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Recent Advances in Production Technology of Fruit Crops

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Introduction-

Increase in the yield of fruit crops are greatly influenced by the improvements in their production technology. Now a days fruit is progressively perceived as a vital part of a good eating routine, and intake of fruit and its products, particularly juices as well as fruit products added with dairy farm subsidiaries, has up pointedly over the previous decade (Childers, 2019). In the recent times, extensive research work has been done in case of advance and modern fruit production technologies. Many new techniques are adopted in the field of horticulture for producing better quality tropical fruits.

Advances in Production Technology of Fruit Crops-

Production of fruit crops accelerated in the past decade with the advancement in fruit cultivation techniques including modern methods. Modern method of fruit production begins with use of advance technique such as-

1. **Use of modern technology for fruit cultivation–**
   - **Improved productivity from the mechanization of agriculture –** Manual labor and hand tools used in agriculture have limitations in terms of energy and output, especially in tropical environments. To reduce manual labor and make processes faster, combine harvesters, tractors, seed cum fertilizer drill, power tillers, rotavators etc are finding greater use in the recent times. Capacity building of farmers can be achieved by tackling affordability issues through policy making and loans which would lead to greater adoption of mechanization services and thus affecting yields by reducing post-harvest losses and an increase in harvest gains.
   - **Climate/ weather prediction through artificial intelligence –** A major advance in agriculture is the use of artificial intelligence (AI). Modern equipment and tools based on AI enable data gathering can be employed to assist in precision farming and informed decision-making. Drones, remote sensors, and satellites gather 24/7 data on

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weather patterns in and around the fields, providing farmers with vital information regarding temperature, rainfall, soil, humidity, etc.

- **Resilient crops developed via the use of biotechnology –** Agriculture refers to a wide resource of methodologies that include traditional breeding methods, genetic engineering, and the development of microorganisms for agriculture. The involvement of biotechnology in agriculture has resulted in all-around benefits for farmers and end consumers with the use of genetic engineering uses for DNA identification and work with genes to increase crop resistance to pests and diseases, and the development of high-yielding varieties.
- **Agriculture Sensors –** Communication technology has evolved rapidly in India and has made farming easy. Sensors are now being used in agriculture to provide data to farmers to monitor and optimize crops as per environmental conditions and challenges. These sensors are based on wireless connectivity and find application in areas such as determining soil composition and moisture content, nutrient detection, location for precision, airflow, etc. Tractors are fitted with distance sensors, steering angle sensing element, steering drive, software controller and remote control as parts to be used in modern fruit cultivation.
- **Hydroponics-** Hydroponics is the technique of growing plants in soil less culture using a water based nutrient solution and can include an aggregate substrate or growing medium such as vermiculite, coconut coir or perlite. In the recent times, strawberries, raspberries, blueberries, cranberries are among some of the fruit crops grown through hydroponics system.
- Use of automatic computer-based technology for irrigation purpose, AI driven robots and drones can assist in operations lie planting, weeding, harvesting and spraying and also analyzing the current market trends for helping the farmers.

2. Meadow orcharding -

Meadow orcharding is a new technique of fruit cultivation which include dense planting of fruit trees, permitting little or short trees which is modified for higher light capture and conveyance and simple motorized field activity. Meadow orcharding provides higher yield because of increase in the no. of trees/unit area which leads to more returns/unit area. Central institute of Subtropical Horticulture, Lucknow investigated the meadow orchard system in

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guava . It was reported that Allahabad Safeda trees of guava can be planted at a distance of 1.0m ×2.0m which gives a density of 5000 tree/ha. This system is intended to provide fruit from 1st year and maintain an easier and smaller structured framework instead of huge and well branched trees. Induction of fruit buds in guava from the first year is done by topping and hedging of the plant and also this process helps in minimization of tree canopy dimension. An experiment was worked on meadow orchard to show the effectiveness of shoot pruning on plant development, blossoming and yield in guava cv. 'gasp prabhat' (Hariom and Shant ,2015). They pruned the half of the shoot of guava tree during month of April and July. They recorded that 50% of pruning vegetative growth of plant led to emergence of new shoots. Pruning of half shoots in April resulted in better fruit weight during winter season.

