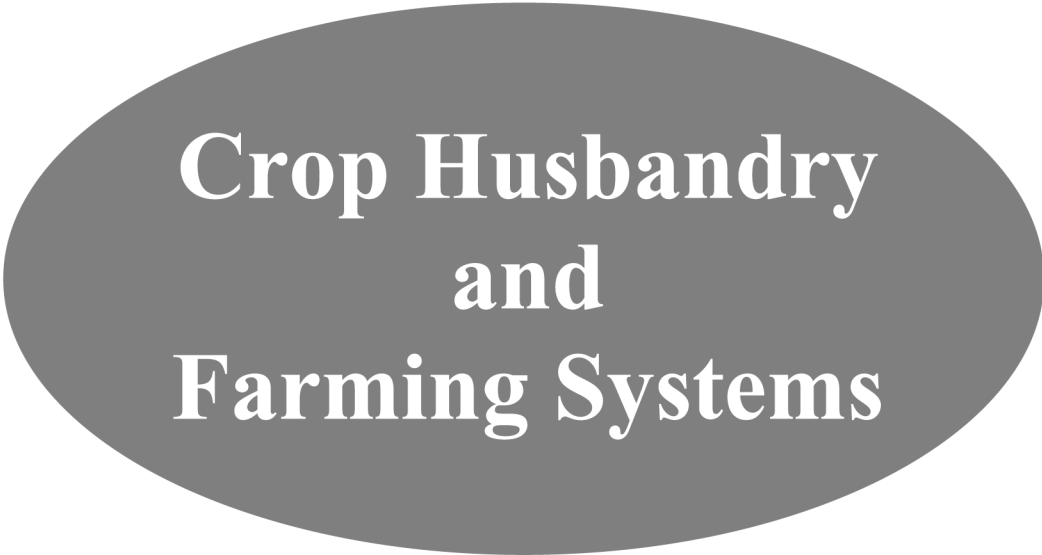




**Part Two**

**Recommendations in  
Brief**

## **Chapter I**



# **Crop Husbandry and Farming Systems**

## Crop Husbandry and Farming Systems

### A. Agro-climatic context

1. Production program under an agro-climatic zone should have zone-priority e.g. orchard development, maize cultivation or seed production in uplands of red and lateritic zone.
2. Seed production program should be drawn according to zones identified for different kinds of seeds by experts and published report. A meeting in this respect may be convened to finalize the zones for crops.
3. For increasing crop diversity as well as remunerative crop, experts be consulted and program launched. Prospect of the State to become self-sufficient in commodities like wheat, sugar, alcohol, milk, eggs, meat, major carps, small fishes, *Macrobrachium* (Galda), etc. production of pulses, oilseeds, etc. in large areas should be considered.

### B. Social context of West Bengal agriculture

1. Land reforms should be continued bringing out of litigation more ceiling surplus land and such vested land should be distributed among landless.
2. Effort to purchase land in identified 8 districts by the Government and distribute the same at the rate of 16 kottah per landless family as homestead land for building a house with toilet, etc. on 5 kottah and vegetable growing on the rest is unique and valuable and should be continued as planned. All such farmers should be extended support for their easy access to inputs.

### C. Natural resources: land and soil

#### Land and land use

1. Utilization plan for the forest floors in the fringe areas as also the orchard floors for growing shade tolerant fodders, medicinal plants, etc. for income generation and to check soil erosion, making the land more productive involving concerned departments.
2. 'Paira' cultivation of 'khesari' and others on rain fed aman lands using either of Ratan, Prateek or 'Nirmal' variety should be reintroduced to increase pulse production in the State. They are high yielding besides being low in beta n-oxalyl amino alanine (BOAA) content considered to be a causative factor of lathyrism.
3. Road side land and 'nayanjuli' farming has to be planned and taken up through SHG formation by local poor with technical advice from SAUs, Government Departments and relevant Institutions. These offer good opportunities for fodder crops and particularly semiaquatic fodder crops.

4. Proper organizations of local poor should take up suitable farming on **mine-waste land, fly-ash ponds, 'baliyari', 'diara' land, swamps, marshes, mud flats**, etc.
5. **City farming** in pots, modern green boxes, and hydroponics using manures produced from city garbage as also nutrient solution needs attention of the corporations and municipalities to make city environment soothing, and to provide citizens a valuable respite and freshening. For this purpose surplus land space in urban houses, their roofs and verandas, verandas in flats and all other space should be used centering round this; 'services' supplying seedlings, saplings, manure packets, ornamental fishes, small aquaria, fish feed, potted ornamentals or even poultry cages for roof-top may grow. Urban and periurban farming are now making significant contributions to the food needs of city people. East Kolkata wetland is considered to be biggest of the later kind in the whole of Asia.

