica was developed.

501	B.V.Rao Centre for Sustainable Food Security.	100
502	Ford Foundation Chair for Women and Sustainable Food Security.	105
503	The Sustainability of Farming Systems.	108

Sub Programme Area 500

Food Security

The work on food security at the Foundation is built around the flagship programme of *Mission 2007: A Hunger Free India*.

MSSRF's work in the area of food security consists of several strands. The Ford Chair focuses on gender issues in food security. The Technical Resource Centre (TRC) on Food Security, supported by the World Food Programme, seeks to address all aspects of Food and Nutrition Security (FANS).

Sub Programme Area 501

B.V. Rao Centre for Sustainable Food Security

The TRC functions as part of the B.V.Rao Centre for Sustainable Food Security, which is implementing projects in the areas of community food and feed banks in Jeypore in Orissa and Namakkal district in Tamil Nadu.

501.1 Community Food and Feed grain Banks Jeypore (Orissa)

The Community Foodgrain Bank (CFBs) initiative, started in mid 2002, is now operating in 8 project villages under the Jeypore Site office. The villages are Maliguda, Kanjei, Bedhaguda, Chemiyaguda, Balia, Badapar and Bisoiput, all in Jeypore block of Koraput district,

and Michashola in Kalahandi district. In all, there are 377 CFB member households.

The corpus stock of grain in the CFBs has grown from 5,509 kg at the time of initiation in August 2002 to 15,410 kg as of January 2006 through interest collection and annual contributions of members. During the period of report, a total of 167 households availed of 3,507 kg of foodgrain loan from CFBs.

Role of MSSRF

With three full cycles of CFB operation complete and the fourth in progress, the role of MSSRF has gradually changed from that of guide to advisor and it is interesting to observe the group dynamics and the synergies at play for cohesive action. For instance, while the total foodgrain corpus has grown, not all villages are regular in making annual voluntary contributions. But Maliguda village with 35 households has been regular in the annual contribution by members, the amount varying depending on the yield and consensus decision by the members; starting with an initial corpus of 697 kg in August 2002, the year-wise contribution of foodgrain in Maliguda (in kilograms) has been 5,10, 2,899 and 1,750 during 2003, 2004 and 2005 respectively. The foodgrain corpus in Maliguda stood at 5,423 kg in January 2006, including an interest component of 367 kg. Surplus foodgrain after lending has been sold in the market and the money deposited in the village development fund.

Support is provided to the handicapped, destitute and elderly by way of free grain or interest-free loans of grain on a case-by-case

basis in many of the villages. For instance, 120 kg of rice was distributed free among 8 people above 65 years of age in Balia village in 2005.

New Initiatives

Moving forward from addressing just food scarcity, several local initiatives have sought to address livelihood security and improve quality of life. While essentially small and micro in terms of scale, these initiatives may be seen as the first step to sustainable development. In all villages, there is a Village Development Committee (VDC) and a Village Development Fund (VDF). Taking all the 8 VDFs together, the total amount in the VDFs was Rs1,06,000 as on Jan'06.

The VDF has been put to innovative and locally relevant uses. In Maliguda, Rs 3,200 realised from selling 8 quintals of paddy, was utilized for renovation of the water harvesting structure, completion of the community bathroom, and purchase of tarpaulin to sit on during community meetings. The Badapar VDC used Rs 2,500 from the VDF to purchase utensils, for hiring out to other villages for catering purposes. There is no charge for the members of the same village. In Chhemiaguda village, 1 ha of land belonging to a landowner in a neighbouring village has been given to the VDC for cultivation for Rs 3,000. In Michashola village, Rs 2,285 from the VDF was incurred as legal expense for recovering 1 ha of village common land illegally occupied by a landlord from an adjacent village. This land is now in the Committee's name and is under community farming. Another Rs 620 was used for community fish farming.

The VDF supports villagers in times of need and has helped lower dependence on moneylenders. The period of loan and the rate of interest depend on the purpose for which the loan is taken.

An initiative to link the CFB with the Public Distribution System PDS was started in the village of Mitchashola in November 2005. This was felt to be necessary as the nearest Fair Price Shop (FPS) is very far from the village and the residents of the village are unable to purchase their quota of PDS supplies in one lot because of lack of purchasing power. An SHG in the village has got a license to run a ration shop. They have raised funds for lifting kerosene stock and selling it to the villagers. Means are being explored to get funds to lift the rice stock.

Self Help Groups

As on date, 19 SHGs are functioning in the 8 project villages. These SHGs availed of a bank loan of Rs 3.29 lakhs, repaid Rs 1.81 lakhs, saved Rs 1.24 lakhs and have now an outstanding amount of only Rs 1.48 lakhs to be repaid to the bank.

The SHGs and SHG members have moved on from thrift to small micro-enterprise activities for additional income generation. Some of the activities include: making value added products from millet, rice and paddy; vegetable cultivation; fish cultivation; goat rearing; and vermi-composting.

Networking

Linkage has been established with the residual literacy campaign for all age groups

implemented by the *Zilla Sakshrata Samiti* (ZSS) for achieving universal literacy in 7 project villages. A total of 120 farmers and volunteers led by Orissa Tribal Empowerment and Livelihood Programme (OTELP) and by some NGOs (AKUSS, ORRISSA, NEED) were given orientation by the project personnel on food security approaches. In the light of this experience, NABARD, Kalahandi has promoted three area level grain banks through a local NGO, Antyodaya, based on the CFB model.

Namakkal, Tamil Nadu Community Foodgrain Banks in Kalrayan Hills

The project has been in operation since July 2003. Operating in collaboration with World Vision, the NGO already working in the area, MSSRF helped to set up CFBs in two villages – Melvazhapadi and Thalvellar. The CFBs are managed by women’s SHGs - 30 members from 2 SHGs in Melvazhapady and 12 from one in Thalvellar. The initial corpus grain support was from MSSRF. In each village, World Vision helped to construct a storehouse for a CFB of 12-ton capacity at a cost of Rs 2 lakhs. The SHG members contributed foodgrain to the corpus stock and labour for storehouse construction. At a camp conducted by the Villupuram District Collector in a neighbouring village in mid-2005, further corpus grain support was promised under the Government Grain Bank scheme. This has been received recently. Similar support has been promised for other CFBs that may be set up.

SHG members from 6 neighbouring villages who visited the CFB villages, have now initiated

replication of the activity in their villages with support from World Vision.

There has been 100 % food grain repayment in the 2 CFBs. Needy, non-food bank members are also approaching the CFB for food grain assistance. A survey in the two villages reveals that migration by members of CFB member households has fallen. This has also helped promote school enrolment. A detailed study of these developments has to be undertaken. World Vision has taken a policy-level decision to promote CFBs in all its project areas.

A zero energy cool chamber linked to a vegetable retail shop has been facilitated in Melvazhapady village and is being managed by a SHG. Aided by good monsoon and following training in millet cultivation and distribution of seeds through TNAU, about additional 28 ha were brought under millet cultivation in 2005. Following a tie up with Rural Innovations Network, the purchase and distribution of 200 insect traps worth Rs 18,000 to 100 women SHG members, to promote grain storage was facilitated.

A baseline survey to collect village-level information was completed in 8 villages in Vellimalai Block in preparation for setting up a VKC with help from the Informatics Division at MSSRF. A draft Household Entitlement Card (HEC) listing details of government schemes in the State has been prepared in Tamil. This is to be finalized and printed for dissemination at all our field sites in the State through the VKCs.

Community Feedgrain Banks

The Community Feedgrain Bank (CFGB) has been operating through two farmers’ clubs, one

in Varagur, Namakkal district and the other in Veerabhayangaram, Villupuram district.

Carrying forward the efforts to increase maize cultivation in the region, a participatory demonstration trial on short duration maize varieties (*Diara & Sakthi*) was conducted. The area under maize has increased by nearly 1,000 acres in the last season. Nearly 250 tonnes of quality maize grain were marketed directly by the farmers' club to poultry units through the CFGB. Eight resource persons from the project villages were selected to undergo training as village animal healthcare workers at KVK, Veterinary College, Namakkal.

A Computer Information Centre was inaugurated at Varagur in Namakkal in December 2005. The Informatics division at MSSRF has been requested to make it a VKC. Required baseline information has been submitted for both Varagur and Veerabhayangaram villages.

There are 6 SHGs in Varagur and 4 in Veerabhayangaram. Of these, 4 in Varagur and 3 in Veerabhayangaram consist solely of landless women. There is an all-male SHG in each village. Two of the SHGs were formed this year. An Integrated Farmers' Club-SHG Vermicomposting model was inaugurated at Varagur in March 2006.

MSSRF played a facilitator role in helping 9 farmers' club members to install micro-irrigation systems worth Rs 2,88,000, with assistance from a bank and a government subsidy of Rs 72,000 at Veerabhayangaram. Loans to the extent of Rs 5,00,000 were received by SHGs and Varagur Farmers' Club from banks for micro-

enterprise activities such as feed preparation and seed production.

Training, Networking and Capacity Building

Networking was carried on with the Agriculture Department to conduct a Mobile Soil Health Camp in Veerabhayangaram. Animal health camps were held in both villages by the Animal Husbandry Department on our initiative. A new Farmers' Club was formed in Pakkampadi, Villupuram District in Feb 2006. They wish to replicate the CFGB model.

Initiatives in Ladakh

With the help of Sir Dorabji Tata Trust, funding was provided to the Departments of Horticulture in Leh and Kargil to provide on-site training to farmers in fruit processing and post harvest technologies. Two such programmes were conducted in Leh in October 2005 and 33 farmers underwent training. Nine camps were conducted in six villages of Kargil district, with thrust on osmotic dehydrarion of apricot fruits. The Departments of Horticulture of Leh and Kargil have now sought assistance to establish high-tech mini-solar apricot drier units.

501.2 The Technical Resource Centre on Food Security

The TRC on Food Security, supported by the WFP, was inaugurated in January 2005. However, it became operational effectively only in June 2005. Over the twelve months from June 2005, the TRC has guided the work of the community food and feed banks in Jeypore and Namakkal. It has also developed an action plan to be implemented over the three-year period, 2005-2008.

Based on the experience in initiating, operating and managing of CFBs by the community, a Training Manual has been prepared for setting up of CFBs at the community level. The Manual was discussed at a workshop in Jeypore on 6 October, 2005 with other NGOs, bankers and government functionaries. It has since been finalised for printing. The OTELP is using the manual for the promotion of CFBs in Laxmipur Block of Koraput district. A draft translation of the Training Manual in Tamil has been prepared, and will be printed after revisions.

The process of setting up and managing CFBs in Orissa and in TN is being documented. An evaluation of the CFB project villages is currently in progress.

A workshop to discuss the need for a Food Guarantee Bill was organized in June 2005 with support from the NCF. The recommendations of the workshop were submitted to the NCF and have found a place in the second report submitted by the NCF to the Govt of India in August 2005.

The TRC worked with the Uttara Devi Resource Centre for Gender and Development (UDRC) of MSSRF in organising the workshop on *Women in Agriculture – What Next?* in November 2005. The TRC has been participating in the meetings convened by the National Alliance Against Hunger, set up by the Government of India. Two meetings were held in 2005.

The TRC staff have participated in and contributed to various forums on Food Security issues, addressing, in the process, diverse groups such as students, academicians and farmers.

Food Security Documentation

An important task of the TRC is to update the MSSRF-WFP work on documenting food security issues through Atlases and Reports. During the year, the major effort was on updating of the Food Insecurity Atlas of Rural India. A meeting of the Technical Advisory Group (TAG) was held in Delhi on 28 March, 2006, to obtain valuable inputs in this regard from expert academicians, policy makers and national and international development partners. It was decided that the document, to be brought out before the end of 2006, would serve as a Report on the State of Food Insecurity in Rural India. Besides working out various indicators as well as an overall index of food insecurity, using the most recent data available, the Report would focus on a chosen theme related to food security. The theme of the public food delivery systems, including the PDS, the Mid Day Meals scheme (MDM) and the Integrated Child Development Services (ICDS), has been chosen. The Report would deal primarily with chronic food insecurity.

Plans for 2006-07

The TRC is working towards becoming a Training and Resource Centre on food security issues.

Some of the activities already ongoing and those planned for the year include:

- Developing modules on food and nutrition security and CFBs, through conducting workshops for Panchayat functionaries, and nutritionists in Home Science and

Agricultural Institutions for upgradation of Nutrition Syllabus

- Preparation of the Training Manual on CFBs and conducting dissemination workshops
- Developing a Report on the State of Food Security in Rural India 2006
- Developing and consolidating a database on food and nutrition security
- Developing linkages with VKCs for wider dissemination of materials on Food and Nutrition Security
- Conducting an evaluation study of the impact of CFBs

501.3 Course developed for UN University of Peace

The BV Rao Centre helped a consultancy on developing a three credit course on “Hunger, Famine and Food Security” for the UN University of Peace in Costa Rica. The course, leading to a Master’s degree in Environmental Science, offered to students from different ethnic backgrounds, consisted of twelve classroom sessions. The course was divided into three units. The first unit addressed food security issues, which began with the synergy between environment and agriculture with a historical perspective, the concept of food and nutrition security, balanced diet, and cultural and gender perspectives in food security. The second unit addressed food insecurity issues such as hunger and famine, basic concepts such as access, rights and entitlements, distribution and pricing and impact of agricultural technology on the environment and hence on food and nutritional insecurity. The third unit included

assessment and measurement of food and nutrition insecurity, urban food security and approaches in the mitigation of food and nutrition insecurity. The pedagogic approach built into the design of the course consisted of proceeding from self-analysis to local and global issues with a view to sensitizing students to look at hunger and poverty issues not merely as a subject of academic study, but as a humanitarian issue with a ‘rights perspective’. The draft outline was first circulated within the Foundation and useful comments and suggestions were received, which helped to enrich the draft curriculum.