3. High density planting–

High Density Planting (HDP) is one of the important methods to achieve high productivity per unit area both in short duration and perennial horticultural crops. High Density Planting (HDP) is a very intensive form of fruit production which has high relevance to the food and nutritional security of our ever-increasing population (Anon, 2010). In recent years, the concept of fruit production is undergoing a change where emphasis is being given to higher production per unit area by increasing the number of tree/unit area. Thus, high density planting system is the fastest way of reducing the gestation period and increasing the productivity of the orchards.

Generally, for successful high-density plantings, the package of different components viz., cultivars, rootstock, canopy management, floor management, irrigation and nutrition management, orchard planning and layout are to be adopted as per the available natural resources, agro-climatic and soil conditions and judicious use of inputs. It is possible by regular pruning and use of bio regulators for maintaining the size and shape of the tree. Mango planted at spacing of 5m x5m (Kesar and Alphonso) gives higher yield under high density. Guava planted at spacing 2.5m x2.5m and 3m x6m under HDP gives higher production as well as more income in Allahabad Safeda and L-49. Banana is planted at 1.0m x 1.2m spacing gives better yield in cv.Rajapuri. So, the HDP is present need as per increasing population and decreasing agricultural area. High Density Planting in Jamun cv. Dhupadhal with 4000 plants/ha recorded higher values for growth attributes and Land Utilization Index Fig productivity increased from 12.5 to 30 quintals/ha. in Poona and from 25.5 to 48 quintals/ha. in Deanna with increase in planting density from 500 plants to 1000 plants per hectare

4. Use of Dwarfing rootstocks -

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Dwarf fruit trees are desirable to make the best use of vertical and horizontal space per unit time and to harness maximum possible returns per unit of inputs and natural resources. Dwarfing rootstocks promote early fruit bearing, reduce vigour and increased yield. The best solution for a natural size control is the selection of dwarfing rootstocks of fruit crops that would allow easy management of the orchards without or with a minimum of requirement of pruning.

Guava- A promising guava (*Psidium guajava*) aneuploid rootstock with dwarf characteristics for planting in high density orchards was developed at the IARI Fruit and Vegetable Technologies Division, India. It is a tetrasomic rootstock developed by the crossing of the diploid guava 'Allahabad Safeda' with a triploid without seeds. The trees reach 3 to 4 m in height, produce fruits of medium to large size, attractive green color and are sweeter than those obtained in orchards using seedlings of the guava 'Allahabad Safeda'. In addition to the dwarf characteristics, this rootstock also showed tolerance to the decline of guava, the main disease that affects the crop under field conditions (Pommer; Murakami, 2008).

Mango- Mango cv. Pusa Surya grafted on Olour and Kurakkan rootstocks produce dwarf trees. Rootstock K-5 and K-2 induced dwarfness in scion of mango cvs. Pusa Surya and Pusa Arunima (Dubey *et al*., 2021).

5. Advance technology for identifying plant diseases –

- Remote sensing with the use of non-contact optical sensors to obtain information about processes occurring in the natural landscape. Optical sensors offer the opportunity for non-destructive disease monitoring at different scales (Mahlein, 2016). As compared to conventional techniques for plant disease/pest monitoring, sensors optimize and reduce the human effort of disease detection in the field. Thus, AI powered image recognition can be used for disease diagnosis such as use of apps like Plantix,
- **Biological control-** The increased concern on environmental over pesticide use has resulted in a large upsurge of biological disease control. Among the various antagonists used for the management of plant diseases, Trichoderma and Pseudomonas play a vital role. It has many advantages as a bio-control agent due to its high rhizosphere competence, ability to synthesize polysaccharide–degrading enzymes, amenability for mass multiplication, broad spectrum action against various pathogens and environmental friendliness (Kumar, 2013). About 26 microbes have been included in the schedule to the insecticide act 1968 for production of microbial

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biopesticides. *T. viride, T. harzainum, Pseudomonas sp., Beauvaria bassiana, Metarrhizium anisopliae* and *Bacillus subtilis* are important biocontrol agents for management of various pest and diseases in India (Singh, 2012).