#### **Degradation of land**

1. One 'Barrage and River Desilting Authority' should be created by Union Government to take charge of this required regular reclamation work for bunds, barrages, reservoirs and canals in Eastern India particularly in the lower Gangetic plains as a regular job.
2. The State Government should also create such a body authorizing them to reclaim water bodies, rivulets, canals, etc.
3. Large scale tank excavation program under district authorities in concerned districts in Teesta-Mahananda basin and Damodar-Ganga basin may find important position in development.
4. Water bodies that are locked in 'sorikana' or multiple ownership problems should be brought under a functional cooperative or so among the owners to bring them under fish farming or at least under aquatic crops.

#### **Soil erosion and conservation**

1. Soil conservation works under NWDPRAs should be continued aggressively or revived in a massive scale through people's participation taking PRI as leader. People's teams can be constituted in the line of 'Forest Protection Committee' keeping some provision of remuneration especially in the districts of Darjeeling, Purulia, Bankura, Birbhum, West Burdwan and Paschim Medinipur. Soil conservation works should be organized by Department of Agriculture in consultation and preferably jointly with Forest Department experts utilizing NREGA funds.
2. To reduce acidity North Bengal soils need be lime treated in small doses continuously for years and not total in one time application. In the west (red lateritic zone) however liming should be done applying total required in one time.

3. Erosion due to slope can be minimized using barrier crops (*Vetiver*, *babui*, etc.) on 'ails', or by creating conservation canal/bund across the slope.
4. Salinity problem in coastal soil could be overcome by growing tolerant crops (chilli, sunflower, cotton, coconut, sapota, bitter gourd and transplanted rice depending on market demand). Rain water harvest and storing in tanks by landshaping helps cropping in rabi season when the salinity problem becomes acute. The State Government should take up necessary steps to introduce integrated crop-livestock ecosustainable farming practices in the coastal regions.

### **Soil testing**

1. Soil Test Laboratories for testing pH, and estimating organic carbon, nitrogen, phosphorus, and potash in soil should be established at each block with initial Government support but to be run as an enterprise by local educated youth that are trained by SAUs against nominal fees.
2. District level Soil Test labs should have micronutrient analysis facilities and established and run by private groups with some initial Government support.
3. Block and district labs should be in a network to be looked after by Rural Development Department with State Laboratories and Soil Science Departments of SAUs to develop uniform policy for their operation.

### **Soil fertility management and improvement and productivity increase**

1. Based upon soil test results pH of lands using chemical fertilizers like urea, ammonium sulphate, or DAP should be monitored and necessary liming program be followed.
2. Monitoring organic carbon content of soil application of organic matter to soil should be made a regular practice. Farmer should be constantly chased to inspire producing and applying organic manure and biofertilizer to soil.
3. Farmer should be convinced growing green manure crop and planting organic matter supplying trees on the bank of his pond or on 'ail'.
4. Farmers should be convinced not to waste animal dung or droppings for fuel purpose. Planting of fuel wood plants like 'subabul', 'sonajhuri', glyricidia, etc. should be advised in homestead spaces.

### **Organic matter and soil**

1. To save our agriculture and soil and to reach the potential productivity of a crop species farmers should consider switching over slowly and partially to organic farming practices without compromising yield increase. Partial substitution will bring down cost of production and offer a premium price for the produce especially if produced through non pesticidal management (NPM). Under improved fertile soil response of chemical fertilizer will be better.

2. Each farmer family shall compulsorily have a compost pit or heap and produce regularly sufficient quantity of compost/ vermi-compost/ phospho-compost/ super-compost
3. Each farmer should have liquid manure production system in an earthen pitcher to cause retting in water of easily decomposable leaves and dilute the solution for spraying on crops.
4. Gram panchayats should take initiative to produce enough 'Dhaincha' seeds required for the village identifying growers interested. Price to be fixed has to be remunerative.
5. As a collaborative program with agriculture Forest Department should launch social backyard forestry in rural poor families to provide substitute fuel for cow-dung cake.

#### **Bio-fertilizers**

1. Initially panchayat samities / blocks should establish bio-fertilizer production plant for the block area to be run by trained village women for selling to farmers. Technical plan of the BFPP, culture of the organisms, and training will be the responsibility of KVKs, RRS, RRSS, and SAUs. The program should include rhizobium, azotobacter, azospirillum and PSB initially.
2. Azolla production and maintaining culture can be taken up by trained women in each Gram Panchayat where water bodies are available. Need of Azolla for transplanted rice and poultry feed for the village should be met.

### **D. Water in agriculture**

#### **Water resources and irrigation**

1. De-silting of reservoirs, canals and rivers should be taken up seriously even though it requires huge investment. First of all a national level authority for reservoirs and canals have been suggested. Secondly the work on entire stretches of canals, channels and small rivers and creeks should be disbursed among adjoining local bodies all over the State keeping regular annual budget provision apart from the ongoing scheme budget.
2. Tank excavation in drainage choked areas should be considered imperative. South 24 Parganas model associated with land shaping and IFS should be followed. Saved resources and public properties shall ultimately justify the expenditure. Planting on the banks should be included.

#### **Development of water resources**

1. As a long term goal ground water tapping should be gradually minimized or stopped. Creation of substitute surface water store should precede this. Annual average rainfall all over the State being more than 1200 mm the quantum of water received appears sufficient provided most of it is harvested and stored.

