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Review

Techniques for crop regulation in guava- a review

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ABSTRACT

Guava (*Psidum guajava* L) is one of the most promising fruit crops of India and is considered to be one of the exquisite nutritionally valuable and remunerative crops. In recent years guava is getting popularity in the international trade due to its nutritional value and processed products. Generally guava bears two crops in a year. The fruits produced in rainy season are rather insipid and watery and do not keep well. The winter crop is the one ordinarily as is not only larger size but of much better fruit quality. Main objective of crop regulation is to force the tree for rest and produce profuse blossom and fruit during any one of 2 or 3 flushes. This aims at regulating uniform and good quality fruit and maximizing produce as well as profit. Fruits like guava, pomegranate and lemon flower 2 to 3 times in a year. A good harvest is possible only if crop is regulated to single season ie Bahar otherwise the uninterrupted continuous blossoms would produce light crops over the whole year and require a high cost for the watch and ward and marketing. The selection of Bahar at a location is mainly determined by availability of water, occurrence of diseases, pests and marketing position. Crop regulation is achieved by the various techniques like withholding irrigation, flower bud thinning, shoot pruning and application of different chemicals.

Keywords: Crop regulation; guava; productivity; quality

INTRODUCTION

Guava (*Psidium guajava* L) is the fifth most important fruit crop of India as well as a popular fruit crop of tropical and sub-tropical areas of the world. It is easily available with reasonable price thus named as Apple of Tropics and Super Fruit for its rich nutraceutical values (Nimisha et al 2013, Parvez et al 1999). Smith (1034) stated that the quantity of fruits borne in a year is greater if only the winter crop is taken. There are three distinct flowering seasons viz spring (Ambe Bahar), rainy (Mrig Bahar) and autumn (Hasta Bahar) with the corresponding harvesting periods during the rainy, winter and spring seasons in guava (Rathore and Singh 1974).

The rainy season crop of guava is rough, insipid, poor in quality, less nutritive and is attacked by several insect pests and diseases (Radha and Mathew 2007).

Flowering season	Flowering	Fruiting
Ambe Bahar (February)	February-March	July-August
Hasta Bahar (October)	October-November	March-April
Mrig Bahar (June)	June-July	November-December

The winter season fruits are superior in quality, free from diseases and pests and fetch more prices in the market. Winter season crop has better storage life and thus can be transported to destination offering remunerative prices (Nautiyal et al 2016.)

Monselise and Goldschmidt (1982) found that the shoots grew faster in first 4 months, slowed down during the next three months and finally started drying

out at the age of one year or initiated new growth which was mostly lateral. The percentage of fruit set and mature fruits was found to be the highest in winter crop followed by the whole year and rainy season crops (Rathore and Singh 1974). The yield in respect of both weight and number of fruits per tree was maximum in the whole year crop followed by winter season and rainy season crops (Rathore and Singh 1976). In the Deccan where the climate is mild it has been a popular practice to obtain flowering in a desired season (Chundawat and Sen 2002). To avoid the undesirable and take the desirable season crop various techniques like withholding of irrigation, flower bud thinning, shoot pruning and the application of different chemicals have been recommended (Singh 2013). All these treatments were effective in reducing the rainy season crop and increasing winter season production.

Withholding irrigation

In guava the operations of withholding water, exposing feeding roots and pruning fibrous roots to force blossom in the desired season are practiced in Mumbai and Deccan. Root pruning is not recommended in Uttar Pradesh as it imposes moisture stress resulting in leaf drop and cessation of growth of crop during period of unwanted Bahar (Singh 2013). The Bahar treatment is of greater significance in southern, central and western India where growth and flowering continue throughout the year (Naik 1963). Cheema et al (1954) recommended withholding of water and removing the earth from around the upper roots by 10 June and again covering it with soil and manure mixture. Two irrigations were also suggested before a normally heavy one when the rains did not start. Singh (1963) recommended withholding of water for those areas of the western India where soils were lighter. However for heavier soils suggested root pruning in addition to the withholding of water during December or January.