Sub Programme Area 502

FORD FOUNDATION CHAIR FOR WOMEN AND SUSTAINABLE FOOD SECURITY

502.1. The Food Security Atlas of Cambodia

United Nations World Food Programme, Cambodia Country Office had requested Prof. MS Swaminathan, Chairman, MSSRF to help them to produce a Food security Atlas of Cambodia. The work was entrusted to the MSSRF team already experienced in producing three similar atlases for India. The work has been completed and will shortly be made available on the World Food Programme (WFP) Cambodia web site.

The country Director of WFP, Cambodia, in the Preface to the publication, has stated that “This is a unique venture for both MSSRF and Cambodia and a true example of South /South collaboration.”

Prof M S Swaminathan, in his foreword to the book, has noted that MSSRF has defined food security as the “physical, economic, social and environmental access to a balanced diet and clean drinking water.” Non-food factors like access to sanitation, primary healthcare and education are also important for providing every citizen with an opportunity for a healthy and productive life. Poverty reduction, food security and nutrition improvement are clearly interlinked. The Royal Government of Cambodia (RGC) is committed to reducing poverty in Cambodia, enhancing the welfare and living standard of the people and ensuring food security and nutrition for all. By “mapping” the intensity and locations of poverty, child malnutrition, literacy, etc., an attempt has been made in the *Atlas* to determine where the Cambodian people are the most vulnerable and food-insecure. The first ever of its kind in Cambodia, the *Atlas* presents the food security situation of Cambodia in its three dimensions of food availability, food access and food absorption.

502.2 Micronutrient Deficiencies in India

The Ford Chair prepared a paper on *Micro Nutrient Deficiencies in India – Approaches to tackle them* for the Micronutrient Initiative (MI), Canada. The findings of the report have been included by MI in their Country report.

The broad picture with respect to malnutrition at the all India level and that of the states may be summarized as follows. Judged from the impact of the deficiency manifesting as disease, the most important deficiencies to fight against are iron and iodine, followed by vitamin ‘A’. On

the whole, iron deficiency, manifested as anaemia, was unacceptably high across a large section of the country especially in children and women. The states of Chattisgarh, Rajasthan and Karnataka are affected, as also the eastern states.

The Report has attempted to compile micronutrient deficiencies in the average diets of urban and rural people in India and in the various states. The findings have limitations due to two major problems: one, of fixing average norms for population, which could be quite erroneous and second, of uncertainty as to the content of the actual consumption and the levels of absorption. Nevertheless, they bring out the existence across the country of widespread micronutrient deficiencies in the population.

At the all - India level, the urban intakes of calcium, iron, beta carotene, riboflavin, and zinc are below the norm in the average diets of urban India. The intakes of thiamine, niacin and vitamin ‘C’ are also below the norm for the lowest expenditure group in urban India, in addition to the other nutrients in which the average diets are deficient. It appears that dietary diversification of rural India has been accompanied not by improved macro and micronutrient intake as would be expected, but rather, by a worsening. The observed increase in the head count ratio for micronutrient deprivation is almost entirely attributable to the reduced cereal intake since intake of all other food items has either increased or remained constant. Although cereals are a poor source of micronutrients per se, the sheer dependence of the Indian diet on cereals implies that they

are the single largest source of most micronutrients.

Unlike the case of the urban population, almost all the classes of rural population show extremely low levels of intake of micronutrients, which probably explains the alarmingly high levels of malnourishment in children observed as underweight for age and stunting. Only micronutrients such as nicotinic acid, phosphorous, thiamine, vitamin C, and folic acid are consumed in excess of the RDA by the high-income class. The middle-income class seems to consume folic acid alone in excess of the RDA. The state level study reveals that zinc, vitamin 'C' vitamin 'A', riboflavin, calcium, iron, thiamine and niacin in that order are the most deficient micronutrients in the average urban diets of the country.

502.3 Introducing Gender and Food Security Concerns into the post graduate Curriculum of Social Sciences

Many colleges and Universities in India are yet to offer topics related to gender concerns as a part of the curriculum of Social Sciences. Many Women's Centres are involved in outreach activities rather than upgrading the curriculum. The universities and colleges that do offer such courses appear to be broadly covering basic theoretical aspects and the contemporary thought related to equality and rights of women. They cover some broadly identified gender issues related to a discipline. Food security does not seem to be a key component of these curricula. The Ford Chair is in the process of identifying activities in terms of workshops/

lectures/ refresher courses to impress upon the faculty and research students of the colleges and universities the need to introduce some interdisciplinary topics related to gender and food security in the Social Sciences curriculum.

502.4 Rural distress in a semi arid region and its impact on gender specific livelihoods

The Ford Chair proposes to study watershed development strategies to alleviate rural distress and provide gender specific livelihood in semi-arid regions through a case study of Mahabub Nagar district of AP.

The District profile has already been prepared with special reference to the gender issues such as feminization of agriculture, heavy seasonal and permanent out-migration and impact of farmers' suicides on women. Nearly half the households in the district are below the poverty line, while the rural poverty level for the state for the year 1999-2000 as per the fifty-fifth round of the NSS is as low as 11 %. It is one of the most backward districts of the country as categorized by the Planning Commission. It has been selected for the National Rural Employment Guarantee Scheme. Watershed development programmes and drought prone area programmes are of major importance in the district. Mehbubnagar district, a hot spot of farmer's suicides, has a semi-arid, rain-fed ecosystem. Some initial GIS work of overlaying maps of soil types, land uses, land cover and rainfall data on block level political map has been done to assess the impact of drought on various factors at the micro level.

Sub Programme Area 503

The Sustainability of Farming Systems

A Case study of the Rice-based Farming System in Northeast Tamil Nadu

The overall aim of this research programme is to study the ecological stability and economic viability of rice farming systems and to understand the causes and concerns for unsustainability in farming systems. The specific objectives to meet the research aim are:

- To assess soil quality in terms of physical, chemical and biological parameters
- To derive an aggregated soil health index for the cropping system
- To assess groundwater quality and irrigation water management
- To document cropping pattern, fertility, pest and water management practices
- To estimate productivity per acre and net incomes
- To record the socio-economic conditions of the farming households.

With the help of the inputs received from the Ohio State University, Ohio, USA and the Water Technology Centre, TNAU, the conceptual framework and methodology of research were worked out. The conceptual framework includes the following components:

Environmental health: The environmental health of a farming system includes soil health, biodiversity, water availability, crop and micro nutrient levels in the soil and pesticide residue in the soil.

Economic viability: The economic viability of any agricultural system is measured as gross production and net farm incomes realised, and is a function of the efficiency of resource use, adequate post harvest mechanisms, pricing mechanisms and credit and risk insurance.

Social wellbeing: This is reflected in education, health and nutrition, sanitation and hygiene which permit both women and men to perform their roles and responsibilities efficiently.

With the help of Rice Research Station, Tirur, Thiruvallur district and Krishi Vigyan Kendra, Puttur, Kancheepuram district, one village, Avaloor in Kancheepuram district was selected for a detailed study. The village is representative of the irrigated intensive farming system typical of the region.

The activities for the year were focused on primary data collection including soil sampling and analysis and questionnaires on management and socio-economic parameters. Simple random sampling has been followed to select the plots and the households. A preliminary assessment of the biophysical resource base was carried out with the help of village maps, assessment of soil differences based on a touch and feel method and discussions with a few farmers. Initial findings revealed that the soil was predominantly sandy clay loam. Paddy is the predominant crop and

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there is intensive mono cropping, with three successive crops of rice. Tanks are a major source of irrigation, supplemented with groundwater. Excessive pumping of groundwater has led to a reduction in water availability and hence the area under paddy cultivation. Competing demands on water are being made by nearby towns and cities for

domestic uses. Discussions revealed that several farmers have received training in integrated nutrient management practices and have been practicing them for more than five years. This provides scope for a comparative study of plots with high levels of integrated nutrient management and those with lower levels of integration.



Information, Education and Communication

Under the NVA, MSSRF has set up 8 Village Resource Centres and 40 Village Knowledge Centres in TN and Pondicherry as well as 5 Village Resource Centres in Rajasthan, Maharashtra, Orissa and AP. A National Consultation was organized on ‘Women in Agriculture in India – ten years after Beijing’. An International Conference on “Human Centred Sustainable Development Paradigm” was organized in August 2005 to commemorate the 80th birthday of Prof Swaminathan.

601	Jamsetji Tata National Virtual Academy.	111
602	Uttara Devi Resource Centre for Gender and Development.	115
603	<i>The Hindu</i> Media Resource Centre.	118
604	Every Child a Scientist Programme	121
605	Library and Information Services.	122
606	Conferences and Workshops.	123

Sub Programme Area 601

Jamsetji Tata National Virtual Academy

The Jamsetji Tata National Virtual Academy (NVA) has become the pivotal base for MSSRF's initiatives in ICT-led development. The main aims of the programme are to empower vulnerable communities to make better choices, achieve better control of their own development and build the skills and capacities of the rural poor with a view to enhancing livelihood opportunities

VRCs and VKCs

Under the NVA, MSSRF has set up 8 Village Resource Centres (VRCs) and 40 Village Knowledge Centres (VKCs) in TN and Pondicherry, as well as 5 VRCs in Rajasthan, Maharashtra, Orissa and AP. All the VRCs are connected through ISRO uplink and downlink satellite.

The VKCs are located in public buildings (Panchayat or SHG building, community hall, school, etc.). The local community takes care of the rent and electricity from day one. NVA takes care of capacity building, monitoring and evaluation, as also facilitating several training programmes. The information content is developed in close interaction with the local people in a bottom-up manner. All the block level knowledge centres are called Village Resource Centres (VRCs). MSSRF project staff operate these VRCs.

In setting up of VRCs and VKCs, NVA has been working with a number of boundary partners (individuals, groups, or organizations) such as the elected Panchayat, traditional Panchayat, Gandhigram Trust, SHG Federation, fishermen associations, NGOs, Temple Trust, Village Development Council, Ponlait (Milk Producers Co-operative union), youth associations and Parish Councils.

The organogram of the knowledge dissemination between VRCs and VKCs is seen in the inside back cover (Figure 6.1).

The processes adopted for setting up the VKCs include conducting village level surveys and meetings; collection of data; consulting policy makers at the district and block level; identifying the interested groups / partners / areas; carrying out a situation analysis and need assessment; signing an MOU with partner organizations; selecting Knowledge Workers (KWs) and facilitating the formation of Village Management Committees (VMCs).

Training Knowledge Workers

NVA has organized several training programmes for the KWs (91 KWs – male 27 and female 64) who maintain the 40 VKCs, on aspects such as concept of VKCs; method of collection and dissemination of need-based content; assisting users and visitors; maintaining user register, bill books and other records pertaining to the VKC; building rapport among users and community members; gender concerns; sensitizing the KWs on the objectives and activities of the VKCs and the use of computer hardware and software.

Connectivity

NVA has tested different technologies like VHF and Direct Sequence Spread Spectrum for rural communication. ISRO VSAT helps communication between the different VRCs and Chennai VRC. Multi Commodity Exchange Market Information Terminal provides spot market prices of more than 250 commodities and future exchange prices. Intel Rural PC has been designed to run on car batteries in order to overcome the problem of erratic power supply. This rural PC also has wireless Internet access. In July 2005, Pondicherry VRC submitted a proposal to the Department of Science and Technology (DST) regarding the implementation of EduSat in VRC. In December 2005, the DST approved the proposal and set up a distance education programme nodal center through EduSat at a VRC as one of the 20 nodal points in India. This pilot programme is being implemented by Vigyan Prasar, which has identified six teaching ends namely, ISRO, IGNOU, DST, CEC, AICTE and VIGYAN PRASAR, and has provided training to the staff on operating the EduSat network. Through this network rural children participated in the national quiz related to astronomy and in the Children's Science Congress.

Community Newspaper

NVA has adopted different technologies for spreading knowledge to the rural community. One of the technologies is the community newspaper ("Namma Ooru Seithi"). This is a fortnightly newspaper. Every month 18,000

copies are produced and these are distributed in 186 villages, to farmers and fishermen associations, SHGs, women federations, panchayats, temples, churches, government departments, libraries, consumer federations, research institutions, etc. On 1 May 2006, NVA started the Marathi version of the community newspaper ("Amchi Gram Vartha").

Awareness, Training, Knowledge Dissemination and Action

A series of need based awareness, training and knowledge dissemination programmes for farmers and SHG members was facilitated through networking with various research organizations, NGOs and Government agencies. The details are given in Table 6.1:

Multipurpose Centre

With the help of the Azim Premji Foundation, VRCs are running a Computer Aided Learning Programme (CALP) for children in classes 4 to 8. From January 2005 to May 2006, a total of 6,188 children were trained in the VRCs, VKCs and schools in Thiruvaiyaru, Annavasal, Sempatti, Thangatchimadam, Pondicherry, Nagapattinam and Kovalam.

With the help of Microsoft Unlimited Potential Programme (MUPP), VRCs at Thiruvaiyaru, Annavasal, Sempatti, Thangatchimadam, Pondicherry and Nagapattinam trained 2,095 beneficiaries in Word, Powerpoint, Excel, Access and web design. Certificates were given to those who successfully completed the training.