2. Introduction of drip, sprinkler, etc. methods of micro-irrigation wherever possible may reduce our total water consumption for irrigation of orchards, plantations and vegetable fields.
3. In command areas construction of field channels should be taken up as a major development program since it will minimize loss of water.

#### **Block-level water budgeting**

1. Extension workers and agronomists in villages in all meetings or training programs should discourage flood irrigation and train people about storing and judicious water use.
2. In boro fields and in up and medium land of aman rice fields System of Rice Intensification (SRI) should be introduced. Agronomists of North 24 Parganas and Bankura may extend their expertise. Growing transplanted rice without standing water as in SRI will reduce water use to a great extent besides significantly boosting yields.
3. In view of the scarce water resources of the State and future threat in relation to availability of irrigation water both in respect of quantity and quality for raising crops, an advisory committee is to be made for micro level crop planning and water budgeting in the state.

#### **Soil moisture management and 'Paira'/ 'Utera' system**

1. A paira crop either of khesari, lentil, mustard, spices or dhaincha as green manure should be introduced in massive scale in the districts of Howrah, Hooghly, Burdwan east, Nadia, Murshidabad, Malda, North and South Dinajpur, Jalpaiguri, Coochbehar, Purba and Paschim Medinipur and North-24 Parganas in rain-fed aman fields.
2. Depending upon requirement or market demand paira crop should be selected from a range of suitable legumes specifically khesari, lentil, etc.

#### **Drainage**

1. Various flood protection works, clearing of drainage congestion and anti-erosion measures as recommended earlier are the steps required to be taken.
2. Protective ring bund should be erected to arrest excess run off load and sea water intrusion.
3. Intermittent surface drainage to reduce salt load in summer is required.
4. Conjunctive use of brackish surface water and fresh ground water will be useful.
5. Ground water recharge system development to minimize water logging suggest more interventions.
6. Plans for building three main drainage lines along rivers Teesta, Jaldhaka and Mahananda for North Bengal and three main drainage lines along rivers Bhagirathi, Damodar and Ichamati for southern and western areas of West

Bengal should be drawn and considered. Linking other areas with these mainlines utilizing other minor rivers according to convenience will be required.

#### **Management of calamities and flood**

1. Using the speed of flowing water the central line of a river should be kept open. Erecting artificial obstructions on banks silting on banks should be induced to create 'Char lands' on the banks of the river.
2. Central authorities should be established for regular planting on the banks and excavation of barrages and reservoirs.
3. Central authorities should take charge of de-silting of major rivers like Ganga, Hooghly, Teesta, and others following 'Central line policy'. This is expected to reduce bank collapse.
4. State Government should also create bodies to regularly excavate the central line of other rivers to allow free flow of water.
5. Dykes and bunds in coastal areas should be raised to check ingress of tidal water from sea.
6. Forest Department should consider implementation of projects for river bank planting in partnership with local bodies concerned.

### **E. Resources and inputs**

#### **Machinery and mechanization**

1. Companies having reputation of manufacturing agricultural machineries should be contacted for establishing factories in West Bengal to meet the fast increasing requirement of the State.
2. District level training cum implement supply shops are necessary for agricultural development. Entrepreneurs should be encouraged through training and facilitating capital on loan from financial institutions.
3. State level training institute for agricultural equipments and machineries, their designing and specifications is needed. This should be organized by the SAUs.

#### **Bio-resources and agriculture**

1. People's Bio-diversity Register of West Bengal is a stupendous task to be completed. However, the initiative already taken in some cities and villages should be encouraged by all-out people's participation. Environment Department's presence in the work should be made perceptible in all corners of the State. The program has to be spread in all the villages and cities of the State.
2. Conservation of bio-resources *in situ* or *ex-situ* as would be required particularly for those having great agricultural prospects, their registration and commercial exploitation should be taken up urgently.

**Fertilizers and manure**

1. Government of India should be approached for early revival of the fertilizer factories of the east. Along-with this private factory owners in the State should also be convinced about re-opening of their factories.
2. Farmers should be advised about use of lime for correction of pH of their soil that has turned acidic due to long use of chemical fertilizers like urea, ammonium sulfate or DAP.

**Manure: production and use**

1. Every farm family should be approached to have its own compost heap or pit utilizing all organic raw materials around. In the event of the family having no cattle, excreta of small animals will also be equally good substitute for cattle dung for compost making.
2. Every family shall have a liquid manure pitcher to ret in water collected soft, succulent leaves available in the premises and diluted to be used as spray fertilizer. The use of adequately fermented (anaerobic digestion) of diluted cow dung- cow urine mixture along with molasses and powdered pulses that are now being routinely used by organic farmers in Maharashtra with great success needs to be promoted.

