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EFFECTIVENESS OF VARIOUS CROP REGULATION TREATMENTS IN GUAVA (*PSIDIUM GUAJAVA*) CV. ALLAHABAD SAFEDA

ARTI SHARMA*, V. K. WALI, R. M. SHARMA AND BINDIYA SHARMA*
Division of Fruit Science, Faculty of Agriculture,
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Main campus Chatha - 180 009
e-mail: drartisharma02@gmail.com

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***Corresponding author**

ABSTRACT
Crop regulation treatments *viz*. Leaf pair pruning (retaining one, two and three leafs), GA_3 sprays (100,150 and 200ppm) at flower bud differentiation stage and NAA (600 ppm) at flowering (control) were used to regulate rainy season crop in guava cv. Allahabad Safeda. One leaf pair pruning resulted into maximum yield reduction in rainy season with subsequent maximum yield (73.05, 72.04 and 76.40 kg during 2010, 2011 and 2012, respectively) and fruit weight (221.70, 205.39 and 226.12 during 2010, 2011 and 2012, respectively) in winter season. Plants with one leaf pruning produced better quality fruits in both the seasons and recorded maximum TSS (12.00,11.80 and 12.40°B during rainy season and 13.73, 12.80 and 13.40 °B during winter season of 2010, 2011 and 2012, respectively and Ascorbic acid (210.30, 201.65 and 205.66mg/100g during rainy season and 259.66, 199.67 and 240.45 mg/100g during winter season of 2010, 2011 and 2012, respectively) and minimum acidity (0.52,0.51 and 0.49 % during rainy season and 0.48, 0.47 and 0.45 during winter season of 2010, 2011 and 2012, respectively). Overall profit was also highest in one leaf pair pruning by withholding rainy season crop. Thus it was concluded that rainy season crop of guava should be avoided by using one leaf pair pruning.

INTRODUCTION

Guava (*Psidium guajava* L.) belongs to the family Myrateace, is native of tropical America and is one of the most important tropical and subtropical fruit. Guava is commercially grown in Andhra Pradesh, Bihar, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttar Pradesh and West Bengal. In India it ranks as fifth major fruit after mango, banana, citrus and apple. It has been under cultivation in India as early as 17th century (Mitra and Bose, 1990).

In northern India, winter season crop is preferred because of its superior quality as compared to monsoon crop (Pandey *et al*., 1980). Rainy season fruits are small in size, inferior in quality due to high temperature and humidity which leads high susceptibility to pest and disease infestation. The marketable yield is very low and the farmers suffer huge losses. Subsequent winter season crop is also less and ripens late. The best remedy to this problem would be to eliminate the rainy season crop and thereby to induce a good winter crop. To overcome this problem scientists have attempted and succeeded in eliminating /avoiding monsoon crop by half shoot pruning, hand deblossming and with the foliar sprays of urea and growth regulators at full bloom and pre bloom stages which correspondingly induce a reasonably good winter season crop (Tiwari *et al*., 1992; Singh *et al*., 1992; Lal *et al*., 2000; Tiwari and Lal, 2007). Gibberellins have been widely studied for use in reducing flower numbers in both stone and pome fruit (Luckwill and Silva, 1979; Moran and Southwick, 2000; Southwick and Glozer2000; Tromp, 1982; Hull and Lewis,1959 and Bradley and Crane,1960). Gibberellins were used at different concentrations as treatment in this experiment to find out the potential of gibberellins to regulate rainy season crop of guava by interfering with flower bud induction. Till now gibberellins have not been tried for crop regulation in guava. Use of leaf pair pruning can help to control rainy season crop (as guava flowers in leaf axil) and can also help to maintain optimum leaf to fruit ratio and canopy management.

The present investigation was undertaken with the objective to standardize a crop regulation technique in guava under Jammu conditions, as results reported elsewhere on various crop regulation treatments may vary owing to various factors *viz*. Climate, soil condition and cultivar and management practices.