Table 6.1: *Need based awareness, training and knowledge dissemination programmes conducted*

Programme	Partners	Topics discussed
Groundnut Advisory (May and June 2005)	Department of Agriculture, ICRISAT and NABARD	Seed selection and treatment, land reforming, soil testing, soil care, irrigation management, weed control, water analysis, crop production and cultivation practices for improving the groundnut yield in irrigated and rainfed conditions. This led to the preparation of a "Farmers' Guide for Improved Groundnut Production – Tamil Nadu".
Clean milk production and quality milk procurement (June and November 2005)	Rajiv Gandhi Veterinary and Animal Sciences Institute, Ponlait	Methods to improve milk production, hygienic practices, goat rearing, deworming in cows
Soil testing camp (July 2005)	Department of Agriculture	Contract farming, soil testing, fertilizer and water management.
Crop insurance (August 2005)	Agriculture Insurance Company of India Ltd.	Crop insurance, methods of estimation of crop yield
Livestock and fodder management interaction meeting (August 2005)	ICRISAT, TANUVAS, Veterinary University Training and Research Centre	Fodder management, rearing of healthy goat, sheep, cattle and poultry
Agrometeorology advisory (August 2005)	TNAU, TRRI, Gandhigram Rural Institute and KVK	Crop contingency plans and records of cropping practices to be provided by VKCs and VRCs, monitoring crop development by VRCs, online information on cropping practices to be provided by VRCs; training of VKC managers and volunteers, role of the Indian Meteorological Department as facilitator in collection and transmission of data, provision of rain gauges and thermometers in villages, use of models for agricultural practices developed by research organizations such as ICRISAT, TRRI, CRIDA, soil testing
Coconut farmers' interaction meeting (September 2005)	Department of Agriculture, Coconut Growers Association	Measures to control mite problem, value added products from coconut, schemes related to APEDA.

Programme	Partners	Topics discussed
Seminar on Samba Crop (September 2005)	SWMRI, PPRC Thirukattupalli	Paddy preservation and storage, cultivation practices for system of rice intensification, use of fungicides and bio-fertilizers and irrigation management.
Veterinary camps (September 2005)	Tamil Nadu Veterinary Department, Thiruvaiyaru	Vaccination, artificial inseminations, fodder cultivation methods
Crop advisory (October 2005)	Department of Agriculture, TRRI, SWMRI	Contingency plan in the event of natural calamities like floods
Gingelly (sesame) advisory	TNAU, Department of Agriculture, TRRI SWMRI, IDHAYAM	Cultivation practices, weed management, post harvest technology
Demonstration cum training programme on Turtle Excluder Device (November 2005)	Fisheries College, Tuticorin, MPEDA	Importance of turtles, species available in the Gulf of Mannar, use of Turtle Excluder Device (TED)
Compost preparation using waste coconut coir (November 2005)	Department of Agriculture	Methods of preparation
Role of Panchayati Raj institutions in setting up new VKCs	MSSRF	Role of village panchayats, SHG, fishermen and farmers' associations
Adult Literacy Programme	Tata Consultancy Services	Training to Knowledge Workers and Animators
Training in plant protection – organic methods (January 2006)	Horticulture College and Research Institute, Periakulam	Crop rotation, intercrop cultivation, <i>panchakavya</i> preparation, biological control of pests
Mushroom cultivation and training (February 2006)	MSSRF	Cultivation practices, harvesting, packing and marketing.
Manufacture and preservation of fish pickle (March 2006)	MSSRF	Training in fish pickle manufacture

Expanding the VRC programme in Maharashtra, Rajasthan, Orissa and Andhra Pradesh

MSSRF-ISRO connected 8 VRCs (Pudukkottai and Nagapattinam in Tamil Nadu, Waifad and Anandwan in Maharashtra, Jeypore in Orissa, Pokran in Rajasthan and ICRISAT and Addakal in AP) during the 93rd Indian Science Congress on 5 January, 2006. During the discussions many issues were raised pertaining to fodder management, water management, boll worm attack in Bt cotton, health, livestock, fisheries and credit. On 1 May 2006, NVA expanded the VRC programme in the Vidarbha region.

NVA Fellows

Contributions from grassroot academicians are essential to tackle the problems of rural communities. In this connection, NVA selected 298 Fellows (Male - 155; Female - 143) from AP, Assam, Chattisgarh, Delhi, Gujarat, Haryana, MP, Maharashtra, Orissa, Pondicherry, Punjab, Rajasthan, TN, UP, HP, Karnataka, WB and Uttaranchal.

NVA has brought out two publications related to its Fellows, detailing the wide range of their expertise and competencies in the field of agriculture, education, micro-finance, environment and health,

On 11 July, 2005, the Hon'ble President inaugurated the Second Convention of the National Alliance for Mission 2007 and addressed the first Convocation of the Jamsetji Tata National Virtual Academy for Rural Prosperity. On 5 January, 2006, NVA organized

the National Virtual Congress of Farmers during the 93rd Indian Science Congress at Hyderabad.

Participatory Knowledge Management Workshops for Fellows

On 10 and 11 July, 2005 (New Delhi), 3 and 4 January, 2006 (Hyderabad), 14 and 15 March, 2006 (Pondicherry) and 30 April, 2006 (Maharashtra), NVA conducted Participatory Knowledge Management Workshops for the Fellows. These workshops covered subjects such as water management, bio-diversity, disaster management and world trade.

Monitoring and Evaluation

VRCs and VKCs have a user register in which details of the user such as age, education, and services received from the VRC/VKC are recorded. VRCs conduct village level meetings and surveys to monitor the programme, on a regular basis. In all 63,584 people utilized the services of the VRCs and VKCs during the year.

NVA conducted a study on VKCs in Pondicherry from an anthropological perspective; it has also collected case studies based on different services provided by VRCs.

Sub Programme Area 602

Uttara Devi Resource Centre for Gender and Development

Last year, the activities of the UDRC were fewer than in previous years, due to the absence of a full-time faculty member for the entire period. However, both the external and internal mandates were addressed.

602.1 External

As 2005 marked the passage of ten years since the Beijing World Conference on Women, which put forward a Platform of Action that India has also ratified, it was felt that it would be useful to review the progress of women in India, with special reference to agriculture and natural resource based livelihoods, during the decade. Ms CP Sujaya, an experienced administrator and women's studies specialist, was invited in July 2005 to prepare such a review paper as Visiting Fellow for Gender and Development for 2005. The paper formed the basis of the discussion at the workshop held on 11 and 12 November on the topic: *Beijing + 10: Women in Agriculture in India - What Next?* The workshop was held with the participation of a number of specialists and administrators. A package of recommendations has been sent to the National Commission on Farmers, Planning Commission, Ministries of Agriculture and Women and Child Development and other concerned authorities as an input into planning for the future. The paper has now been published as a small book titled *Climbing a Long Road: Women in Agriculture in India- Ten Years after Beijing*, and is being widely disseminated.

In March 2006, following an expression of interest from STHREE publishers, Dr Maithreyi Krishnaraj, one of the most distinguished scholars in women's studies in the country, was invited as the Visiting Fellow for 2006 to prepare and edit a collection of invited papers on the theme *Gender, Livelihoods and Food Security in Rural India*. Some of the papers had been presented at the seminar *Gender, Rice and*

Food Security, held in September, 2004 to mark the International Year of Rice, while some new ones were added. Dr Krishnaraj is currently engaged in editing the collection of papers.

Advocacy for the KAU-MSSRF undergraduate curriculum titled *Gender in Agriculture and Rural Livelihoods* continued throughout the year through presentations at various fora, dissemination through our web-site and printed brochures, and other measures. Schools of Social Work, Women's Studies Centres and several NGOs involved in rural development have expressed interest and copies have been sold.

Advocacy on gender issues continued through public lectures at different fora, presentations, participation in seminars, workshops and conferences, public meetings, campaigns, and social movements.

602.2 Internal

Two formal training courses on gender issues were held for the staff of MSSRF, with the involvement of senior Faculty. The first, a four-day orientation for staff recruited recently, was held in September, 2005. Four main themes were taken up, one on each day, with each day and theme handled by one Faculty member. The themes were: Village Studies, or understanding the village community; livelihoods, or understanding the local economic and social situation; gender, or understanding the gender issues at the village level; and process methodology, or understanding MSSRF's approach to science-led development and how to put the approach into practice.

The course included a number of practical group exercises each day and concluded with individual assignments to be carried out in the field. The course has been documented in depth for future use.

In November 2005, a three day FAO-sponsored ICT-enabled course was held for 21 senior staff of MSSRF, mostly from the field sites, as well as partner organizations, and one observer. The training was primarily based on the CDROM-based learning resource package titled *Women and Gender in Agriculture and Rural Development in Asia* developed by FAO, as well as MSSRF's undergraduate course, also available on CD. The FAO CD has a number of links to web-sites. The course was directed by FAO's Gender Specialist from Bangkok, with the support of an external ICT specialist, as well as a senior faculty member from MSSRF. The objectives of the course were both to familiarise and contextuallise gender concerns in the relevant development area and gain experience in using ICT based learning resources to enhance organisational capacity.

After an initial introduction to the course materials and guided tours with explanations by the resource person, the participants worked individually; sessions for review and classification were followed by group discussions in the evenings and late night assignments. This procedure was followed for three days. On the last day, the assignment was to develop an action plan for their own situation to show how they would operationalise the learnings, both to modify programmes where needed and train others.

The feedback from participants indicated that all of them appreciated the opportunity for independent learning according to the individual's need and pace, and to continue learning over a long period from the materials.

Gender mainstreaming, or the process of institutionalizing the gender perspective in all the programmes and activities of MSSRF, continued through informal meetings and discussions with staff, individually or in groups, workshops, staff seminars, and visits to field sites to discuss context-specific issues, and specific programmes developed according to need. The in-house research study undertaken in 2004 is being analyzed and interpreted and the report is under preparation.

602.3 Voicing Silence

Now in its fourteenth year, *Voicing Silence* has shrunk into a small-budget activity at MSSRF, but continues to play its role as a catalyst in bridging the gap between theatre and development, and has explored new avenues each year.

Last year, the main task was to nurture, support and develop *Kannadi Kalai Kuzhu*, the *aravani* theatre group set up the previous year. The play *Manasin Azhaippu*, developed and widely performed in the first year, succeeded not only in creating widespread interest and awareness about the social and human rights issues it projected, but also brought many concrete benefits and support from both Government and non-governmental bodies. The most significant achievement was getting the right to vote early in 2006; thousands of *aravanis* got their voter identity cards and voted in May, 2006.

After about 40 performances throughout TN, the group felt it was time to have one more play in their repertoire and approached *Voicing Silence* for help. Through a series of workshops during September and October, 2005, involving several resource persons, a new play was developed and launched at a special show held in late November, 2006. Unlike the first play, this one *Uraiyadha Ninaivugal*, (Unsettling Memories) is more inward-looking, and explores in depth the relationships, the joys and sorrows in family and personal relationships, the pains of suffering, and the comforts of finding a new community, ending with a powerful challenge to society to accept them just as they are — persons. The two plays together give an insight into both the public and private lives of *aravanis*, and can form a good package for this year's campaign, which has already started.

Besides creating and rehearsing a new play for performance, the second main form of support has been in helping the group to manage their own fund-raising for the theatre campaign, by helping them to draw up project proposals and putting them in touch with potential donors. Hopefully, they should become self-reliant in the near future.

Sub Programme Area603

The Hindu Media Resource Centre

To create an understanding and awareness of the socially and scientifically relevant issues, using the mass media communication systems as a tool, MSSRF's *The Hindu Media Resource Centre* (THMRC) creates a platform for

interaction, bringing together both media professionals and experts from diverse fields.

The mass media communication systems that are networked by THMRC include radio, television, print and the web. It covers Community Radio (CR), satellite commercial private television network, cable network, neighbourhood journals, community newspapers, VRCs and online groups.

Three media workshops were organized during the year. On 26 December, 2005, a workshop titled "Managing Tsunami: Lessons of 26 December 2004" discussed the post-tsunami initiatives taken up by MSSRF. One of the panelists, Prof PC Kesavan, enlightened the media on the possibility of creating a new profile for Andaman, especially in organic farming, formation of bio-villages, cultivation of mangroves and aquaculture of mud crabs and prawns. Prof MS Swaminathan who chaired the workshop explained the role of post-disaster reconstruction strategies factoring geo-physical and geomorphological studies, vulnerability mapping, computer simulation models, harnessing traditional wisdom, and establishing community food and water banks.

The second workshop on "Integrated Coastal Zone Management: on CRZ Notification 1991", was organized for the benefit of media personnel in Visakhapatnam. The leading national dailies carried headlines on the workshop and highlighted the 12 recommendations for integrated CMZ in which regulation, education and social mobilization are the major components.

The third workshop titled “*Vetriyin Marupakam*” meaning “The Other Side of Success” was organized in coordination with The Hunger Project (THP) team to highlight the issues and challenges faced by women in their journey towards empowerment. The Hunger Project is a global strategic organization and a worldwide movement committed to the sustainable end of world hunger. Eighty women Panchayat representatives and leaders covering the entire state of TN participated to discuss the power issues. They regretted that in spite of many of them actively working in the public sphere, they still face opposition from men in entering the political arena. Successful women concluded that it was only the 33 % reservation bill that gave them empowerment to contest in elections; otherwise, their plight would have remained miserable and they could not even have come out of their houses.

Ninety-one media professionals participated in the 3 media workshops and brought out 32 feature stories in addition to 5 news stories in the mainstream media.

Two public Fora were organized and the first one, titled “Biodiversity and Freedom From Hunger” was a follow up of the international consultation on “Role of Biodiversity in Achieving the United Nations Millennium Development Goal of Freedom From Hunger and Poverty”. In the public forum, concern was expressed on the narrowing base of global food and nutritional security and the need for better deployment of plant biodiversity. The Prime Minister’s message, which stressed the need for

integrating frontier science and technology with traditional wisdom and associated cropping patterns to eliminate hunger and poverty, was the lead article in all the mass media.

Another public forum titled “Beyond Tsunami: New Lives and Livelihoods” showcased the power of global convergences and partnerships. Prof MS Swaminathan, Chairman, MSSRF, in his remarks sounded a wake-up call by showing up deficiencies in calamity management. He observed, “Tsunami opened up possibilities to deliberate on sustainable fishing opportunities. The coastal systems were under severe anthropogenic stress. The calamity united every one and proved what synergies could achieve”. Fifteen print journalists in addition to students, research scholars and public attended both the fora.

