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Short communication

Effect of plant growth regulators on physico-chemical characters and yield of guava cv. Sardar under high density planting system

M.C. Jain* and L.K. Dashora
College of Horticulture and Forestry, MPUAT, Jhalawar (RAJ.)

Guava (*Psidium guajava* L.) belongs to family Myrtaceae and is a very common fruit, popular among rich and poors alike due to its moderate price, nourishing value and good taste. It is known as 'apple of tropics' and rich in vit-C and pectin content besides being a good source of other vitamins and minerals. Plant growth regulators modify or regulated physiological processes in an appreciable measure in the plant when used in a small concentration. The use of plant growth regulators has assumed an integral part of modern fruit production especially under high density orcharding to improve quality and production of fruits and use of plant growth regulators has resulted outstanding achievements in several other fruit crops with regards to improvement in quality and yield.

A field trial on the pre flowering (on 16th July) foliar application of various plant growth regulators on well established 10-year-old guava cv. Sardar trees planted under high density system with a spacing of 3 m × 3 m was conducted at instructional farm Department of Horticulture, Rajasthan College of Agriculture, MPUAT-Udaipur during two consecutive years in randomised block design with three replications. Treatments consisted of five different plant growth regulators with two concentrations of each sprayed before flowering (on 16th July) namely α-naphthalene acetic acid (100 and 200 ppm), ethrel (250 and 500 ppm), paclobutrazol (250 and 500 ppm), cycocel (500 and 1000 ppm) and triacontanol (5 and 10 ppm) and the plain distilled water sprayed on the plants for control. In this way total 11 treatments were used in this experiment for winter season guava. Experimental unit was one plant/treatment. Therefore total 33 plants were used. Observations were recorded on size of fruit (length & diameter of fruit in cm), weight of fruit (g), volume of fruit (cc) organoleptic score by a panel of five judges, yield (kg/plant). Total soluble solids were determined by using the standard method recommended by AOAC (2). Pectin content was determined by calcium pectate method (Ranganna, 6). Total sugars content was determined by using anthrone reagent method (Dubois *et al*., *3*). Reducing sugar content was measured by following Nelsons modifications of Somogyi's method, (Somogyi, 8) using arsenomolybdate colour forming reagent and two copper reagent 'A' and 'B'. Non-reducing sugar was obtained by subtracting reducing sugar from the amount of total sugar and multiplying the resultant by factor 0.95. Statistical analysis was carried out as per the methods prescribed by Panse and Sukhatme (5).

It is revealed from pooled data presented in Table 1 that physical characteristics like size of fruit (length & diameter of fruit), weight of fruit, volume of fruit, organoleptic score and yield (kg/plant) were significantly influenced by the use of various plant growth regulators at different concentration. Pooled mean indicated that application of paclobutrazol (PBZ) at 500 ppm exhibited maximum fruit length (7.40 cm) followed by 200 ppm NAA (7.12 cm) treatment. Mean maximum diameter 7.30 cm was recorded at 200 ppm NAA (T_3) closely followed by 500 ppm paclobutrazol. The mean minimum length (5.85 cm) and diameter (5.94) were recorded at control (T_1). Similarly, mean maximum fruit weight (191.46 g) and volume (188.16 cc) were recorded in 500 ppm PBZ (T_7) followed by 200 ppm NAA as compared to mean minimum at control. Among the various PGRs treatments attempted under high density planting system the mean maximum yield (39.28 kg/plant) was recorded at 500 ppm paclobutrazol as compared to mean minimum 26.25 kg/plant at control. The increase in size of fruit with respect to length, diameter, weight and volume due to application of PBZ might be because of the fact that partitioning of assimilates by pp-333 more towards the fruit development which is strong sink (Anbu *et al*., 1). The increase in size of fruit as a result of foliar application of NAA in present investigation might be due to it had improved the internal physiology of developing fruit in terms of better supply of water, nutrients and other compounds vital for their proper growth and development which resulted in improved size and ultimately greater yield as compared to control (Pandey, 4).

It is evident from the data obtained that application of 500 ppm ethrel had exhibited highest organoleptic score (8.87/10) as compared to mean minimum (6.75/10) in control. It may be due to fact that ethrel is

*Corresponding author's: E-mail: jainmcchf@yahoo.co.in

Table 1. Effect of plant growth regulators on physical characteristics and yield of guava cv. Sardar under high density planting system (pooled mean of two years).

