# CHAPTER 6

# BIOTECHNOLOGY FOR SOCIETAL DEVELOPMENT

While pursuing research on almost all frontiers of biotechnology heading towards excellence in science, the department has paid special attention to the application of research results and leads for the welfare of the society. Biotechnological empowerment of women, SC/ST population and rural people through training, demonstration and relevant R&D projects is also a priority for the department.

## 6.1 PROGRAMMES FOR SC & ST POPULATION

Socio-economic status of SC/ST communities could be improved through training and demonstration of biotechnological products, processes and their application in various sectors. Universities, national laboratories, and non-governmental organizations (NGOs) undertake projects for the benefit of the target population. More than 40 projects have been supported this year on cultivation and use of mushroom and spirulina, organic farming incorporating vermicomposting, production and use of biofertilizers, biopesticides and biocontrol agents, cultivation and processing of medicinal and aromatic plants, aquaculture, floriculture, poultry farming and human health care. Salient achievements are given below:

### 6.1.1 Medicinal and Aromatic Plants

Safed musli, a highly remunerative species is being cultivated by farmers, both tribal and non tribal around Udaipur. The estimated collection of its tubers for sale has been in the order of 10 quintals. A package of practices suited to local areas, covering crop production, processing and storage has been developed, tested and perfected. Atleast 50 tribal farmers have adopted this crop for cultivation on their land as a source of their income.

Eighteen motivation and training programmes on cultivation of citronella and extraction of its aromatic oil have been organized at 17 places for the benefit of tribal farmers of as many as 57 villages in five districts of Arunachal Pradesh. Around 700 local people including 25 government officials participated and out of these 341 beneficiaries were

selected to start cultivation and processing of citronella grass through seven co-operative societies established in Itanagar. So far, 269 beneficiaries have sold 15,557 quintals of fresh grass and made an income of Rs. 21.46 lakh. Average income generated per family per year from the project is Rs. 7978. About 6,82,000 citronella slips were raised at Regional Research Laboratory, Itanagar farm and distributed free of cost to the beneficiaries. Seven units for citronella distillation were installed at Karsingsa (Doimukh Circle), Hime (Likabali Circle), Ramghat (Balijan Circle), Tipi (Bhalukpong Giba Circel) in Arunachal Pradesh. Thirty-five local persons of the above seven co-operative societies have been trained to run and maintain these processing units. More than 14,000 liters of citronella oil has been produced by the co-operative societies and marketed to get Rs. 34.49 lakhs. Approximately 290 acres of land in different villages of Arunachal Pradesh have been covered under this crop, benefiting 135 families. A similar project has been implemented for tribals of Bodoland Autonomous Council, Assam where two distillation units have been established. Since the project proved to be highly successful, efforts are being made to replicate this model in other parts of the country .

### 6.1.2 Mushroom Cultivation .

Trained rural women at Parbhani have adopted mushroom cultivation to supplement their income and improve their diet. Anganwadi workers have also spread the message on the importance of mushroom at village level. The villagers are now aware of the nutritive value of the mushrooms. Training on cultivation of mushroom and its processing were conducted at various places. This has helped many people of the target groups to supplement their income in and around Jabalpur, Ujjain and Bhopal in Madhya Pradesh; Neempith, Hasnabad, Hoogly, Burdwan, Siliguri and Kancharapara in West Bengal; Salem, Madurai, Virudhunagar and Didigul in Tamil Nadu; Trivandrum in Kerala, Imphal in Manipur and Parbani in Maharashtra. The project beneficiaries are not only getting hands-on training but also quality spawn. "Mushroom wine", a new product, has been developed and a process for its commercial production is being developed.

### 6.1.3 Biopesticides/Biocontrol Agents

Grasserie is a devastating disease of silk worms. The incidence of this disease in sericulture zone of Tamil Nadu ranges from 0.4 to 90.5%. To produce botanicals for controlling this disease, each of the beneficiary farmers cultivated *Psoralea coryleifolia* plants on a minimum ten cents ($400m^2$) of their land. A farmers' mela was organized in a village of Coimbatore district to popularize the package on use of botanicals for grasserie disease management. The soya flour-based formulations of *P.coryleifolia* and *Trivulus terrestris* were found to be effective as they reduced the incidence of grasserie by 73.53 percent and 64.74 percent respectively. Similarly, training and demonstration were conducted at Pudupatti and Alanganallur Block and Sellamagavandanpatti (Vadipatti Taluk) village of Madurai District in production and application of neem and other plant-based biopesticides to control crop and storage pests of pulses. The unemployed graduates belonging to weaker sections in two villages have already been trained in biopesticide production. They were also trained in collection and preservation of plant material, large-scale extraction, partial purification and formulation. Another training programme for farmers has been conducted at village Mirwat and Nirpana in Beed district of Maharashtra on the use of bio-control agents in integrated pest management system in relation to specific crops.

