Effect of various methods of crop regulation on growth, yield and fruit quality of guava (*Psidium guajava* L.) cv. Pant Prabhat

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ABSTRACT : An experiment on crop regulation was carried out during the year 2004-05 on six-years-old bearing trees of guava (*Psidium guajava* L) cv. Pant Prabhat, to investigate the effect of various crop regulation methods on yield and fruit quality. The treatments were comprised of six shoot pruning methods i.e. (T_1): One leaf pair pruning (retaining one leaf pair at the base of the shoot) (T_2): Two leaf pair pruning (retaining two leaf pairs at the base of the shoot), (T_3): One terminal leaf pair (hand removal of leaves and flowers retaining only one leaf pair at the top of shoot), (T_4): two terminal leaf pair(hand removal of leaves and flowers retaining only two leaf pairs at the top of shoot), (T_5): Flower bud thinning by hand and (T_6): Control. All the treatments were applied in the first week of May. The experiment was laid out in a Randomized Block Design (RBD) with four replications. The annual increase in tree height, tree spread and trunk diameter were affected significantly by various treatments. Maximum number of flower bud emergence was found in one leaf pair pruning. All the treatments yielded significantly more than control trees in winter season crop. Maximum number of fruits and yield (kg) per tree was found in one leaf pair shoot pruning. Maximum fruit weight and fruit size was found with the treatment flower bud thinning by hand. The quality parameters like TSS, acidity, ascorbic acid, sugars content were found higher with the treatment one leaf pair shoot pruning.

Key words: Crop regulation, growth, guava, fruit quality, yield.

Guava (*Psidium guajava* L.) is one of the most important fruit crops of India. Guava bears two or three crops in a year and produce about 90 per cent crop in rainy season, 8-9 per cent in winter season and 1-2 per cent in spring season under Tarai conditions. Fruits of rainy season are insipid, watery, less nutritive, poor in keeping quality and also attacked by insect pest and diseases. On the other hand fruits of winter season crop are superior in quality, comparatively free from insect pest and diseases thus, fetches more price in the market. Also fruit of winter season crop have better storage life and can be transported over the long distance. In support of this Singh (1969) suggested to take only one crop (winter crop) having quality fruits and it escape attack of white fly. In order to increase the yield of winter season crop, it is necessary to conserve the energy and restore the vigour of plant, which is lost due to rainy season crop. This can be done by removal of rainy season's flowers by mechanical and chemical methods. Foliar spray of NAA have been reported to be successful in regulating guava crop, but its concentration varies from few hundred to thousand ppm depending upon the variety, region and stage of plant in relation to flowering. There are also other mechanical methods like withholding of irrigation during summer and root pruning but it did not recommended in Tarai region of UP and Uttarakhand due to harmful effect on plants. It was therefore considered appropriate to workout alternative method which could be equally effective in regulating the size of guava crop in different seasons besides being handy.

MATERIALS AND METHODS

An experiment was conducted at Horticultural Research Centre, Patharchatta of G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand to find out a suitable method for crop regulation in guava. The experimental material consisted of six-year-old uniform grafted trees of guava cv. Pant Prabhat planted at 8m X 8m distance. The treatment consisted of six pruning intensities, i.e. T_1: One leaf pair pruning (retaining one leaf pair at the base of the shoot) T_2: Two leaf pair pruning (retaining two leaf pair at the base of the shoot), T_3: Retaining one terminal leaf pair (hand removal of leaves

and flowers retaining only one leaf pair at the top of shoot), T_4: Retaining two terminal leaf pairs (hand removal of leaves and flowers retaining only two leaf pairs at the top of shoot), T_5: Flower bud thinning by hand and T_6: Control. Thus, there were 6 treatments each replicated four times in Randomized Block Design with single tree as a treatment unit. All the treatments were applied in first week of May. Flower bud thinning by hand treatment was applied twice again after fifteen days interval. Data were recorded on tree height, tree spread, trunk diameter, emergence of flower bud per branch, per cent fruit set per branch, number of fruits per tree (by counting total number of fruits retained at the time of harvesting on trees), yield kg tree^{-1}, fruit weight (weight of ten fruits was recorded on a physical balance and mean weight (g) was obtained by dividing the total weight of the fruits with the ten number of fruits), fruit length (measured in cm from the apex to stem end of the fruit by digital Vernier's calliper), fruit diameter (measured in cm at widest point of fruit by digital Vernier's calliper), total soluble solids (with the help of digital refractrometer) and acidity (calculated by titrating the fruit pulp aliquot against 0.1 NaOH, ascorbic acid, sugars and pectin during both rainy and winter seasons were estimated with the standard procedure as suggested by A.O.A.C. (1980).