Public lectures and special seminars are frequently organized to help understand issues at the global and national level. THMRC organised 6 such seminars this year. One was a significant event to commemorate the 75th Anniversary of Mahatma Gandhi’s Dandi March and Salt Sathyagraha on 2 April, 2006. The seminar titled “Beyond Tsunami: Significance of the Dandi March” was chaired by the then Union Minister of Petroleum and Panchayati Raj Shri Mani Shankar Aiyer. The Minister advocated a participative approach for the rehabilitation plans, stating that development and prosperity must not be imposed, as that would be disruptive. In this context he also added that Panchayat institutions should be involved in all planning and implementation activities

besides making the decisions for the community. Mr N Ravi, Editor, *The Hindu*, who was the panelist, said that the context of the Dandi March is significant even today, as it highlights the message that traditional rights to resources are to be safeguarded as an interaction between man and nature.

Another seminar titled “Fish For All” was organized to felicitate World Food Prize winner Dr Modadugu Vijay Guptha, for his work in enhancing the nutrition status of nearly a million people in Asia and Africa. He stressed the importance of aquaculture to improve fish production, as wild stock production is not keeping pace with demand.

To report the findings of a three-year study undertaken by India-United Kingdom research institutions on the impact of climate change in India, a seminar titled “Indo-UK programme on Impact of Climate Change in India” was organized in coordination with the British High Commission. Prof NH Ravindra Nath, member of the study team, remarked that the impact of climate change on forest ecosystems would be felt in the next 30 to 40 years.

Participating in the 6 seminars, 75 media professionals brought out 16 feature stories and 7 news stories. This year THMRC collaborated for 24 national and international consultations, in which 181 published feature articles, contributed by 262 media representatives, have been documented and placed in the media tracking column of our website.

Students of the Journalism and Mass

Communication Department of the University of Madras, Chennai, took up an in-depth study to analyse the effectiveness of the strategies adopted by THMRC in achieving the mandate of reaching the mass media. The researchers participated in and tracked the media reports, in addition to interacting with the editors of the media. The findings of the study are listed below:

- The media professionals prefer specific media interactions for reporting news stories.
- Media workshops are very useful for writing in-depth, issue-based feature writing.
- Media workshops are preferable to seminars and lectures.

To help the media further, a *Concept Bank* is being maintained and updated. This involves compilation of write-ups, which can be developed into soft news feature articles and are classified on the basis of themes like women empowerment, SHG success stories, education, bio-tech research, livelihood interventions, biodiversity, tsunami rehabilitation activities, audio video resources directory and so on. Today the *Concept Bank* possesses 102 such stories, which can motivate the media professionals to identify their theme for news features.

Another tool used to reach the media, students and general public at large is the website. (www.mssrf.org). New initiatives like Chairman’s Desk and Ask the Expert have been well received by one and all. Regular monitoring of the access

of our website reveals that there is a substantial increase in page hits.

MSSRF Info Ticker: Ticker is a software developed by THMRC, which can be downloaded from the website. Once installed, it will fetch details and information from our website and display the same. It is mainly used for providing information about important public events and happenings at MSSRF Head Office and site offices. In addition to the general dissemination, the Ticker also communicates across projects and site offices.

As part of visual documentation a film titled “15 years... 15 Steps...” was produced. This film illustrates 15 significant achievements of MSSRF in the 15 years.

An exclusive website named “DISCOURSE” was developed for the benefit of the MSSRF staff both at the headquarters and at the site offices. The website has the feature of restricted access using a user Id and password.

As an internal mandate, a workshop was organized at Thangatchimadam of Ramana-
thapuram District to enhance the communication skills of the KWs of the VRCs. Twenty-five KWs were taught various communication techniques which can be adopted for dissemination.

Public relations is another concern of THMRC. There were 1,773 visitors, including foreign delegates, government officials, students from schools and colleges, research scholars and representatives from NGOs.

Sub Programme 604

Every Child a Scientist Programme

The programme was started in August 2002 in Chennai, for children in the age group of 13-15 years and belonging to economically underprivileged sections of society. The Centre has a number of computers and multimedia material to make learning an enjoyable experience. With encouragement from the Deputy Commissioner of Education, Chennai, it has established a good rapport with corporation school headmasters, teachers, orphanage schools and government-aided schools in Zones VIII, IX and X.

Around 350 students were introduced to topics like eco-technology, biodiversity, information and communication technology, health and hygiene, environmental issues, and bio-technology.

The Centre has also developed resource material on various topics like biodiversity, marine animals, seaweeds and information technology, in the local language.

New initiatives included this year were butterfly rearing, making charts on environmental issues with newspaper cuttings and holding competitions every month to sustain their interest in nature. Students were encouraged to collect information on plants and animals and were asked to make posters which were then displayed in their respective school notice boards to benefit all the students in that school.

Touch and Smell Garden

This garden was developed to allow the visually challenged to experience the biodiversity in

plants and learn through the senses of touch and smell. The programme was strengthened with a Braille embosser that runs on software in different Indian languages and has options to convert from Braille to Tamil text and vice versa. This facility is being used to generate resource booklets for the visually challenged on a number of topics of relevance.

Additional seed albums on condiments and spices were developed, facilitating children to learn about different types and shapes of plant seeds and their characteristic features.

A national-level workshop for Heads / Principals of all schools for the visually impaired in the country is being planned with an aim to reach out to as many schools as possible to replicate such a garden in their premises.

Genetic literacy and Genome clubs

This programme is in its third year with the focus on two major target groups, namely, school children and Panchayat members at the grassroot level. Thirteen camps/workshops were held during the year, benefiting more than 1,000 participants who were introduced to topics such as biodiversity and biotechnology, implications of biotechnology for rural development, biodiversity acts and the role of institutions dealing with biodiversity material, biodiversity and its conservation through genome clubs, implication of biological diversity in research, commercialization related to Indian systems of medicine, ethno medicine of tribal communities of South India and the fundamental need for conservation of biodiversity.

For the Panchayat leaders, the workshop included topics like basic biology of gene and genetic diversity of rice from the Jeypore tract, genetic literacy, genome club and biotechnology and the importance of genetic awareness for rural development. A workshop was conducted for school teachers on the role of teachers in rural development and biodiversity conservation through genetic awareness programmes.

Vacation training programme for school children on Bioresources and Biotechnology

This year MSSRF conducted a programme for 25 students of standard X in Chennai from 22 April to 18 May 2006, to create an awareness on biodiversity conservation. The programme offered them a unique opportunity to interact with experts in the field and be inspired while learning from them. As part of the course, the students visited the biodiversity rich areas of Siruvani hills, and prominent institutes in Coimbatore, Kottakkal, Sadras Kuppam and Kalpakkam. They conducted experiments in the laboratory at MSSRF and submitted a project report at the end of the programme.

Sub Programme Area 605

Library and Information Services

The library is pursuing the objective of providing efficient information service to the users. Currently, there are 15,155 books of which 1,110 were included during the year. In addition it also holds 194 CDs, 113 journals, 184 newspaper clippings for the year 2005-2006 and 1,954 back

volumes of journals. The library also houses reports of MSSRF, development reports and annual reports of different organizations.

The library services range from reference service to current awareness service, selective dissemination service, document delivery, publication and distribution service and photocopying service. Various web-sites are browsed to cull-out information relating to the research undertaken by MSSRF and the same is sent to in-house staff through electronic media. The library is also planning to implement a web-based library catalogue whereby a larger community would be benefited.

The library serves not only the in-house staff, but also caters to the needs of users from various organizations, universities, colleges and schools. There were 1,087 external users during the year. About 20 school students made use of the library. Around 200 students and research scholars from different universities within India and the University of Ottawa, University of Bristol, University of Tokyo, Yale University, University of San Francisco and University of Bonn, Germany, visited the library.

Sub Programme Area 606

Conferences and Workshops

Workshop on National Food Guarantee Act, 19 June, 2005, MSSRF, Chennai

The TRC on food security organized a workshop at MSSRF on Sunday, 19 June, 2005 to discuss the need for a National Food Guarantee Act. The group of academicians, lawyers and

representatives of NGOs and multilateral institutions who participated, submitted their recommendations as an input for the report of the NCF. It was decided to constitute a small working group to draft a food guarantee bill.

Some of the major conclusions of the deliberations were:

- The proposed legislation should integrate the features of the Employment Guarantee Acts (National and Maharashtra) and Food for Work Programmes.
- It should be gender sensitive.
- The concept of “work” should be enlarged to cover also skilled work related to human and social development, as for example, establishing and running crèches, balwadis, preparing noon meals, etc.;
- The Gram Panchayat / Local Body can form in the respective village a Consortium of Agencies like SHGs, Mahila Mandals, Farmers’ Clubs etc, to provide oversight to the implementation of the integrated food for work and employment guarantee approach to the elimination of hunger and poverty.
- The recently enacted Right to Information Act will facilitate the process of empowering the rural poor (often illiterate) in understanding their entitlements under various pro-poor schemes of the Central and State Governments.
- The Act should provide scope for including feasible land reform measures like providing dalits and the poor with homestead land of sufficient extent to ensure, besides living

space for the household, land to grow vegetables, fruits and other produce, contributing to household nutrition and food security. SHGs can also be given space on lease in common property land for raising nutrition gardens.

- Integration with primary health care is exceedingly important.
- The Act could stimulate a movement for storing grain and water everywhere through community food and water banks. A national network of community food banks could be established.

Travelling workshop on Agronomic Rehabilitation of Tsunami Ravaged Lands in Tamil Nadu, 16-19 July, 2005, Nagappattinam, Cuddalore

Tsunami waves caused extensive damage to the basic agricultural resources like soil and water as well as to standing crops like paddy and groundnut, in some parts of TN and Pondicherry. Since the devastation took place, several institutions such as the Department of Agriculture, TN, research institutes and NGOs, have been involved in rehabilitating the affected communities. To understand the multi-dimensional nature of the problem and develop a soil health rehabilitation package, a traveling workshop was organized from 16 to 18 July, 2005, with multidisciplinary experts representing eleven organizations (soil survey, soil testing, agronomy, soil science, livelihoods, natural resources, plant breeding and genetics, anthropology etc) from different parts of the country. The participants visited nine villages, conducted spot measurements for pH and EC

in 18 fields, held discussions with farmers in all villages in Nagappattinam and Cuddalore districts and made suggestions regarding soil and water rehabilitation measures and livelihoods restoration. These suggestions have been printed in Tamil and English and distributed extensively to farmers in the affected villages, officials of the state agricultural department and NGOs working in the tsunami affected villages.

International Conference on Human Centred Sustainable Development Paradigm, 7-10 August, 2005, Chennai

An international conference was organized at the Chennai Trade Centre in commemoration of the 80th birthday of Prof MS Swaminathan. The conference was intended to showcase various ongoing activities of MSSRF in relation to developments in the field of sustainable agriculture and rural development. The conference was attended by more than 650 participants including researchers, development planners, policy makers, stake holder representatives involved in various programmes and projects of MSSRF and a large number of students. The conference was inaugurated by Shri. Surjit Singh Barnala, Honourable Governor of TN while Shri SM Krishna, Honourable Governor of Maharashtra was the Chief Guest at the valedictory session. A large number of thematic areas were discussed, including evergreen revolution, sustainable livelihood, natural resource management, food and nutrition security, knowledge empowered communities, gender and development and policy issues in effective delivery mechanism for sustainable livelihood options for rural communities. Many invitees representing

international research centres and long time associates of Professor M S Swaminathan also participated in the meeting. The conference had two sessions highlighting the contributions of Professor MS Swaminathan to science and technology and public policy. The conference provided a platform for elaborate discussions on issues related to sustainable development in a human centered approach to provide an impetus for developing an action plan for ensuring food and nutritional security of rural communities.

International Workshop on Molecular Markers for Allele Mining, 22-26 August, 2005, Chennai

In collaboration with the Generation Challenge Programme of CGIAR, MSSRF hosted the international workshop to highlight the developments in the field of molecular markers in genetic resource characterization, conservation and management and to provide new genetic combinations for identifying desired genetic material for crop improvement. It had 49 scientists representing the CGIAR System that included participants from IRRI, CIMMYT, ICRISAT, IITA, CIAT, representatives from Advanced Research Institutions from Australia, France, USA, Germany and Netherlands as well as participants from the National Agricultural Research Centres in India. The workshop brought out the recent developments in the field of molecular marker technology and provided an opportunity for discussions on possible pros and cons for utilizing these techniques for genetic resources management and crop improvement. The workshop also provided a platform for sharing expertise between

scientists of advanced research centres and national agricultural research systems to bring the power of partnership in providing viable solutions to hunger and poverty in the global context through accelerated agricultural research.

Mission 2007 Trainers Workshop, 22-23 September, 2005, Chennai

The participants included 16 leading Mission 2007 partners. The workshop was jointly organized by IDRC's Telecenter.org and MSSRF. The main goal of the workshop was to draw up a capacity building programme for training village knowledge workers. Based on the inputs from the meeting, Telecenter.org is now in the process of developing a capacity building programme. It will include three components, namely, participatory train-the-trainer workshops, online practice for Mission 2007 partners; and a common curriculum for all Mission 2007 partners.

International Workshop on ICT for Community Empowerment, 3 - 7 October, 2005, Kannivadi

An international workshop on ICT for community empowerment through NFE was organized and nearly 45 participants from South and South-East Asian countries participated. The computer based functional literacy model developed by the VKCs was shared with the Community Learning Centres and Community Multimedia Centres. 23,740 trainee days were organized in the five centres covering nearly 177 learners, including 120 women. These centres focus on non-formal education related to the livelihood security of the forest-based tribal groups,

agricultural labourers and small and marginal farmers of semiarid regions. Skill enhancement programmes were carried out, based on the need for hardware management and software programmes. The centres are slowly emerging as the focal points in the villages to organise training programmes and village meetings.

