Chapter – 12

ENHANCING THE PRODUCTIVITY OF GUAVA (*Psidium Guajava* L.) THROUGH HI-TECH PRACTICES

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Introduction

Fruit culture is highly profitable as itincreases the employment opportunities, besides commercialization is possible in the rural sector. It also provides ample opportunities for sustaining large number of agro-industries to generate substantial employment opportunities (Bardhan, 2016). Horticulture production in India increased substantially recent years due to adoption of advanced technologies by the farmers. The higher production is progressed due to area expansion. Over the last decade, the area under horticulture grew by 2.6% per annum and annual production increased by 6% in India. During 2018-2019 production of horticulture crops with 314.67 Million MT of horticultural produce from an area of 25.87 Million Hectares surpasses the agricultural production of 285.21 Million MT from an area of 95.45 Million Hectares (Indian Hort. Database, 2018-19). The production of fruits has increased from 50.9 MT to 96.75 MT since 2004-05 to 2018-19. Fruit crops holds second rank in production by contributing 31.5 % production share. Due to tremendous increase in population and increased demand it is essential to improve the production with the available resources. Maximum of vitamin E contents was observed. Reveal that guava fruits have potent antioxidant activities which may be responsible for its pharmacological effects. This can be achieved by increasing the productivity through hi-tech cultural practices. In this review, the recent hi-tech practices that have positive impact on the productivity of guava is compiled and presented Guava (*Psidium guajava*) is one of the most important commercial fruits in India.

Guava is native to tropical America stretching from Mexico to Peru. It is the fourth most important fruit after mango, banana and citrus. India is the major producer of Guava. The area under guava is 260.07 Thousand Ha and the production 3826.40 Thousand MT (2016-17). The export from India is 1.23 Thousand MT and the Value is 553.26 Lakh Rupees (Indian Hort. Database, 2018-19). It grows very well in tropical as well as subtropical climate. It is considered to be more remunerative crop to the farmer's due to its high productivity, easier cultivation and less cultivation cost. In the recent past, it has gained momentum owing to its versatility in adaptability to a wide range of soil conditions, especially problem soils such as saline, alkaline and even in clayey soils too. It is available at reasonable price and known for its rich nutraceutical values (Kumar and Mishra, 2012) thus, named as apple of tropics and super fruit (Maji*et al.,* 2015). Amongst various tropical fruit crops in India, guava, if left on its own, give the variable quantities and qualities from the various flowering flushes throughout the year. In general, guava flowers twice in a year i.e.in March-April (*Ambe bahar*) and June-July (*Mrig bahar*), of which fruits ripen in rainy and winter season, respectively. However, in central and Southern part of India, there is a third crop with flowers appearing in October (*Hastha bahar*), of which fruits ripen in the month of March was also realized. This pattern of flowering and fruiting is not desirable for commercial exploitation. Moreover, the fruits of *Ambe bahar* which are harvested during the months of July- September and insipid, watery, and poor in quality and heavily infested with fruit fly resulting in significant loss to most of the guava growers (Mishra and Tiwari, 2000).The winter season fruits are superior in quality, free from pests which fetch high monetary returns (Singh *et al.,* 2000). Many works have been carried out for improving the yield and fruit quality of guava in India through various technologies. Hence, it is highly essential to implement certain important modern, innovative and hi-tech methods for improving the quality as well as quantity of guava production.

High Density Planting

There is a shift in farmers‟ insight from production to productivity and profitability which can be achieved through high density planting. High density planting has been in practice as a prime method for improving productivity of temperate fruit crops like Apple. In the past one decade, strenuous efforts were made to adopt high density planting in tropical fruit crops also. Presently, the trials on mango and guava HDP are practiced as successful technologies. Apart from high density planting, moderate density levels were also found to increase the productivity of guava at certain places.

Fruit yield was increased significantly with decrease in density of plants during both the crop seasons. In rainy season, the yield per tree was significantly affected by plant spacing, and minimum yield was recorded during winter season.

Canopy Management Practices

Training and pruning practices are integral part of high density planting systems. High density planting obviously needs to be combined with training and pruning techniques. Studies indicated that pruning of guava trees can enhance the productivity under high planting density. Guava responds well to pruning, because it bears fruits on current season's growth and flowers appear in leaf axils. Pruning restores the, distance between shoot and root system, besides maintains the growth and vigor of shoots by allowing fewer growing points to grow vigorously.

Flower Induction

Flower production is bound to increase due to pruning. Pruning from April to June enhanced the flowering percentage as compared to pruning in February and March. The number of flowers per shoot on severely pruned (60%) trees of guava was more when compared to mild pruned (30%) trees and control. Pruning thrice a year produced maximum number of flowers per plant while pruning of 80% of canopy in October produced minimum number of flowers per plant during winter season.

Crop Regulation

Amongst various tropical fruit crops in India, guava, if left on its own, give the variable quantities and qualities from the various flowering flushes throughout the year. Under natural conditions, these crops produce flowers thrice in a year i.e. February – March (*AmbeBahar*), June –July (*Mrig Bahar*) and October – November (*Hasth Bahar*) with the corresponding harvest during rainy, winterand spring seasons, respectively (Boora *et al.,* 2016, Lal*et al.,* 2017).Regulated crops are desired to avoid glut in the market and also ensure the regular supply of fruits. The choice of bahar at a particular location is determined by prevailing production constraints like availability of irrigation water, quality of produce, market demand and extent of damage by insect-pests and diseases The principle behind crop regulation is to induce flowering and fruiting in desired season of the year that contribute to increased fruit yield, quality, profitability and sustainability of the environment by reducing the use of the frequency of the pesticides.