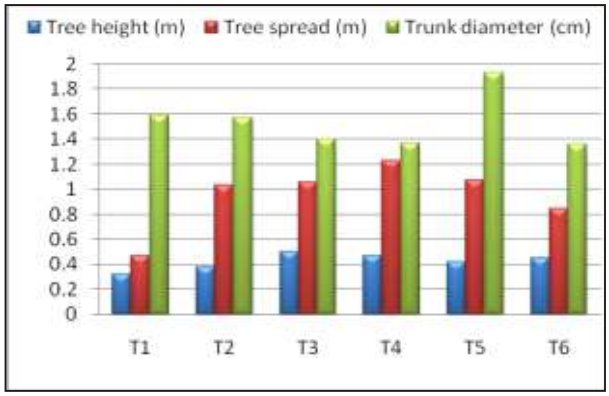
RESULTS AND DISCUSSION

The data on the effect of various treatments of crop regulation on vegetative growth presented in Fig 1 (A) indicates that, annual increase in tree height was not affected significantly by various treatments however, the maximum annual increase in tree height (0.50 m) was observed in the treatment T_3 (Retaining one terminal leaf pair). Whereas, maximum annual increase in plant spread (1.23 m) was registered with the treatment T_4 (Retaining terminal two leaf pair) and maximum annual increase in trunk diameter was recorded with the treatment T_5 (Flower bud thinning by hand). It may be due to uninterrupted growth of shoot during rainy season and synthesis of more photosynthates in spreaded canopy and no crop load during rainy season (Singh *et al*., 1992).

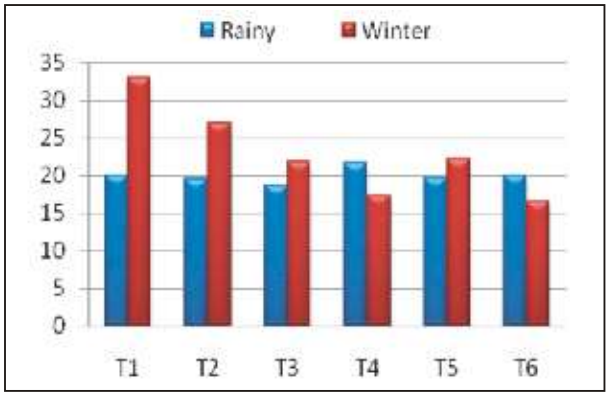
The data presented in Fig 1 (B) showed that the emergence of flower buds per branch for rainy season crop was not significant, however, it was significantly affected in winter season crop. During winter season, maximum number of flower buds per branch (33.0) was found in T_1 (one leaf pair pruning). All the treatments were significantly superior to T_6 (Control). In general all the treatments gave significant increment in the emergence of flower buds for winter season crop as compared to control. These findings are in conformity with Pandey *et al*. (1980) and Lal *et al*. (1996). The data on per cent fruit set per branch (Fig 1- C) was significantly higher with the treatment T_6 (68.78 %) during rainy season. Whereas, per cent fruit set, during winter season showed non-significant differences. In general, per cent fruit set was found lower for rainy season crop as compared to winter season. It might be due to high temperature during summer, which appears to be the main cause of the lesser fruit set percentage for rainy season crop (Rathore and Singh, 1974 ; Dwivedi *et al*., 1990; Singh, 2000 and Pratibha and Lal, 2013).

The data related to physical quality of fruits as fruit weight and fruit size (length and diameter) were significantly affected by various treatments during both rainy and winter seasons Fig 1 (D, E, F). In general the winter season fruits were comparatively heavier than rainy season fruits. The highest mean fruit weight (156.90g) during rainy season was recorded with the treatment T_1 (one leaf pair pruning) while, the lowest mean fruit weight (122.50g) was recorded with the treatment T_6 (Control). During winter season the highest mean fruit weight (173.52g) was recorded with the treatment T_5 (Flower bud thinning by hand) followed by the treatment T_1 (one leaf pair pruning). The mean fruit length and fruit diameter was found maximum with the treatment T_1 (one leaf pair pruning) and minimum with the treatment T_6 (Control) during rainy season. In case of winter season, the mean fruit length was found maximum with the treatment T_2 (6.39cm) and fruit diameter was found maximum with the treatment T_5 (6.90 cm) followed by the treatment T_2. However, minimum mean fruit length and fruit diameter was recorded with the treatment T_6 (Control). The smallest fruit size of control trees was associated with heavier crop load during rainy season which caused the drain of the food reserve of trees on the one hand while, increasing competition among the growing fruit population for the food supply on the other. Similar reports have been made by Lal (1983), Lal, *et al*. (2000), Pratibha *et. al*. (2013) and Thakre *et. al*. (2016).