***Women in Agriculture in India ~ What Next?
11-12 November 2005, Chennai***

A two-day workshop was organized by MSSRF on Nov 11-12, 2005, on the theme: *Women in Agriculture in India: What Next?* to discuss the status and problems of women in agriculture in India ten years after the Fourth World Women's Conference held in Beijing in 1995, in the light of the commitments made by the Government of India at the Beijing conference and later in the Common Minimum Programme of the UPA Government. About 25 participants drawn from the government, academia and civil society participated.

The consensus that emerged, noted that issues concerning Indian women ten years after the Beijing Conference of 1995 must be seen in the background of the consequences of the implementation of neoliberal macroeconomic policies since 1991, as well as the overall path of economic development since Independence. The major recommendations of the meeting were classified under the heads of Land and Productive Assets, Labour and Employment Generation, Common Property Resources and NRM, Support Services, Self Help Groups, Data Gathering and Women in Technology.

Ten Years after Beijing: Gender, Science and Technology, 18-19 November, 2005, New Delhi

MSSRF worked closely with the National Academy of Agricultural Sciences (NAAS) and the National Commission on Farmers (NCF), in organizing a two-day consultation on *Ten Years after Beijing: Gender, Science and Technology*. The event was supported by UNDP, Government of NCT of Delhi and Department of Women and Child Development, Government of India.

The meeting was convened to take stock of the situation facing women in the country ten years after the World Women's Conference in Beijing in 1995. There were about 75 participants from all over the country, largely women professionals from agricultural and home science universities, government departments, national and international donor agencies and NGOs.

The meeting provided a platform for taking stock of the situation facing women in agriculture in the country and requested deliberation on issues like engendering various programmes and formation of a National Action and Policy Research Network for Women in Agriculture. This was followed by a panel discussion on Science for Women and Women in Science. There were technical sessions on Agriculture, Health, Environment and Food Security, Civil Society Initiatives – Learning from Successes, and Access to Technology and Skill Empowerment, with presentations by invited speakers followed by interactive discussion. National and International Roadmaps for the

future were presented by key participants at the penultimate session.

The Chief Guest at the valedictory session was HRH Princess Maha Chakri Sirindhorn of Thailand. The draft of the recommendations of the consultation was presented at the concluding session.

NGO Workshop on Bioshield Development and Management, 23-24 November, 2005, Chennai

Immediately after the tsunami there were reports in the electronic and print media that the mangroves, shelterbelts and other coastal vegetation had played a role in reducing its impact which was later confirmed by systematic scientific studies. This has created a great deal of interest among grassroots NGOs and funding and supporting agencies to become involved in coastal bioshield development and management as a measure of preparedness to tsunami and other sea-borne natural disasters. To gain an insight into the technical and participatory aspects of bioshield development and management, many NGOs approached MSSRF to provide training to their middle level managers and field level staff. Hence, a three-day workshop on Bioshield Development and Management was conducted, the objectives of which were to raise awareness about the role of mangroves and other coastal vegetation in reducing the impact of coastal disasters such as cyclone, storm surges and tsunami; to provide orientation to technical aspects of raising mangrove and non-mangrove vegetation as bioshields; to provide orientation to the participatory process of developing and

managing mangrove and non-mangrove bioshields. Representatives from 14 grassroots NGOs such as Centre for Rural Education and Economic Development, Chidambaram, People's Action for Development, Vembar, Covenant Centre for Development, Madurai, Centre for Ecology and Research, Thanjavur, Aranya: Forest and Sanctuary, Auroville, SNEHA, Nagapattinam participated in the workshop.

The following topics were covered in the workshop: how to identify suitable lands for mangrove and non-mangrove bioshield, including analysis of environmental condition, assessment of ownership, getting concurrence from Panchayat and government institutions; technical aspects including biophysical condition, species suitable to meet the ecological requirement of the bioshield and economical requirement of the community, planting methods and aftercare; and participatory and management aspects such as group formation in the village, partnership with other agencies, joint planning, implementation and monitoring. The experiences gained during the implementation of the JMM programme from 1993-2003 formed the basis of the curriculum development for this orientation workshop.

Workshop on ICT-enabled development: South-South Exchange through Travelling Workshop, 28 November ~ 5 December, 2005, Chennai

The South-South Exchange travelling workshop was organized for the fourth successive year. It brought together 20 development practitioners

from 11 countries (including five from India) to learn and discuss the MSSRF approach on ICT-enabled development activities, share knowledge with others and interact directly with the community, knowledge workers and NVA Fellows. These workshops acted as informal classrooms and provided a platform for cross-cultural exchange of knowledge between the villagers and the visitors.

National Symposium on Biodiversity, 6 December, 2005, Chennai

MSSRF organized a national symposium on Biodiversity, Agriculture and Nutritional Security along with the National Academy of Sciences, Allahabad at MSSRF, Chennai. This symposium, dedicated to the memory of the late Dr TN Khoshoo had the following objectives:

- to review the existing national framework on biodiversity, particularly the policy and legal components influencing conservation, sustainable use, access and benefit sharing,
- to assess the existing framework on agrobiodiversity conservation and utilization towards meeting the arising challenges on national food and nutritional security, and
- to examine the embedding of the grassroot democratic/community institutions in conservation, sustainable use, access and equitable benefit sharing.

Prof Swaminathan in his address recalled the contributions of late Dr TN Khoshoo towards the cause of national biodiversity. He emphasized the importance of awareness generation on two legislations related to biological diversity and farmers' rights at the

levels of communities, grassroot democratic institutions and administrators, for deriving the full benefits from these two acts by the local communities and farmers.

The recommendations that emerged at the symposium are as follows:

- The laws and policies on biodiversity and associated traditional knowledge have a profound impact on the livelihood of people, particularly the poorest, women and marginalized, and therefore need to be formulated and implemented with the active and total participation of civil society.
- The national policy on biodiversity needs to be mainstreamed with the larger public interest.
- The full benefits of the Biological Diversity Act and the Protection of Plant Varieties and Farmers' Rights Act will not accrue to the communities and farmers without a massive national awareness campaign involving the stakeholders and empowering them with capacity building and appropriate institutional linkages. The concerned Ministries are requested to undertake this capacity building campaign involving all competent civil society institutions, including non-governmental organizations.
- Documentation of traditional knowledge, its validation and further research to create a larger economic stake to such knowledge with ecological safeguards may be undertaken on a priority basis.
- Stronger governmental interventions are required to support and promote *in situ* on

farm conservation of plant genetic resources and for recognizing and rewarding farm women and men and communities undertaking conservation in centres of genetic diversity and innovating plant genetic resources.

National Virtual Congress of Farmers, 5 January, 2006, Hyderabad

There is a growing incidence of suicides among farmers living in “distress hotspots” in the states of AP and Maharashtra. The causes for such suicides vary from area to area, but are broadly connected to the cumulative impact of the failure of the formal credit system, poor quality of inputs, lack of credible and timely extension advice as well as an exploitative marketing system. Timely information and knowledge empowerment can help to save lives and livelihoods. Knowledge of Government programmes for socially and economically underprivileged sections of farming and rural communities will be of great help. In this background MSSRF-ISRO connected 8 VRCs during the 93rd Indian Science Congress, on 5 January, 2006. H E the President of India, along with dignitaries from ICRISAT, ISRO, Government of AP, FAO and NCF, held a video-conference with farmers, fishers and tribal women and men in eight centres. During the discussion many pertinent issues were brought up for necessary action.

Workshop on mangrove bioshield for NGOs and Grassroot Level Institutions, 19-21 January, 2006, Karaikal

The participants were from NGO's, CBO's, and Panchayat, fisherman, agriculturists and SHGs

from coastal regions. Very few of them were familiar with mangroves and found lectures and field visits helpful. They felt that more training programmes should be conducted for coastal Panchayat leaders and stakeholders for the effective establishment of coastal bioshield.

World Wetlands Day Celebrations, 2 February, 2006, Kakinada

MSSRF Kakinada field centre, Andhra Pradesh, and India and Wildlife Management Division, Rajahmundry jointly organized an awareness rally in Coringa village abutting Coringa Wild life sanctuary on the occasion of World Wetlands Day. Students of the Green Corps of Aditya Public School, Jagannaickpur, Kakinada, participated in this awareness rally. Placards on the importance of wetlands, particularly the conservation of mangroves for coastal and livelihood security, were prepared by the students. At the end, a meeting was held at the Coringa Wildlife Sanctuary Forest complex. The need to conserve wetlands as they are the livelihood resources of the poor, particularly the fishermen, was emphasized.

Interactive Workshop on Crop Biofortification for alleviating micronutrient malnutrition, 13-14 February, 2006, Chennai

The Government of India has initiated a network programme on crop biofortification, involving major crops. Globally there are also ongoing efforts on crop biofortification coordinated by the HarvestPlus programme of CGIAR. In order to develop the linkages and also to share the knowledge and material generated in both the programmes, an interactive workshop was

organized jointly by HarvestPlus and Department of Biotechnology, Government of India at MSSRF. The workshop was attended by 49 participants representing international agricultural scientists, ICAR Institute, State Agricultural Universities and the private sector. The discussions during the two-day conference related to the nature and extent of micronutrient deficiency, ongoing interventions, possible initiatives and policy issues in the development and delivery of biofortified crop varieties. A joint action plan was developed for identifying the priority areas of intervention in both major and neglected crop species to provide an integrated approach for biofortification programmes.

The meeting also considered the issues related to developing common methodologies and a structured collaborative programme between the Department of Biotechnology funded projects of the Govt. of India and the HarvestPlus programme. A Memorandum of Understanding is under development and will provide scope for both the programmes to benefit from each other.

Panchyat Raj Institutions (PRIs) training workshop on mangrove bioshield, 17-18 March, 2006, Chidambaram

Forty participants from PRIs and 8 Commune Special Officers attended a two-day workshop at Chidambaram and interacted with experts and rural communities on experiences in coastal bioshield establishment and management. The participants felt the need for adopting methods suggested by MSSRF and wanted to have continued interaction with MSSRF for technical support.

The participants gave the following feedback:

- PRIs should create awareness on coastal bioshield among the people.
- PRIs should play an active role in restoring coastal degraded areas with community participation.
- PRIs should prevent encroachment of coastal areas.
- Communities should be trained on the functions and uses of bio-shield.
- Communities should be trained in bio-shield nursery establishments.
- Communities should be trained in bio-shield plantation and management.
- School children should be made aware of the importance of bioshield.
- PRIs should promote integrated livelihood options for coastal dependent communities

5th Pugwash Conference on HIV/AIDS: Sharing of Experiences, What Works? 7-9 April, 2006, Chennai

In recognition of the global nature of the HIV/AIDS pandemic, it was decided to bring together experts from “first wave” countries where the epidemic had struck first and with great intensity (e.g. South Africa, Kenya and Uganda) and those from “second wave” countries where the epidemic threatens to spiral out of control (e.g. India which has the second largest population living with HIV) to exchange successful and replicable strategies for the prevention, management and mitigation of HIV and AIDS.

Hosted by MSSRF, the conference was co-sponsored by the UN World Food Programme (WFP), Bill & Melinda Gates Foundation, the National AIDS Control Organization, the UN Development Program and the Indian Council of Medical Research. The WFP played an active role as co-organizer.

There were 52 participants from 8 countries. Approximately 65 % of the participants were from India and 35 % were from other countries (i.e. South Africa, Kenya, Uganda, the US, the UK, Italy and France). Participants represented a wide variety of fields (e.g. clinical medicine, nutrition, social science, and ecology) and institutional affiliations (e.g. universities & research institutions, civil society organizations, hospitals and government).

The conference comprised 8 plenary sessions that focused on the following themes: policy and state responses to HIV/AIDS; access and adherence to ART; nutrition and food security for people infected and affected by HIV and AIDS; preventing infections among young people, especially young women; behaviour change; sexual violence and the social construction of male and female sexuality; preventing paediatric HIV; and controlling HIV within the defence services. In each session, presenters shared experiences from both Africa and India.

The Hindu Media Resource Centre organized a public forum on the evening of 7 April, for community members and the media to learn about the HIV epidemic and the state's response in South Africa, Uganda and India.

On 8 April the participants went on a field visit to HIV projects run by local organizations. Participants were able to choose among 4 projects (2 prevention and 2 care & support) run by Voluntary Health Services (the AIDS Prevention and Control Project), the Tamil Nadu AIDS Initiative, Tambram Hospital and YRG CARE. On Saturday evening, Professor Swaminathan, the World Food Program's Deputy Executive Director and the WFP's Representative and Country Director for India released a short film about WFP's activities in India to an audience of journalists and conference participants.

Annual Dialogue on the theme Hunger Free India: Mission 2007, 20-22 April, 2006, Chennai

This year's *Annual Dialogue*, on Food Security, coordinated by the TRC, was held in April at MSSRF, Chennai. The focal theme of the *Dialogue* was ***Mission 2007: Hunger Free India***. The theme was a follow up of chapter two of the second report of the National Commission on Farmers (NCF) titled, '*Serving Farmers And Saving Farming: From Crisis to Confidence*'.

Around 50 invitees, comprising academics, lawyers, social activists and journalists as well as civil servants involved in policy implementation took part in the *Dialogue*. The outcome of the dialogue was a set of recommendations, the major points of which are outlined below. The recommendations were released at a press conference held at the conclusion of the *Dialogue*, with a view to wider dissemination. The following are the recommendations

Enhancing Production and Profitability of Small holdings

- Reverse the disastrous decline in rural development expenditure and step up public investment in irrigation and rural infrastructure.
- Carry out land reforms through acquisition of ceiling surplus land and redistribution.
- Implement the NCF recommendations for the “Year of Agricultural Renewal”, with respect to soil health cards for small farmers and other issues.

