



## **Themes of High Priority Research Areas of Sugar Crops**

### **THEME-1: SUSTAINABLE IMPROVEMENT OF SUGAR CROPS**

#### **Sub-Theme 1.1: Management and adaptation of Genetic Resources**

**(1.1.1)** Purchase/import/exchange and collection of true seed (Fuzz) and or germplasm (Promising/commercial clones as introduction or breeding material) from international research institutes/organizations like Agricultural Research Service-United States Department of Agriculture (ARS-USDA) (Houma, Canal point, Florida State University and Louisiana State University), Visacane CIRAD (Centre de Cooperation International en Recherche Agronomique pour le Development), Reunion France, Sugarcane Research Institute, Sri-Lanka, CTC (Centro de Tecnologia Canavieira) /RIDESA (Rede Interuniversitaria Para O Desenvolvimento Do Setor Sucoenergetico) Brazil, Okinawa Institute of Science and Technology (OIST), Japan, Sugarcane Breeding Center, Thailand, Barbados, International Society of Sugarcane Technologists (ISSCT) Germplasm Bank at Miami, USA and Coimbatore India as well as other organizations.

**(1.1.2)** Establish sugarcane basic, commercial and molecular breeding through:

Climate adaptability characterization of the accessions, Identification and Mapping of QTLs, Trait Expression Profiling, Allele Mining and Pedigree Studies.

**(1.1.3)** Develop protocol for approved and un-approved varieties of sugar crops

**(1.1.4)** Develop high sugar yielding and high sugar recovery varieties of sugar crops (sugarcane, sugar beet and sweet sorghum) with resistance to biotic stresses and having tolerance against abiotic stresses

**(1.2.5)** Testing and evaluation of site-specific sugar crops varieties with excellent ratoonability (Sugarcane) to increase the profitability of growers and sugar mills.

### **Sub-Theme 1.2: Upgradation in Production Technology**

**(1.2.1)** Latest agronomical approaches:

**(1.2.1.1)** Develop economically viable production technologies for sugar crops

**(1.2.1.2)** Sugar crops true to type seed production technologies

**(1.2.1.3)** Intercropping system of sugar crops with legumes, oil seeds, fodders and vegetables and suited to different zones to augment farm income.

**(1.2.1.4)** Integrated weed management through biological, mechanization, cultural practices, pre and post-emergence herbicides and precision agriculture technologies.

**(1.2.1.5)** Efficient tillage practices for plant and ratoon crop

**(1.2.1.6)** High density plantation technologies

**(1.2.1.7)** Development and certification of Organic sugar crops

## **THEME-2: MECHANIZATION FOR DIVERSIFICATION AND COMMERCIALIZATION**

### **Sub-Theme 2.1: Mechanization in Sugar Crops**

**(2.1.1)** Mechanization of farming particularly focusing small land holding farmers both i.e. mechanized plantation and mechanized harvesting to reduce cost of production in the field and post-harvest losses in the factory.

**(2.1.2)** Mechanized technologies of sugar crops for planting, harvesting handling, Storage and transportation through reverse engineering.

**(2.1.3)** Diversification in sugar crops through technologies targeting: Bios of sustainability i.e. Bio-Fuel, Bio-Compost, Bio-Energy, Bio-Phene, Bio-Water and bio-Foam.

(2.1.4) Use of remote sensing technologies for variety identification, disease pest forecasting, nutritional diagnosis, weed detection, yield estimates and management of raw material.

(2.1.5) Developing technologies for organic recycling in sugar crop production systems

(2.1.6) Exploring the sugar crops Phyto-biomes for developing bioproducts.

## **Sub-Theme 2.2: Management of Pests, Diseases, and Natural/Biological Resources**

(2.2.1) Identifying sources of resistance for important weeds, insects and diseases.

(2.2.2) Exploitation of new generation fungicides/pheromones and other management strategies.

(2.2.3) Developing molecular diagnostics and creating a nation-wide database using computer aided computational technologies for weeds, diseases and pest-identification and sugar crop nutrition requirement (Digital Agriculture).

(2.2.4) Develop treatment facilities to control the quarantines pests.

(2.2.5) Studies on utilization of new technologies like Enzyme linked immuno sorbent assay (ELISA), Tissue Blot Immunosorbent Assay (TBIA) for screening of fungal, bacterial, phytoplasma diseases of sugar crops.

**(2.2.6)** Develop cropping pattern and integrated nutrient management methodologies to decrease nutrient depletion in soil and enhance organic matter content.

**(2.2.7)** Improve fertilizer use efficiency/recommendation through different application technologies such as spot application and slow release fertilizers under different ecological zones.

**(2.2.8)** Soil health improvement through recycling of sugar industry effluents and sugar crops residue.

**(2.2.9)** Research on use of ripeners, bio-fertilizers, low volatility fertilizers, bio pesticides and bio weedicides, bio-fungicides, bio-nematicides etc.

### **THEME-3: CONSERVING RESOURCES AND PROTECTING ENVIRONMENT**

#### **Sub-Theme 3.1: Climate Change Mitigation**

**(3.1.1)** Visualizing the possible climate change scenarios in different sugar crops growing regions and their impact on growth and productivity through crop modeling

**(3.1.2)** Developing climate resilient varieties of sugar crops and management technologies to mitigate the effects of climate change.

#### **Sub-Theme 3.2: Water Use Efficiency**

**(3.2.1)** Use of Hydrogels to improve water use efficiency.

**(3.2.2)** Exploring the resource conservation technologies for site specific nutrient management, efficient irrigation management, bed planting, ridge sowing, furrow sowing (U and V shape) and water saving technologies in sugar crops and high efficiency irrigation systems like pivot irrigation, drip and sprinkler irrigation.

**(3.2.3)** Use of innovative technologies like magnetizers etc to treat salty underground water.

#### **THEME-4: Post-Harvest Losses and Value Addition**

**(4.1)** Post-harvest losses studies of sugar crops during crushing season with respect to time, temperature and varieties.

**(4.2)** Value addition through bioengineering for the production of vaccines, therapeutics, vitamins, bioplastics, antioxidants, industrial enzymes and biopolymers.

**(4.3)** Development of natural cleaning agents for various types of sugar.

**(4.4)** Development of technologies to promote sugarcane juice as value added product as cottage industry.

#### **THEME-5: CAPACITY BUILDING AND OUTREACH**

##### **Sub-Theme 5.1: Infrastructure and Human Resource Development**

**(5.1.1)** Creating infrastructural facilities/laboratories and skill full upgradation of trained man power in frontier areas like Breeding,

Agronomy, Plant Protection, Bioinformatics, Remote sensing, Geo-informatics, Nanotechnology, Farm Management and development of Extension Services.

(5.1.2) Use of mechatronics, drones, robotics, GPS, Satellite technology for efficient planning and low-cost sugar productions.

### **Sub-Theme 5.2: Technology Assessment and Transfer**

(5.2.1) Research on emerging technologies like Near Infrared technology (Dry Chemistry), Nano technology etc. for transparent and controlled data quality system.

(5.2.2) Impact analysis of universities and research institutions working on sugar crops in Punjab.

(5.2.3) Publication of books, research papers, research articles, monograph, extension articles and bibliography on sugar crops.

(5.2.4) Organize national and international workshops, trainings, congresses, conventions, seminars and symposia.