

## **WEST BENGAL**

### **Objectives of West Bengal Biotechnology Programme:**

Over the past 25 years implementation of rural land reform programme has unleashed an economic resurgence in West Bengal, which is expected to prompt its rapid stride into a highly industrialized state. The vision presented here would ensure that all sections of our society are equal partners in the march towards progress. Twentieth century gave birth to two technological revolutions in the areas of information technology and biotechnology. These two are expected to touch every sphere of human activity. Information technology has already matured and has given rise to huge opportunities for revenue generation and jobs. However, before this wave begins to subside we should be ready for growth in another quarter so that the natural and human resources of West Bengal are utilized to their fullest potential. Hence the need of the hour is to harness these resources for developmental activity through a visionary policy in the area of biotechnology. It should be emphasized that the strengths of West Bengal lie in its highly successful agriculture sector. It also has untapped unique resources in the mangroves unlike any other country in the country. Focusing on these strengths, a biotechnology vision statement for West Bengal has been developed which will further enhance and organize the existing strengths and strengthen the weaker but potentially important development programmes.

Our mission is to ensure scientific and technological empowerment of West Bengal's human resources. We aim to create a strong infrastructure both for research and commercialization. We intend to launch a major well directed effort for generation of products, processes and technologies to enhance the cost effectiveness and productivity of agriculture, modern medicine, pollution control, biodiversity conservation and bio-industrial development.

In totality, we aim to-

1. Generate skilled manpower
2. Enhance the knowledge base
3. Strengthen existing infrastructure and create new infrastructure
4. Map the bioresources of West Bengal
5. Develop entrepreneurship programme in the rural sector, special programmes for women's development, SC/ST and enhance industrialization at the cutting edge of science.

We have identified specific areas where Biotechnology can be used to enhance and strengthen the resources of West Bengal. These areas would utilize research leads, which have been identified from basic studies and modification of existing resources for their different approaches required for incorporating biotechnology in the rural, industrial and societal development of West Bengal.

## **The Salient Features:**

### **Introduction to Biotechnology at the grass roots level**

- Awareness of biotechnology in the rural sector for the upliftment of the weaker sections of society and to incorporate modern technologies in rural society.
- Benefiting rural development through Biotechnology.
- Developing biotechnology programmes for participation of women in the rural sector.
- Developing biotechnology programmes involving SC/ST/OBC and other minorities.
- Developing of large scale manufacture of bio-fertilizers, bio-pesticide, food processing and packaging at the semi-urban and rural sites.

### **Mapping of Bio-resources of West Bengal**

- Any major initiative would require an inventory and mapping of the bioresources within the state. This will have to be done within the next five years with the help of the universities, undergraduate colleges, research intuitions, NGO's and private companies.
- To identify specific biosphere zones and ensure sustainable exploitation of the bio resources from these regions while maintaining ecological balance and conservation ob biodiversity.
- Molecular characterization and the bio-prospecting of indigenous resources.
- Natural and unique reserves in the mangroves, forests, marine life, fresh water resources will be highlighted and further developed using biotechnology for maximal benefit.
- Specialized technology for enhancing sericulture and improving silk and tussar quality through biotechnology.

### **Developmental Infrastructure:**

- To develop selected high quality infrastructure through implementation of Biotech park, Agritech Park, Ecology park, Bioinformatics park in different regions of the state.
- To ensure better coordination between different R&D organizations working in the area of biotechnology and bioinformatics.
- Entrepreneurship development programme: The organizations should be encouraged to enter partnership with private companies for manufacture, marketing and transfer of technology so that the products of Biotechnology research can be brought to the common man.

- To create an environment for growth of biotech industry , by opening up the locked resources in the universities and research institutions , through entrepreneurship development programme.
- To set up service centers either by the governments or in partnership with business groups for diagnosis of diseases by sophisticated methods.
- To implement the fruits of biotechnological development in the health sector by promoting interaction between medical professionals and scientists in allied fields.
- To set up a core facility for genomics, proteomics, bioinformatics which may be used by research and industry organizations by payment of fees.
- Infrastructure support for the implementation of grass root and biotechnology programmes should be set up at the district level highlighting the needs of agriculture, animal husbandry, fisheries, waste management, biomass development for animal, poultry, fish etc. at the rural level.

### **Human Resource Development:**

- To further strengthen the human resource development programme by including components of biotechnology and Bio informatics to existing life science teaching courses both at the undergraduate and post-graduate level.
- Research Institutes, Colleges, Universities, NGO's and Private organizations should undertake technicians/technology training courses for specific requirements.
- Spreading awareness, popularizations of biotechnology by organizing training programmes for rural population and grass root workers.

Create trained and knowledgeable IPR professionals I the area of biotechnology.