**Bio-fertilizers**

1. Each block should facilitate local youth to establish bio-fertilizer producing unit to supply at a reasonable price packets of these fertilizers to farmers. Such entrepreneurs shall begin with only one or two kind of microorganisms like rhizobium, azotobacter, PSB, etc after having training and cultures from SAUs and other reputed institutions and capital from nationalized banks. Similar packing, price, etc. should be followed all over the State under technical coordination of the Department of Agriculture.
2. Azolla production program may be taken up by families having a pond or so after being trained and supplied with azolla culture (matter crop) initially required for the purpose by the Department of Agriculture.

**Organic farming**

1. While appreciating Government of West Bengal's decision to go for 64 bio-villages in 2008-09 financial year the Commission strongly recommends setting up of at least one appropriate fully organic biovillage in each block during the ensuing financial year. BCKV's small organic farm may serve as a model for organic management. The Department of Agriculture may discuss with scientists in SAUs to select villages and determine the models and other details.
2. The three hill subdivisions of the Darjeeling district should be immediately brought under total organic agriculture with certified organic management.

**Soil ameliorants**

1. Effort of using lime/ basic slag and purulia-phos and tamarind seed powder to ameliorate soil that needs this should be planned based upon requirement of the soil, proximity of raw material source, quantity required, etc.

**Quality seed production technology**

1. To achieve self-sufficiency in seeds for important field crops the West Bengal State Seed Corporation (WBSSC) along with participation of other suitable partners should chalk out appropriate plans and launch a comprehensive seed production program for the State.
2. Government farms should be developed as model of seed production farms and besides producing seeds it should act as nucleus of seed village to be organized around the state farms.
3. Horticulture Department should launch appropriate programme for production of seeds of important vegetables and flower crops to meet the requirement of the State. Tribals in Paschim Medinipur, Bankura, Birbhum and Purulia should be trained and inspired for production of seeds of amaranthus, okra, spinach, lablab bean, gourd, pumpkin, etc.
4. Breeder and Foundation seed production and supply should be ensured. SAUs and State farms have to share the responsibility.
5. Primary Agricultural Cooperatives (PACs) have to take responsibility of producing certified seeds by establishing seed villages like Gontra, Nadia. NGOs may also share the responsibility provided they adhere to specifications prescribed by Certification Agency.
6. SHGs should be organized to take up the job of threshing, drying, cleaning and grading of produced seeds.
7. Rural farmers should be trained to produce high quality seeds especially of the locally adapted crop cultivars and properly maintain their genetic purity and physiological qualities to save the seeds for themselves and also for exchange with neighbours.
8. Considering the importance of production and certification of good quality seed in relation to augment of production and productivity of different crops in the State an advisory committee should be made to make the State self sufficient.

**Hybrid seed production**

1. Seed producers having link and access to established hybrid seed producing companies in South India may be encouraged to take collaborative program of production of hybrid seeds of rice, maize, oilseeds and pulses (if there be any recommendable variety) and selected vegetables in the State with some facilities by State Government like providing land.

## **Seed production for crops with commercial prospects**

### **Rice**

1. Organized initiatives are urgently required to enlist our high quality crop varieties and proceed for their registration under GI through Patent Information Center, Kolkata and then invite enterprising seedsmen to take over for commercial use.

### **Wheat**

1. Private seed producer should be selected for producing quality wheat seeds required by the State, store them and supply during the season. Payment by growers shall be after being satisfied by growing the crop.

### **Jute**

1. Selected private seed producer of the State should be given the responsibility for quality jute seed production in the State and supply the same to growers taking payment after the crop has grown satisfactorily.

### **Potato**

1. State can very well have large tissue culture space to develop a micro-tuber laboratory. This unit should be under private control or at SAU to take charge of producing quality micro-tuber seeds for the growers under technical supervision of scientists of SAUs to evade regular transport expenditure as also some dreadful diseases (late blight last year) coming through tuber seeds from other states.
2. In the last season 195 q of potato foundation seeds of 4 varieties and only 45 q of certified seed of Kufri Ashok were available at State Seed Farm, Anandanagar on 1<sup>st</sup> week of September. This should also be strengthened to meet a part of the requirement.

**Comment:** A regular transparent macro-potato-seed production network should identify the supplier of Foundation seeds, grower of Certified seed and so on indicating the quantities to be produced. While this chain of macro-seed tuber production in potato requires 4-5 years of time with increasing chance of infection outdoor, the indoor mini and micro-tuber production program takes 2 years and the seed remains free from pathogen infection.

### **Pulses**

1. Selecting the varieties program for seed production of pulse crops like chickpea, pigeon-pea, lentil, mung, kalai, and khesari should be produced in farms in Red and Lateritic Region under the supervision of the Department of Agriculture.

### **Oilseed**

1. In Berhampur farm certified seeds of oilseed crops like mustard, groundnut, sesamum, niger, and linseed should also be produced in quantity required by the State.

**Maize**

1. Maize seed production both of selected composite and hybrid varieties should be organized in western districts. With proper management practices seed yield may reach above 5.5 tonnes per ha. This will fetch good return for the farmers joining the program.

