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EFFECT OF CROP REGULATORS ON GROWTH, YIELD AND QUALITY OF GUAVA

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ABSTRACT

The experiment was conducted at Mandsaur (M.P.) on five year old guava tree cv. Chittidar during 2010-2011. Results revealed that foliar spray of 60 ppm 2,4-D was reported to increase canopy spread, volume of fruit (185.38 ml), pulp thickness , pulp weight (175.57g), pulp per cent (96.6), diameter of fruit (7.34cm), average fruit weight (181.71g), and reduced the seed per cent and seed pulp ratio which ultimately increased the yield per tree. Various quality parameters namely total sugars (7.49%), reducing sugar (4.73%), non reducing sugar (2.76%) and TSS (11.42˚ brix) were also improved with application of 60ppm 2,4-D. Maximum fruit length at harvest (97.30cm), minimum seed weight (5.43g), maximum TSS/acid ratio (37.80) and minimum acidity (0.27%) of fruit were recorded under foliar application of 300 ppm NAA.

Key words: Guava, crop regulators, yield, quality

INTRODUCTION

Guava (*Psidium guajava* L.) is one of the most popular fruit grown in tropical and sub-tropical regions of India, which belongs to the family Myrtaceae. At present in India, it occupies nearly 0.204 million hectares area with a production of 2.46 million tonnes and productivity 11.12 million tones / hectare and 2763 hectares area with a production of 55260 tones and productivity 20.0 tones/hectare in Madhya Pradesh (NHB, 2011). In subtropical climate, three distinct periods of flowering and fruiting are found in the guava. These three distinct periods are Ambe bahar (February to March flowering and fruit ripens in July-August), Mrig bahar (June to July flowering and fruit ripens in October to December) and Hasta bahar (October to November flowering and fruit ripens in February to April) (Shukla et al. 2008). The heaviest flowering has always been obtained in summer season. Because the food reserved is already exhausted in flowering and vegetative growth during summer, the rainy season flowering for the winter crop is always less. In general, production of poor quality fruits and excessive fruit fly attack in guava are typical characteristics during rainy season. In order to avoid heavy crop load during rainy season use of chemicals is an important tool for crop regulation to get quantum and quality yield.

MATERIALS AND METHODS

The experiment was conducted at the Department of Fruit Science, K.N.K. College of Horticulture, Mandsaur (M.P.) on five year old guava tree cv. Chittidar during 2010-2011. The experiment was conducted in randomized block design. The experiment comprised of 10 treatments consisting of foliar spray of urea, NAA, 2,4-D and control. The treatments were control (T_0), 8% urea (T_1), 12% urea (T_2), 16% urea (T_3), 100ppm NAA (T_4), 200ppm NAA (T_5) and 300ppm NAA (T_6), 30ppm 2,4-D (T_7), 45ppm 2,4-D (T_8) and 60ppm 2,4-D (T_9). First foliar spray of crop regulating chemicals was done on 24th May 2010 and same spray is repeated after 10 days. The growth parameters like height of the plant, canopy spread and canopy height was measured with the help of measuring device at the time of treatment application and at harvest and increase in same during the experimental period was calculated. Flowering and fruiting characters were recorded by selecting four branches randomly from all directions of a tree. The observations on yield parameters of fruits were recorded and yield per tree (in kg) were worked out by average fruit weight of four fruits and multiplied by the total number of fruit. The data on physico- chemical parameters of fruits were recorded. Physical and chemical parameters of fruits were determined using to average size fruits collected randomly from each replication. The TSS (^{0}Brix) was determined with the help of a hand refractometer. Acidity was estimated by simple acid– alkali titration method as described in A.O.A.C. (1970). Sugars in fruits were estimated by the method suggested by Nelson (1944). Assay method of ascorbic acid was followed as given by Ranganna (1977). The estimation of pectin was according to the method of Kertesz (1951).

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RESULTS AND DISCUSSION

The morphological characters of the tree were significantly influenced by different treatments (Table 1). Maximum increment in plant height, leaf length, leaf width, canopy spread in N-S and E-W direction with foliar application of 60 ppm 2,4-D may be due to immediate absorption of auxins, which increased the endogenous auxin level that resulted in cell elongation and enhanced vegetative growth (Singh *et al*.1992 and Brar 2010). Maximum fruit set was reported with application of foliar spray of 200ppm NAA. Similar findings are reported by Jain and Dashora (2007). Increased fruit set can be attributed to deblossoming of rainy season crop which increased the carbohydrate content and C/N ratio of leaves and shoot and high carbohydrate was thought to increase fruit set in following winter.

