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# Hi- Tech Horticulture-A Concept to make Farming Economical

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## Introduction

'Hi-tech Horticulture' may be defined as the deployment of any technology, which is modern, less environment dependent, capital intensive and has the capacity to improve the productivity and quality of horticultural crops. In recent years, with the increase in population, there is also increase in the demand for food and nutritional security. The conventional method of farming cannot cope with the increased demand, thus it is required to upgrade the technologies in the agriculture field. Also, the effect of climate change is likely to increase in terms of high temperatures, weather instability, the emergence of new pests and diseases, in addition to the danger of increasing sea levels and water decline from glacier sources, therefore to feed the increasing population we have to work smartly and also it is our moral responsibility to preserve the natural resources for future generations. The Food and Agriculture Organization (FAO) forecasts a 15-20 percent decline in global agricultural production by 2080. Consequently, designing appropriate solutions to reduce the effects of climate change is one of the greatest challenges for plant scientists today. To meet the needs of agriculture, strong research and development support is required to provide science-based solutions to improve the quality of life of people including farmers who also consume food and produce food for their livelihoods. Horticultural sector provide great scope for the use of hi technology in this area since by cultivating in small area of land the productivity is higher (especially vegetable,

flowers crops and medicinal crops) as compared to other agronomic crops. Hi-Technology horticulture provides a tremendous potential for producing high quantity and quality of produce.

## Potential areas in Hi tech Horticulture

### a. Protected /greenhouse cultivation

Protected cultivation practice is outlined as a cropping technique where controlled micro-climate influences the growth and development of a plant. With the advancement in agriculture, several protected cultivation practices has been adopted massively in commercial farming. Among these protecting cultivation practices, green house, Plastic house, arte fact house, internet house and shade house etc., is useful. A greenhouse could be a framed or inflated structure lined with a clear or semi-transparent material that during which within crops may be full-grown underneath the conditions of a minimum of partly controlled setting.



## b. Hi-tech propagation

Availability of quality planting material in required quantities in time is the basic need for horticulture industry (Bhattacharyya *et al.*, 2017). In recent time micro propagation has come out as one of the important tool for easy and quick production of large quantity of plant material and has been used in crops like banana, chilli, tomato and many high value ornamental plants like gerbera, orchid etc. There is a high scope in our country for micro propagation of crops especially in ornamental crop. Protray growing of seedling (tomato, chilli etc..) can be practised where the large number of high quantity and quality of seedling can be grown in less area and time without much labour required. Growing of grafted seedlings and propagation of cutting can be done by use of poly bags.



## c. Hydroponics

Hydroponics is a technology which in recent days gaining importance in High-tech Horticulture where subset of hydro culture adopted for growing most of the high value horticultural crops without using field based substrates i.e., soil. In this technology plants are cultivated by using different growing media with proper minerals in the nutrient solutions and a subset of hydro culture which involves growing plants (usually crops) without soil, by using mineral nutrient solutions in an aqueous solvent. Terrestrial plants may grow with their roots exposed to the nutritious liquid, or, in addition, the roots may be physically supported by an inert medium such

as perlite, gravel, or other substrates. Despite inert media, roots can cause changes of the rhizosphere pH and root exudates can affect rhizosphere biology. Plants commonly grown hydroponically, on inert media, include tomatoes, peppers, cucumbers, strawberries, lettuces, cannabis and model plants like *Arabidopsis thaliana*. Hydroponics offers many advantages, notably a decrease in water usage in agriculture. Since hydroponics takes much less water to grow produce, it could be possible in the future for people in harsh environments with little accessible water to grow their own food.

## d. Aeroponics

Aeroponics is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. The word "Aeroponic" is derived from the Greek meanings of *aer* ("air") and *ponos* ("labour"). Aeroponic culture differs from both conventional hydroponics, aquaponics and in-vitro (plant tissue culture) growing. Unlike hydroponics, which uses a liquid nutrient solution as growing medium and essential minerals to sustain plant growth, or aquaponics, which uses water and fish waste, aeroponics is conducted without a growing medium. It is sometimes considered a type of hydroponics, since water is used in aeroponics to transmit nutrients. The basic principle of aeroponic growing is to grow plants suspended in a closed or semi-closed environment by spraying the plant's dangling roots and lower stem with an atomized or sprayed, nutrient-rich water solution. The leaves and crown, often called the canopy, extend above. The roots of the plant are separated by the plant support structure. Often, closed-cell foam is compressed around the lower stem and inserted into an opening in the aeroponic chamber, which decreases labor and expense, for larger plants, trellising is used to suspend the weight of vegetation and fruit.