### 6.1.4 Human Health Care

A project has been implemented in West Bengal on the detection and control of thalassaemia which has generated awareness amongst the local people and lot of enthusiasm was seen among them to make use of services for examination of their blood. So far 6500 tribal people have been screened in Birbhum, Murshidabad, Malda, Bankura and Burdwan districts. Thalassaemia carriers were found to be as much as 8% in the samples tested. Marriage counseling was provided in 130 villages of the five districts. In the course of the examination, many other diseases were diagnosed.

. Educational material for creating awareness on sickle cell anaemia was prepared and distributed among tribal community and health worker in Wayanad district of Kerala. As many as 74,751 tribal people have been screened with sickling test. Of these 8,204 were

detected to be carriers of sickle hemoglobin, while 1,378 were homozygotes having sickle cell diseases. Color-coded and laminated report cards were distributed to beneficiaries. Carriers were given counseling to marry non-carriers while nearly 245 target couples of whom both partners are carriers were advised prenatal diagnosis during pregnancy to avoid the birth of an affected child. Twenty two children below 5 years, were identified as homozygotes and were given oral Penicillin prophylaxis and vaccination against *Streptococcus pneumoniae*. There were followed up till the end of project; they were healthy with minimum symptoms and thus, survived the critical stage. A total of 385 persons with the disease received *pneumococcal* vaccine.

### 6.1.5 Sericulture

Around 250 farmers have been trained in mulberry cultivation and silkworm rearing in Panjampatty block of Dindigul district, Tamil Nadu. training and demonstrations were given on land preparation, planting of cuttings and saplings, manuring, watering, silkworm rearing and cocoon marketing. At the same time, production and application of vermicompost in mulberry cultivation was demonstrated to the farmers.

### 6.1.6 Floriculture

Three major flower-growing centres have been developed in the vicinity of Guwahati at Bongora, Hajo, and Siplajhar / Mangaldoi, all area located at a distance of between 20 and 40 km. from Guwahati. At all the places, after initial reluctance the farmers came forward with great enthusiasm to adopt floriculture for their livelihood. Overall flower production increased three to five times. Planting material of tuberose, gladiolus, white marigold and gerbera were given to farmers for cultivation. Floriculture in Bongora area has been firmly established as farmers are phasing out vegetable cultivation with floriculture, which is claimed to be four to five times profitable than that of vegetable cultivation.

### 6.1.7 Aquaculture

The objective of the project was to demonstrate the carp seed production and semi-intensive carp polyculture to achieve production upto 5-6 tones/ha at Chandrapur in

Maharashtra. Carp breeding was successfully demonstrated and spawn was raised to fingerling stage with satisfactory survival. A mini feed mill was installed to meet the requirement of feed for carp culture. The results were very encouraging as the production could be achieved up to 4.0 to 5.0 tones/ha. In order to create mass awareness about semi-intensive carp culture, two farmers' meets and two training programmes were organized. Some of the farmers have already started fish culture in their farms and others have taken up community fish culture in village ponds with the help of their co-operative societies. The project has helped the rural people, SC/ST, OBC and cured leprosy patients to improve their income. Similar projects have also been implemented at Tirunelvelli and Tuticorin districts of Tamil Nadu and Raigad district of Maharashtra and at Satchand block of Agartala, Tripura.

### 6.1.8 Cultivation of Sea Weeds

The laboratory study on uptake of wastes/residual materials by seedweeds from prawn aquaculture pond has shown good results at Rameswaram district, Tamil Nadu. Economically important seaweeds such as *Cladophora fascicularis, Ulva lactuca, Codium tomentosum, Sargassum wightii, Turbinaria conoides, Gracilaria edulis, G. verrucosa* and *Acanthophora spicifera* were collected from coast of Gulf of Mannar, identified and studied in the laboratory for their utility in residual material uptake.