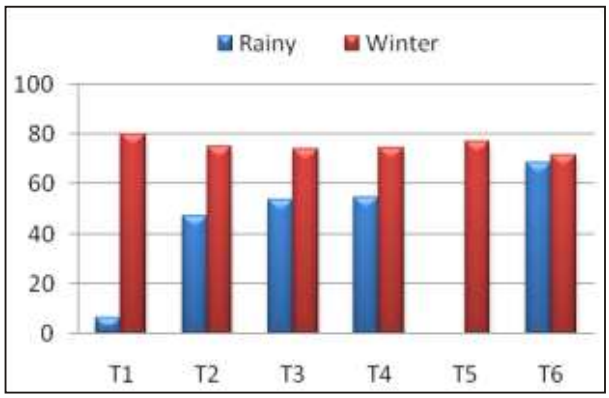
It is evident from the data presented in Table 1 that, average number of fruits per tree during both rainy and winter season, total number of fruits per tree and fruit yield kg tree^{-1} were affected significantly by various treatments. Maximum number of fruits (557.0) and yield kg tree^{-1}(68.15) were found with the treatment T_6 (Control) during rainy season. It might be due to more



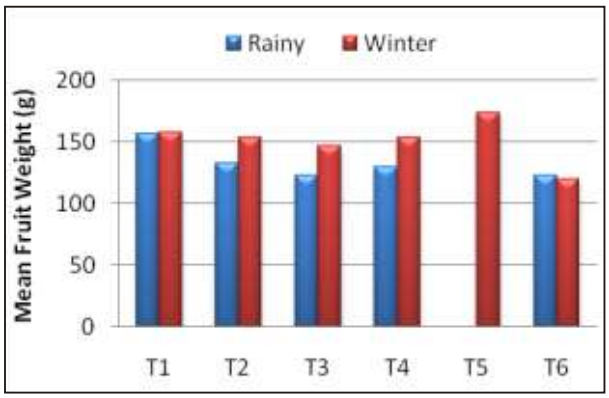
A. Effect of various treatments on annual increase in tree height, tree spread and trunk diameter



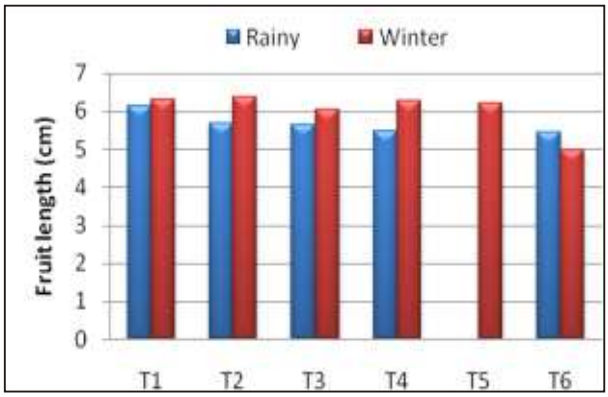
B. Effect of various treatments on emergence of flower buds per branch



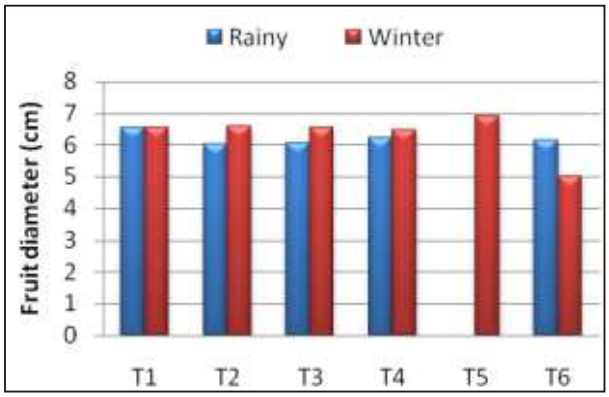
C. Effect of various treatments on per cent fruit set per branch



D. Effect of various treatments on mean fruit weight (g)



E. Effect of various treatments on mean fruit length (cm)



F. Effect of various treatments on mean fruit diameter (cm)

Fig 1: Effect of various treatments on growth and physical quality of fruits of Guava cv. Pant Prabhat

number of fruit set. (Pandey *et al*., 1980, Lal, *et al*., 2000; Saxena 2002 and Pratibha *et. al*., 2013). While, during winter season the lowest yield was found with the treatment T_6 (Control). This might be due to the exhaustion of food reserve in the plant because of heavy crop load during rainy season (Lal *et al*., 2000 and Thakrey *et al*., 2013). Maximum number of fruits (411.0) and yield kg $tree^{-1}$(64.79) were recorded with the treatment T_1 (one leaf pair pruning) during winter season. This might be due to higher number of flower buds emergence and highest percentage of fruit set as well as least percentage of flower/fruit drop in treatment T_1 trees (Lal, 1992 and Lal *et al*., 1996).