Treatment	Fruit length (cm)	Fruit dia. (cm)	Fruit weight (g)	Fruit volume (cc)	Organoleptic score (out of 10)	Fruit yield (kg/plant)
Control (water spray (T_1)	5.85	5.94	139.42	129.31	6.75	26.25
NAA 100 ppm (T_2)	6.77	7.04	166.81	161.53	7.67	34.50
NAA 200 ppm (T_3)	712	7.30	182.37	178.95	8.05	35.16
Ethrel 250 ppm (T_4)	6.07	6.16	142.21	139.33	8.50	29.95
Ethrel 500 ppm (T_5)	5.86	6.01	142.02	137.60	8.87	30.06
Paclobutrazol 250 ppm (T_6)	6.76	6.72	168.33	155.25	7.75	35.83
Paclobutrazol 500 ppm (T_7)	7.40	7.23	191.46	188.16	8.36	39.28
CCC 500 ppm (T_8)	6.33	6.47	154.37	148.01	7.41	32.95
CCC 1000 ppm (T_9)	6.49	6.60	164.64	159.25	7.75	35.33
Triacontanol 5 ppm (T_{10})	6.27	6.38	146.93	140.25	7.12	29.08
Triacontanol 10 ppm (T_{11})	6.55	6.48	155.61	150.77	7.58	31.95
CD at 5%	0.31	0.34	7.44	12.10	0.51	2.57

Table 2. Effect of plant growth regulators on chemical characteristics of guava cv. Sardar under high density planting system (pooled mean of two years).

Treatment	TSS (%)	Acidity (%)	Ascorbic acid (mg/100g pulp)	Pectin (%)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugars (%)
Control (water spray (T1)	12.15	0.610	174.02	0.61	3.93	2.36	6.43
NAA 100 ppm (T2)	13.45	0.425	201.95	0.74	4.20	2.57	6.89
NAA 200 ppm (T3)	14.05	0.405	208.37	0.76	4.31	2.69	7.15
Ethrel 250 ppm (T4)	14.63	0.410	190.25	0.68	4.45	2.77	7.37
Ethrel 500 ppm (T5)	15.66	0.390	192.60	0.68	4.58	3.11	7.86
Paclobutrazol 250 ppm (T6)	14.35	0.435	207.11	0.73	4.37	2.74	7.22
Paclobutrazol 500 ppm (T7)	14.70	0.410	210.82	0.78	4.45	2.85	7.41
CCC 500 ppm (T8)	13.20	0.485	195.87	0.71	4.13	2.59	6.80
CCC 1000 ppm (T9)	13.80	0.450	201.11	0.74	4.19	2.66	6.97
Triacontanol 5 ppm (T10)	13.00	0.530	187.37	0.70	4.06	2.42	6.73
Triacontanol 10 ppm (T11)	13.30	0.500	190.42	0.73	4.14	2.51	6.81
CD at 5%	0.837	0.024	2.360	0.045	0.103	0.21	0.21

a ripening hormone and increase the sugar acid ratio and reduced the fruit pressure, which is an index of fruit hardness or softness. The softening of fruit with ethrel might be explained through its action on cell wall hydrolysis and changes in complex substances to simpler one as carried out in ripening which is under the control of ethylene. Similar organoleptic rating attributed characters like colour and taste were increased in apple by application of ethrel as it increased the activity of phenylalanine-ammonia lyase enzyme sharply in treated fruits, which seemed to be the determining factor of colour development (Singh *et al.*, 7).

The data on chemical characters presented in Table 2 revealed that mean highest TSS (15.66%) lowest acidity (0.39%), maximum reducing sugar (4.58%), non-reducing sugar (3.11%) and total sugars (7.86%) were recorded in 500 ppm ethrel treatment followed by 500 ppm PBZ treatment. Whereas maximum mean ascorbic acid of 210.82 mg/100 g pulp and pectin of 0.775 percent were recorded at 500 ppm PBZ treatment. However minimum mean TSS, sugars

ascorbic acid, pectin content and maximum acidity were recorded in control fruits. The increase in TSS, sugars and reduction in acidity due to application of ethrel in the present investigation might be because of its action on converting complex substances (starch) into simpler ones (sugars) through higher respiration and carbon assimilation activity (Yadav *et al.*, 10). Vijaylakshmi and Srinivasan (9) explained that the beneficial effect of paclobutrazol might be due to its influence of physiological processes, particularly respiration and photosynthesis that possibly led to accumulation of dry matter, minerals and carbohydrates.

Thus, from the present study it may be concluded that among various plant growth regulators used under investigation, 500 ppm paclobutrazol is superior to the other plant growth regulators with respect to important attributes contributing towards the better yield of quality fruits of winter season guava cv. Sardar grown under high density planting system.

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