

Hi-Tech Horticulture: Way Forward

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In recent years, horticulture has become one of the potential agricultural enterprises that contribute to economic growth. The horticulture industry is no longer simply a means of diversification. It is also an integral part of food and nutritional security as well as economic security. Horticulture crops, in general, require more knowledge and capital than staple crops. India is the domicile for numerous horticultural crops of commercial significance. Horticulture in India today is one of the most dynamic and vibrant sectors of the economy. It contributes nearly 30% of the agricultural GDP. The Food and Agriculture Organization (FAO) ranks India as the second largest producer of fruits and vegetables after China. In India, the diversified climate has led to the availability of a wide variety of fruits and vegetables throughout the year. In India, the productivity of horticulture crops has increased by 38% between 2004-05 and 2019-20. The most significant changes in the recent past have been diversification, market orientation and commercialization, involving the introduction of new crops and varieties, an increase in the share of horticulture in cropping patterns, diversion into processing and export-oriented production of a variety of crops. As part of the whole value chain, a number of technological innovations have been developed, including technology for establishing orchards, providing planting material that is true to type, engineering and managing plant architecture, mulching, fruit thinning, nutrient management, water management, pest and disease management, post harvest processing and marketing. Over the last decade, there have been positive changes in the horticulture sector due to the importance given to it by all stakeholders, including the public and private sectors. A major reason for this is that diversifying to horticultural crops has now become the major option for improving livelihood security and health. Therefore, a conscious effort is required to implement certain initiatives that would lead to the future growth and development of the horticulture sector.

Hi-tech Horticulture: Way Forward

The term hi-tech horticulture is also defined as a modern, environmentally friendly, acceptable, intensive technique that helps farmers obtain high productivity and quality products for more money. Generally, hi-tech horticulture refers to the use of precise production techniques to maximize yields and quality of horticultural crops at the appropriate time and quantity. It involves the adoption of technology that is modern, less environment-dependent, capital-intensive, and capable of improving productivity and quality of horticultural crops. Through the application of modern techniques of crop production, post-harvest management techniques, and proper seed selection, it is an integrated chain system of cultivation of fruits, flowers, vegetables, and spices. Agro-climatic barriers have been overcome by high-tech horticulture, making most vegetables available in all calendar months although at a premium price. Hi-tech horticulture encompasses a wide range of technologies derived from biotechnology and genetic engineering, including genetically modified crop varieties (GM), micropropagation, integrated water, nutrient, weed, and pest management, protected cultivation, organic farming, rapid detection of viral diseases through immunodiagnostic methods, post-harvest technologies, including cold chain.

Hi-tech horticulture is an effective means of doubling the productivity of horticultural crops and effectively doubling farmers' income. The overall theme of hi-tech horticulture may include the following: (a) development of climate-resilient production technologies through hi-tech interventions, (b) conservation of existing germplasm and the utilization of underutilized plants and land use through the development of new varieties/hybrids suitable for hi-tech horticulture, (c) application of biotechnology and nanotechnology, (d) precision farming targeting yield, nutrient management, and irrigation resource conservation, and (e) development of a postharvest chain to reduce postharvest losses and to impart value addition.

- **Germplasm conservation:** To achieve food and nutritional security for the growing population, germplasm enhancement and its utilization are crucial for improving productivity. Horticultural crops require intensified collection and conservation activities. It would be possible to conserve the genetic diversity of indigenous plants by using hi-tech technology-intensive methods such as in vitro conservation and cryopreservation. Horticultural crops require intensified collection and conservation activities. It would be possible to conserve the genetic diversity of indigenous plants

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- **Hi-tech propagation:** Planting material availability is a key requirement for the expansion of a truthful horticulture industry. Micropropagation is one of the most efficient ways to produce large numbers of plants quickly. In India, the development and standardization of grafting has revolutionized the planting and production scenario of fruit crops like mangoes, guavas, and grapes.
- **Nutrient management:** A large part of the success of hi-tech horticulture is due to the use of judicious irrigation and nutrients. Drip irrigation has led to higher yields and better quality in fruit (bananas, grapes, papayas, pomegranates, mandarins, coconuts, areca nuts, and cashews), vegetables (cabbage, cauliflower, tomato, gherkin, baby corn), cut flowers (rose, carnation and gerbera), and plantation crops (tea, coffee and rubber). The nutritional requirement for various horticultural crops for different agro-climatic zones has been worked out and successfully adopted by farmers. But the focus is required for the use of biofertilizers, VAM fungi, biological N fixers and other beneficial microbial agents for effective nutrient use efficiency.
- **Biotechnological interventions for crop improvement:** A variety of conventional approaches have been supplemented by biotechnological tools for the conservation, characterization and utilization of horticultural crops for increasing productivity and production. The breeders can use these tools to improve yield, disease resistance, abiotic stress tolerance, and quality more precisely and quickly.
- **Precision farming:** To improve crop performance and environment quality, precision farming utilizes technologies and principles to manage spatial and temporal variability related to all aspects of horticultural production. By utilizing location-specific hi-tech interventions, precision farming demands efficient resource management.
- **Post-harvest management:** Post-harvest losses are especially high in tropical climates and unorganized market systems require urgent development. Various handling procedures of fresh produce must be implemented to reduce losses. These include sorting, grading, waxing, precooling and improving storage, packaging, and transportation systems. It will help in providing better economic return to the growers. Mechanization especially with reference to harvesting and postharvest handling is



gaining momentum. Appropriate field heat removal techniques, viz., cold air system, hydro-cooling, vacuum cooling or slush system, need to be adopted at the field level to reduce post-harvest losses of horticultural produce significantly. In addition to adding value, appropriate processing can also reduce post-harvest losses.

- **Cold-chain:** A cold chain or cool chain is a temperature-controlled supply chain. An unbroken cold chain is an uninterrupted series of refrigerated production, storage and distribution activities, along with associated equipment and logistics, which maintain a desired low-temperature range. The cold chain sector is part of India's second Green Revolution and high value products such as fruits, vegetables, meat, fish, poultry and dairy are critically dependent on it.

Conclusion

In agriculture, there is already a paradigm shift moving away from cereal production towards diversified farming. The concept of food security has been defined as the physical, social and economic access by all people to sufficient, safe and nutritious food that meets their dietary needs and food preferences for a healthy and active life. Along with improving biological productivity and nutritional standards, horticultural crops can also increase farm profitability and provide livelihood opportunities. In response to an increasing per capita income and an accelerated growth in health conscious consumers, horticultural produce demand is expected to increase, which will also require more production. Both the quality and price of the production must be competitive. Thus, horticultural development needs to be viewed as an integrated approach that addresses important gaps, while enhancing efficiency through targeted research. Consequently, technology-driven horticulture will address nutritional security, health care, and ultimately economic development concerns.