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Pruning for Winter Crop Production in High Density Guava Plantations – A Review

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A B S T R A C T

High density meadow orcharding and crop regulation has made an important breakthrough for optimization of the guava fruit production. The land rates are hiking day by day and there is need for early returns from the invested capital, so it became a worldwide trend to plant trees on a high planting density and to manipulate tree architecture by canopy management to control growth pattern, shape of the plant and increase the fruit production. In guava, three distinct flowering seasons were identified in different parts of India. Flowering occurs on the current season's growth, even though the crop is available around the year. The rainy crop is of inferior quality, infested with fruit flies and do not keep well, whereas the winter crop produces a better fruit quality, fetch a premium price and has a long shelf life. Hence rainy season crop is regulated to next winter season by pruning. Pruning at different timings have shown different effects on the growth, flowering and yield parameters of the crop. It's essential to standardize the pruning time in order to get crop with higher returns.

Introduction

Guava (*Psidium guajava* L.) commonly known as "Poor Man's Apple" or "Apple of Tropics" is one of the major fruit crop of Subtropical and tropical climatic regions. The center of origin of the crop is believed to be Tropical America, extending from Mexico to Peru. In the early 17th century the Portuguese introduced this plant to India (Singh, 1995) and today India is one of the major producers of Guava. Guava belongs to the family 'Myrtaceae' and is having chromosome number 2n = 22. The

Genus *Psidium* consists of more than 150 species but only *Psidium guajava* is commercially exploited. The common guava is diploid but many of natural and artificial triploids 2n = 33 and aneuploids do exist.

Present status

Among guava producing countries, India ranks 1st in area and production followed by China and Thailand. The highest productivity of 15.8 tones/ha had been recorded in Brazil. In India, guava is the 5th most important fruit in production after Banana, Mango, Citrus and Papaya. It occupies an area of 2.61 lac hectares with annual production of 36.4 lacs MT and productivity of 13.94 MT/ha in India. Though it is grown successfully all over the country but Uttar Pradesh, Bihar, Madhya Pradesh and Maharashtra are leading producers. Among Indian states Uttar Pradesh ranks 1st both in area (49 thousand ha) and production (9.19 lacs MT) alone while Punjab accounts for the highest productivity 22.46 MT/ha. (Anonymous, 2017)

Composition

Guava is an excellent source of ascorbic acid, dietry fibre, pectin and minerals. The composition of guava fruits varies widely with cultivars, stage of maturity and season. The predominant sugars are fructose (59%), glucose (36%) and sucrose (5%) (Mahor *et al.,* 2014). Fructose is the principal sugar in the green ripe fruits while fully ripe fruits contain higher amount of sucrose.

Importance of pruning

Pruning in guava is pre-requisite for the better growth and yield of fruits because it bears on current season growth and flowers appear in the axils of new leaves. In Guava there are three distinct flowering seasons: Spring (Ambebahar), Rainy (Mrigbahar) and autumn (Hasthabahar) with the corresponding rainy, winter and spring harvesting cycles. After 7-8 years guava plants owe to excess vegetative growth and intermingling of the branches on the lower half of the tree canopy resulting in unfruitfulness, as the fruitful bud becomes blind and there is a decline in the yield with sub-optimal fruit quality. Pruning on bearing trees leads to the formation of new shoots, avoid overcrowding of branches, removal of criss-cross branches, diseased branches as well as water sprouts and root suckers. Hence pruning is considered as an important practice especially in meadow orchards where restriction of vegetative growth is essential for maintenance of plant canopy at a desirable height influencing the vigor, productivity and quality of the fruits to encourage new shoot emergence after harvest. Several workers have reported increase in vegetative and qualitative attributes of guava as a result of pruning at different periods. Therefore pruning levels and time of pruning in guava under high density conditions has achieved a greater importance.

Vegetative growth parameters

Plant height

Lian (2019) pruned the plants of L-49 guava at different times (mid-April, mid-May, mid-June) and recorded the plant height to be maximum with mid-April pruning. Similar observations were recorded when Singh (2005) carried rejuvenation pruning on fifteen years old L-49 guava plants from April to June. Likewise, Sah (2017), Rajwant and Dhaliwal (2001) reported maximum increase in the plant height with pruning in the month of April.

Nikumbhe (2017) monitored the effect of the different times of pruning (May, June, July, August and September) and observed maximum increase in the plant height in May pruned plants while minimum with pruning in August. These results were in line with the findings of Pandey (2013) and Kindo (2005) who reported maximum increase with May pruning.