Developing a Food Guarantee Bill

- Following up on the NREGA and recognising that the right to food and the right to livelihood are intimately related, we need to move towards a comprehensive “Food and Employment Guarantee Act”.

Community Food Security Systems

- Universal PDS with uniform prices affordable to the poor should be maintained and strengthened. There is also a role for community based food security systems, such as community grain banks, in specific situations.

Reform of the delivery system

- The overall approach of the delivery system should be life-cycle based and involve appropriate supplementation programmes.

Hidden Hunger

- Food security is a pre requisite for nutrition security. Hence steps taken for mitigation of micronutrient malnutrition should also

simultaneously address protein energy malnutrition. Synergy and convergence should be ensured in nutrition intervention programmes. A life-cycle approach that emphasizes all nutrients and dietary plans for the community as a whole at the local level are important.

- The quality of service delivery, monitoring and supervision needs to be improved. The ICDS is a very critical intervention programme and the *anganwadi* worker plays a key role in the convergence of services for the mother and the child under six years of age. She should be recognized as a regular full time employee with specific skills and her remuneration should be revised accordingly.

Rural Livelihoods

- The Dialogue recommends that the policies of indiscriminate liberalisation (such as the drastically low levels of import duty on cotton), which have contributed a great deal to the rural and agrarian crisis, should be critically reconsidered.
- The economic policies should be reoriented to provide adequate support for India’s agriculture and its vast rural population. In particular, policies must provide adequate rural infrastructure, including power, and promote employment, besides ensuring credit facilities and remunerative prices for the produce.

Fourth Commonwealth-India Small Business Competitiveness Development Programme, 23-28, April 2006, Chennai and Pondicherry

The Commonwealth Secretariat, Export-Import

Bank of India (EXIM Bank), MSSRF and Government of India's Ministry of Small Scale Industries and Agro & Rural Industries jointly hosted a six-day capacity building programme on Small and Medium Enterprise Development. Sixty participants from 34 commonwealth countries across the six continents participated, 34 of them were women participants. In the workshop, the participants discussed SMEs and poverty alleviation; SMEs and economic development; comparative roles of institutions; SME development – the role of SHGs and NGOs in India; SME development – the role of indigenous business, agro & rural industries and SME financing.

Launch of Education and Livelihood Rehabilitation Programme in Vidarbha, 1 May, 2006, Nagpur

The following initiatives were launched at a function held at the College of Agriculture, Nagpur and chaired by Professor M S Swaminathan, on 1 May 2006, Maharashtra Day:

- Education Support Programme for children of farm families where there have been suicides: a pilot launched in Wardha district, the programme will enable boys and girls from families affected by suicides to pursue their education from the primary school level to the plus two level. About 70 children will benefit under this scheme. A local level coordination committee headed by Mr J L Salway, Chairman, Wardha District Land Development Bank, has been formed for implementing the programme.
- Livelihood Rehabilitation Programme: selected widows and children of farmers who have committed suicide and who have at least class VIII level education, are being given training to become managers of VKCs/ *Gyan Chaupals*. The VKC movement is to be expanded with VRCs to be setup in Amravati, Yawatmal and Washim in the coming months. Training in spinning is also being provided to widows and children of some of the affected farm families at the Waifad VRC, under an agreement with Mahila Seva Mandal, Sewagram, which will also buy back the yarn.
- Functional Literacy programme: Tata Consultancy Services (TCS) and the Amravati district administration have tied up to explore introduction of the functional literacy package of TCS at NREG worksites in Amravati district on a pilot basis, in order to enable the labourers at the site to acquire literacy skills.
- The Panjabrao Deshmukh Krishi Vidyapith and Rashtriyasant Tukdoji Maharaj Nagpur University, at Professor Swaminathan's suggestion, announced the launch of Hope Generation Teams of students and teachers to go to distress hotspots to address the problems of farmers.

Mission 2007 Technology Partners Meeting, 4 May, 2006, Chennai,

Under *Mission 2007: Every Village a Knowledge Centre*, MSRF and International Development Research Center organized a one-day brainstorming session at MSSRF, Chennai. The main aim of the meeting was to decide how

technology partners could support the capacity building training for VKC workers, rural children, rural youth, panchyat raj members; development of e-learning packages for rural communities; software development for domestic needs, especially in panchyats, rural schools, hospitals, markets, etc.; setting up of urban to rural call centers, setting up of rural to urban e-marketing facilities, etc. Some of the major decisions of the meeting are as follows:

- *Mission 2007* partners should attempt developing a common minimum framework for service standards to help the Government implement the Gyan Choupals.
- A framework should be developed for *Mission 2007* technology partners to collectively engage and contribute one or two common programmes.
- Service charges levied against rural service providers should be withdrawn for Gyan Choupals.
- Media Lab Asia tools would be made available to all *Mission 2007* partners.
- TCS would adopt Community Knowledge management Toolbox as their contribution to *Mission 2007*.
- *Mission 2007* Secretariat would aim to map all the VKCs operating in each and every village, block, district and state.

Interaction meeting on development of community-based disaster preparedness modules, 26 May, 2006, Chennai

MSSRF conducted an interaction meeting on how to develop a community-based disaster

(hazard + vulnerability = disaster) preparedness module for tsunami rehabilitation area (bioshield, livelihood, VRC/VKCs, agronomic and children education) staff.

Two experts from SEEDS acted as resource persons and covered aspects such as tsunami impact, the next disaster, risk reduction, community-based action and community based disaster preparedness strategies. The participants were divided into six thematic groups (Bioshield, Livelihood, Health, Shelter, Education and VRC/VKC) for in-depth discussion on the above issues. Experts also shared the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters to the participants. Officials from ISRO also participated in this meeting and discussed several government initiatives in disaster management (including guidelines to state governments, national disaster management framework, disaster prevention and mitigation, etc.). This meeting also included lectures on “Integrating Disaster Management with Sustainable Management” and “Satellite Remote Sensing and Disaster Susceptibility Appraisal”.

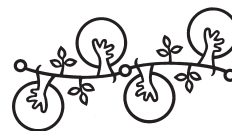
Workshop on Creating and Networking of Village Knowledge Centres, 6-7 June, 2006, Pondicherry

Since 1997 MSSRF has been setting up VRCs and VKCs. On 6 and 7 June 2006, it shared its experiences with NGOs in the form of an interaction workshop. Fifty three participants from 41 NGOs, one Farmers club and one Panchayat leader participated.

The following aspects were discussed in the workshop

- Concept and activities of VRCs and VKCs
- Steps and process involved in VRC and VKC establishment
- Importance of 5Cs (Connectivity, Content, Capacity Building, Care and Management and Coordination)
- Opportunities and constraints for NGOs in establishing VKCs
- Significant issues and needs in the area of operation
- Possible collaborations for establishing and operating VKCs – role of NGOs and MSSRF
- *Mission 2007: Every Village a Knowledge Centre*
- Networking exercise
- State level sharing of forums, setting up of Tamil Nadu *Mission 2007* NGO Chapter

Sub Programme Area 700



Special Projects

The study on measuring the impact of science and technology on agriculture and rural development has made significant progress and the report will be finalized shortly. Initiatives taken for medium and long-term rehabilitation programmes in the tsunami affected areas have made good progress. A detailed situational analysis has been carried out to identify the areas of intervention in the V&A project sites.

701	Measures of Impact of Science and Technology: Agriculture and Rural Development. ...	137
702	Tsunami Rehabilitation Measures	138
703	Vulnerability Assessment And Enhancing The Adaptive Capacity To Climate Change In Semi-Arid India - SDC (V & A) Project	148

Sub Programme Area 701

Measures of Impact of Science and Technology: Agriculture and Rural Development

The study on measuring the impact of science and technology on agriculture and rural development, was commissioned by the Office of the Principal Scientific Adviser to the Government of India in March 2004. It has been conceived primarily in the context of assessments made by UNDP's Human Development Report of 2001 concerning the technological achievement of various countries including India. The main focus is to measure the significant contributions of technological interventions across the major sectors of rural economy such as agriculture, animal husbandry, fisheries, forestry, energy, irrigation and water resources and health in post-independent India. It concentrates on a few significant technological interventions that have been catalytic in bringing about rapid transformation in a particular sector and has a detailed analytical description of the development of catalytic technologies as well as a quantitative analysis of technological achievement across the various sectors under consideration.

The study has identified 'varietal improvement programme' as the catalytic technological intervention in post-independent India in the agricultural sector. To understand the changes triggered by the varietal improvement programme in the sphere of production, several

indicators such as level of production, yield per hectare, per capita output and value of output per hectare are analysed with regard to some selected crops over a fifty-year period since 1950-51. While changes with regard to many indicators are discussed, 'value of output per hectare' is chosen as a summary measure of technological achievement in the agricultural sector. In the animal husbandry sector, the study concentrates on cattle, poultry and small ruminants. In the dairy sector, 'artificial insemination with improved germplasm' is identified as the catalytic technology and 'value of milk per milch animal' is used as an indicator to measure technological achievement. Introduction of 'hybrid layers' in the poultry sector and 'intensive health coverage programme' among small ruminants have been strategic technological interventions. As regards fisheries, the development of 'composite fish culture' is identified as the catalytic technology in the growth of freshwater aquaculture and carp production is used as an indicator to measure achievement in this field since the year 1986. In forestry, technological interventions in the spheres of conservation, restoration, production, protection and wildlife are analysed. With reference to irrigation, technologies that have been instrumental in improving the coverage of irrigation in the country, in particular, technologies related to canal irrigation and high-speed drilling in sub-surface irrigation, are analysed. Regarding energy, the study discusses technological interventions that helped augment the supply of various sources of energy such as thermal, hydro, nuclear and renewable as well as the progress of energy consumption in rural areas over time. In the area

of rural health, the national level programmes that were initiated to combat major diseases in the country and the impact these programmes have had on the incidence of diseases are analysed. The technical aspects of the health programmes specifically dealing with communicable diseases, non-communicable diseases, vaccine preventable diseases and major nutritional deficiencies are discussed. Life expectancy at birth over the last three decades is used as an indicator to compute technology achievement in the health sector.

The first draft of the study report is now ready and consultations are being held in different places to receive comments from experts. A Reality Check Workshop was held on 19 April, 2006 at the Acharya N G Ranga Agricultural University, Secunderabad. Two more consultations were held on 16 May and 6 June at Anand Agricultural University and at Forest Research Institute, Dehradun, respectively. The research report will be finalized shortly.

Sub Programme Area 702

Tsunami Rehabilitation Measures

Initiatives were taken for medium and long term rehabilitation programmes based on the framework suggested by Prof MS Swaminathan, Chairman MSSRF 'Beyond Tsunami: An agenda for action' focusing on (i) strengthening the ecological foundations of sustainable human security, (ii) rehabilitating livelihoods and fostering sustainable livelihood security and (iii) putting in place knowledge

centres. Attempts have been made to develop bioshields (see SPA 102.2 - 4), rebuild livelihoods, establish the VKCs (see SPA 601) and reclaim soil in the tsunami affected agricultural fields in Cuddalore, Nagapattinam, Kancheepuram and Kanyakumari districts in the state of TN and Karaikal and Pondicherry regions of Pondicherry. Process mode has been adopted to facilitate the activities. Effective coordination was ensured with the fishermen, the agricultural communities, other NGOs and government departments involved in similar activities in the Tsunami affected villages. The village development councils (with the representation of village leaders, traditional and elected panchayat, SHG leaders, etc) are playing a very crucial role in identifying the concerns and planning, implementing and monitoring the rehabilitation activities. Several individual and institutional donors have supported the implementation and rehabilitation activities.

702.1 Reviving and Strengthening the Livelihood through Catalytic Interventions

MSSRF extended support in three villages viz Samiyarpettai, Muzukuthurai (Cuddalore district) and Madavamedu (Nagapattinam district) to buy new nets and repair boats and engines. The village level committee played a crucial role in pooling and distributing the resources received from MSSRF and other NGOs to the local people without any internal conflict. When the other NGOs supplied the boats, MSSRF helped to buy yarn for net making and gap filling, which helped the fishermen to resume fishing. The support

extended by MSSRF to these three villages is helping around 700 fishermen to engage in fishing activities. This helped the fishermen households to earn an average income of Rs. 250 per day during regular fishing seasons.

Training on need based skill development:

Mechanics to repair the engine and boats are generally not available in all coastal villages, and the local fishermen hire them from outside. Imparting the skill to repair engines and boats was identified as one of the important needs of the fishermen in the post-tsunami context. A hands - on training programme was organized for a week in a workshop at Cuddalore. Twelve youths from the above mentioned three project villages received training on Lombardini engines. The youths reported that the training they have undergone on engine and boat repairing is now helping them to manage the problem on their own, without the help of mechanics from outside.

Micro Credit and Women s Enterprise activities

The fisher women of Samiyarpettai, Muzukuthurai, and Madavamedu have revived fish vending, and other small business. The revolving fund has helped them to avoid entering into a debt trap of the middlemen. The women in these 3 villages said that the support extended in the form of 'revolving fund' for SHGs was very useful. It is helping them to have a continuous access to credit with low interest. In the 3 villages, the women have stopped taking loans from the moneylenders and the capital has gone up with an additional amount of (Rs.25,000) from the interest collected from the

borrowers. In these villages, 325 women used the money for fish vending; 125 were involved in dry fish business and 25 women started small business.