Experiments were designed for maximum uptake under different light conditions. A linear relationship of chronological nutrient removal and medium nutrient concentration was found in the experiments. The green alga, *Ulva lactuca* , showed the highest nitrate, nitrite and ammonia uptake under sunlight. Uptake further increased under red light, whereas red algae *G. edulis* and *Gracilaria verrucosa* showed the highest uptake of phosphate in sunlight and further increased under blue light.

### 6.1.9 Vermicomposting and Organic Farming

Awareness building programmes on vermi-biotechnology were carried out among school and college students, farmers and NGOs in Tonk, Kota, Jhalawar, Jaipur, Alwar and Baran districts of Rajasthan; Amrawati, Wasim and Ahmednagar districts of Maharashtra; Dindigul and Coimbatore districts of Tamil Nadu; Jabalpur and Betul districts of Madhya

Pradesh; and Aligarh, Maharajganj, Varanasi, Unnao, Barabanki and Lucknow districts of Uttar Pradesh. About 20 hatcheries and demonstration units have been established in these districts to train farmers and provide them worms. About 7,000 farmers have benefited. Some of the beneficiaries have earned up to Rs. 20,000 through sale of earthworms. Since farmers are aware of the utility of vermicompost on crop productivity, some of the beneficiaries have reduced the use of chemical fertilizers. Field demonstrations have shown that application of vermicompost reduces the cost of crop production through savings on chemical fertilizers, irrigation, use of pesticides and, at the same time, adds value to their produce. Some of the beneficiaries have started vermiculture and vermicomposting as small scale cottage industry. Success of the programme is reflected in production and use of the vermicompost by farmers even after the completion of the project duration.

### 6.1.10 *Spirulina* Cultivation

Two hundred women from five villages near Jaipur have been trained in commercial cultivation of *Spirulina.* The programme was promoted among the women as they have started *Spirulina* preparations namely papad, biscuits, noodles and capsules for marketing. A cooperative society has been formed and registered as "Manjul Spirulina Sanwardhan Sansthan" which is continuing the prouction successfully even after completion of the project. In all, more than 10,000 people have benefited from this programme.

## 6.2 PROGRAMMES FOR WOMEN

During the Ninth plan, more than 50 projects were implemented throughout the country for the economic benefit of women specially in rural areas. It was noted that, given a chance, women could best utilize these technologies for awareness creation and entrepreneurship development. The department hence initiated a separate programme for the Tenth Plan in a big way for women empowerment not only for additional income generation but also overall socio-economic development, ranging from awareness on technologies, health improvement, food security to entrepreneurship and career development. More than 2,000 women were trained in various technologies, some of them had already set up their production units. Highlights of some of the projects are given below.

### 6.2.1 Food & Nutrition

Efforts were made to improve nutritive value of daily diet by supplementing locally available plant species rich in essential elements and protein. At Itanagar, 23 plant species such as *Amaranthus sp., Spondias pinnata, Calamus acanthosputhus and Bidens biternata* were identified; a further 36 species are being evaluated for their nutritive value. Of these, eight edible plant species being used extensively, having market demand were selected for their *ex situ* cultivation. Also tuber crops such as cassava, *(Manihot esculenta), sweet* potato *(Ipomoea batataus)* and different colocasias species are used by the community. The beneficiaries were also trained in multiple cropping system and growing $N_2$-fixing plant species in the form of hedgerows. In addition to these projects, forty NGOs were trained at Jaipur and CFTRI, Mysore in low cost technology for Spirulina production, processing and marketing both for human consumption as well as animal feed supplement. Some of the NGOs have already started their production units.

### 6.2.2 Floriculture

At Shillong 30 women have been trained in orchid micropropagation. The beneficiaries were provided with various orchid species including the hybrid ones, for their hardening at their own land. In another project 15 women farmers were trained in floral craft.

### 6.2.3 Medicinal Plants

Under this category the beneficiaries were trained in identification of medicinally important plant species for their large scale propagation for their economic benefit as well as the conservation of local species. Around 700 women of U.P. villages were trained in the cultivation of *Jatropha* and other medicinal plants along with their normal crops; beneficiaries are earning approximately Rs. 1600 per year through the sale of green fodder, medicinal plants and *Jatropha* seed. Seventy seven important species were grown by the beneficiaries of East Singhbhum, Jharkhand for their uses in various traditional medicine formulations.