**Seed processing**

1. Number of regional seed processing, packaging and storage infrastructure requires to be developed in State-private partnership.
2. People of producer villages should be organized into cooperatives or SHG to purchase from growers, undertake primary processing and then sale to the subsequent, packaging and storage for sale.

**Fish seed production**

1. Small hatcheries for catfish, prawn, mura, rohu, tilapia, and galda (*Macrobrachium*) should be organized facilitating rural youth with training, bank loan and infrastructure development.

**F. Production systems****Crop production and crop sequence**

1. At the onset of monsoon rice bean should be grown as fodder and food crops that can act as a cover crop to reduce soil moisture loss besides food and fodder.
2. Drought resistant *Stylosanthes seabra* and Guinea grass should be grown in red lateritic area. *Coix spp* can be grown in saline area to meet the fodder requirements of the respective zones. Improved varieties are Bidhan Coix-1, Makuni guinea grass, Bidhan rice bean-1 and 2, and EC 408405 or Humilis for Stylo.
3. Top feed species like subabul, *Glyricidia*, and *Inga dulcis* should be seeded in new bunds in July or on sloppy lands (50%) also preferably in east-west direction.
4. Selected shade-tolerant fodder species should be grown in the floor of forest fringe and orchards.
5. Considering that a large area of cultivated land in this State is under aman rice crop sequences should be planned centering it. However, the duration of aman rice in field is to some extent regulated by the variety to be put in the desired crop sequence. Under all circumstances where water control is possible, an adoption of System of Rice Intensification (SRI) is strongly recommended.
6. Each combination should preferably include one leguminous crop.
7. In rainfed area paira cropping with khesari or lentil or mustard or even kharif or sunnhemp avoids tilling of land and shortens duration.
8. In view of the large deficit between present requirement and production of pulse and oil seed crops in the State as well as its magnitude in the coming years, an

advisory committee is proposed to be formed for pulses and oil seed crops in relation to its strategic inclusion in the cropping sequence throughout the State with an aim to reduce the gap between requirement and production.

### **Farming system**

1. Farming systems matching with farmer's economic strength and requirement should be planned based on his own and local resources and possibilities. However, every farm-family must have animals small / medium / large in manageable numbers, fish culture in his pond, bee-keeping box under his one or two fruit trees to support his crop agriculture, animal rearing leading to income increase, human resource utilization and family nutrition.
2. Mutual dependence between crops, animals, fishes, etc. should be best exploited to harvest the synergistic benefit that is so much required for livelihood and nutrition security of the farming family and income and employment increase for family members.
3. An integrated farming system model have food-grain, vegetable, flower, one or two top-feed fodder and fruit-plants, spices and medicinal plants along with one or two cattle, goat, sheep or pig, duck and fowl, bee boxes, fishes and others as is possible to ensure food, nutrition, income, employment for the family members.
4. The Commission strongly recommends the adoption of the System of Rice Intensification (SRI), in situations permitting regulation of water, besides intensive research and extension programmes of SRI in our State. Incorporation of seed invigoration in SRI with the ultimate objective of sowing sprouted rice seed directly in the field avoiding transplantation should be critically studied to avoid raising of nurseries and the more difficult-to-do transplantation of very young seedlings in the field.

### **Crop diversity increase**

1. Selected crops traditionally grown in some parts of the State may be introduced in some more areas. Considering the need for selection and adjustment of some of them according to the agro-climate, economic conditions and need of the farmers the system of introduction be decided.

### **Farm forest development**

1. In the barren uncultivated lands of lateritic and other regions farm forests should be developed generally by planting sonajhuri, gamar, teak and eucalyptus for meeting requirements of fuel, fodder, timber, etc. Growing rice, groundnut, black-gram, or cowpea between rows of the plants mentioned above will provide more food and biomass.

2. For saline zone nurseries producing sonajhuri, jhau, siris, arjun, neem and white poplar should be established to supply seedlings for wasteland planting program to launch.
3. In laterite tract nurseries for producing and supplying seedlings of saal, karanja, mahua, siris, khaer, babul, palash, and mahaneem to cover wastelands should be established.
4. For wet lands in different areas karanja, arjun, sisu, snai, jarul and mysore gum are selected species. Waste wet lands need these seedlings for planting.
5. For ravine area seedlings required to be produced and planted are gamar, sisu, teak, jhau, and black siris.

Village people should be asked to form groups to take up the job of seedling production and planting. Forest Department has to provide training and seeds, etc.

Following the system being developed in Vietnam it is suggested to utilize forest floor engaging more fringe-area people in addition to the existing forest protection committees, and issuance of permits for collecting minor forest products.

#### **Cultivation of edible microbes**

1. In each block at least one Mushroom Seed Production Centre (MSPC) should be established. Training youths (2-4 per block) in this job and supplying culture by SAUs, while providing loans to such persons for infrastructure development may start the process of such development.
2. About 100 women surrounding each MSPC should be trained by mushroom seed producers to grow mushroom after purchasing seed packets from MSPC and arranging fresh straw after harvest of rice.
3. Separate team / teams with members of mushroom growers should be formed to market mushroom in nearest town.
4. Mushroom grown refuse should be dried and ground into manure powder since it contains 2-4% nitrogen due to presence of mycelium.

