

Hi-tech Agriculture in India

1. Introduction

High-tech farming mainly refers to agricultural operations involving the latest technologies. It is a capital intensive agriculture since large capital outlay is required towards purchase of specialized equipment, maintenance of assets, training of labour, etc. Hi-tech agriculture mainly relates to commercial farming system aimed at catering to the needs of both, domestic as well as export markets. It uses farming technology to increase yields, ensures high quality (usually pesticide-free) and realizes increased market value. Growing temperate vegetables in a tropical climate and developing disease-resistant plants through genetic engineering are common examples of hi-tech agriculture.

1.1 Advantages of high-technology farming

- Increase in yield up to 5 to 8 times – high productivity per unit area
- Significant saving in key inputs like water (up to 50%), fertilizers (25%) and pesticides.
- Better growth and uniformity in quality
- Feasible even in undulating terrains, saline, water logged, sandy & hilly lands

1.2 Potential areas for Hi-tech agriculture

- Urban and peri-urban areas to meet requirements of fresh produce like vegetables, fruits and flowers round the year
- Areas with limited land and water resources
- Areas where availability of land for cultivation is restricted because of snowfall and where low temperature is prevalent restricting cultivation of crops under open field conditions.
- Small and marginal land holdings for adopting intensive production technologies
- As an agri-business enterprise for enterprising youth in rural and urban peripherals

A summary of the hi-tech agriculture activities having potential for productivity enhancement and investment is given in Table below:

Sr.No	Activity	Details
1	Soil less agriculture	Growing underground is a hydroponic vertical farm using 70% less water than typical farming operation. It utilizes a closed-loop ebb and flow system where water with nutrients floods the beds of sprouts few times a day and then is recycled through a reservoir and reused.

2	Protected cultivation under greenhouse	In a greenhouse together with solar and photovoltaic systems. Pumps, UV filters and lighting can be sustainable and environment friendly through the use of modern solar technology and can be supported and operated independently. The aquaponic solar greenhouse allows the simultaneous production of vegetables, fish and solar power. This leads to a very low or even negative CO ₂ footprint (CO ₂ sink) for the food produced.
3	Hydroponics	The concept behind hydroponics is to eradicate imminent barriers that exist between the roots, water, nutrients and oxygen for proper growth. It is a method of growing plants without soil by instead using mineral nutrient solutions in water solvent. The nutrients used in hydroponic systems can come from an array of different sources, including (but not limited to) from fish excrement, duck manure or purchased chemical fertilizers. Plants commonly grown hydroponically include tomatoes, pepper, cucumber and lettuces.
4	Aeroponics	Aeroponics is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. Unlike hydroponics, which uses a liquid nutrient solution as a growing medium and essential minerals to sustain plant growth or aquaponics which uses water and fish waste, aeroponics is conducted without a growing medium.
5	Vertical farming	Vertical farming, with vegetables grown in temperature, moisture and nutrition-controlled indoor environments can also guarantee improvements in yield while at the same time limiting environmental externalities. Main characteristics of vertical farming is given below : <ul style="list-style-type: none"> i. It is one step higher than greenhouse technology and open field cultivation. ii. It is being progressively practiced in mushrooms, poultry, hydroponic fodder, strawberry, leafy-vegetables particularly lettuce, herbs, ornamental horticulture and other crops production. iii. It is considered potential to provide sustainability to farming, combat chronic climate change and reduce major inputs to crop production like land, water, nutrients, pesticides and others. iv. It has the immense potential to attract the youth to farming by adding pride to the profession, agriculture.

2. High Value Crops (HVC)

High Value Crops (HVCs) are those, which give significantly higher value productivity or net income per unit of resources used for production, compared to other competing

activities. Diversification towards high-value crops such as fruits, vegetables, especially in a country like India where demand for high-value food products has been increasing faster than for staple crops, has proven to increase income level of farmers. Some of the important activities under HCV are indicated below:

- Fruit and vegetable cultivation especially catering to urban and metro markets (in the urban peripheral)
- Cultivation of off-season and exotic vegetables under greenhouse for exports (asparagus, celery, bell pepper, sweet corn, green and lima beans)
- Floriculture- open and greenhouse production for domestic and export markets
- Exclusive production of crops for processing/ specific to user industry needs/ under contract farming arrangements- i.e. gherkins, potato, fruits and select vegetables for processing, flowers (for extracts), medicinal and aromatic plants
- Mushroom cultivation
- Hi tech nursery units for fruit crops, vegetables, flowers, etc.

2.1 Prospects for High Value Crops

Urbanization is a key determinant of demand for HVCs because of higher per capita income, change in tastes and preferences and greater participation of women in labor markets. About 28% of India's population lives in urban areas, which is expected to become 35% by 2020, leading to rapid growth in demand for high value food commodities. The consumption pattern in rural areas is also fast changing in similar pattern.

2.2 Export prospects of Hi-tech Agriculture

- ***Fresh fruits and vegetables*** - India's exports of fresh fruit and vegetable during 2018-19 stood at Rs. 10062.93 crore. An increasing acceptance of new products with market development efforts has been witnessed lately given the fact that there is a good international demand for certain fruits and vegetable products.
- ***Floriculture*** is being viewed as a high growth Industry. The liberalized economy has given an impetus to the Indian entrepreneurs for establishing export oriented floriculture units under controlled climatic conditions. There are more than 300 export-oriented units and majority of which (50%) are located in Southern States of Karnataka, Andhra Pradesh & Tamil Nadu. India's total export of floriculture & fruit and vegetable seeds products has been Rs. 1420.64 crore in 2018-19.
- ***Processed fruits and vegetables:*** India's exports for processed fruits and vegetables stood at Rs.5591.34 crore during 2018-19. Due to special efforts of the Ministry of Commerce and Industries, Govt. of India and APEDA, the international demand for Indian processed fruits and vegetables has set a rising trend during last few years.