Gaps in Prevailing System

Fruit production is seasonal activity and during the peak season price drops sharply owing to the glut in the market. At same time in multiple flushing species like citrus, guava and pomegranate, the desired yield and quality is not obtained during the peak demand period in the market. This condition is not economically sustainable. Therefore, to obtain higher fruit yield during a particular period, these fruit crops are given arresting period with artificial means so that the natural flowering tendency of the trees is altered. To increase fruit yield, quality and profit, the flowering and fruiting of guava can be regulated to produce flower on desired season of the year. In Northern Indian Plains, adoption of various practices such as withholding irrigation after harvesting during the months of April- May is followed. Following the shedding of flowers, the tree goes to rest and irrigated in June which produces profuse flowering after 30 -35 days. By the way, the crop is regulated.

With holding of Irrigation Water

Withholding watering of trees from February to middle of May results in the shedding of flowers and trees go to a rest period during which accumulation of food materials takes place in branches but not sandy in heavy soils .

Root Exposure and Root Pruning

Carefully, 7-10cm upper soil around the tree trunk in a radius of 40-60 cm are removed so that roots are exposed to the sun which results in reduced moisture supply to the top, therefore, the leaves begin to shed the leaves and tree goes to a rest period. After above 3-4 weeks, the exposed roots again covered with soil and manure mixture followed by watering to get a good crop.

Shoot Pruning

Guava flowers are always borne on newly emerging vegetative shoots; irrespective of the time of years, shoot pruning have been reported to be successful. Shoot pruning is helpful in reducing the tree size and improving the fruit quality. The time and intensity of pruning affected tree sprout and yield guava cv. VNR Bihi.

Deblossoming

Deblossoming of rainy season crop subsequently increased the winter season crop Manual deblossoming on a commercial scale is economically not viable. In contrast to this found it economically profitable when 50% of rainy season crop is removed manually. Deblossoming with 100 ppm NAA and 200ppm NAA were effective for guava cv VNR Bihi in rainfed plateau conditions in Eastern India.

Branch bending/ Shoot Bending &Fruit Thinning

Breaking the apical dominance and activating the latent buds present on the branch produce better quality fruits in the offseason and maintaining increased C:Nratio and induce more flowering and fruit set. Flower thinning by Naphthalene Acetamide (NAD) 2,4-D Potassium Iodide and ethephon Urea spray was also found efficient for deblossoming. Flower thinning during summer tends to improve fruit quality and increased the yield of winter season crop. Meanwhile, shoot bending is a potential method to have better quality off-season crop.

Fertilization

The amount of fertilizers to be applied in high density /meadow orchard of guava depends on the age of tree, condition of plant and type of soil. For proper growth and higher yield, following fertilizer doses should be applied i.e. urea, SSP and MoP.

Fertigation

Fertilizers should be applied in a form that it becomes available in synchrony with crop demand for maximum utilization of nutrients from fertilizers. To meet the crop nutrient demand fertigation provides adequate supplies of water and nutrients with precise timing and uniform distribution. Fertigation also ensures substantial saving in usage of fertilizers and reduces leaching losses than the conventional practice, optimum split applications of fertilizer will improve quality and quantity of crop yield, which is similar to frequent water application. Higher yield is obtained in guava through fertigation than basin irrigation. Fertigation at 75% recommended NK level with urea and multi-K gave 12.3% higher yield than soil application at 100% NK level indicating a saving of 25% NK in addition to improvement in productivity.

Mulching

The effect of organic and inorganic mulching materials on growth, fruiting and fruit quality of guava, grown on new alluvial zone of West Bengal. Different soil covers were used in the experiment instead of using polythene mulch as control. The soil covers used were cover crops like cowpea, Sugarcane trash (O cm thickness), Saw dust (5 cm thickness), Dry guava leaves (10 cm thickness), Paddy straw (10 cm thickness), black polythene (250 gauge) and white polythene (250 gauge). Maximum number of fruits and the highest yield per plant was obtained when black polythene was used as mulch. Different mulching treatments also showed increase in weight of individual fruit, number of fruits per plant, yield of fruit per plant as well as per hectare.

Foliar Nutrition

The spray of guava trees with Dormex at 2% in January then sprays twice with combination from (urea at 1%+K_2SO_4at2%+$ZnSO_4$at0.5%+ Borax at 0.3%) at full bloom and after fruit set (one month later) to improve vegetative growth; nutritional status; yield and fruit quality of guava.

Root Stock

Mirzapur Seedling, Cheeni guava and Karela could be used as rootstock under saline condition which increases the area and productivity of guava in India. It is concluded that the above-mentioned novel techniques for guava is scientifically proven that are highly potential enough to improve the crop productivity. The ultimate aim is to increase the productivity per unit area with the effective utilization of optimum inputs. All these studies showed that productivity could be increased by increasing the population per unit area. It is certain that the increased population will not alone perform well unless their stature maintained according to the space allotted to each of them. Hence, it is important to adopt canopy management and crop regulation practices viz., pruning, withholding of irrigation water, root exposure and root pruning, shoot pruning, shoot bending, deblossoming practices and using saline tolerant rootstock etc. Even though number of plants with well- developed framework is maintained, the plants may starve for nutrients due to competition. This can be overcome by following the nutrient recommendation standardized for particular planting density. Fertigation and micro-nutrient application are the major practices in guava to obtain higher yields.

The method of application of all essential inputs *viz*., growth regulators, and micro-nutrients for plant growth also had influence on crop growth and productivity. For instance, using drip system for irrigation and fertigation ensure effective uptake of water and nutrients by the plants. Hence, it is clear that the technologies capable of improving plant growth via different cultural practices have to be utilized in an integrated manner forgetting remarkable results. So, it is our duty to popularize and handover these techniques to farmers so that our ultimate goal can be achieved practically.

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