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RESEARCH PAPER

Effect of various plant growth regulators on yield and quality of guava (*Psidium guajava* L.) cv. LUCKNOW-49

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Abstract : The present investigation was carried out to determine the suitable and optimum concentration of boron and plant growth regulators for maximum productivity and quality of guava cv. LUCKNOW-49 during *Kharif* season. From the present study it can be concluded that the treatment T_{10} (0.2% boron + GA_3 60 ppm+ NAA 150 ppm + ethrel 750 ppm) was found best for physical parameters and treatment T_5 (0.2% boron + NAA 150 ppm) for yield point of view, while for quality point of view the treatment T_9 (0.2% boron + ethrel 1000 ppm) was found best. As far as the relative economics of the treatment is concerned, the maximum net realization of Rs. 1,72,807 per hectare with highest 1:6.6 cost benefit ratio (CBR) was obtained by the treatment T_5 (0.2% boron + NAA 150 ppm) as compared to other treatments. Therefore, the treatment T_5 (0.2% boron + NAA 150 ppm) is best among all treatment for higher production.

Key Words : Guava (*Psidium guajava* L.), Boron, NAA, Ethrel yield, Quality

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INTRODUCTION

The guava is one of the most common fruits in India. It claims to be the fourth most important fruit crop in area and production after mango, banana and citrus. Amongst about 150 species of genus *Psidium* only *Psidium guajava* has been put under commercial cultivation. It was largely grown in warm tropical countries of the world but now it is grown all over the tropical and subtropical regions and in all parts of India. Guava is the most popular fruit in India for the reason that the tree is hardy in nature, it can grown in wide range of soils and climatic conditions. In India, most of the guava varieties produce medium to small inferior quality fruits having more number of seeds which are hard to chew. Very limited work has been done on use of micronutrients and plant growth regulators for improving fruits size and quality in India as well as in different parts of world. Presently plant growth regulators are given considerable importance and they have been tried in fruit crops by several workers. The importance of micronutrients and synthetic plant growth regulators in achieving higher yield and better quality of fruit crops has been well recognized in recent time. Present field experiment was designed to determine the effect of boron and various plant growth regulators on yield and quality of guava, var. Lucknow-49.

MATERIAL AND METHODS

The present experiment was conducted at Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh during *Kharif* season on guava cv. LUCKNOW-49. The experiment was laid out in Randomized Block Design with 0.3 per cent boron and three growth regulators each at three concentrations *viz.*, GA_3- 30, 60 and 90 ppm, NAA-100,150 and 200 ppm and ethrel-500, 750 and

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1000 ppm and control (water spray) with three replicates. The first spray of boron and growth regulators were applied as foliar spray at the flower initiation stage and second spray was applied after three weeks of first spray. Plants with uniform growth and size were selected from orchard with distance of 6×6 meters in medium black soil. Orchard management operations like manures and fertilization, irrigation, weeding, plant protection measures, pruning etc. were carried out as per normal practices. The observations were recorded on physical characters *viz.*, fruit set, fruit drop, fruit weight, fruit size (length and width) and biochemical parameters like total soluble solid, total sugars, acidity and ascorbic acid and yield parameters like yield (kg/tree) and estimated yield (kg/ha).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented in Table 1, 2 and 3.

Fruit set :

An application of boron and plant growth regulators significantly increased the fruit set percentage of guava. The

Table 1 : Effect of boron and plant growth regulators on physical parameter of guava (*Psidium guajava* L.)

Treatments	Fruit set (%)	Fruit drop (%)	Fruit weight (%)	Fruit size	
				Length (cm)	Width (cm)
0.2% Boron + GA_3 30 ppm	71.00	28.33	77.07	6.20	6.23
0.2% Boron + GA_3 60 ppm	72.00	27.33	80.00	6.27	6.30
0.2% Boron + GA_3 90 ppm	74.00	25.00	81.00	6.30	6.63
0.2% Boron + NAA 100 ppm	76.20	24.00	82.17	6.00	5.50
0.2% Boron + NAA 150 ppm	76.33	23.00	86.02	5.80	5.50
0.2% Boron + NAA 200 ppm	76.00	23.33	85.00	6.07	5.60
0.2% Boron + Ethrel 500 ppm	70.00	28.04	78.00	5.70	5.40
0.2% Boron + Ethrel 750 ppm	69.00	29.00	77.00	5.67	5.37
0.2% Boron + Ethrel 1000 ppm	68.00	29.20	73.33	5.63	5.30
0.2% Boron + GA_3 60 ppm + NAA 150 ppm + Ethrel 750 ppm	73.00	26.04	78.03	6.50	6.67
0.2% Boron	72.67	27.00	80.00	6.03	5.57
Control (water spray)	65.67	34.00	66.00	4.50	4.45
S.E. ±	1.76	1.25	1.25	0.38	0.27
C.D. (P=0.05)	5.19	3.68	3.68	1.13	0.78
C.V. %	4.23	7.8	7.79	11.27	8.2

Table 2 : Effect of boron and plant growth regulators on yield and biochemical parameters of guava (*Psidium guajava* L.)