Table 1: Effect of various treatments on yield and chemical characteristics of fruits in Guava cv. Pant Prabhat

S. No.	Treatments	No. of fruits per tree			Fruit yield (kg Tree^{1})			T.S.S (^{o}B)		Acidity (%)		Ascorbic acid (mg/100 g pulp)	
		Rainy	Winter	Total	Rainy	Winter	Total	Rainy	Winter	Rainy	Winter	Rainy	Winter
1.	One leaf pair pruning T_1	40.0	411.0	451.0	6.28	64.79	71.07	8.26	13.22	0.37	2.30	204.35	250.5
2.	Two leaf pair pruning T_2	156.0	318.0	474.0	20.67	46.96	69.66	8.20	13.20	0.36	2.25	196.62	225.5
3.	One terminal leaf pair pruning T_3	74.96	305.0	381.00	9.21	44.93	54.14	7.88	12.31	0.32	1.95	158.18	195.0
4.	Two terminal leaf pair pruning T_4	146.0	232.0	378.0	19.04	35.70	54.74	8.03	12.58	0.30	1.98	192.10	198.0
5.	Flower bud thinning by hand T_5	0	328.0	328.0	0	57.70	57.70	-	12.62	-	2.30	-	230.0
6.	Control T_6	557.0	44.0	601.0	68.15	5.28	73.43	7.02	11.89	0.32	2.13	156.80	213.25
	CD 5 %	54.14	15.49	57.05	8.74	7.482	11.02	1.769	1.470	NS	NS	131.44	NS

Table 2: Effect of various treatments on chemical characteristics of fruits in Guava cv. Pant Prabhat

S. No.	Treatments	Reducing sugar (%)		Non- reducing sugar (%)		Total sugar (%)		T.S.S : Acid		Sugar :Acid		Pectin (%)	
		Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter
1.	One leaf pair pruning T_1	4.10	5.58	2.73	3.34	6.83	9.26	22.99	5.79	18.74	4.04	0.80	1.35
2.	Two leaf pair pruning T_2	3.63	4.88	2.59	3.63	6.22	8.51	31.05	5.94	23.35	4.05	0.75	1.32
3.	One terminal leaf pair pruning T_3	3.52	4.39	2.36	3.22	5.88	7.61	31.41	7.88	22.54	3.78	0.62	0.97
4.	Two terminal leaf pair pruning T_4	3.50	5.15	2.33	3.15	5.83	8.28	28.48	6.23	21.41	4.19	0.42	0.62
5.	Flower bud thinning by hand T_5	-	4.06	-	3.67	-	7.73	-	5.51	-	3.40	-	0.94
6.	Control T_6	3.14	4.03	2.28	3.14	5.42	7.17	21.93	4.09	16.93	3.36	0.75	1.30
	CD 5 %	0.764	0.945	1.04	NS	0.563	0.786	17.24	NS	16.981	NS	0.50	NS

It is evident from the data presented in Table 1 and Table 2 that all the treatments were found superior to control (T_6) so far as the total soluble solids, ascorbic acid, reducing sugar, non reducing sugar and total sugars are concerned during both rainy and winter seasons. In general winter season's fruits were found superior than rainy season's fruits with respect to TSS, ascorbic acid, reducing sugar, non reducing sugar and total sugars. This result confirms the findings of earlier workers (Sachan *et al*., 1969 and Rathore, 1976). The maximum TSS was found with the treatment one leaf pair pruning followed by two leaf pair pruning during both rainy and winter season (Lal *et al*., 2000). Total titratable acidity of fruits did not affected significantly by various treatments during both rainy and winter seasons. In general, the percent acidity was found

maximum during winter season than rainy season (Table 2). Maximum ascorbic acid and maximum total sugar were recorded with the treatment T_1 (One leaf pair pruning) during both rainy and winter seasons. The TSS: acid ratio, sugar: acid ratio and pectin content were affected significantly by different treatments during rainy seasons whereas these characters were not significantly affected during winter season. The superiority of fruits during winter season in respect of TSS, acidity, ascorbic acid, sugar and pectin content may be due to the effect of low temperature prevailed at the time of fruit ripening. Low temperature not only retards the excessive loss of respiratory substances but also increases the translocation of photosynthates from leaves to other parts of the plant including fruits.

In the light of the results obtained, it can be concluded that all the treatments are capable of not only changing the cropping pattern of guava, but also improve the physico-chemical qualities of fruits. Although the control trees gave higher yield during rainy season but the quality of such fruits remained much inferior and therefore fetches less price in the market. On the other hand one leaf pair pruning treatment (retaining one leaf pair at the base of shoot) when applied in first week of May, not only gave higher yield in winter season but also markedly improve fruit quality, fetches more price in the market as compare to control (T_6).

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