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Recent Advances in Orchard Management

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INTRODUCTION

At present, horticulture is recognized as a potential sector to enhance agricultural production, improve house hold nutritional security and income generation through diversification and employment, value addition and export. Inspite of the enormous success achieved in horticulture sector, several constraints still exist. 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 need to address these issues in the area of biotic and abiotic stresses and their impact on different horticultural crops.

An orchard is an intentional planting of trees or shrubs that is maintained for food production. There are many traditional orchard management practices which are carried out by the growers for commercial fruit production. But in this era, human faced with 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 shifting from traditional to advance management innovations like use of HDP, use of resistant rootstock against biotic and abiotic stresses, efficient irrigation systems, Hi-tech cultivation, and site-specific management of crop. Precision orchard management not only saves labour resources and increases the income of growers, but also has great significance in improving resource utilization.

High density planting system: 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.

First established in apple in Europe during sixties and common use in pineapple, banana, mango, apple, citrus and guava crops. In this system, four planting densities are recognized for apples 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). Recently, super high density planting system has been also established in apple orchards with a plant population of 20,000 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.

Suitable genotype/cultivar of fruit crop for HDP:

Use of genetically dwarf scion cultivars		
Crop	**Genetically dwarf cultivars**	**Desirable features**
Mango	Amrapalli	Precocious & tend to bear regularly
Papaya	Pusa Nanha	Dwarf & tend to bear at lower height
Banana	Dwarf Cavendish	High yielding with dwarf stature
Apple	Spur varieties like Red Chief, Oregon Spur	Bear on short stem, spurs; grow to 60-70% of standard cultivars in vigour and bear more spurs and yield more
Peach	Red heaven	Dwarfing & high yielding

Use of Dwarfing Rootstock	
Crop	**Dwarfing Rootstock**
Apple	M9, M26, M27, Bud.9, P22 & Ottawa3
Pear	Quince C
Peach	Siberian C, St Julien X
Guava	*Psidium friedrichsthalianum*

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. Due to limited availability of arable land and high market demand for fruit crops, they are frequently cultivated under unfavorable soil and environmental conditions like thermal stress, drought, flooding, salinity and contamination of organic pollutants. One way to substantiate or reduce these losses in production would be the use of appropriate rootstocks, which are capable of reducing the effect of external stresses on the scion. Rootstocks have a primary role in determining orchard efficiency. Therefore, it is important step to find a rootstock with the maximum desirable characteristics to meet the set of environmental conditions where the tree is to be grown. It means a root-stock considered best for a certain variety and environmental conditions may not be a best choice for some other variety and environmental regime.

Few examples:

Crop	**Source**	**Desirable features**
Mango	Kurrukan	Salt resistant
	Olour	vigorous rootstock
	Rumani	Dwarfing
	Gomera I	Most adaptable in saline conditions where low water quality
	Bappakai and Olour	Salt tolerant for high survival, germination and growth percentage under salt stress condition
	Moovandan and Nekkare	Salt tolerent
	Species *Mangifera minor*	Resistant to anthracnose
Guava	*P. friedrichsthalianum*	Dwarfing and wilt resistant
	P. fredrichsthalianum var. *lucidum*	Wilt resistant
	P. pumilum	Most dwarfing
	P. cattleianum	Tolerant to low temperature
Plum	Pixy	Dwarfing rootstock
	Myrobalan	Resistant to cold, collor rot & nematodes
	Myro-29C	Vigorous suitable for hard soil
Grape	*M. rotundifolia*	Resistant to phylloxera, downy mildew, anthracnose & nematode
	V. labrusca	Cold hardy
	V. aestivali	Resistant to many fungal disease and best for hot climate.

Irrigation

It is defined as the artificial supply of water to support plant growth and production in absence of adequate supply of water through rainfall is known as irrigation. Irrigation is very important in fruit crops as sufficient moisture must be maintained in soil for obtaining yield of good quality fruits. There are three important aspects of irrigation:

i) Time of irrigation

ii) Quantity of water in required.

iii) Appropriate System irrigation

- **Systems of Irrigation**: Several methods of irrigation are employed in orchard depending upon age of the trees, topography of soil and availability of irrigation water. Descriptions of commonly adopted methods of irrigations are outlined below:
  1. Surface irrigation: Flood system, basin, boarder method, Furrow method etc.
  2. Sub-surface irrigation: Drip irrigation
  3. Overhead irrigation: Sprinkler irrigation