However Kumar and Rattanpal (2010) reported no significant effect of the pruning time on the plant height and found it maximum in unpruned plants. These results were supported by the findings of Lal (1992) and Anez (1998) where unpruned plants were recorded with maximum increase in plant height

Shoot length

When ten years old plants of Lalit guava planted at as spacing of 6 x 6 m were pruned at different times Meena (2016) recorded maximum increase (24.32 cm) in the shoot length in May pruned plants while minimum increase (10.88 cm) in control followed by pruning in June (17.12 cm). The results of this experiment were in line with the findings of Dhliwal (2004), Anez (1998) and Mohammad (2002) who reported maximum increase in the shoot length with pruning in May.

Lian (2019) revealed that the shoot length had been significantly influenced by the difference in the time of pruning. The highest shoot length (23.67 cm) was recorded in mid-May pruned plants which were at par with mid-April pruning (23.11 cm) and lowest (20.89 cm) in mid-June pruned plants.

Contrary to the above findingsNikumbhe(2017) reported highest increase in the shoot length in unpruned plants (120 cm) followed by pruning in May (86.50 cm) while lowest in the September pruned plants (67.50 cm).

Plant spread

Sah (2017) recorded the highest increase in plant spread with three-leaf pair pruning in comparison to full-shoot pruning during June, as the net photosynthetic area gets reduced for some time with full shoot pruning resulting in reduced plant spread. Likewise, Singh (2007) studied the response of guava (cv. Allahabad Safeda) plants to different rejuvenation periods. The plants were pruned leaving four scaffold branches per leaf from April to June. The plant spread was observed to be significantly affected with different rejuvenation periods. The plant spread was lowest in May and highest in June pruned plants.

However, Meena (2016) recorded highest increase in the plant spread with pruning in May, when 10 years old plants of Lalit guava were subjected to pruning at different timings (April, May and June). Similar results were obtained by Lian (2019) on L-49 guava plants.

Flowering parameters

Time of flowering

It is a general tendency to grow new shoots after pruning as soon as possible, but, the response was different as per the time and severity of pruning. Meena (2016) reported that the control plants flowered very late (51.33 days) while pruning treatments triggered early blooming. Plants pruned at 45 cm during April flowered at an interval of 32.67 days after pruning, while over 45 days in other pruning treatments. Dhaliwal and Kaur (2003) observed an early flowering with an increase in the severity of pruning, while delayed pruning resulted in late flowering, reduction in flowering age and flowering percentage. Basu (2007) studied the effect of different times of pruning on the cropping behavior of 11 years old L-49 guava. Pruning in the month of April resulted in early flowering (i.e. 51 days after pruning) while delayed flowering when pruned in July (66 days after pruning).

However, Singh (2001) subjected 15 years old plants of Allahabad Safeda and Sardar guava

to pruning at varying timings and observed that pruning in May resulted in flowering from July- September while, February pruned plants flowered during April.

Fruit set

The interaction effect of the intensity and time of pruning was studied by Ali (2014) on 10 years old guava plants. The fruit set was recorded to be maximum during both the rainy (73%) and winter (75%) seasons with pruning of 10 cm of shoots in May. Likewise Lian (2019) observed a sudden decrease in percent fruit set with increase in the intensity of pruning. The maximum fruit set (83.33%) was reported by pruning of 50% of the shoot length in mid-May while lowest with pruning of 75% shoot length during mid- June. The reproductive growth was observed to be increasing with light pruning while severe pruning favors vegetative growth.

Contrary to the above findings Brar (2007) observed the fruit set to be positively correlated with the increase in the severity of pruning during both the rainy and winter seasons, when eleven years old Sardar guava plants were pruned in May at three different pruning intensities (15, 30 and 45 cm). The results of this observation were parallel to the findings of Singh (2011) and Lotter (1990) who reported an increment in the percent fruit set with the increase in the severity of pruning.

However, Boora *et al.*, (2016) observed that reduction in the fruit set during the rainy season crop is necessary to improve the fruit set during the winter crop.

Fruit yield

After the pruning of plants in MayBagchi *et al.*, (2008) observed an increase in the concentration of proline, peroxidase, polyphenol oxidase, tryptophan and reduction of phenolics in the different plant parts, leading to increased flowering and fruiting during the winters and contributing higher yield per plant.