Backyard Poultry and Mushroom Poduction and Marketing

At Sadraskuppam in Kancheepuram district, two enterprises, viz. poultry farming (broiler birds) and mushroom (oyster) production were initiated. Two women SHGs are being involved in poultry management. After 40 days, around 4,300 birds were sold and the net profit made by the SHGs was around Rs 25,000. The technical and business support extended by Venkateshwara Hatcheries included the market buy back. The members of the mushroom production group were taken for an exposure visit to another SHG in Pondicherry, producing mushroom. The group members started selling the product in the local market. Similarly, in Pattinamcherry of Karaikal region, around 35 women SHG members are producing mushroom and selling it to supermarkets in Karaikal town. The quality and the timely supply would ensure market tieup in both the cases.

Diversification of Livelihoods through Coastal Aquaculture

Transecting was done in the backwaters near Madavamedu, Pazhayar and Muzhukuthurai (in the Pichavaram region) to establish the feasibility and suitability for culture fisheries with the help of experts from Periyar Integrated Fish Farm, Chennai, MSSRF staff and the community members. The team traversed the backwaters of the region and found that the

estuaries near the villages could be used for crab fattening (through pen culture and cage methods), and the open back waters for other activities like mud crab fattening, grooper, sea bass fish in floating cage culture and oyster and green wood culture. During the visit discussions were held with the fisherfolk on water availability (seasonal) in the backwaters and mangrove canal and ownership details. An exploratory survey was conducted to assess the availability of water crabs in the three landing spots which shows that around 7.5 % of the landing crabs are water crabs; hence there is a possibility to introduce crab fattening as one of the income generating activities in the village. In Madavamedu, the process of crab fattening by the cage method in an area of 100 sq.feet was initiated and managed by the village community on an experimental basis. The group members have planned to expand the area and number of cages. Discussion to design other activities like pen culturing of grooper, sea bass etc is in progress.

Value Addition to Fish Based Products: Fish and Prawn Pickle and Fish Masala

To generate more employment and income for women in the coastal villages, with the available resources, a three-day, intensive, hands - on training programme was conducted at Chidambaram with the support of resource persons from Fisheries College and Research Institute, Thoothukudi. Around 50 women from three villages participated in the programme in which the following major aspects were covered: i) grading and sorting of quality fish ii) hygienic handling of fish iii) value addition methods like

making fish and prawn pickle and fish masala and iv) economics of each of the value added items. The participants were involved in the preparation process. Three items, fish and prawn pickle and fish masala were prepared through practical demonstration. A practical manual prepared in Tamil was also given to the participants. The product has the advantages of multiple level marketing viz. within the village, in neighbouring villages, in the nearby towns and urban supermarkets.

Production and Marketing of Arbuscular Mycorrhizae (VAM) and Vermicompost by Landless Labourers

By looking at the cropping pattern in the coastal region, which is rich in agro forestry resources and to promote employment opportunities in the tsunami-affected farming village of Vettaikaraniruppu in Nagapattinam district, the members of a women SHG, belonging to landless labourer households, were trained by the scientists from TNAU, Coimbatore on the production and marketing of VAM. The group planned and produced around 400 kg in the first cycle. The test result showed the quality of the product is good (with 98 % spore colonization). A business tie up has been developed with Nithya Bio Products, Villupuram for marketing. The company promised to enter into an agreement and the group has planned to upscale the production in the future. Around 60 women members of SHGs from landless households in Vettaikaraniruppu in Nagapattinam and Keezhavanjoor, Karaikal are producing vermicompost. Discussions are going on with Nithya Bio Products for market linkages.

702.2 Agronomic Rehabilitation

In response to the great damage caused by the tsunami waves in agricultural fields, MSSRF attempted to understand the ground situation and develop strategies for effective agronomic rehabilitation, involving the local farming communities and other stakeholders.

Travelling workshop on Agronomic Rehabilitation of Tsunami Ravaged Lands

To understand the multi-dimensional nature of the problem and to develop a scientific soil health rehabilitation package, MSSRF organized a travelling workshop for three days with multidisciplinary experts from different parts of the country. The participants visited the 9 tsunami hit villages of Pushpavanam, Vellapallam, Manikapanku, Kumarakudi, Kalamanaallur, Neithavasal, Vellapallam, Thirumullaivasal and T S Pettai. Spot measurements for pH and EC were conducted in 18 fields and discussions were held with farmers. It was followed by a one-day interactive discussion at Chennai to consolidate the observations and evolve recommendations. In general, three kinds of damage to agricultural land had been caused by the tsunami waves:

- Deposition of slushy grayish brown clay
- Deposition of sandy soils and
- Seawater intrusion, which receded leaving salt in the field.

The team suggested the promotion of on-farm and non-farm enterprises like coconut based value added products, apiculture, dairy, small

growers poultry estates, cashew processing, production of biofertilizers and biopesticides with appropriate backward, lateral and forward linkages. This would promote multiple livelihood opportunities not only to the majority of small and marginal farmers but also to the landless labourers who form a sizable part of the local population and who had lost their livelihood opportunities. The recommendations were gathered in a Report, both in Tamil and English and disseminated to farmers, civil organizations, district coordination committees and government officials. They were also immediately uploaded in the MSSRF web site and disseminated through VKCs promoted by MSSRF functioning in Nagapattinam and Cuddalore districts and at village meetings.

Participatory Field Demonstration

Based on the issues identified by the travelling workshop and on the basis of the intensity and type of the damage, five participatory field demonstrations were carried out in collaboration with the farmers in the following identified villages: Vellapallam (Rice), Vettaikaranirruppu (Groundnut and Casuarinas), Anaikovil (Rice), Neithavasal (Rice and groundnut) and TS Pettai (Groundnut). The total area covered under agronomic rehabilitation is around 23.97 ha and 67 farmers are involved in the activity. The intervention focused on capacity development of the farmers through participation, diagnoses, analysis and evaluation of results and helped to develop local resource persons to share the results with other farmers in the region, promote grassroot farmers' organizations, and develop a model for *farmer-led extension*.

Soil Reclamation Process

Field specific soil reclamation practices were followed in each of the villages. In Vellapallam and Vettaikaranirruppu, slushy clay material which had a high organic matter content had been deposited. Heavy metal analysis of the deposited material indicated the concentration of chromium, lead, zinc, copper, nickel, cadmium and mercury within the permissible limits and thus the deposited clay could be incorporated into the fields. In Anaikovil, Neithavasal and TS Pettai villages, sandy layers had been deposited in groundnut fields and seawater had intruded and stagnated in the paddy fields. The following measures were taken in collaboration with the local farmers in an integrated manner to tackle the issues:

- *Deep ploughing and land smoothening:* In all the selected fields, deep ploughing was carried out using rotavator before sowing; field bunds were reformed/strengthened wherever necessary and land leveling was carried out.
- *Spreading and incorporation of sand/clay deposit:* In some of the fields, farmers scraped the deposited top layer and heaped it in the field with the help of some NGOs. With the consent of the farmers, it was spread evenly and incorporated into the soil through deep ploughing.
- *Removal of cyperus and other weed species:* The growth of cyperus weed was abundant especially in the clay deposited fields; it was uprooted and ploughed into the fields.
- *Providing proper drainage facilities:* In many of the fields, water drainage systems were blocked with debris and sediments, which were removed and clear drainage was reestablished.
- *Sowing and in situ ploughing of green manure species:* In almost all the paddy fields irrespective of the paddy cultivation method *Sesbania aculeate* was grown and incorporated in the field at the time of flowering. On an average nearly 12.5 tonnes per ha of green manure was ploughed into the soil.
- *Leaching:* Leaching was carried out in the fields wherever seawater had intruded and stagnated, leading to an increase in the concentration of soluble salts.
- *Application of Farm Yard Manure (FYM) and Biofertilizers:* On an average 5 t of FYM was applied before last ploughing. In addition, salt tolerant strains of Phosphobacteria and *Azospirillum* were applied @ 2 kg per ha. and *Pseudomonas* species @ 2.5 litre per ha.
- *Selection of salt tolerant varieties:* Salt tolerant paddy varieties like TRY 2, CO 43, MDU 5, ADT 43 and traditional landraces like *kuzhivedichan* were grown, and wherever possible, the transplantation method of cultivation was followed.
- *Gravity drip system to enhance water use efficiency:* Due to the increase in the salinity, pond water cultivation of second crops like vegetables was affected. To overcome the problem, frequent irrigation of the crop and increase in water use efficiency, including

simple techniques like mulching and application of coir pith compost, were introduced.

Soil Quality Status

Periodical soil tests were carried out in the benchmark sites as well as in the participating farmers fields in collaboration with Agricultural College and Research Institute, Trichy. The results indicate that both pH and EC levels are normal and the soil is suitable for crop cultivation.

Water Quality of Farm Ponds

In the villages of Anakovil, Vettaikaraniruppu and Vellapallam the pH measured 8.40, 8.50 to 8.88 and 8.01 to 8.63 respectively, while the EC was 2.60, 3.7 to 14 and 2.29 to 6.93.

The water quality in the farm ponds indicates medium to high salinity levels that cause crop loss in the second crop. Future efforts will focus on reducing the water salinity.

Crop Performance

Rice and groundnut from the demonstration fields were harvested, though the rice yield in the tsunami affected areas was further reduced

by continuous rain and flood during panicle initiation stage. Stagnation of water in the field affected the yield and reduced nearly 40-80 % of the crop across the demonstration sites. The groundnut pod yield was comparable with that of the previous year. In Neithavasal village, rice grown during the second season immediately after the monsoon recorded a good grain yield (2.5 t /ha whereas the normal average yield is around 2 to 2.2 t/ha). It is learnt that in this vulnerable coastal system, attention should be given to select varieties which have the characteristics of salinity tolerance and flood resistance. Also, the planting method should be direct sowing instead of transplanting to reduce the crop duration and help to overcome the flood hazards during the NEM.

Soil Fertility Management

To improve the soil conditions, it was planned to increase the addition of organic matter in all the demonstration fields, covering about 60 acres, belonging to 67 farmers in five villages. It was done through a combination of methods like *in situ* incorporation of green manures and application of FYM @ 5 t /ha. It was also planned to introduce allied enterprises/

Changes in the soil quality of the bench marked sites

Village	Jan 05		April 05		July 05		Oct 05		Dec 05		Jan 06	
	pH	EC	pH	EC	pH	EC	pH	EC	pH	EC	pH	EC
<i>Anaikovil</i>	7.1	8.3	6.99	0.48	6.85	1.9	8.1	1.1	7.8	1.1	6.9	0.14
<i>Neithavasal</i>	7.3	15.5	7.86	5.89	7.60	5.7	6.8	1.2	6.8	1.2	6.57	0.16
<i>Vettaikaraniruppu</i>	8.2	2.3	8.34	1.76	-	-	7.0	0.6	7.7	0.6	-	-
<i>Vellapallam</i>	7.8	15.0	8.96	0.13	8.60	4.9	7.1	1.5	8.0	1.5	6.85	0.02

EC – Electrical Conductivity dsm^{-1}

activities, which would help to strengthen the local agro ecosystem and generate employment and additional income to farm/labourers families.

Decentralized vermicompost: Considering the fast decomposition rate of the added organic matter, the availability of cow dung and other agro wastes and soil texture, vermicomposting technology was demonstrated to the local farmers in four villages. Thirty farmers were trained in the production process with hands-on experience and exposure visits to the commercial production unit managed by a farmer. The local production cost is around Rs 0.85 per kg and the cost benefit ratio is 1: 2.09.

Water Management

Farm ponds play a vital role in providing irrigation to the second crop. The major activities carried out were removal of salt water and desilting of farm ponds, followed by strengthening the pond bunds through the planting of fodder crops.

To provide an alternative to the traditional methods of lifting of water, pedal pump technology, which has the capacity to deliver 60- 80 liters of water per minute, was demonstrated in two villages with the support of the organization 'Water for Third World'. According to the farmers, the technology is affordable and replicable. 'Water for Third World' has shown an interest in training the local people on the production of pumps and helping the farmers to replicate it in their fields.

Where the soil is of a sandy texture, the use of pedal pumps or direct irrigation is not needed

to increase the water use efficiency. Hence it was decided to introduce Gravity Drip Irrigation, coupled with pedal pump lifting technology. The initial survey to instal the unit was completed in two villages (Vellapallam and Vettaikaranirruppu) covering an area of 400 and 200 M² for vegetables and coconut respectively.

Contingency Cropping

Owing to heavy flooding during the north-east monsoon and the frequent cyclones, farmers incurred heavy losses of nearly 40-70 % in their standing paddy crop. Small scale planting of sweet potato was undertaken as a life-saving crop with the support of CTCRI, Tiruvanathapuram. Five thousand cuttings of three different varieties viz. *Kanjangad*, *Sree Rathna* and *Sree Arun* were distributed to 37 farmers in six villages. *Sree Rathna* and *Sree Arun* (spreading type) are of 90 to 100 days duration whereas *Kanjangad* is semi-spreading with a duration of 120 days. The results indicated that the harvested quantity was 12 tonnes per ha for *Sree Rathna*, 18 tonnes per ha for *Sree Arun* and 19 tonnes per ha for *Kanjangad*. In future, it is essential to develop a contingency crop plan for each of the villages and develop linkages to get the seeds or planting materials.

Training and Capacity Building

In each of the villages the farmers were mobilized and need-based training and capacity building programmes were organised. Several technical and academic institutions were involved in the training programme. Training and capacity building programmes were organised

on soil reclamation, IPM in paddy and seed treatment techniques using biofungicides and biofertilizers, water saving irrigation methods, high value multipurpose tree crops and fodder crops, livestock management, especially the small ruminants, vermicomposting and effective microorganism usage and improved agronomic practices for groundnut cultivation. Totally around 747 trainee days were completed. These farmers are slowly emerging as local resource persons.