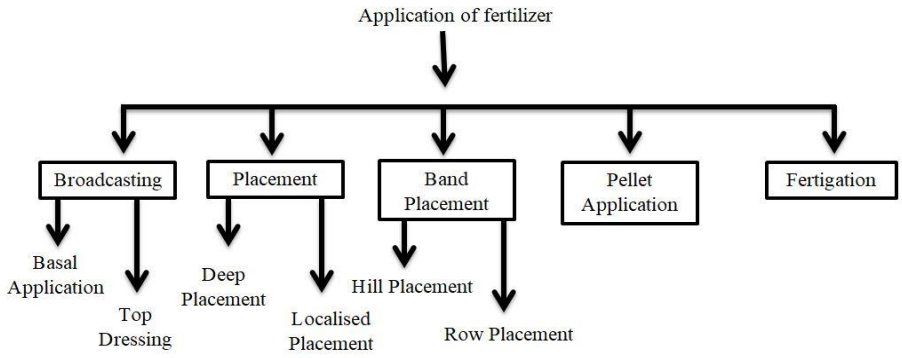
Keeping attention toward major drawback such as wastage of water is more; weed growth is excessive, risk of bark diseases like collar rot or foot rot exist as the tree trunk remain in contact with water for a longer time; nutrients present in the soil in a basin are washed away and move to the next basin etc. of various method like flood system, basin system, furrow system. In such situation drip irrigation opens new possibilities for fruit tree growing because water supplied to the plant is equivalent to its consumptive use. This is a highly water use efficient (WUE) system of irrigation having very less water requirement. This is an outstanding irrigation technique especially for arid region, where there are two basic constraints for surface irrigation, namely undulating land terrain and less water availability. 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.

- **Advantages of drip irrigation**:
  1. Water saving to the tune of 30 to 70 per cent.
  2. Increase yield and fruit quality.
  3. Higher returns per unit area and time.
  4. It saves labour cost.
  5. Improved water penetration.
  6. Eliminate soil erosion.
  7. Reduced weed growth.
  8. Saving in fertilizers and chemicals (40-60%).
  9. Poor quality water can be used more safely.
  10. Even undulated land can be irrigated.

Advances in fertilizer application

The different methods of fertilizer application are as follows:



Among various fertilizer applications method fertigation is a technique of fertilizer application in which fertilizer is incorporated within the irrigation water by the drip system where timing, amounts and concentrations of fertilizers applied are easily controlled. Fertigation ensures saving in fertilizer (30-50%), due to "better fertilizer use efficiency" and "reduction in leaching". Method of fertilizer application is also important in improving the use efficiency of nutrients. Fertigation is the only irrigation strategy, which helps in adequate supplies of water and nutrients with precise timing and uniform distribution to meet the nutrient demand of horticultural crops. Besides, fertigation ensures substantial saving in fertilizer usage and reduces leaching losses along with maximization of profitability and yields are a target. Fertigation has been found to be one of the most successful ways of water and nutrient application, particularly N, K and micronutrients through drip system. Besides increasing the economic yields, fertigation helps in proper utilization of fertilizer nutrients, saves labour, and increases the productivity. Yield advantages have been reported across the wide range of crops under diverse agro climatic situations. Fruit crops have been found to be responsive to fertigation due to their wide spacing nature, continuous need of water and nutrients at optimal rate to give high yields with good quality, and high capital returns on the investments.

Protected cultivation

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 includes 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 (including Chinese sweet cherry and mazzard cherry), plum and citrus, have proved to be successful for protected cultivation in China.

Mulch

Mulching is an important soil management practice of covering the soil surface around the base of plants to make conditions more favourable for growing and to conserve the available soil moisture. Mulch is a layer of material applied to the surface of an area of soil. This is one of the important soil management practices adopted in certain countries. The commonly used mulch materials in fruit orchards are organic (fallen leaves, paddy straw, saw dust, hay etc.) and inorganic (plastic mulch, rubber mulch and polygene etc.). Organic mulch materials also include pruned materials in fruit orchards. Mulching facilitates for more retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil, as it adds nutrients to the soil and ultimately enhances the growth and yield of crops. Due to the beneficial effects of mulching practice in fruit cultivation, it always ensure the better quality fruit production with high yield and better return to the grower.

Few examples of uses of mulch in fruit crops:

Guava: It is reported that the guava treatment with black polythene produced maximum number of fruits as well as highest yield per plant. Also paddy straw was found to be effective to improve the fruit quality of guava. Organic mulches, such as straw, dried grass or compost, are excellent for use under guava trees to eliminate weeds and to conserve moisture.

Strawberry: Higher yields have been noticed in strawberries (*Fragaria* sp.) when using clear plastic in combination with soil fumigation with methyl bromide and chloropicrin. It is also recorded the maximum number of runner per plant, runner platelets per runner and runner plantlets per plant in strawberry were with paddy straw mulch. Further observed that the black polyethylene mulch in strawberry had the best growth, fruit weight, yield and quality.

CONCLUSION

As enormous success achieved in horticulture sector, several constraints still exist such as traditional method of fertilizer application, irrigation application, inferior quality planting materials *etc*. along with 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 need for adaption of advance horticultural technique that is beneficial to improving the growth, quality and productivity of fruit crops. Therefore, it can be adopted by growers to achieve more returns.

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