Table 1: Effect of crop regulating chemicals on morphological parameters of guava plant

Treatments	Plant height (m)	Canopy spread N-S (m)	Canopy spread E-W (m)	Leaf length (cm)	Leaf width (cm)	Fruit Setting (%)
T_0 (Control)	0.31	0.46	0.49	0.58	0.20	63.81
T_1 (8% Urea)	0.36	0.54	0.59	0.64	0.24	72.83
T_2 (12% Urea)	0.41	0.60	0.65	0.77	0.29	73.00
T_3 (16% Urea)	0.38	0.57	0.61	0.76	0.28	70.50
T_4 (100 ppm NAA)	0.35	0.55	0.61	0.72	0.26	87.61
T_5 (200 ppm NAA)	0.37	0.59	0.65	0.76	0.28	90.33
T_6 (300 ppm NAA)	0.37	0.60	0.67	0.77	0.30	84.07
T_7 (30 ppm 2,4-D)	0.38	0.56	0.58	0.76	0.30	76.50
T_8 (45 ppm 2,4-D)	0.39	0.57	0.66	0.77	0.31	78.50
T_9 (60 ppm 2,4-D)	0.43	0.62	0.69	0.78	0.32	86.38
C.D. (P=0.05)	NS	NS	0.078	NS	NS	6.053

(Data given for plant height, canopy spread, leaf length and leaf width are the increment during the investigation period)

The various physical parameters were significantly influenced by application of different chemicals (Table 2). Maximum fruit volume (185.38 ml), diameter of fruit at harvest (7.34 cm), pulp weight (175.57 g), pulp per cent (96.6%), and minimum seed pulp ratio (0.03) was recorded with foliar spray of 60 ppm 2, 4-D. Increment in length of terminal shoots formed more internodes as compared to lesser length. Ultimately these produced more number of leaves and flower buds. This might have lead to increase in size of fruits (Dubey *et al*. 2002). Maximum fruit length at harvest and minimum seed weight were recorded with 300 ppm NAA. Application of auxin accelerated the development of fruit. Similar findings were reported by Yadav *et al*. (2001) in guava.

Table 2: Effect of crop regulating chemicals on physical parameters of guava fruit

Treatments	Fruit volume (ml)	Fruit length (cm)	Fruit diameter (cm)	Pulp weight (g)	Seed weight (g)	Seed: pulp ratio	Pulp percent	Seed percent
T_0 (Control)	95.63	5.33	5.44	87.20	5.92	0.07	93.6	6.3
T_1 (8% Urea)	109.36	6.02	6.13	100.41	5.97	0.06	94.3	5.6
T_2 (12% Urea)	120.05	5.63	6.20	109.14	6.02	0.06	94.7	5.2
T_3 (16% Urea)	100.52	5.52	5.82	90.51	5.95	0.07	93.8	6.1
T_4 (100 ppm NAA)	138.17	6.02	6.70	128.61	5.67	0.04	95.7	4.2
T_5 (200 ppm NAA)	149.99	6.32	6.79	138.16	5.56	0.04	96.1	3.8
T_6 (300 ppm NAA)	166.49	7.30	6.83	153.50	5.43	0.04	96.5	3.4
T_7 (30 ppm 2,4-D)	154.03	6.18	6.63	146.21	6.06	0.04	96.0	3.9
T_8 (45 ppm 2,4-D)	173.68	6.37	7.04	167.23	6.08	0.04	96.5	3.5
T_9 (60 ppm 2,4-D)	185.38	6.91	7.34	175.57	6.14	0.03	96.6	3.3
C.D. (P=0.05)	6.89	0.82	0.72	6.31	NS	0.01	0.62	0.62

The data revealed that the different treatments had significant effect on yield parameters of tree (Table 3). The maximum fruit weight (181.71 g) was recorded with foliar spray of 60 ppm 2, 4-D which might be due to greater size of fruit and certain changes in metabolism of fruit which reflected in more accumulation of water and enhanced deposition of soluble solids. Exogenous application of auxin increased the sink strength of treated organs with strong

movement of metabolites takes place from weaker sink to stronger sink depending upon the hormonal level.