#### **Insect based production**

##### **Mulberry silk**

1. Development of mulberry gardens on marginal lands on the one hand and establishment of family based center for production of different items for silk culture infrastructure, reeling centers and market for selling polu on the other are required for increase in silk production.

##### **Tasar**

1. Programs should be taken to spread tasar cultivation on host trees in lateritic zone on a large scale.

2. Indoor cultivation of tasar insect following technology developed by BCKV should be initiated in concerned areas.

#### **Eri or endi**

1. In different corners of terai zone castor areas should be developed at least in 100 spots on marginal lands to boost up cultivation and production of eri silk.

#### **Muga**

1. Muga production should be spread in Coochbehar by increasing 'som' and 'soalu' planting. Groups may be formed to look after this program in partnership with the Forest Department.

#### **Lac**

1. Processing of lac and its marketing should be emphasized so that the producers get remunerative price.
2. Distribution of lac-stick should accompany training of the persons selected for the job.

#### **Bee keeping**

1. Awareness generation on bee keeping is essential not only for honey but for sustaining the productivity of agricultural and horticultural crops as well as many other forest plants that are cross-pollinated by bees; as such necessary steps by all concerned organizations on an emergency footing should be initiated.
2. Bee keeping should be a family program for every cultivator family in all the agro-climatic zones. This will necessitate production of bee boxes in large scale in all the districts. Persons should be trained and supplied with specifications.
3. Extractors should be manufactured by local artisans providing them training and specifications.
4. Packing and marketing of honey produced are very important issues.

This area of production system can occupy a major development program involving village people after obtaining training and technology from SAUs.

#### **Specialized farming**

1. Roadside farming should be organized both in terms of extending support through providing technology, planting material and growing the crops and also marketing since roadside farming is done by poorer section of people.
2. Amateur flower and vegetable growers mostly in cities should be given training, while supplying planting material. Unemployed and non-student youth

may be encouraged to take up this profession of pot cultivation, potted plant supply, etc.

3. Waste lands left by coal miners may be brought under cultivation of different crops/ trees. The SAUs should take up necessary steps to develop technology and farming mode for their best use.
4. Selected crops be grown by SHGs on sandy river banks and diara lands in post-monsoon season with spot application in 'thupi' of organic manure.

## **G. Crop protection**

### **Environment, climate change and disorders**

1. Planting selected trees in ails (field boundaries) lying in proper direction may contribute reduction of carbon dioxide in air by more efficient carbon assimilation. They also act as effective bird perches and provide loppings for compost making, fuel, etc.
2. Conservation of soil and water would correct problems and thereby reduce cyclone *i.e.* hazards and droughts.
3. Providing the bare land a crop round the year covers it suitably.
4. Minimizing tillage on soil through paira cropping, and organic farming is required.
5. Correctives for all the specific problem types mentioned above also can protect crops or their produces to some extent.
6. Agricultural scientists, engineers, meteorologists, statisticians of repute in the State should be invited to sit together in a Standing Committee on Disaster Management to design the work plan for the coastal districts. State Council of Science and Technology and Department of Environment may also do the needful.

### **Crop protection from pests and diseases**

1. Allowing natural eco-system in and around the crop field to continue which routine pesticide use be avoided helping the natural balance of pests-predators or pathogens-suppressor to continue.
2. Use of mild repelling agents like kerosine emulsion, or tobacco decoction, cattle urine preparations or erecting birds' perch or dead toad/crab 's foul odor can be made.
3. Use of traps – light, pheromone, etc. should be launched in a massive way.

### **Bio-pesticides and botanical pesticides**

1. Blockwise bio-pesticide production centers have to be established. Rural youth should be trained and supplied cultures of *Trichoderma*, *Pseudomonas*, *Bacillus*, *Beauveria*, *Metarrhizium*, etc. by SAUs and facilitated to receive capital and build up infrastructure for the purpose.

2. Growing and cultivation of identified trees and crops to supply raw materials of botanical pesticides should be initiated. Production centers for neem and citronella oil, EC or granules, should also be developed with lower investment. SHG should be organized.
3. Training and culture of *Trichogramma* and other insect predators and parasites should be mass produced in the form of egg-cards for sale to farmers.
4. Training of extension staff and innovative farmers on identification of NPV affected larvae in crop field and procedure of their multiplication should be done by KVKs and RRS of SAUs.
5. Taking technology from SAUs VAM production on roots of potted plants like maize and its collection and application on to the roots of some trees at the time of planting is recommended.

#### **Plant health clinic**

1. Plant health clinic should constitute a part of Agri-clinic at the block level having experts supported with digital plant health guide in CD at the block 'Tathya Kendra'. The digital PHG should be developed by selected experts of the State given assistance in CD development under guidance of the universities.
2. Transplanted rice cultivation should shift to SRI system in 'Boro' and up & medium aman lands and increased weed pressure should be controlled exclusively with paddy weeder. Direct seeding of pre-invigorated sprouted paddy seeds should be developed to avoid the problem of very young seedlings (2-leaf stage) without injury to the tender roots.
3. Local artisans should be trained and provided specifications for producing paddy weeders required in a village.

