

Vegetable Improvement Division

Institute Projects

1. Improvement of Cucurbitaceous crops for stress tolerance, yield and quality traits This project focuses on genetic enhancement of cucurbits including cucumber, bottle gourd, bitter melon, pumpkin, and muskmelon for resilience against biotic and abiotic stresses while improving yield potential and consumer-preferred quality attributes. The research addresses climate change challenges through development of heat, drought, and disease tolerant varieties. Farmers benefit from stable yields under adverse conditions while agri-industries gain access to processing-suitable genotypes with uniform fruit characteristics and extended shelf-life.

2. Improvement of Okra for stress tolerance, yield and quality traits The project aims at developing okra varieties and hybrids with resistance to Yellow Vein Mosaic Virus, tolerance to heat stress, and superior pod quality for fresh market and processing sectors. Research encompasses exploitation of wild *Abelmoschus* species for introgression of resistance genes and quality traits. Improved varieties ensure reduced pesticide dependency for farmers and consistent raw material supply for processing industries producing dehydrated okra and frozen vegetable products.

3. Improvement of Solanaceous vegetable crops for stress tolerance, yield and quality traits This comprehensive project addresses genetic improvement of tomato, brinjal, chilli, and capsicum for multiple stress tolerance, enhanced nutritional quality, and high marketable yield. Research priorities include resistance to ToLCV, bacterial wilt, and fruit borers alongside biofortification for beta-carotene and anthocyanins. The outcomes directly benefit farmers through reduced crop losses and input costs, while providing industries with varieties suitable for processing into paste, puree, and dehydrated products.

4. Improvement of leguminous vegetable crops for stress tolerance, yield and quality traits The project targets genetic enhancement of vegetable pea, French bean, cowpea, and dolichos bean for powdery mildew resistance, heat tolerance, and improved pod quality with extended harvesting duration. Development of determinate, bush-type varieties facilitates mechanical harvesting and reduces labour costs. Farmers gain from multiple pickings and premium market prices, while frozen food industries benefit from varieties with high recovery percentage and retention of colour after processing.

5. Improvement of Cauliflower & Carrot for stress tolerance and quality traits This project focuses on developing early-maturing cauliflower hybrids with heat tolerance enabling off-season cultivation and biofortified carrots with enhanced beta-carotene and anthocyanin content. Research includes CMS-based hybrid development for cauliflower and rainbow carrot varieties for nutritional security. Farmers achieve higher returns through early market arrival, while the outcomes support government initiatives on nutritional security and dietary diversification.

6. Biotechnological Interventions for Management of Stresses, yield and Quality in Vegetable crops The project employs cutting-edge biotechnological tools including transgenics, marker-assisted breeding, and genome editing for addressing biotic and abiotic stresses in

vegetables. Research encompasses development of Bt brinjal and tomato for insect resistance, CRISPR/Cas9-based gene editing for disease resistance and quality improvement. These interventions accelerate breeding cycles, reduce time for variety development, and provide farmers with superior genotypes possessing multiple desirable traits.

7. Seed management perspectives in vegetable crops This project addresses critical aspects of vegetable seed production, quality assessment, enhancement technologies, and storage for ensuring availability of quality planting material. Research covers hybrid seed production techniques, seed priming, and pelleting technologies. The outcomes directly strengthen seed systems, ensuring farmers' access to quality seeds while enabling seed industries to adopt standardized protocols for commercial seed production.

8. Maintenance and Promotion of ICAR-IIVR Varieties/Hybrids The project ensures nucleus and breeder seed production of released IIVR varieties and hybrids while facilitating their promotion through demonstrations and technology licensing. Activities include maintenance breeding for genetic purity and collaboration with public and private seed sectors. This ensures continuous availability of improved cultivars to farmers and supports seed industries in commercial multiplication and marketing of IIVR-developed varieties.

9. Enabling climate resilience and ensuring food & nutritional security through genome editing in horticultural crops This frontier research project utilizes CRISPR/Cas9-based genome editing for developing climate-resilient and nutritionally enhanced vegetable varieties without introducing foreign genes. Target traits include viral disease resistance, delayed ripening, and enhanced nutritional content. The technology offers precise genetic modifications acceptable under regulatory frameworks, benefiting farmers with stress-tolerant varieties and consumers with nutrient-dense vegetables.