MATERIALS AND METHODS

The present study on crop regulation in guava cv. Allahabad Safeda under subtropical agro climatic conditions of Jammu region was undertaken during the year 2010-2012 at Fruit Science, Research orchard of Sher-e- Kashmir University of Agricultural Sciences and Technology of Jammu (SKUAST-J), Udheywalla, Jammu to ascertain the effect of NAA, GA and leaf pair pruning on the elimination of rainy season crop and subsequent induction of winter season crop in terms of yield and quality. Ten year old plants of guava cv. Allahabad Safeda were selected and seven treatments namely T_1: 1pair leaf pruning, T_2: 2pair leaf pruning, T_3: 3pair leaf pruning, (Retaining one, two and three leaf pair at the base of new shoot growth during last fortnight of April) T_4: GA 100ppm, T_5: GA 150ppm,

T_6: GA 200ppm, T_7: NAA 600ppm (control) were applied in the month of April and May. NAA 600 ppm was taken as control because it is the previously recommended method for crop regulation by SKUAST-J in Jammu sub tropics. NAA and GA were given as foliar sprays twice, at the rate of 7 litres of solution per plant per spray. NAA was applied twice, in middle of April and first week of May, while GA was applied during first week of April. Each treatment was replicated thrice with three plants per replication. All the cultural operations including weeding, irrigation, manuring ,fertilization and plant protection were carried as per the package of practices of SKUAST-J. Observations were recorded on yield/ plant (kg)(By weighing all the harvested fruit from tree), average fruit weight (gm) (By weighing fruit on electronic balance), TSS (° B) (using hand refractometer), Total titrable acidity as % of citric acid was determined by the method given by A.O.A.C(1990) and Ascorbic acid mg/100g of pulp as per the method given by A.O.A.C(1990) . Profitability of various treatments was also calculated. The experiment was laid in randomized block design. The data were subjected to analysis of variance (Panse and Sukhatme, 1967).

RESULTS AND DISCUSSION

Leaf pair pruning at different levels proved to be most effective in avoiding rainy season crop whereas GA at all the concentrations seemed to be ineffective as compared to control. In all the three years leaf pair pruning at all levels resulted in significant reduction in rainy season crop over control with one leaf pair pruning resulting in maximum yield reduction in rainy season (9.73, 12.40 and 10.00 kg, respectively) crop with subsequent highest yield in winter season crop (73.05, 72.40 and 76.40 kg, respectively) followed by two and three leaf pair pruning. GA at all concentrations gave significantly higher yield in rainy season as compared to control, Thereby giving lower yield in winter season. These results could be explained in the light of fact that shoot pruning results into leaf removal and removal of terminal growth which results into more growth of lateral leaf area. Basu(2014) have also reported that lower leaf; fruit ratio and shoot removal in grape resulted into increased and good quality fruit yield. Tiwari and lal (2007) also reported higher yield reduction in rainy season crop with one leaf pair pruning over NAA treatment, with subsequently higher yield in winter season. This higher yield in winter season as result of leaf pair pruning might be because of retention of vigour due to crop regulation in rainy season. In absence of crop regulation trees get exhausted because of heavy crop load during rainy season resulting into poor yield in winter. Sharma and sardana (2012) have also demonstrated that growth regulation treatments alter the source- sink relationship by diverting the assimilates to the desirable sinks. One leaf pair pruning resulted in significantly higher average fruit weight throughout the experiment as compared to all other treatments in both rainy as well as in winter season and was followed by two leaf pair pruning, three leaf pair pruning and NAA (600ppm) . GA treatment yielded small sized fruits as compared to other treatments. This might be because GA does not effect yield and and fruiting directly but indirectly. Muralidhara *et al*. (2014) stated the growth regulation by gibberllins relates almost extensively to its stem elongation properties by two ways *viz*. Direct effect on stem elongation by inducing cell wall loosening, by increasing cell wall extensibility, stimulating the wall synthesis, reducing the rigidity of cell wall and by increasing cell division leading

Table 1: Effect of various crop growth regulation treatments on yield (kg) and average fruit weight (gm) of guava cv. Allahabad Safeda

Treatments	Yield(kg)						Average fruit weight (gm)					
	2010		2011		2012		2010		2011		2012	
	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season
T1	9.73	73.05	12.40	72.40	10.00	76.40	195.83	221.70	190.88	205.39	201.24	226.12
T2	16.83	65.21	20.63	60.31	18.40	63.36	188.27	201.98	176.29	200.58	197.64	201.47
T3	30.36	52.61	24.50	49.76	31.70	53.26	120.40	141.01	170.43	191.71	190.55	201.61
T4	51.23	25.55	46.43	31.03	40.30	26.53	98.42	125.64	110.70	141.27	110.73	130.52
T5	50.83	31.98	51.40	27.06	50.26	30.40	104.69	120.22	103.00	130.74	119.97	138.02
T6	47.73	28.96	43.36	36.23	52.76	31.43	111.18	135.78	103.27	125.85	116.02	140.79
T7	31.16	51.14	28.50	47.53	34.28	48.46	130.61	144.43	151.89	170.37	166.91	185.04
C.D.	3.17	7.65	4.37	4.11	N.S.	4.33	4.59	5.11	61.40	4.05	3.18	2.90

