

Recent Developments in Orchard Management

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INTRODUCTION

Horticulture, a vital component of Indian agriculture plays a key role in nutritional security, employment generation and economic growth. India stands as the second-largest producer of horticultural crops globally with significant outputs in fruits and vegetables. Despite its potential, the sector faces numerous challenges including climate change, water scarcity, post-harvest losses and limited market access. Besides new emerging challenges, poor productivity per unit area continues to be a concern in most of the horticultural crops with climate change impacting the productivity further. There is urgent need to address these issues.

An orchard is a place where several fruit crops have been planted in a systematic manner and are overseen to produce profits through consecutive yields. In this era, humans are facing the challenges of a growing global population, nutritional insecurities, better quality produces, rural poverty, and natural resource management etc. In such situations existing orchard management practices could not fulfil the requirement of quality and quantity production. So, there is need to shift from traditional to advance management innovations like use of HDP, use of resistant rootstock, use of Drip irrigation systems, Hi-tech cultivation, use of mulching, intercropping etc.

1. **High density planting system:** It is planting of more number of plants than optimum through manipulation of tree size. HDP is one of the improved production technologies to achieve the objective of enhanced productivity of fruit crops. HDP aims to achieve the twin requisites of productivity by maintaining a balance between vegetative and reproductive load without impairing the plant health. In this system, four planting densities are recognized viz., low HDP (250 trees per hectare), moderate HDP (250-500 trees per hectare), high HDP (500 to 1250 trees per hectare) and ultra-high HDP (>1250 trees per hectare). Various advantages of high-density planting system are early cropping and higher yields for a long time, reduced labour costs, improved fruit quality, efficient utilization of land and other resources, better canopy management, farm mechanization, convenient spray of pesticides etc.
2. **Use of rootstock:** The role of rootstocks and its use in different fruit crops has significant impact on fruit crop production by influencing canopy architecture, nutritional uptake, flowering, yield and fruit quality. Besides, it can also confront biotic and abiotic stresses such as soil pathogens, thermal stress, salinity and nutritional stress. In Mango crop, Kurrukan, Rumani and Moovandan rootstocks are used for salt resistant, dwarfing and salt tolerant traits respectively. Similarly, *P. friedrichsthalianum* is used in guava for dwarfing and wilt resistant traits. In plum crop, Pixy and Myrobalan are used as dwarfing and cold resistant rootstock respectively.
3. **Use of Nano fertilizer in orchard:** Nano fertilizers are the important tools in agriculture to improve crop growth, yield and quality parameters with increase nutrient use efficiency, reduce wastage of fertilizers and cost of cultivation. Nano-fertilizers are very effective for precise nutrient management in precision agriculture with matching the crop growth stage for nutrient and may provide nutrient throughout the crop growth period.
4. **Drip irrigation system:** It is a highly efficient micro-irrigation technique that delivers water and nutrients directly to a plant's root zone through a network of valves, pipes, and emitters. This method can achieve 95–100% water use efficiency by significantly reducing evaporation, surface runoff, and deep percolation. A drip irrigation has four basic components: suction, regulation, control and discharge, which are accomplished by water lifting pump, hydro-cyclone filter, sand filter, fertilizer mixing tank, screen filter, pressure regulator, water meter, main line, lateral and dripper. Correct use of drip can save water, reduce groundwater pollution, and improve water use efficiency and harvest index.
5. **Intercropping:** The practice of planting any profitable crop in the early alley spaces of fruit trees or in the early stages of unoccupied spaces for a long-term crop is known as intercropping. When the soil is dry and erodes during the rainy season, plant intercrops there. When these crops are ploughed into the soil, they contribute organic matter, lessen erosion, and enhance the soil's biological complexity and water-holding capacity. Because legumes fix atmospheric nitrogen in their nodules, they raise soil nitrogen levels and are therefore a good choice for cover crops. They limit the growth of weeds in the rainy season. Crops like green gram, black gram, cowpea, cluster bean, and soybean should be prioritized during the kharif season, although pea, fenugreek, broad bean, and lentil can be utilized as cover crops in the winter. In newly planted orchards, the area between the trees is best used by intercropping. If the permanent trees are properly spaced, they will not use a significant portion of the land for several years. They also function as a cover crop, and the cultivation, irrigation, and manuring of the intercrops improve the soil.

- 6. Mulching:** Crop wastes including straw, cotton stalks, leaves, sawdust, pine needles, coir dust, and other materials like polythene films are used to cover the tree basins and the spaces between the trees. Reducing weed development and preserving soil moisture are the two basic objectives of mulching. The most important way to preserve soil moisture and enhance growth conditions for plants is to mulch the soil around them. Among the common materials used for mulching are sawdust, hay, straw, residual crop residue, leaves and plastic. Bio mulching materials such as dry leaves, paddy straw, paddy husk, jowar trash, sawdust, dry grasses, and dry coconut leaves are used to minimize evaporation losses, control weed growth, and create a microclimate that regulates soil temperature, humidity, and microbial activity. A thin coating of straw prevents the soil from drying up completely and also reduces competition for nutrients and weed growth. By stopping the growth of weeds and managing soil moisture, it helps save moisture. It will also improve soil structure, stabilize temperature oscillations in the soil, and increase soil organic matter. In addition to increasing nutrient availability because of improved soil conditions, microflora shields the primary crop from competition for moisture and nutrients. These materials were found to have defects and to be more costly than necessary, despite their usefulness. For this reason, plastic film is the most often used material for mulching. Any horticulture crop's quality and yield might be improved by mulching. Plastic films aid in moisture conservation, soil temperature raising, and weed development inhibition.
- 7. Protected cultivation:** It is a technique of protecting plants from adverse biotic and abiotic stresses and providing favourable environmental or growth conditions to the plants. With the advancement in agriculture various types of protected cultivation practices suitable for a specific type of agro-climatic zone has emerged. Protected cultivation is a specialized form of agriculture. The purpose of protected cultivation is to grow crops by altering the natural environment of the crop so that the harvest period can be extended. The benefits of such systems include easier cultivation (e.g., irrigation, weed control, pest management, harvest), decrease in yield lost by ecological factors, working in all weather conditions, enhancement in marketable fruits, consistent high yield, and most important, earliness and higher profitability. It also increases the yield, improve the quality and stability of production and make commodities available when there is no outdoor production. Its primary emphasis is on production of high-value horticultural crops. Various kinds of fruit, such as strawberry, grape, peach, nectarine, flat peach, apricot, cherry, plum and citrus, have proved to be successful for protected cultivation.
- 8. Sod culture:** This practice is followed in the orchard located on sloppy land, particularly when the gradient of the slope is greater than 10 per cent. In this system, grasses are allowed to grow in the interspaces between the trees without tillage or mulching. It Controls soil erosion, maintains optimum soil moisture to ensure water and nutrients supply to trees, maintains organic matter, provides better aeration to the roots, enhances microbiological activity in the soil through better aeration, avoids bruising of falling fruits.