In order to enhance the awareness among the farmers on biofertilizers, 'Biofertilizer day' was organized at Vettaikaraniruppu village, with the support of the Department of Microbiology, TNAU, Coimbatore, Agricultural department and TRRI, Aduthurai in which about 120 women and 60 men participated. Exhibits of the different types of biofertilizers were arranged.

Strengthening Livestock Resources

Apart from agriculture, the activity that supplements the income of the farm households is goat and cattle rearing. Healthy feeding systems and animal health care received attention. In order to strengthen the resources, exposure visits were organized to Livestock Research Institution, Kattupakkam, and Chennai. The visits helped the farmers to realize the importance of animal health care and nutritional management. Based on the farmers' requirement, slips of CO 3 variety of *Cumbu Napier* grass were supplied and steps were taken to introduce protein rich green forage like *agathi*, *soundal*, *Lucerne* etc.

702.3 ICT based Village Knowledge Centres for Strengthening the Ecological and Livelihood Security of Coastal Communities

VKCs located in the coastal areas of Pondicherry played a major role immediately after the first tsunami attack and in post-tsunami relief. The public address network in these VKCs helped to distribute the tsunami relief materials to the affected community in an effective way. Ten VKCs were established in the tsunami affected coastal districts of Kancheepuram, Cuddalore, Nagapattinam and Kanyakumari districts of TN with the support extended by several donors.

Villagers in the tsunami affected areas were desirous of establishing VKCs in their villages. VKCs were established and are functioning in the tsunami affected villages.

Capacity Building for the VKC Workers

Training and capacity building was organized for the VKC workers in the tsunami affected villages. Under this programme many skills and methodologies for the dissemination of content were covered.

NVA Fellows ~ SHGs Members Interaction Meeting at Kovalam

A meeting between the Jamsetji Tata National Virtual Academy fellows and local SHGs was organized at Kovalam, in Kancheepuram District. The NVA Fellows shared their experiences with SHG members. The Fellows explained how VKCs could help in meeting the local information needs. They could supply information about the developmental schemes

promoted by different agencies and facilitate linkages with these agencies. They also explained how the knowledge obtained from the VKCs has added value to their personal life. The other topic they discussed was the accounts software, which would help the SHGs to keep their accounts in order. Since the accounts are computerized, it paves the path for accountability, transparency and trust building among the group members. VKCs could also provide a database on local doctors, lawyers and other professionals.

Computer Aided Learning Programme

In Nagapattinam the Computer Aided Learning Programme is being conducted in two VKCs at Akkarapettai and Prathabaramapuram. This programme is being conducted for the past six months. Children from the age group of 7 to 18 and youth up to 24 years of age are participating in the programme. Children from government and private schools and school dropouts (from fifth to ninth standard) are regular visitors. The Knowledge Workers assist the children to run the CDs and guide them to get through the programme.

Early Warning System

An early warning system has been set up with the support of Indira Gandhi Centre for Atomic Research (IGCAR) for disseminating disaster related information as an experiment in the VKC at Sadraskuppam, Kancheepuram district. The information on any natural disaster can reach the community within an hour. The transmit activator can reach the siren located on top of the VKC from any point within a 500 meter radius.

Satellite Connectivity

Under the joint ISRO-MSSRF Village Resource Centre programme, ISRO has expanded the VRC programme with satellite connectivity to the tsunami affected villages in Pondicherry, Nagapattinam, Chidambaram and Kanyakumari. These centers are facilitating teleconferences between farm and fishing families at these locations and MSSRF scientists as well as with leading experts in the area of health, education, agriculture, fisheries, marketing and disaster management. The Nagapattinam VRC has been connected to National NVA Hub in Chennai with the technical (satellite connectivity) support of ISRO. Video conferences with farm and fisher families of Nagapattinam district were organized.

702.4 Human Development

Long term Educational and Nutritional Support for Children Orphaned by the Tsunami

MSSRF has been implementing a programme in association with Bharat Soka Gakkai to extend necessary support for the education and nutritional security of children orphaned by the tsunami in Nagapattinam district of TN. Details about the orphaned children were gathered from the district social welfare department and DRDA. NGOs which are actively working in the tsunami affected villages were consulted. Finally a survey was conducted to identify the most needy children in the four fishermen villages of Keelamoovarkarai (9 children), Madathukuppam (19 children), Naickerkuppam (9 Children) and Thoduvai (10 children) in Sirkazhi and Kollidam

blocks of Nagapattinam district, where no other organization is taking care of the education and nutritional needs of orphaned children.

MSSRF has identified three tsunami orphaned children who need financial support to continue their studies in Kanyakumari district with the support of the District educational officer and Social Welfare department. MSSRF and the District Educational Office have prepared a plan to support the children up to 12th standard.

Confidence and Capacity Building for Tsunami Widows

With the support of The Kanyakumari Rehabilitation Resource Centre (KRRC) the district level NGOs coordination committee, Nagercoil, KODI Trust, an NGO working in the coastal areas of Kanyakumari district agreed to collaborate and execute the programme. With the help of KODI Trust, widows who are members of SHGs were identified. A training programme on dry fish processing was organized. Experienced persons in the field were hired as resource persons and 25 women from five SHGs participated in the training programme.

The MSSRF field centre at Koodangulam is conducting entrepreneurial training programmes for tsunami victims in collaboration with the DRDA. The programme has been conducted in Vijapathy panchayat for women SHG members. The number of women covered was around 2,275 (2066 backward class, 147 schedule caste and 62 handicapped). The training programme includes skill building for enterprise development, production of fish-based, value-added products and exposure visits.

Psychological Rehabilitation

Back to Normalcy: The play *The New Wave* was organized by MSSRF in collaboration with *Nalamdana*, a Chennai-based NGO, towards psychological rehabilitation at Muzhkuthurai, Madavamedu and Sadraskuppam for tsunami victims, with the support of the local village Panchayats. People from other hamlets also witnessed the play. The play focused on helping the fishing community to overcome the fear of the sea, the tsunami, and some social problems like alcoholism and domestic violence, breaking social relationships and institutions in the post-tsunami context. The importance of mangrove forests was also covered. During the feedback the village youths promised that they would not demand a dowry.

702.5 Training and Capacity Building for NGOs and PRIs

The toolkits on Coastal Biovillages, Bioshield and VKC meant for field level workers and project managers engaged in the development work have been published. These toolkits were translated into Tamil and distributed to all Government and Non Government partnering institutions. Training programmes on the development of coastal bioshields and coastal biovillages were organized for NGOs actively involved in rehabilitation activities (see programme area 101).

Training on Coastal Biovillages

MSSRF organized workshops on 'Coastal Biovillages' for the representatives of around 60 NGOs working in the tsunami affected villages to revive and strengthen livelihoods. Each

training programme was organized for 3 days. During the first 2 days the following aspects were discussed in detail: the steps involved in developing a biovillage; natural resource management and livelihood opportunities in aquaculture (both in capture and culture fisheries) and agriculture; agronomic rehabilitation of the tsunami affected agricultural fields; development of ecoenterprises and promotion of employment opportunities; and the role of grassroot institutions like biocouncils, fisher and farmers associations in village development. During the first workshop the field visit was organized to Kodathur, Pondicherry, to discuss some of the ongoing livelihood activities with effective forward and backward linkages with the support of banks, technical institutions, government departments and a marketing company. During the second workshop a field visit was organized to an aquaculture based IFS and a meeting was organized with the IFS practising farmers.

An awareness programme was organized on the MPEDA schemes and subsidies at Nagapattinam with the support of a resource person from MPEDA. Around 126 fishermen from five villages participated in the programme. Also, through them, an onboard training programme on hygienic handling of marine products was arranged.

In addition to the above activities, MSSRF is facilitating the fisher and farming families in 3 tsunami affected villages to get the multiple use solar powered lights with the support of the Barrett Foundation. The light would be useful for the family members in different ways.

Sub Programme 703

Vulnerability Assessment and Enhancing the Adaptive Capacity to Climate Change in Semi-Arid India - SDC (V & A) Project

The overall goal of the V & A programme is to secure the livelihoods of the rural poor and vulnerable communities by (i) promoting adaptation measures that build and enhance their capacity to cope with the adverse impacts of climate change and (ii) improving their disaster preparedness.

The focus of the programme is on optimising and integrating climate-change related knowledge in existing service delivery systems in the two Indian States of AP and Rajasthan. Another important aim of the V & A programme is to catalyse and enhance communication and policy dialogue on climate change issues at different decision levels.

During the inception stage of the project, a detailed *situational analysis* was carried out, which helped in identifying two *mandals* namely Kondurg and Midjil in Mehbubnagar district in AP and Jhadol and Kundai blocks in Udaipur district of Rajasthan, for project implementation.

Climate data for the past 30 years (1961 – 1990) was analysed. Employing tools like moving average, probability analysis, water balance, rainfall stability period analysis and moisture index, both monthly and yearly data was analysed for the respective regions. The

analysis indicated that there was only climate variability in both the districts during the studied period. Both the sites are similar in terms of occurrence of water deficit in all twelve months of the year and both come under semi-arid climate with high risk. In the case of Mehabnagar, over 30 years of the study period, the distribution was 22 years of normal rainfall, while the district was under excess rainfall for 3 years and with deficit rainfall for 2 years. The ratio for excess to deficit was 3:1. The trend analysis indicated that there was a deficit period of 8 years, followed by 6 years of increase. Thus, the study on yearly and monthly rainfall data indicated only variability rather than any change. Focusing on the number of rainy days, the study revealed that between the first year of the study and the terminal year, there was a 32 % reduction in the number of rainy days in total. However, within the study period, only variability was seen. With respect to maximum and minimum temperatures, no change was observed, except annual variability. The 50 % initial probability was around annual mean rainfall. The Length of Growing Period (LGP) was 169 days between May and October.

In case of Udaipur, during the same period of time, the district was under excess rainfall for 4 years, with 18 years of normal rainfall, and 8 years of deficit rainfall. The trend analysis on monthly and yearly data set indicated only variability. With respect to the number of rainy days there was an increase in rainy days during the terminal year in comparison with the first year of the study period. The analysis of maximum and minimum temperatures indicated only variability. The 50 % initial probability rainfall was only 50 % of the mean

annual rainfall. The length of growing period was only 96 days.

Based on interactions with the community and the NGOs working in the respective areas, possible interventions (relating to agricultural practices, use of water and energy) that suit the needs of the local communities in adapting to the climate induced stresses were identified.

The activities planned for 2006 include facilitation of *Participatory Technology Development* (PTD) in agriculture, water and energy for selected farmers and community groups, demonstration of the use of certain selected local specific best practices, and building capacities of extension officers at various levels (local, block and district level) through curriculum development and training on assessment tools and adaptation measures. Besides development of information packages, education and communication materials, a variety of awareness-raising campaigns using local theatres and folk arts have been initiated.

The Steering Committee of the V&A project met during the year and approved the Yearly Plan of Operation (YPO) and the budget. Other significant meetings that took place this year include an in-house capacity building workshop for programme partners, a knowledge sharing workshop among the various agencies working on climate change in India and a high level Project Review Committee meeting. Project partners participated in the Conference of Party Meeting (COP 11) of the United Nations Framework Convention on Climate Change (UNFCCC) held in Montreal, Canada in December 2005.

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- Parasuraman, N. 2005. *Technology Symposium on Disaster Management and Mitigation Technologies*. The Canadian Consulate, Chennai. September 26.
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- Parida, Ajay. 2005. *Harvest Plus Project Advisory Committee Meeting*. CIAT, Cali, Columbia. November 8-9.
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- Ramasubramanian, R. 2006. *International Training of Trainers on Wetland Management Facilitating Multistakeholders Process and Curriculum Development*. Wageningen International, Netherlands. May 26.
- Sengottuvel, D. 2005. *Organic Farming Training Programme*. KVK, Gandhigram. August 7-13.
- Senthilkumaran, S. 2006. *Outcome Mapping Training*. International Development Research Center (IDRC), Colombo, Sri Lanka. March 27-31.
- Subbiah, Vijay R. 2006. *National Seminar on Contract Farming and Crop Insurance*. Tamil Nadu Agricultural University, Michigan State University, Anna Institute of Management, Chennai. April 12-13.
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Awards/Honours

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M S Swaminathan Research Foundation (MSSRF) was registered in 1988 as a non-profit Trust, recognized 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 recognized the Foundation for receiving funds from sources abroad under the provisions of Foreign Contribution (Regulation) Act, 1976.

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List of Acronyms

ADB	Asian Development Bank
AICTE	All India Council for Technical Education
APEDA	Agriculture and Processed Food Products Export Development Authority
CBOs	Community Based Organizations
CGIAR	Consulate Group on International Agricultural Research
CIAT	International Centre for tropical Agriculture
CTCRI	Central Tuber Crops Research Institute
CIMMYT	International Maize and Wheat Improvement Centre
CRIDA	Centre for Research in Dryland Agriculture
DRDA	District Rural Development Agency
IARI	Indian Agricultural Research Institute
ICAR	Indian Council for Agricultural Research
ICRISAT	International Crop Research Institute for Semi Arid Tropics
IDRC	International Development Research Centre
IGCAR	Indira Gandhi Centre for Atomic Research
IGNOU	Indira Gandhi National Open University
IITA	International Institute of Tropical Agriculture
ISRO	Indian Space Research Organization
KVK	Krishi Vigyan Kendra
KKNPP	Kudankulam Nuclear Power Plant
MPEDA	Marine Products Export Development Authority
NABARD	National Bank for Agriculture and Rural Development
NEM	North East Monsoon
NSS	National Sample Survey
NPCIL	Nuclear Power Corporation of India Ltd
RBD	Random Block Design
RCGM	Review Committee on Genetic Manipulation

RDA	Recommended Daily Allowance
SWMRI	Soil and Water Management Research Institute
TANVAS	Tamil Nadu University for Animal Sciences
TRRI	Tirur Rice Research Institute
UNDP	United Nations Development Programme



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