Table 3: Effect of crop regulating chemicals on number of fruits/tree, average fruit weight and yield/tree

Treatments	Number of fruits/tree	Average fruit Weight (g)	Yield/tree (Kg)
T_0 (Control)	194.33	93.12	18.09
T_1 (8% Urea)	207.00	106.38	22.02
T_2 (12% Urea)	211.00	115.16	24.32
T_3 (16% Urea)	248.33	96.46	23.98
T_4 (100 ppm NAA)	223.33	134.28	29.94
T_5 (200 ppm NAA)	227.67	143.72	32.70
T_6 (300 ppm NAA)	231.00	158.93	36.78
T_7 (30 ppm 2,4-D)	218.33	152.27	33.24
T_8 (45 ppm 2,4-D)	221.33	173.31	38.36
T_9 (60 ppm 2,4-D)	226.67	181.71	41.19
CD (P=0.05)	23.85	6.39	3.88

Foliar spray of 16% urea produced maximum number of fruits (226.67). It might be due to production of more number of flowers that can be supported by photosynthesis and remobilization. It might also be due to residual effect of higher concentration of urea on flower abscission in rainy season and further increase in higher number of fruits per plant (Sahay and Kumar; 2004). Maximum yield per tree (41.19 kg) was observed with foliar spray of 60 ppm 2, 4-D. The result is supported by findings of Mitra *et al.* (1982). As the flowers were killed in rainy season crop, the reserved food materials and auxins force the plant to produce more flowers, more fruit set and yield. These findings are in accordance with the observations made by Singh and Kumar (1993).

The data (Table 4) indicate that application of various chemicals significantly improved the fruit quality of guava in terms of total sugars, reducing sugar, non reducing sugar, TSS, ascorbic acid content of fruit, pectin per cent, TSS/acid ratio and acidity per cent of fruit (Table 4). Maximum increase in T.S.S., total sugars, reducing sugar and non reducing sugar was noticed with foliar spray of 60 ppm 2, 4-D. This may be due to quick metabolic transformation of starch into soluble sugars and early ripening in response to growth substances. Similar observations were recorded by Mitra *et al*. (1982) in L-49 guava by deblossoming with 2, 4-D and NAA.

Table 4: Effect of crop regulating chemicals on chemical parameters of guava fruit

Treatments	TSS (^{0}Brix)	Acidity (%)	TSS: acid Ratio	Ascorbic Acid (mg/100g pulp)	Reducing Sugar (%)	Non reducing sugar (%)	Total Sugars (%)	Pectin (%)
T_0 (Control)	9.11	0.38	24.01	224.02	3.92	2.35	6.27	0.53
T_1 (8% Urea)	9.68	0.34	28.50	244.13	4.15	2.50	6.65	0.61
T_2 (12% Urea)	9.73	0.33	29.58	256.86	4.20	2.52	6.72	0.63
T_3 (16% Urea)	9.55	0.33	29.06	249.06	4.17	2.47	6.64	0.60
T_4 (100 ppm NAA)	9.71	0.32	30.54	236.32	4.24	2.55	6.79	0.56
T_5 (200 ppm NAA)	9.84	0.30	32.47	237.92	4.26	2.56	6.82	0.58
T_6 (300 ppm NAA)	10.12	0.27	37.80	239.20	4.36	2.62	6.98	0.60
T_7 (30 ppm 2,4-D)	9.73	0.31	31.46	238.21	4.29	2.57	6.86	0.54
T_8 (45 ppm 2,4-D)	11.01	0.34	32.42	241.17	4.45	2.71	7.16	0.55
T_9 (60 ppm 2,4-D)	11.42	0.35	32.67	243.20	4.73	2.76	7.49	0.57
CD (P=0.05)	0.56	0.03	4.40	5.14	0.22	0.12	0.31	0.05

Acidity of fruits was reduced by application of all the chemicals, however maximum reduction was noted with foliar spray of 300 ppm NAA. The lower acidity might be due to early ripening of fruits caused by treatment, where acid might have been used during respiration or fastly converted into sugars. Similar results were obtained by Dubey *et al*. (2002). Maximum TSS/ acid ratio was also reported with foliar spray of 300 ppm NAA. A consistent decrease in acid content and increase in TSS resulted into an increase in TSS/acid ratio. Foliar spray of 12% urea resulted in maximum pectin content during the study. The increase in pectin content of fruit was also reported by Sahay *et al.* (2001) and Mohammed *et al.* (2006) in guava. Foliar spray of 12% urea also resulted in maximum ascorbic acid content. Similar results were obtained by Sahay and Kumar (2004) with urea sprays.

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