Table 2: Effect of various crop growth regulation treatments on acidity (%) and TSS (°B) of guava cv. Allahabad Safeda

Treatments	Acidity (%)						TSS (°B)					
	2010		2011		2012		2010		2011		2012	
	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season
T1	.52	.48	.51	.47	.49	.45	12.00	13.73	11.80	12.80	12.40	13.40
T2	.56	.50	.50	.49	.51	.47	12.13	13.06	11.50	12.10	11.90	12.60
T3	.58	.51	.56	.20	.54	.50	11.80	12.03	10.56	11.20	10.53	12.00
T4	.60	.55	.66	.56	.60	.56	10.80	11.63	10.80	11.00	11.20	11.80
T5	.65	.56	.62	.60	.59	.53	10.20	11.90	10.20	11.70	10.50	11.53
T6	.62	.58	.60	.53	.63	.57	10.60	11.96	10.50	11.90	10.96	11.08
T7	.59	.52	.58	.50	.52	.50	11.03	12.40	11.00	12.00	11.60	12.03
C.D.	.03	.03	.04	.18	.02	.03	.80	.43	.43	.32	.18	.26

Table 3: Effect of various crop growth regulation treatments on ascorbic acid content (mg/100gm) of guava cv. Allahabad Safeda

Treatments	Ascorbic acid content (mg/100gm)					
	2010		2011		2012	
	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season
T1: 1pair leaf pruning	210.30	259.63	201.65	199.67	205.66	240.45
T2: 2pair leaf pruning	199.76	230.48	195.83	198.34	192.86	209.91
T3: 3pair leaf pruning	192.25	208.93	188.79	190.70	189.57	194.73
T4: GA 100ppm	181.44	190.08	180.72	191.64	180.06	195.70
T5: GA 150ppm	178.90	185.86	176.10	186.42	184.95\	194.82
T6: GA 200ppm	172.25	195.49	182.27	189.65	176.42	198.17
T7: NAA 600ppm	189.65	205.75	190.19	194.83	182.85	199.67
C.D.	9.75	10.95	11.65	N.S.	10.34	9.12

Table 4: Effect of various crop growth regulation treatments on Gross income (Rupees)of guava cv. Allahabad Safeda

Treatments	Gross income (Rupees)								
	2010			2011			2012		
	Rainy season	Winter season	Total	Rainy season	Winter season	Total	Rainy season	Winter season	Total
T1: 1pair leaf pruning	243.25	2556.75	2800.00	310.00	2534.00	2844.00	250.00	2674.00	2924.00
T2: 2pair leaf pruning	420.75	2282.35	2703.1	515.75	2110.85	2626.60	460.00	2217.6	2677.60
T3: 3pair leaf pruning	759.25	1841.35	2600.6	612.50	1741.60	2354.10	792.50	1864.10	2656.60
T4: GA 100ppm	1280.75	894.25	2175.00	1160.75	1086.05	2246.80	1007.50	928.55	1936.05
T5: GA 150ppm	1270.75	1119.30	2390.05	1285.00	947.10	2232.10	1256.75	1064.00	2320.75
T6: GA 200ppm	1193.25	1013.60	2206.85	1084.25	1268.05	2352.30	1319.25	1100.05	2419.30
T7: NAA 600ppm	779.25	1789.90	2569.15	712.50	1663.55	2376.05	857.25	1696.10	2553.10

Table 5: Cost of various crop growth regulation treatments and net profit (Rs.) in guava cv. Allahabad Safeda

Treatments	Cost of crop regulation(Rs.)	Net profit (Rs.) over control		
		2010	2011	2012
T1: 1pair leaf pruning	42	188.85	425.95	328.90
T2: 2pair leaf pruning	42	91.95	208.55	82.50
T3: 3pair leaf pruning	42	-10.51	-63.95	61.50
T4: GA 100ppm	15.20	-409.35	-144.45	-632.25
T5: GA 150ppm	19.05	-198.15	-124.90	-251.40
T6: GA 200ppm	22.90	-385.20	-46.65	-156.70
T7: NAA 600ppm	14.85	-	-	-

to more growth and indirectly by synthesis of IAA, These results are in conformity with the findings of Tiwari and Lal (2007), who have also reported that one leaf pair shoot pruning done in the first month of May results into maximum winter season yield of superior quality fruits.