### 6.2.4 Angora Rabbit and Poultry Rearing

The purpose of these projects is to promote entrepreneurship development among local people through training and demonstration of the complete package of breeding, health care and feed formulation required for rearing these animals and management practices for establishing a farm unit. Approximately 300 women from five villages of NOIDA were trained in complete package of poultry farming and 20 of them established their poultry farm units. Each beneficiary was able to earn Rs. 2500-3000 per month through sale of 6-week-old chicks in local markets. In Jammu and Pithoragarh more than 2000 women were trained in angora rabbit rearing, wool production and processing. The beneficiaries sell their handloom products in local market and make a good profit.

### 6.2.5 Vermicompost and Biofertiliser

Four nodal production-cum-training centers have been set up in each of the four districts viz. Belonia, Dhalai, Sabroom and Badharghat. 218 women have been trained on vermicomposting; 132 women are earning Rs. 5000 by sale of 12 quintal of vermicompost per annum. As a result of the success of the project, Tripura state government has planned to set up 20, 000 vermicomposting units.

### 6.2.6 Agroprocessing

Agro-processing-cum-training center was established in Jhalawar, a backward district of Rajasthan. About 60 women from different villages of Jhalawar were trained in processing of horticultural produces. Around 130 women were trained in production of soyabean based products, processing and packaging of various spices and herbal products of henna, amla, ashwagandha etc. Since bamboo and lantana were found abundantly in the region, 66 youth/women of village Baseda were trained in production of various decorative items of lantana/bamboo.

### 6.2.7 Awareness on Genetic Disorders

During the year blood groups from one thousand families were collected. Families from different level of literacy were selected from 3 different villages near Lucknow. Awareness was created on genetic disorders viz. thalasemia, sickle cell anaemia, Down syndrome and mental retardation.

### 6.2.8 Golden Jubilee Biotech Park for Women

The Park has become functional with 13 industrial sheds being occupied by the entrepreneurs. Out of these, seven entrepreneurs had set up their commercial units and started marketing their products of herbal cosmetics, biofertilisers and vermicompost, biopesticides, spices etc. and the three more are in the process of commissioning their units for rearing ornamental fish, food product testing and packaging of food products, and manufacturing of eco-friendly disposable cups. The technology resource centre has created a database for about 500 technologies developed by various R&D institutions. The Park is also conducting workshops and training programmes for prospective entrepreneurs.

### 6.2.9 Biotechnology Complex in Almora

A biotechnology complex for capacity building and economic upliftment with particular focus to women of the Indian Himalayan region has been established at Kosi-Katarmal, Almora under the aegies of the National Bioresource Development Board. Approximately, 2700 people, mainly women from 10 villages were trained in vermicomposting, fish-farming, water harvesting, cultivation of mushrooms and medicinal plants, biofencing and biobriqueting.

## 6.3 PROGRAMMES FOR RURAL AREAS

Biotechnology has great potential in improving productivity of our crops and animals, maintaining soil wealth and in creation of new job avenues for the benefit of rural population. There are various environment-friendly, easy to adopt, and low-cost packages for rural people which help in improving their socio-economic status. With this purpose, the department has

funded projects under this programme. Twelve projects of previous years continued during this year and around 5 new ones including one biovillage will be implemented. More than 3,000 persons were trained and encouraged to start their enterprises in biotech areas utilizing locally available resources of livestock, water bodies, horticultural produce, medicinal plants and agro-wastes. On an average each individual is earning Rs.1500-2000 per month as additional income through the sale of their products. Highlights of the projects in different areas are given below.

### 6.3.1 Food & Nutrition

The projects focus on improvement of nutritive value of daily diet through supplementation with local nutritionally rich, low-cost edible plants and animal species. In 19 villages belonging to Nalvari and Jorhat Districts in Assam 500 persons were trained in mushroom cultivation utilizing locally available agrowastes. The trained beneficiaries, formed 50 self help groups for producing, processing, packaging and marketing. On an average each group is producing about 11,000-12,000 kg of fresh mushroom per month; half of it is being sold in the local market and the remaining dehydrated for off-season sale. A spawn production unit has been established at the project site in Nalvari district. At Fisheries College in Berhampur, Orissa a project has been initiated for training of fisherwomen of the six coastal districts for preparation of value-added fish products such as fish finger, fish roll, chops etc. and their proper packaging as an innovative ready-to-cook and eat products.