### **Regulatory Policies:**

- To simplify the Government regulating policies and setting up one window clearness projects.
- To set up an implementation cell to oversee and ensure proper utilization of biotechnology in each sector.
- To offer incentives in terms of land power and tax concessions in making , setting up biotech industries an attractive proposition.
- To set up regulatory validating agencies for phyto (herbal) and biotechnology modified products to ensure sustainable marketability.
- To facilitate flow of venture capital funds and bank credit.
- To expand the scope of usage of patent cell through setting up of a network over the state.
- To spread awareness about investment opportunities in biotechnology.

- To set up a marketing structure to popularize and commercialize the selling and buying of biotechnology and biotech products.
- To enhance the knowledge of various issues regarding patents amongst various cross sections of the people.

### **Specific Incentives-**

1. Sales tax
2. Land for Biotech Parks/Companies
3. Power supply- exemption from power cuts
4. Labour concessions
5. Grants for training institutes using their existing infrastructure.

### **The Immediate future:**

### **Development and implementation of Vision 2010**

#### **Agriculture:**

1. Transgenic of cereal crops like rice, Brassica, chickpea, potato, tomato, other vegetables, Large scale seed production. Development of hybrid seeds, nutritionally enhanced vegetables (more protein content, higher lysine content) with higher yields.
2. Development of edible vaccines in plants and fruits such as banana.
3. Improving Jute and Tea cultivation.
4. Planting of trees of economic importance which will grow easily in West Bengal's climatic and soil conditions but which may not be growing on a mass scale at present due to lack of technology or incentives.
5. Development of Agro-Forestry plantation (bamboo, teak, eucalyptus, pine etc.) to replace denude forests and to increase economic value by inter cropping.
6. Development of horticulture plants according to economic importance.
7. Enhancement of floriculture using tissue culture, micro-propagation and macro-propagation.
8. Regional hardening facilities to provide benefit of tissue culture facilities at the grass roots level.
9. Agriculture in the Himalayan and sub-Himalayan regions including cereals like barley, sorghum, millet etc.
10. Medicinal and aromatic plants in high altitudes and plains.
11. Establishment of gene-banks, germplasm for maintenance and propagation of superior quality crops and plants of special value.

#### **Biofertilizer and Biopesticides**

1. Development of biofertilizers such as blue green algae to enhance soil fertility and decrease dependence on chemical fertilizers.

2. Identification of indigenous micro-flora for the development of bacterial consortium useful as biofertilizers, biopesticides.
3. Development of bio-pesticides and bio-control agents against specific indigenous targets in rural areas in the plains and mountainous agricultural lands.

### **Animal Biotechnology**

1. To develop/apply methods for enhancing milk yields in cattle.
2. To develop better strains of livestock species using known or new methods of biotechnology (Transgenic cattle).
3. Use biotechnology for developing diagnosis and vaccines for major live stock disease such as foot and mouth disease, rabies, haemorrhage, septicaemia, anthrax etc.
4. Use of transgenic animals as bio –factories for the production of economically viable nutraceuticals and pharmaceuticals.
5. Establishment of cell lines and sperm banking facilities for maintenance and propagation of superior quality livestock.
6. Use of animals as living models for the study of human disease and evaluation of pharmaceuticals.

### **Fisheries:**

1. Develop better methods for pisci-culture to cultivate commercially viable fish such as catla, rohu, mugur etc.
2. Scientific methods of cultivation of fresh water and sea water Prawn culture farms for higher yields and better quality, especially useful for exports.
3. Diagnostics for bacterial and viral diseases affecting local edible fishes and prawns.

### **Bioprospecting and bioresource mapping:**

1. Developing of a database documenting economically and ecologically important sports such as the Sunderban region (mangrove), Himalayan and sub-Himalayan regions, plains of Purulia, Birbhum, Bankura and Midnapore.
2. Identification of novel biologically important natural compounds from these unique bioreserves to be used for development of drugs, vaccines, therapeutics, biofertilizers and biocontrol agents.
3. Inventory of ethno-botanical flora and fauna of different areas of West Bengal.
4. Developing agro-forestry database and prediction of natural disasters using remote sensing methods.
5. Developments of genetic markers for plant and animal breeding programmes.

### **Environmental protection and ecosphere management:**

1. Bio-remediation and waste recycling in specific location by new microbial consortia.

2. Development of biofertilizers and bio-sensors for pollution control.
3. Biotechnological interventions for pollution and waste management for specific eco-systems.
4. Development of efficient waste disposal strategies using biotechnological methods.

### **Alternative energy resources:**

1. Identification and development of crops for bioengineering , bio-fuels and bio-energy.
2. Use of extremophiles as a source for bio-energy.

### **Biomass Development:**

1. Use of lingo-cellulose material for development of economically viable animal feed.
2. Conversion of waste materials for the development of biomass.
3. Cultivation of [Spirulina](#) as a high value low cost nutrient for rural and tribal areas.
4. Fish feed formulation and development using cheap and locally available material is with the help of biotechnological intervention.