One leaf pair pruned plants produced fruits with lowest acidity in both the seasons, in all the experimental years (0.52% and 0.48 %; 0.51% and 0.47%; 0.49% and 0.45%; in rainy and winter season during 2010, 2011 and 2012, respectively). Three leaf pair pruning and NAA 600 ppm were at par with each other. Highest TSS was recorded in fruits growing on one leaf pair pruned plants (12.00 and 13.73°B ; 11.80 and 12.80°B ; 12.40 and 13.40°B during rainy and winter season of 2010, 2011 and 2012, respectively) except in rainy season of 2010 where two leaf pair pruning recorded maximum TSS (12.13°B). GA at all the concentrations resulted into fruits with lower TSS when compared to control as well as leaf pair pruning. GA used at different concentrations gave inconsistent results regarding TSS and acidity content of guava fruits. Increased TSS content in leaf pruned plants might be due to due better absorption of nutrients by these plants. Das (2014) while working on litchi has indicated that shoot pruning clearly influence rooting pattern of tree. Thus in guava also shoot pruning might have altered rooting pattern which in turn resulted into better absorption of nutrirnts by tree and increased yield.

Oneleaf pair pruned plants were also found to be superior in terms of ascorbic acid content of fruits (210.30 and 259.63 mg/100gm; 201.65 and 199.67 mg/100 gm; 205.66 and 240.43 mg/100gm during rainy and winter season crops of 2010, 2011 and 2012, respectively).GA treated plants at all the concentrations exhibited lower ascorbic acid content throughout the experiment. Three leaf pair pruned plants were at par with control during all the experimental years. GA treated plants yielded more gross income during rainy season but total gross income was highest in one leaf pair pruned plants. Highest total gross income of Rs2800.00, 2844.00 and 2924.50 in 2010, 2011 and 2012, respectively, was obtained in one leaf pair pruned plants followed by two leaf pair pruning (Rs. 2703.10, 2626.60 and 2677.60 in 2010, 2011 and 2012, respectively), three leaf pair pruning (Rs. 2600.60, 2354.10 and 2656.60 in 2010, 2011 and 2012, respectively) and control (Rs. 2569.15, 2376.05 and 2553.10 in 2010, 2011 and 2012, respectively).

Table 6: Net profit (Rs.) over control in a hectare area in guava cv. Allahabad Safeda using various crop growth regulation treatments

Treatments	Net profit (Rs.) over control/ ha		
	2010	2011	2012
T1: 1pair leaf pruning	9835.94	22184.90	17130.20
T2: 2pair leaf pruning	4789.06	10861.98	4296.87
T3: 3pair leaf pruning	-4926.56	-3330.73	3203.12
T4: GA 100ppm	-21320.31	-7523.44	-32929.68
T5: GA 150ppm	-10318.99	-6505.20	-13093.75
T6: GA 200ppm	-20062.50	-2429.69	-8161.46
T7: NAA 600ppm	-	-	-

A net profit of Rs. 188.85, 425.95 and 328.90 was obtained by one leaf pair pruning during 2010, 2011 and 2012, respectively and was followed by two leaf pair pruning (Rs. 91.95, 208.55 and 82.50 in 2010, 2011 and 2012, respectively). Three leaf pair pruning during 2010 and all the GA treated plants recorded a loss of income over control. Similar results were reported by Tiwari and lal (2007). One pair leaf pruning resulted into net profit of Rs. 9835.94, 22184.90 and 17130.20 in 2010,2011 and 2012, respectively and was followed by two leaf pair pruning (Rs. 4789.06, 10861.98 and 4296.87 in 2010, 2011 and 2012, respectively).

It was concluded by the present study that one leaf pair pruning during last fortnight of April can be profitably used to regulate rainy season crop in guava cv. Allahabad Safeda and for getting higher yield of better quality in winter season. Further investigation is needed to ascertain the role of GA in crop regulation in guava by standardising concentration, timing and number of GA applications.

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