#### **Registration of local elite varieties**

1. Documents should be prepared for our elite and special varieties like the rice cultivars tulaipanji, radhunipagol, badsahbhog, kanakchur, sitasal, sonamung, black gram, cucurbits, kalo kachu, pathar kuchi, tomato, akashmukhi chilli, Darjeeling tea, lakshmanbhog, himsagar, fajli mango, black bengal goat, garole sheep, ghungroo pig, maurala, parse, bhetki, kachki, tangra and many other fishes.
2. Cultures of *Rhizobium* strains, *Azotobacter*, *Azospirillum*, PSB, *Volvariella*, *Calocybe*, *Pleuratus* mushrooms, *Trichoderma harzianum*, *Bacillus subtilis*, *Pseudomonas fluorescence*, etc. cultures should also be registered.

### **H. Post harvest activities**

#### **Harvesting, storage, grading, packaging**

1. Farmers' awareness development meetings should be organized to tell them about correct stage of crop and field for harvest dealing each crop separately.

2. Specifications of drying grains and spot checking of moisture content have also to be taught. Jute retting in water bodies should be at least improved by use of concrete weights. Ribboning and retting in concrete tanks with less water should be introduced on a large scale. Microbial culture use should be popularized.
3. Grading system has to be introduced in case of all the crop produces so that the farmers get remunerative price.
4. Each village should plan development of storages with emphasis on major produces of their fields. Each block should plan for at least one multi-chamber cold store.

### **Agricultural produces and food processing**

#### **Rice**

1. Modernization of rice mills to minimize broken grains and quickly polish out bran to extract oil is strongly recommended.
2. Husks should be used to generate electricity as is already being done.

#### **Jute**

1. Geo-textiles should be produced and used for preventing land slides, erosions and in road-making. SHG should be organized to take up production program of woven and non-woven products from jute through development of an effective marketing system.
2. Paper pulp and paper production industry development using whole jute plant is to be seriously taken up by appropriate industry house(s).

#### **Sugar and alcohol**

1. Sugar beet factory in South 24 Parganas producing alcohol should be revived by producing sugar beet nearby to run the mill for 100 days. Running the mill for another 200 days in the year will require saccharification unit and supply of rice grains. Even low cost F-grade rice from storage godowns serves the purpose. The mill should be authorized for bottling of alcohol and use of sugarcane molasses for alcohol production that has good demand.

## **I. Technology, infrastructure and agricultural development**

### **Biotechnology**

1. The West Bengal State Agriculture Commission reiterates its decision on the ban on field trials and commercial cultivation of GM crops in West Bengal. Following the release of the IAASTD report it will be wise to keep watch on the highly controversial issues including GM crops the development of which is entirely under the control of multinationals. Environmental and biosafety issues as well as difficulties of the small and marginal farmers should be satisfactorily resolved before introducing GM crops in the State.

**Soft biotechnology**

1. Private production centers of tissue culture plants of banana, coconut, citrus, mahua, ginger, large cardamom, etc. should be encouraged.
2. Regulation of the quality of such products is very important and should be organized by the Government. Establishing freedom from viral or bacterial infection through apical meristem culture requires expertise, as such, infrastructure, so important for future of agriculture should be properly developed.
3. Production center of micro-propagated saplings of medicinal plants like sarpagandha, aswagandha, thankuni, kalmegh, chirata, ginger, turmeric, ghritakumari, tulsi, citronella, neem, brahmi, pudina, amlaki, nayantara, anantamul, basak, etc. may help in saturating different areas of the State with medicinal plants that are in good demand.

**Computer, compact disk and IT for agriculture**

1. Call centres at each block with digital technology and knowledge bank with one IT personnel of the same village should be established to offer advices to farmers taking it from the conserved CD through a computer.

**Agricultural wastes and bioenergy**

1. Following WEBREDA technology small bioenergy generation plants should be developed in each gram panchayat using agricultural wastes including rice husks etc.
2. Bio-gas plants should be established by farmers having livestock for meeting the energy-need of the family kitchen using animal excreta and chopped greens and crop residues.
3. The State Government should explore the possibility of using NREGA funds for labour use (in the installation of gobar gas plant) besides giving adequate subsidy for materials such as those used in the construction of gas chambers, pipelines, burners, etc.

**Rural infrastructure for agriculture**

1. Besides having more north-south and east-west 4-6 lane corridors of National and State Highway status villages should have road connections through PMGSY.
2. Electrification of all villages, increased irrigated area and assured supply of quality inputs are necessary.
3. Community threshing floor, storage godowns and cold store are required in every village.

**Industry and growth of agriculture**

1. Industrialization and urbanization should continue to extend indirect support to agriculture by providing better market as also machineries, inputs for increasing production and processing facilities for providing better for agricultural produces.
2. Small industry development with organized marketing of their produce should continue to grow with all government support.