### 6.3.2 Floriculture

Institute for Himalayan Bioresource Technology (IHBT), Palampur conducted training courses in micro-propagation of orchids and virus free lilies with a view to developing entrepreneurship among local people in floriculture and floral craft. Around 70 rural women were trained for *in vitro* cultivation of 17 cultivars of virus-free Asiatic and Oriental hybrid lilies. In addition, 40 women were trained in micropropagation of seven orchid hybrid species along with local ones. A mobile van fitted with a custom-built laminar flow cabinet and a portable genset for effective monitoring and regulated operations was used for training women beneficiaries in their villages. Two tissue culture units, one near Jwalamukhi and another near Dharmashala, were established. The beneficiaries were trained

in hardening procedures using poly-tunnels specially designed for tissue culture plants. A market tie-up was established through the Federation of Kangra Floriculturists.

### 6.3.3 Aquaculture

At Madhubani, Bihar an NGO has undertaken a project on makhana cultivation along with fish farming and has trained 120 local fish farmers in aquaculture practices. Air-breathing fish such as magur, kapari and singhi were found to be most suitable for integrated farming with makhana crop.

### 6.3.4 Medicinal Plants

More than 1500 plant species of medicinal value including some locally rare species are being maintained in nurseries covering an area of more than three hundred hectares under the project implemented in West Bengal, Uttaranchal, Jharkhand, Rajasthan, Uttar Pradesh, Himachal Pradesh and Tripura. Rural women of Darjeeling hills were encouraged to cultivate chirayita (*Swertia chirayita*) for its high commercial value. At Purulia, W.B., Sainik School students along with villagers created a rich biodiversity park on a 6-acre barren land of Sainik School. The beneficiaries were trained in methods of vegetative propagation and seed germination for medicinal plants such as *Allium ampeloprasun, Asparagus racemosus, Scilla indica, and Oroxylum indicum.*

### 6.3.5 Vermicompost and Biofertiliser

Indian Institute of Technology, Kharagpur created awareness for utilization of wastes from agriculture, forest activities, weed biomass and kitchen wastes for its use in vermicomposting. The beneficiaries were trained on use of metallic drum culture technique, cement tank, earthen pits and multi-tier structures etc. They were provided with earthworm species, *Eisenia foetida.* The fungus and bacterial culture (*Trichoderma viridae, Phanerocrete crysosporium, Paiciliomyces fusiparous and Bacillus pol myxa*) were maintained at IIT as mother stock to supply to different centers. The beneficiaries were also trained in pre-decomposition procedures and application of citrate-soluble phosphatic fertilizers such as bone meal, rock phosphate etc. at a standard dose to improve the

phosphorous content of compost. Vermiwash being rich in nutrients, enzymes and hormones was found to be an excellent spray material for improving growth and yield of the crops. The major crops grown under demonstration were vegetables such as chilli, tomato, potato, cauliflower, cabbage and leafy vegetables such as spinach and amaranthus, cash crops such as tea, and horticulture crops such as like guava, amla and sapota. At Kanyakumari, the application of *Azolla* as biofertiliser was demonstrated at farmers' field . It was reported that around 40% of nitrogen fertilizer and 25% saving of phosphate fertilizer as well as the organic built-up of soil improved; at the same time grain yield increased by 10-15%.

The scientists at Utkal University isolated and conserved 120 species of blue green algae from rice fields of Orissa state. Seven best nitrogen fixing species namely *Cylindrospermum* UU142, *Anabaena variabilis* UU147, *Anabaena sp.* UU2493, *Nostoc sp.* UU24100, *Calothrix parietina* UU1423, *A. prolifica* UU29147 and *Aulosira fertilissima* UU25118, were selected for their large-scale production and use as biofertiliser. Field demonstrations on application of BGA biofertilisers were conducted in 23 villages covering an area of 25 acre. Soil-and fresh straw-based BGA inoculums were distributed to farmers and the inoculated fields showed 6-8% increase in yield in the first paddy crop.

### 6.3.6 Seaweed Cultivation

Central Marine Fisheries Research Institute, Ramnad, trained 50 fisher-folk from Seeniappa Dharga and Vadakadu in vegetative propagation of *Gracilaria edulis*, a red algae on coir rope net. Healthy plants of *Gracilaria edulis* were collected from Gulf of Mannar Island and distributed to the farmers as planting material. About 860 kg (wet wt) of the alga was harvested from 0.6 hectare area of the sea-shore. Farmers were also familiarized about various environmental factors, water movement, sedimentation, appropriate season for seaweed cultivation and protection of the culture site from grazing by fishes. They were also trained in post-harvest technology of drying, cleaning and processing of the seaweed for producing food grade agar.