- **Animal products:** Indian boneless meat of bovine animals has very good international acceptance. During 2018-19, export of animal products recorded at its peak of Rs.30309.38 crore.
- **Other processed products:** Among the other products, Guar gum and Shelled groundnut contribute major share of Indian exports. During 2018-19, export of other processed products were recorded at Rs.17986.40 crore.
- **Cereals:** Amongst the agro export products, cereals contribute maximum to the extent of Rs.56841.27 crore as recorded during 2018-19. Major commodities being Basmati and parboiled rice amongst the cereals exported.

2.3 High Value Agriculture for Small Farmers

While high value crops are mainly associated to big farmers, there is significant scope for small and marginal farmers to diversify towards high value agriculture through aggregation measures for increasing their income. However, the challenge lies in development of infrastructure, transfer of technology, appropriate marketing interventions, availability of affordable capital, etc.

3. Govt. Interventions

The important promotional interventions of Government departments towards high value agriculture sector include:

- Incentives/subsidy support for adopting high value agriculture production technologies especially under National Horticulture Mission and other programmes of National Horticulture Board.
- Export facilitation and promotional interventions of Agricultural & Processed Food Products Export Development Authority (APEDA)/ Marine Products Export Development Authority (MPEDA)
- Promotional interventions of Commodity Boards
- Programmes like precision farming supported by the State Governments with focus on high value crops

4. Initiatives of NABARD

- Guidance to banks in appraisal of hi-tech agricultural projects including investment assessments, techno-financial appraisal, risk management and monitoring systems.
- Over 143 model bankable projects have been developed including important hi-tech and high value agriculture sector activities and state/location specific model projects by the respective Regional Offices.
- Financial support being extended to the State Govt. for infrastructure development (food parks) under RIDF
- Providing consultancy services to prospective entrepreneurs

- Support for Training cum Exposure visits of small/ marginal farmers and entrepreneurs under Capacity Building Programme for Adoption of Technology.

5. Issues under Hi-tech Agriculture promotion

Some of the important issues in promotion of high-value crops, are as under:

- i. Bringing more and more small holders under high value agriculture production system
- ii. Transfer of technology
- iii. Access to institutional credit
- iv. Institutional development for input support, extension, training and capacity building
- v. Marketing linkages for ensuring remunerative price of produce on sustainable basis.
- vi. Enabling policy interventions
- vii. High value crops like fruits and vegetables are perishable in nature and measures towards diversification calls for simultaneously addressing critical infrastructure needs like cold storages, quick transport facility, etc.
- viii. Absence of specific risk mitigation measures to off-set high production and market related risks.

6. Suggested policy frame work

- Crop Diversification policy needs to ensure well balanced production of food crops (cereals and pulses) to meet food security needs and high value crops to match demand projections. The focus may be more on productivity enhancement interventions.
- Aggregation of input services and output handling specially suitable for small and marginal farmers
- Enabling environment for improved post-harvest management with greater stake for private investments,
- Intensive quality and trade literacy programmes for all stake holders across the country.
- Ensure better share for producers in consumer price (presently only 30%) through cooperative models such as SAFAL, HOPCOMS, etc.
- Impetus for growers/processing agencies on the lines of MAHAGRAPES
- Export of HV commodities requires controls on food safety and quality. Hence, both expertise and infrastructures are needed for addressing food safety issues.
- Production and marketing of high value commodities are capital intensive, where institutional finance with realistic terms of lending is crucial. Appropriate risk mitigation measures such as insurance are required to be introduced.

7. Strategies for promotion of Hi-tech agriculture in India

Greater participation of farmers particularly small and marginal farmers in hi-tech agriculture may be encouraged keeping in view the opportunities for improving farm income. The core strategy involves adopting a compact area and activity specific development approach to enable input, technology and extension support, creation of critical common infrastructure and aggregation of production for marketing and value addition. Some of the suggested strategies include:

- i. Study of successful models for replication (i.e. Precision farming programme in Tamil Nadu)
- ii. Identifying activity/crop specific locations and potential mapping
- iii. Development with Group approach such as Farmers' Societies, Producer Companies, JLGs /SHGs, etc.
- iv. Assessment of infrastructure needs including post-harvest handling and transport logistics
- v. Preparation of Sector/ activity specific credit linked Development Plans (Area Development Plans / Banking Plans)
- vi. Supporting infrastructure for post-harvest handling, warehousing, marketing, etc. through PPP mode or private sector investments.
- vii. ICT enabled services such as market information, technology inputs and credit access
- viii. User Industry tie-up for contract farming ensuring clean, equitable and farmer centric agreements with well-defined clauses dealing with quality standard, withdrawal conditions, credit linking with financing institutions, enabling provision for arbitration mechanism, inclusion of appropriate risk mitigation measures, etc.

8. Role of NABARD in supporting Hi-tech Agriculture

- Framing of appropriate policies with special reference to credit availability
- Resource mapping and infrastructure needs assessment
- Credit facilitation through banks and other financial institutions including subsidiaries of NABARD.
- Professional consultancy services through NABCONS for project development, monitoring, etc.
- Monitoring and Mid-term evaluation
- Supporting critical infrastructure under RIDF and development of food parks