Industry development and urbanization should be encouraged to minimize human pressure for job in agriculture. Population dependent on agriculture should come down to avoid further pressure on land fragmentation of small holdings in course of time.

**J. Rural development through panchayat**

1. Panchayat structure in the State should be utilized for coordinating the services to meet the requirement of farmers with technical experts of the line departments particularly at block or PS level.
2. At gram panchayat and block level, personnel should proceed in development work in unidirectional way following the course outlined by Rural Development Department. Creation of Rural Engineering and Technology Cell and conducting all public works and road development as also irrigation and public health under common departmental leadership is required for speedy and desired progress of agriculture.
3. Capacity building through trainings of different category of people should be organized by panchayat samitis with technical experts of line departments.
4. Line department activities in regard to agricultural development in a village or block or district be in coordination with panchayat and sister line departments.
5. Input production program through Comprehensive Area Development Corporation (CADC) by Panchayat and Rural Development Department (P and RD) should be in coordination with line department programs of input production and supply.

**K. Rural development and organizations****Panchayati raj**

1. At village level Gram Panchayat Pradhan should have some village youth as secretary for guiding and leading activities of line departments like Agriculture, ARD, Fishery, Horticulture and Food Processing, etc.
2. Panchayat samities at block level should have identified village youth as assistant to Sabhapati to lead and coordinate implementation of line department activities and implementation of different development projects.

**Self-help groups**

*Details given in separate section.*

**Cooperatives**

*Details given in separate section*

**KVKs**

1. KVKs should organize trainings round the year for capacity building of the farmers.
2. KVKs should arrange 'counseling camps' in farmers' field for taking some urgent message to the farmers.
3. Special efforts should be made to meet aged and experienced farmers of the village and record in detail his experiences and traditional knowledge and technology.
4. KVKs should offer under approval of SAU – certificate and diploma courses to educated rural youth and SHG members to develop enterprise.

**NGOs**

1. NGOs should be encouraged to participate in developmental work of villages especially backward ones maintaining transparency and auditability of their organization to the Rural Development Department.
2. Rural Development Department should hold annual meeting for stock takings and progress about their activities and for assigning any responsibility for development work.

Selected NGO specially involved in agricultural and rural development works in the State should be considered for allocation of government sponsored project funds for specific rural welfare-oriented programs.

**State agricultural extension network**

1. Different kinds of trainings for different categories of extension workers should be planned, developed and held by ATC, KVK, RRS, RRSS and SAUs round the year for capacity building of the personnel / farmers.
2. State level expert committee should be constituted of agri-academics for formulation of training courses every alternate year incorporating newer ideas and technologies.

Innovative and knowledgeable farmers should be identified (5-10 per village) and brought under Government extension programme against contractual payment for disseminating one particular technology to a population of farmers.

**L. Agricultural marketing**

*Details given in separate section.*

**M. Support services: agricultural education, research and extension**

*Details given in separate section*

**N. Comprehensive farmer insurance scheme**

1. Regarding risk coverage under the crop insurance scheme Gram Panchayat should be treated as a unit.
2. In order to insulate the farmers from financial distress and in the process make agriculture financially viable, production of all the crops, right from sowing to post-harvest operation, including market risks should be covered under comprehensive insurance. The risks covered should include:
  - (a) inadequate germination of seeds sown owing to poor quality of seeds, adverse climatic conditions or natural calamities, below a threshold germination level,
  - (b) inadequate yield of crops below a threshold yield level owing to lightening, hailstorm, massive pest attack, massive crop disease and other natural calamities,
  - (c) fall in market price of the crop at post-harvest stage below the Minimum Support Price, and
  - (d) damage of harvested crop owing to inadequate storage/ processing/ transport facilities.
3. The comprehensive Farmer Insurance Scheme should also cover the risk of death and incapacitation of the farmer in accidents like lightening, snakebite etc. while working in the field.
4. The said Insurance Scheme should further cover the damage caused by massive soil erosion owing to change of course of the rivers, earthquake etc.
5. Since the premium for Comprehensive Farmer Insurance for the proposed coverage will be considerably high, the Union and the State Governments may bear at least 90% of the premium cost for the small and marginal farmers.

The Insurance Scheme should be transparent and wide publicity should be given to it by involving Gram Panchayats.

**O. Backward villages and development**

1. All the steps being taken should be further emphasized with an eye to the people of scheduled castes, scheduled tribes, backward and minority communities as also the women folk and children of the villages concerned. Rebuilding of soil fertility by improving ecosystem services is urgently needed using local organic resources that would not require increased investment.

2. Development of roads in the villages connecting urban areas and reclamation of water-bodies to bring low lands under production should get priority.

All out employment generation should be made through development of services, roads, transport and communication development and primary processing and wherever possible livestock integration of crop husbandry systems. Market and storage system development, small scale, cottage, medium industries development and intensive mixed farming also generate employment and income. To provide basic urban amenities in villages should be the goal for rural development.