### 6.3.7 Agroprocessing

In Rajasthan, villagers were trained in preparation of value added products a common nursery was established in collaboration with local voluntary organization. Low cost nursery of certain medicinal plants were raised by 15 farmers. About 2 ha of land has been planted with bamboo in village Develkhera of district Jhalawar so as to sustain the availability of resources.

### 6.3.8 Biovillage

During the previous years, the Biovillage project at Mocha, Gujarat had benefited thousands of villagers through a reverse osmosis plant with a capacity of producing 30 thousand litre of drinking water per day, application of biofertilisers and biopesticides. The phase II of the project with more activities like application of biofertilisers and biopesticides, seaweed cultivation and waste land utilization by planting *Salvadora*, installation of biogass and Reverse Osmosis (R.O.) plants are being implemented. Another Biovillage project has been implemented in Madhya Pradesh through the State S&T Council, under which villagers from 10 villages covering 5 districts are being trained in mushroom cultivation, sericulture, vermicomposting, biofertiliser, bee-keeping, spirulina cultivation, post harvest technology, development of vegetable dyes and herbal products etc.

### 6.3.9 Rehabilitation of Earthquake Affected People of Gujarat

The Department implemented six projects for the rehabilitation of earthquake-affected people of Kutch Region of Gujarat in March 2001 immediately after the earthquake which completed their tenure on 30$^{th}$ September, 2002. The projects were on production and utilization of spirulina, vermicomposting, bio-control agents, animal feed and preventive vaccination, poly house farming and plantation with forest and fruit trees suitable for the area.

Keeping success of this programme in view, and also the requirement of the area, the Department has implemented the 'Krishi Jaiv Prodhyogiki Prasar Programme' at Bhuj, from October, 2002 initially for three years and will continue for two more years based on the

success of each activity. The programme has included all ongoing activities of the earlier rehabilitation programme so that the benefit could reach to the larger population.

Important achievements of rehabilitation programme are as follows:

- 1050 beds in 579 beneficiaries' plots with production capacity per batch of 50.4 tons were established by 30th June 2002. These units have been established in the villages namely Khamra, Ningal, Sinugra, Pantia, Modsar, Luharia, Nani, Nangalbar, Sapeba, Reldi, Kandrai, Ratnal, Sumrasar, Chakar Kotda, Bhujogi, Tharavada, Sarli, Naraintur, Surajpur, Kundanpura etc. A number of trials and demonstrations were conducted at farmers' field for different crops like cereals, fodder, vegetables, cash crops, fruits etc. These field demonstrations have encouraged the farmers in using vermicompost in their fields. The average increase in yield of various crops was recorded to be 40 percent.

- The linkages have been established with local KISAN SANGH, having 1.5 lakhs members, and other NGO's for the beneficiaries' identification. It is expected that over 2000 vermicompost units would be set up in Kutch District alone. The KISAN SANGH has also taken-up the responsibility to motivate their members to set up units on their own.

- BAIF Development Research Foundation, Baroda, provided nutritious feed for 580 cattle during the lean season in the Saraspur and Purasar villages of the Kutch district and they have received many letters of appreciation and thanks from these two villages through the Minister of Industries, Government of Gujarat.

- More than 35,000 cattle were vaccinated against foot and mouth disease (FMD) using Clovax vaccine in 22 villages of Kutch districts and 14 villages of Rajkot district. This vaccination programme benefited more than 1500 families.

- Due to the effort of the department, even during the lean period the milk production increased by 0.9 to 1.3 liter per day per animal resulting sustenance of income of families which are completely dependant on their livestock.

- More than 186 women farmers have been trained in cultivation of spirulina and its use and about 400 women have enrolled themselves for training purpose. Laboratory cultures have been transferred in to experimental tanks. Mass culture in 100 $ft^2$ tank has been commissioned. Six ponds of 100 $m^2$ capacity are under construction and their production will start soon.

- *Trichogramma* and other biocontrol agents are being produced as part of integrated pest management programme and used for training and demonstrations.

- A greenhouse has been established to raise planting material of pomegranate, amla, bel (*Aegle marmelos*), ber (*Zizypus sp*.) and *Prosopis* for plantation in the beneficiaries' plots. Suitable species of bamboo propagated through plant tissue culture have been introduced for cultivation by the beneficiaries in this non-traditional area

- So far more than 5000 families have benefited through these projects. The projects on vermiculture and vermicomposting and animal feed and preventive vaccination have attracted a large number of local people as well as media. Now efforts are being made to improve the breed of the cattle through artificial insemination.