

Centre for Plant Molecular Biology and Biotechnology

Advances in biotechnology and bioinformatics have opened up newer opportunities in crop improvement to increase yields of crops, photosynthetic and nutrients use efficiency, biotic and abiotic stress resistance, grain quality, and development of novel drugs and products. Mandate of the Centre is to provide a platform for biotechnology education and research at the interface of multiple disciplines. Realizing the potential applications of molecular biology and biotechnology the following focus areas have been identified for biotechnology research with a view to enhancing agricultural production and improving livelihood of farmers of the state.

Major Research Focus areas in Agricultural Biotechnology:

1. Molecular Breeding for developing improved crop varieties
2. Genomics and Bioinformatics
3. Bio-prospecting and Tissue Culture

I. MOLECULAR BREEDING

Vagaries of monsoon, climate change, problem soils, pests and pathogens pose major threat to agriculture production and thereby affecting livelihood of millions of small and marginal farmers. Development of pest and disease resistant, climate resilient crop varieties will help sustain food and agricultural production even during unfavorable conditions. Cultivation of crop varieties with better resource use efficiency will help reduce cost of cultivation by reducing application of synthetic fertilizers. Micronutrient malnutrition is a major problem afflicting millions of poor particularly women and children in rural areas. Conventional intervention such as food diversification, fortification and medical interventions have not produced expected results. Varieties of staple food crops which are inherently rich in micronutrients, in their edible parts could be a sustainable solution to address malnutrition.

Research priorities

1. Molecular breeding of stress tolerant crop varieties

- [MAB for developing multiple stress tolerant SMART rice
- [MAB for developing stress tolerant cotton, maize etc.,
- [Genetic Engineering of rice, cotton, pulses and banana for resistance against major pests and diseases
- [Molecular breeding for crops varieties with enhanced nutrient use efficiency

2. Molecular breeding for value addition in food and feed crops

- [MAB for enhanced iron, zinc, beta-carotene and vitamin E content in rice
- [MAB for developing rice with therapeutic values
- [MAB for developing nutrient rich maize (β carotene and QPM)

3. **Development and dissemination of molecular diagnostic tools for crop protection**
4. **Impact of biotechnology products on agricultural ecosystem**

II. GENOMICS AND BIOINFORMATICS

Many indigenous species of plants and microbes endemic to Tamil Nadu have not been characterized and their potential utility still undiscovered. Sequencing native plant species and identifying useful traits / genes will improve their applications in agriculture. Small millets, minor pulses and indigenous oilseeds possess high level of stress tolerance and nutrient use efficiency. However, the genes associated with those traits are unknown. These genetic resources could be exploited to improve major crops such as rice.

The volume of genomic information available to the biological community is continuously increasing which demands construction of specific databases to cater to the requirements of the diverse research communities.

Research priorities

1. Whole genome sequencing of native crops and beneficial micro-organisms

- [Genome sequencing of major crops/organisms of Tamil Nadu
- [Molecular markers discovery for plant breeding applications
- [Identifying novel genes associated with drought/salinity tolerance traits in rice through NGS/microarrays/proteomics
- [Metagenomics of native microflora
- [Molecular diversity in plant associated organisms

2. DNA fingerprinting of major crop varieties

- [Establishment of referral panel of standard SSR markers for varietal identification in major agricultural/horticultural crops
- [Developing genotype specific robust markers (e.g. SSR) major crops of Tamil Nadu

3. Development of databases for agricultural crops and new bioinformatic tools for genome analysis

- [Designing and developing user friendly genomic databases for public use
- [Assisting in new drug discovery through protein modelling, docking and simulations

III. BIO-PROSPECTING AND TISSUE CULTURE

Tamil Nadu has diverse flora and fauna and its biological diversity remains under-utilized. Proper utilization of these resources will lead to isolation of novel bio-molecules and genes/alleles of agronomic importance. Bioprospecting for insecticidal, antimicrobial and therapeutic molecules is going to be one of the major research priorities. CPMB&B is poised to take up the challenging task of optimizing tissue culture protocols for rapid multiplication of coconut seedlings through micro propagation.

Research priorities

1. Biochemical profiling of nutritionally/medicinally important native genetic resources
2. Identification, isolation and characterization of novel biomolecules from indigenous plants
3. Production of high value secondary metabolites through hairy root culture.
4. Understanding the metabolic pathways in microorganisms for enhancing the production of biofuels.
5. Micro-propagation of economically important plantation crops (Coconut) and medicinal crops