- **Disease forecasting and monitoring-** Plant disease forecasting and monitoring provides early information about the probable occurrence of a disease to facilitate management at appropriate time either to stop pathogen multiplication or further spread of the disease. It is essential to determine number of sprays and prepare schedules of application for economically sound disease control, and limit the chance of development of pathogen resistance to the pesticides. It can be achieved by establishing relationships between pathogen population and physical weather parameters like air temperature, rainfall, relative humidity, cloudiness, dry wetness or leaf wetness duration, at susceptible stage and favorable weather conditions.
- **New generation fungicides-** The process of fungicides discovery has undergone a noteworthy change over the years. After the era of broad spectrum multisite and site-specific systemic fungicides, several novel action fungicides of different chemical classes have been developed in the past two decades. These are more eco- friendly and used at a much lower dose rates as compared to the earlier compounds. Most noted among these are the strobilurins, Oxazolidinediones (faoxadone), Phenoxyquinolines, Anilinopyrimidines (cyprodinil, pyrimethanil), phenylpyrroles (fenpicloil, fludioxonil), Spiroketalamines (spiroxamine), Benzamides (mandipropamid), Cyanoimidazoles (cyazofamid), Thiocarbamates (ethaboxam) and Amdoximes etc.

6. Use of nanotechnology-

Nanotechnology offers an imperative role in improving the existing crop management techniques. Generally, only a very low concentration of agrochemicals could reach the target site of crops due to leaching of chemicals, microbial degradation etc. Hence, repetitive application is needed for effective control causing unfavourable effects such as rapid occurrence of resistance and soil and water pollution. Nano-formulated agrochemicals are designed in such a way that they possess all necessary properties like effective concentration (with high solubility, stability and effectiveness), time-controlled release in response to certain stimuli, improved target activity and less eco-toxicity with safe and easy mode of delivery. For eg- IFFCO (Indian Farmers Fertilizer Cooperative) Nano Urea is the only nano fertilizer

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approved by the government of India and included in the Fertilizer Control Order (FCO). Application of 1bottle of Nano urea can effectively replace atleast 1bag of urea.

7. Advance techniques for successful dry land fruit cultivation -

- **Development of water harvesting module-** Investments are being made to develop water harvesting modules for successful dryland cultivation of fruit crops. Under dryland conditions, cultivation potential lies in the availability of an adequate but erratic water resource provided by the rain. Local runoff water resources can be diverted, stored, and managed, construction of earthen and concrete check dam according to the catchment area, development of micro catchment module, and Horti-Silvi-pastoral system, to minimize water loss under dryland conditions. Optimizing Water Productivity and Nutrient Dynamics through Integrated Water and Nutrient Management of Fruit Crops shall be adopted in dry land areas.
- **Orchard floor management-** Under dryland condition, inter cropping during initial years in orchards of ber, aonla had no adverse effects on plant growth for up to 7 years. Intercropping of tropical fruits with guar, cucurbits, okra, and leguminous vegetable crops can increase the income of farmers. Cover cropping with lobia, moth bean was found to increase the water-holding capacity of light soils due to increased organic carbon content in these regions. Among the different cucurbits tried as intercrops, aonla + bottle gourd fetches more net economic return under rainfed conditions of western India's semi-arid ecosystem.
- **Hardening of plants in the nursery-** The term hardening includes "Any treatment that makes the tissues firm to withstand unfavourable environment like low temperature, high temperature, water stress, hot dry wind etc." In this process seedlings are given some artificial shocks at least 7-10 days before uprooting and transplanting. These shocks include
  - Exposure to the full sunlight,
  - Removal of all the shedding nets, polythene sheets
  - Irrigation is stopped slowly and slowly.

8. Exploitation Of stock-scion interactions for canopy vigour management And sustainable productivity -

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Rootstock trial in mango (cv. Totapuri)- For eight years old Totapuri trees, maximum canopy vigour was with Turpentine and Olour rootstocks while least was with Nekkare followed by Vellaikulamban. Fruit yield was highest on Turpentine followed by Olour rootstock and least on Nekkare followed by Kensington and Vellaikulamban rootstocks.

Rootstock evaluation in jackfruit- Jack on jack, jack on Rudrakshi and jack on *A. hirsuta* were on par with respect to plant height while *A. hypergyrea* recorded least vigour parameters.

Conclusion-

The article explains about various recent fruit production techniques. Techniques related with robotics are quite expensive but profitable for growers with large commercial production. Most techniques are even in the experimentation stage for the benefit of fruit industry. Management of fruit crops is an important aspect involving maximum share of time for production of good quality fruits for the market. Modern techniques like use of drones, automatic robotic system, information technology for carrying out different operations of fruit production technology could help the growers by reducing time and labour requirement and thus intended towards increasing yield by achieving the goals of sustainability.

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