Das (2018) investigated the effect of the different time of pruning on both the rainy and winter season crops of guava and obtained maximum yield during the rainy season with pruning in the month of October while pruning in the month of May yielded highest crop in the winter season. Similar results of fruit yield were obtained by Dubey *et al.*, (2002), Gopi Krishna (1981), Joshi (2014) and Meena (2005) when plants were pruned in the month of May for the production of winter season crop.

However, Adhikari (2015) reported a significant fall in the fruit yield during the winter season with the enhancement of pruing severity. While, highest yield in the winter season crop was obtained with mild pruning of the guava plants in early May. Likewise Sah (2017) and Prabhakar (2016) observed similar trend for fruit yield.

Fruit quality

Fruit size

The fruit size was observed to be significantly affected with the time of pruning when, Sah (2017) subjected seven years old plants of guava growing under meadow orcharding to half shoot pruning at different timings. The fruit length was recorded maximum in the plants pruned during June while, maximum fruit width in April pruned plants.

Severe pruning was reported to have a marked effect on the fruit size. Adhikari (2015) reported that the maximum size was obtained the fruit produced on the plants pruned at 30 cm level of pruning during mid-May.

Likewise, Basu (2007) recorded maximum fruit size in the fruits produced on the plants pruned in May.

Fruit weight

As a result of pruning the number and area of leaves increases causing an increase in the number of photosynthates and lead to increase in the fruit weight during the winter season crop (Singh *et al.*, 2001). The fruit weight was observed to be increasing with the enhancement of pruning severity and delay in the time of pruning Adhikari (2015). Pruning at the level of 30 cm in early-May produced heavier fruits in the rainy season while during winters heavier fruit were produced with pruning at 30 cm level in mid-May. Similar trend was observed by Basu (2007) when eleven years old plants of Sardar guava were pruned keeping 4 scaffold branches in the May.

However, Das (2018) reported that therewas no significant effect of the pruning treatments on the fruit weight of the rainy and summer season crops for three continuous years except for the winter season crop. The plants pruned in May yielded fruits with maximum weight during the winters in all the three years.

Biochemical parameters

The fruits produced in the winter season were found to be rich in biochemical aspects than rainy season crop, as the higher crop loads lead to the drainage of food reserves hiking the competition for food reserve among the fruits. Aswathy(2017) subjected guava plants to pruning at different timings and observed that fruits produced in winter were superior in quality than the rainy season crop. The plants pruned in May produced fruits with highest TSS (11.11°B) and acidity (0.28 %) while total sugars and ascorbic acid content was recorded maximum in plants pruned during mid-April. These results were parallel to the findings of Ali (2014), Sahar *et al.*, (2014), Sah (2017) and Shiranal (2018).

A significant increase in the TSS and acidity was recorded by Parmar (2019) with increase in the severity of pruning during May while, an inverse trend in the total sugars and Ascorbic acid content. The pruning at 50 % level in May produced fruits with TSS (11.46°B), acidity (0.79%), Ascorbic acid (177.2 mg/100 g) and total sugars (7.37 %) while fruits from 25 % pruned plants were recorded with TSS (11.08°B), acidity (0.76 %), Ascorbic acid (180.2 mg/100 g) and total sugars (7.84 %). These results were in line to the findings of Balamohan (2019), Kumar (2010), Basu (2007), Lal (2002), Kindo (2005) and Sah (2013). This increase in the sugars and ascorbic acid might be due to the impact of high temperatures during flowering, fruit formation and maturation, leading to the degradation of polysaccharides into simple sugars by various metabolic processes, conversion of organic acids into the sugars and the reduction of moisture content as suggested by Lakpathi *et al.*, (2013).

Time of maturity

Singh (2001) observed that the fruits on the plants pruned in the May start getting mature by the mid-November and the first harvest was obtained on the last week of November. The harvesting spam was concentrated from November to January. However fruits on the plants pruned in the June matured in the end of December. Likewise, Singh *et al.*, (2015) recorded fruit maturity 136 days after the pruning in the month of May.

Tiwari (2018) subjected the plants of Allahabad Safeda to pruning of 50 % of shoot in the August then harvesting was done in January-February. Similarly when thirteen

years old plants of guava were subjected to pruning at 1/3rdlength in the month of April, the fruits got matured by the first October and harvesting was continued till November.

On the basis of the above findings it can be concluded that selection of the optimum time of pruning is a major operation as whole the cropping, flowering, fruit quality and harvesting pattern can be manipulated by choosing the right time of pruning according to the climatic conditions and adaptation of the crop to the climatic conditions.

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