### **Medical Biotechnology:**

1. Development of diagnostic kits for major infectious and tropical diseases.
2. Development of diagnostics kits for genetically inherited disorders.
3. Upscaling and commercialization of already developed and available ELISA and PCR based diagnostics.
4. Upscaling and commercialization of genomics based technologies like micro array, chips and drug development.
5. Characterization of anti-microbial and anti-viral agents from natural products.
6. Microbial production of recombinant therapeutic agents at low cost.
7. Methods to develop and use stem cell lines for research and tissue regeneration for medical use.
8. Reproductive health and contraceptive research.
9. Developing strategies for prevention and cure of disease introduced by faulty diet and lifestyle like diabetes, heart disease and obesity.

### **Industry:**

1. Development of joint R&D programme between basic research scientists and private industries for commercially viable projects.
2. Setting up production units for commonly used biotechnological and biomedical instruments.
3. Production and commercialisation of recombinant biological and related materials like disposable plastic wares.

4. Modernization of industries using fermentations technology for production of alcohols and other important solvents and industrial enzymes.
5. Production of value added by-products from microbial sources such as Spirulina, fungi etc. for use in pharmaceuticals and food industry.
6. Use of innovative recombinant DNA technology to upgrade and modernize industrial products currently in the market.
7. Development of knowledge base using biotechnological research and promotion of contract research.
8. To set up biotech product development fund and technology platforms.
9. To replace synthetic products by developing new technology based on biological materials.
10. Developing of small scale industrial sector for bio-pesticide, bio-fertilizers, food processing and packaging industries.

### **Manpower development:**

1. To further strengthen the human resource development programme by including components of Biotechnology and Bioinformatics to existing life Science teaching courses both at the undergraduate and post-graduate level.
2. Research Institutions, Colleges, Universities, NGO's and Private organizations should undertake technicians/technology training courses for specific requirements.
3. Popularization and awareness of the uses of biotechnology in rural and urban areas through lectures, films, TV programmes etc.
4. Short term courses incorporating Biotechnology with business management to be included in the curricula of management and business schools.
5. Introduction of law courses emphasizing Bio-safety, ethics, intellectual property rights (IPR) for biotechnology industry.
6. Diploma and certificate courses (after 10+2 Higher Secondary, CBSE, ISC) for training biotechnology personal in the fields of agriculture, animal husbandry, recombinant DNA technology to be initiated by the state and private sector.

### **Development of Infrastructure:**

1. To develop selected high quality infrastructure through implementation on Biotech park, Agritech park, bioinformatics park and hardening facilities in different regions of the state.
2. To ensure better coordination between different R&D organisations such as IICB, Bose Institute, NICED, University of Calcutta, Jadavpur University and others, working in the area of biotechnology and bioinformatics. These organisations should be encouraged to enter partnership with private companies for manufacturer, marketing and transfer to technology so that the products of Biotechnology research can be brought to the common man.
3. To create an environment for growth of biotech industry by opening up the locked resources in the universities and research institutions, through entrepreneurship developing programme.

4. To set up service centres either by the government or in partnership with business groups for diagnosis of diseases by sophisticated methods, DNA and protein sequencing so that routine yet necessary information could be retrieved without duplication of infrastructure. At least 2-3 such centres would be required for the state.
5. To set up a core facility for genomics, proteomics, bioinformatics which may be used by research and industry organisations by payment of fees.
6. Strengthening of existing infrastructure with expansion wherever necessary.
7. Creation of centres of excellence in frontier areas of research (Functional genomics, proteomics, Bio informatics), containment facilities as required under bio-safety regulations, Intellectual Property Rights implementation cells.

### **Bio-safety, Ethical, Proprietary Regulations:**

Establishment of transparency in scientific techniques and results obtained by implementing ethical and biosafety regulations will be necessary. Protection of proprietary rights will have to be undertaken to maintain the individuals discoveries and for proper commercialisation. Rigorous implementation of biosafety guidelines will be essential.

### **Biotechnology and societal development:**

1. In this it is essential to lay emphasis on the rural sector. The concept of Bio-village should be spread through out the state.
2. Location and natural resource specific projects to be developed.
3. Involvement of women and SC/ST should be emphasised in rural development programmes.
4. Genetic counselling centres to be set up with diagnostics centres for genetic disorders for helping the needy.

### **Intellectual property Rights:**

Keeping in view that Biotechnology has a pervasive role in agriculture and industry. Food and medicine, Environment and Ecology, Plant and Animal cloning and also the fact that Biotechnology is a knowledge based industry and intellectual, rather than financial capital, our approach to the question of intellectual property protection in this area should be positive, rather than defensive. However in view of the complexities involved in patenting Biotechnological inventions, we need to build up our knowledge and expertise in this area and evolve an IPR system over a period of time in the light of the experience and after the amendment of the patents Act 1970, passing of Biodiversity bill 1999 and Protection of Plant varieties and Farmer's Right's Bill 1999 which are considered by the 30 member Joint Parliamentary Committee for their recommendations.