Bending of guava shoots for crop regulation

Most of the growers of West Bengal prefer winter season crop and regulate flowering by bending the shoots in the month of August-September (Mitra et al 2008). This practice is very much dependent on training of guava branches. On the basis of calculation of expected flowering the branches of guava plants are bent down about 45-60 days before the expected date of flowering and to produce fruits in the off season. First time bending of branches of guava plant should be employed at the age of 2 years of plant. Before bending the leaves small shoots, flowers and fruits from branch are removed or cut off keeping 10-12 inches of terminal twigs intact. During autumn (September-November) the new shootlets take 20-25 days to emerge. Bent branches should be untied when the new shootlets are about 1 cm in length. Flowering occurs in the new shootlets at 4-5 pairs of leaf stage after 45-50 days of summer and 60-65 days of autumn bending. Manures and fertilizers should be applied 15 days before bending of branches and again at pea stage of fruit growth followed by irrigation (Singh 2013).

Hand thinning

It is possible to regulate cropping pattern in guava by hand thinning of flower buds and thinning of flowers during the months of March and April in Red Flushed, Allahabad Safeda and Sardar varieties which has proved to be the most effective in reducing size of rainy season crop by withholding water (Singh and Singh 2011).

Pruning

Annual pruning is used as a cheap and effective culture technique for regulating cropping pattern and increasing fruit yield and quality in guava (Bhagawati et al 2015). In guava maximum number of fruits in winter crop was obtained from trees in which three-fourth shoot length was pruned in the month of May (Singh 2013). The practice is popularly known as elicit treatment and is achieved by root exposure and root pruning or exposure to hot sun before the onset of monsoon. Root pruning however has a harmful effect on the longevity of trees (Sharma 2006). In order to have a good winter harvest deblossoming of rainy season crop and root pruning have been suggested in Uttar Pradesh where root pruning is not desirable. Gopikrishna (1981) studied the effect of pruning on vegetative growth, flowering and fruiting in Sardar guava for obtaining winter crop in Maharashtra. Branches were left without pruning or pruned by 10 cm (mild) or 25 cm severe punning levels. The pruning favoured the production of more flowers in July-August flush thereby more fruits in winter season.

Sharma (2006) reported that 50 per cent shoot pruning of guava cv L-45 (Sardar) in May produced the highest fruit yield of winter crop. Maximum crop regulation in terms of minimum fruit yield (5.82 kg/ tree) in summer season was recorded in pruning of the total flowering/fruit bearing portion of current season shoots followed by heading back of current season shoots to the levels of 2 basal leaves which resulted in maximum fruit yield of 104.98 kg/tree and 100.91 kg/tree respectively in winter season (Singh et

al 2007). Plants with one leaf pruning produced better quality fruits in both the seasons and recorded maximum TSS and ascorbic acid and minimum acidity. Maximum yield (88.0 kg/tree) was recorded with one leaf pair pruning during winter season (Tiwari and Lal 2007). Overall yield during both the seasons was maximum in control (110 kg/tree) however due to good quality fruit during winter season higher income was obtained with the treated trees as compared to control. Overall profit was also highest in one leaf pair pruning by withholding rainy season crop (Sharma and Krishna 2014). Overall pruning was found to have rejuvenating impact on aged trees due to better light interception leading to better photosynthetic rate and better nutrient and water supply with reduced canopy and better quality yields (Bhagawati et al 2015).