### e. Vertical Farming

As urban populations continue to rise, innovators are looking beyond traditional farming as a way to feed everyone while having less impact on our land and water resources. Vertical farming is one such solution that's been implemented around the world. By vertical farming, horticultural crops can be cultivated easily in urban areas by planting in vertically stacked layers in order to save space and use minimal energy and water for irrigation. In India, vertical farming is at nascent stages; however, there are few start-ups & agri-tech companies revolution in the field. Vertical Farming has several advantages, which makes it promising for the future of agriculture. The land requirement is quite low, water consumption is 80 percent less, the water is recycled and saved, it is pesticide-free and in cases of high-tech farms there is no real dependency on the weather.



### f. Integrated Pest Management (IPM) and Integrated Nutrient Management (INM)

Integrated Pest Management (IPM) has become a widely practiced Hi-tech horticulture practice now. Integrated Pest Management in horticultural production is one of the key requirements for promoting sustainable agriculture. Integrated Pest Management aims at a judicious use of cultural, biological and chemical control of pests and diseases. Integrated Nutrient Management (INM) Integrated Nutrient Management (INM) also

has become a widely practiced Hi-tech horticulture practice now. Integrated Nutrient Management (INM) refers to maintenance of soil fertility and plant nutrient supply to an optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. Another important aspect of INM is the enhancing of the Fertilizer Use Efficiency (FUE) by proper placement of fertilizer in close proximity to the rhizosphere of the highest root activity. Integrated Nutrient Management has become one of the common practices among progressive horticulture producers today.

### g. Plasticulture

Plasticulture has become a popular hi-tech horticulture technology today. Plastics have various applications in commercial horticultural production. The practice of using plastics for commercial horticultural production is termed as 'Plasticulture'. Various applications of plastics in horticulture include Protected Cultivation (greenhouse structures; high and low tunnels etc), Plastic Mulching and Plastic Lining. Plasticulture improves the economic efficiency of production systems and helps in efficient water and energy management. Plasticulture reduces temperature fluctuations and moisture fluctuations and also helps in controlling pest and disease infestations. Plasticulture plays a dominant role in precise irrigation and nutrient applications by reducing wastage of water and nutrients and by reducing soil erosion. Use of plastics has proved beneficial to promote the judicious utilization of natural resources like soil, water, sunlight and temperature.

### h. New technologies like Global Positioning System (GPS) and geographic information systems (GIS)

GPS receivers collect location information for mapping the boundaries of the fields,

irrigation systems, roads and the problematic areas in crops like weeds or diseases. GPS accuracy helps farmers to build farm maps with correct acreage for field areas, positions on the road and distances between points of interest. In farm preparation, field mapping, soil sampling, crop scouting and yield mapping, such technologies are used. These advanced systems allow the farmers to produce their crops accurately by applying the accurate quantities of pesticides, herbicides and fertilizers.

#### **i. Use of Drones**

Drones are the wireless and sensor-equipped devices used for surveying in the fields. They easily capture the whole data at lower altitudes and also capture high-quality images. These are also used for spraying insecticides and pesticides in the fields.

#### **j. Food processing and value addition**

As most of the crops in horticulture are perishable in nature, it is necessary to process them so they can be used for longer periods. Moreover, horticulture food processing forms a major percent of the entire food processing industry. For long term use, horticultural foods such as fruits and vegetables are processed into various value-added products such as pickles, preserves, squashes, marmalade, concentrate, fruit mixes, jam, jelly, canned vegetables and canned fruits. Talking about flowers, they not only excel for their aesthetic value, but they are also rich sources of Nutraceutical goods. Hi-tech horticulture has scope for many new avenues in the future.

#### **Advantages of Hi-tech**

- Yield increases up to 5 to 8 times – high productivity per unit area.
- Better quality growth and uniformity is there.
- Big savings in key inputs such as water (up to 50 percent), fertilizers (up to 25

percent) and pesticides.

- Possibilities of off season production.
- Round the year production of crops.
- Impact on natural ecosystems will be reduced.
- Less runoff of chemicals into rivers and ground waters.
- In the regions of extreme climatic condition hi tech structures are only option available option for crop production.

#### **Disadvantage of hi tech**

- Initial expenses are very high means requires high capital investment.
- Skilled labour is required to operate the farms.
- Need for research and development.
- Requires time and commitment.
- Experience and technical knowledge is very necessary.
- Water and electricity risks are always there.
- System failure threats.
- Diseases and pests may spread quickly.

#### **Conclusion**

Hi-tech horticulture is being commercially used for production of exotic (non-native) and off-season vegetables, export-quality cut flowers and also for raising quality seedlings. Economic returns from the high value agricultural produce can be increased substantially when grown under Hi-tech horticulture hence, it is a powerful tool for doubling productivity of horticultural crops and be used for doubling farmers' income also prosper our country by providing food as well as nutritional security.