Chemical application

In guava deblossoming with 600 ppm NAA prevents flowering and cropping during rainy season in order to increase cropping in winter season. It can also be achieved through manual removal of flowers or use of NAA at 50 ppm followed by 2, 4-D at 30 ppm and hand deblossoming followed by half shoot pruning. Double spray of NAA at 800-1000 ppm at 20 days interval was found best in winter season crop (Singh 2013). Maji et al (2015) concluded that summer deblossoming with NAD @ 60 ppm might be the most effective crop regulating treatment followed by NAA @ 500 ppm and NAD @ 40 ppm to get superior quality fruits of guava cv L-49 (Sardar) as well as more profit from winter season cropping. Singh (2013) observed that spraying with NAA at 100 ppm reduced the rainy season crop considerably but the best results were obtained by hand thinning of summer flowers which reduced the rainy season crop by 81 per cent and increased the following winter crop by 181.4 per cent. Rathore (1975) reported that NAA at 80 and 100 ppm greatly reduced the fruit set in guava when sprayed in the month of April. Among the different fruit thinning chemicals used for crop regulation in guava NAD at 50 ppm and 2, 4-D at 30 ppm were the most effective chemicals for deblossoming of summer flowers (Kumar and Hoda 1977). Application of NAA 600 ppm and 800 ppm, flower bud thinning by hand and one leaf pair and two leaf pair shoot pruning carried out in the first week of May significantly reduced the rainy season crop and subsequently increased the winter season crop (Tiwari and Lal 2007). Deblossoming at unopened bud stage and fruit thinning at different intervals after fruit setting also showed better results (Parvez et al 1999). Dubey et al (2002) reported that 250 ppm of NAA caused maximum deblossoming in the rainy season lowering maximum yield and quality fruits during winter season. Gaur (1996) reported that for higher production in guava cv Allahabad Safeda trees were sprayed with either 600 ppm NAA or 16 per cent urea or pruned to remove the top half of the current season's growth. Singh et al (2000) observed that sprays of ethephon (600, 1200 or 1800 ppm), NAA (200, 400 or 600 ppm), urea (10, 15 or 20%) or potassium iodide (0.5, 1 or 2%) applied at flowering in April and again 2 weeks later in May on guava cv Allahabad Safeda and pruning (50, 75 or 100%) of current season's growth performed on 10 May reduced fruit yield during the rainy season and produced the highest yield in the winter season. Agnihotri et al (2013) reported that guava cv Lucknow-49 trees sprayed twice (last week of April and 2 weeks later) with NAA (200, 250 or 300 ppm), maleic hydrazide (150, 200 or 250 ppm), urea (5, 10 or 15%), 2,4-D (20, 30 or 40 ppm) or NAD (naphthalene acetamide) (25, 50 or 75 ppm) reduced fruit set in the rainy season crop but increased it in the winter season (Choudhary et al 1997). Now a days defoliation has been used to induce new shoots and flowers. In a fruit management programme working with Beaumont guava at Hawaii noted maximum number of lateral shoot production by defoliation with ethepon at 1200 ppm and maximum shoot length with ethepon at 600 ppm (Bose et al 2002).

Spraying 10 per cent urea during May when maximum flowers had opened regulated crop for winter season (Singh et al 2002). Dwivedi et al (1990) found that spraying of 15 per cent urea was the best treatment with respect to removal of summer season flowers and improving yield and quality of fruits during the winter season cropping. According to Singh et al (2000) 2 sprays of 10 and 15 per cent urea at 10 day intervals during flowering in the summer season was economically feasible for crop regulation in Allahabad Safeda and Sardar guava respectively. Fruit weight, total soluble solids, ascorbic acid and reducing sugar contents were highest with foliar spraying of 25 per cent urea on Allahabad Safeda and decreased with increasing urea concentration in Sardar.

According to Sahay and Kumar (2004) and Singh et al (2002) double spray of urea (15%) at 50 per cent bloom stage and second 10 days after first spray, hand deblossoming and three-fourth current shoot pruning on 30 May can be used for winter cropping in Sardar guava. Spraying the same trees with PP333 at

50 or 100 ppm following 15 June promoted flowering in late summer and gave winter yield with high quality (Sharma and Krishna 2014).

CONCLUSION

Crop regulation in guava can be adopted successfully by various cultural and chemical methods. Among cultural methods half shoot pruning of current season and manual removal of 50 per cent flowering of summer season in May were found superior. Among chemicals foliar application of 15 per cent urea and NAA at 200-250 ppm were the most effective. Depending upon the availability of labour and chemicals a suitable technique should be adopted to obtain higher quantity and quality of fruits from guava orchards.

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