Treatments	Yield per tree (kg)	Yield per hectare (kg)	TSS (%)	Total sugars (%)	Acidity (%)	Ascorbic acid (mg/100g of pulp)
0.2% Boron + GA_3 30 ppm	70.00	19444	10.06	6.26	0.68	175.00
0.2% Boron + GA_3 60 ppm	70.13	19481	10.10	6.34	0.62	184.67
0.2% Boron + GA_3 90 ppm	70.87	19685	10.08	6.49	0.52	189.33
0.2% Boron + NAA 100 ppm	70.03	19453	10.00	6.50	0.63	170.00
0.2% Boron + NAA 150 ppm	71.67	19907	10.06	6.56	0.64	170.67
0.2% Boron + NAA 200 ppm	71.00	19722	10.05	6.58	0.65	171.67
0.2% Boron + Ethrel 500 ppm	53.33	14814	11.20	7.21	0.64	170.00
0.2% Boron + Ethrel 750 ppm	51.37	14268	11.24	7.30	0.67	172.00
0.2% Boron + Ethrel 1000 ppm	50.07	13907	11.33	7.40	0.71	172.67
0.2% Boron + GA_3 60 ppm + NAA 150 ppm + Ethrel 750 ppm	69.33	19259	11.08	6.67	0.67	177.00
0.2% Boron	63.33	17592	10.13	6.49	0.63	170.67
Control (water spray)	43.00	11944	8.20	5.43	0.80	150
S.E. ±	2.29	636.83	0.40	0.22	0.034	5.08
C.D. (P=0.05)	6.72	1867	1.19	0.65	0.10	14.90
C.V. %	6.32	6.32	6.94	6.99	9.05	5.09

maximum percentage of fruit set (76.33%) was observed with 0.2 per cent boron + NAA 150 ppm, which was at par with 0.2 per cent boron + NAA 100 ppm. More fruit set due to NAA spray was due to profuse flowering. It seems to have helped to increase the fruit set either by improving pollen germination or by helping the growth of pollen tubes and thus facilitate in timely fertilization before the stigma loses its receptivity or the style becomes non-functional. These findings are in agreement with Brahmachari *et al*. (1996) and Choudhary *et al.* (1997) in guava, they observed that NAA at 100 ppm resulted in maximum percentage of fruit set.

Fruit drop :

The minimum percentage of fruit drop (23.00%) was observed in 0.2 per cent boron + NAA 150 ppm, which was at par with 0.2 per cent boron + NAA 200 ppm. The NAA has helped in fruit retention because auxin prevents the abscission and facilitated the ovary to remain attached with the shoot, resulting in lower fruit drop. Similar results were found by Singh *et al.* (1996) and Rajput *et al.* (1977) they reported that the spray of NAA (200) resulted in reduced flower or fruit drop in guava cv. ALLAHABAD SAFEDA.

Fruit size : length and width :

The results indicated that the size of fruit with respect to length and width was significantly increased by foliar application of boron and plant growth regulators. Maximum values for both the characters were recorded under 0.2 per cent boron + GA_3 60 ppm+ NAA 150 ppm + ethrel 750 ppm. It might be due to cumulative effect of micronutrient and plant growth regulators. Similar results were found by Pandey *et al.* (1988). They observed that the maximum size of fruits was obtained applying 2 per cent urea + 0.4 per cent $ZnSO_4$ + 250 ppm ethrel (ethepon) + 10 ppm NAA.

Fruit weight :

The results indicated that the weight of fruits (86.02 g) was observed in the 0.2 per cent boron + NAA 150 ppm, which was at par with the 0.2 per cent boron + NAA 200 ppm. Kher *et al*. (2005) and Yadav *et al*. (2001) also reported application of NAA (20, 40, 60 and 80 ppm) sprayed 15 days before harvest increased the fruit weight in guava due to accumulation of sugars and high pulp percentage in sprayed fruits.

Total soluble solids (TSS) and total sugar :

The maximum TSS (11.33 %) and total sugar (7.40 %) were recorded in the 0.2 per cent boron + ethrel 1000 ppm, which was at par with the 0.2 per cent boron + ethrel 750 ppm and 0.2 per cent boron + ethrel 500 ppm, Biswas *et al*. (1988) also reported that the TSS increased due to its action on converting complex substances into simple ones, which enhances the metabolic activity in fruits. In case of total sugar, application of ethrel (ethephon) at 0.250 ml/lt. resulted in higher total sugar content in guava, further Sandhu and Bal (1989) also found similar trend in *ber*, due to the ethrel promoted hydrolysis of starch into sugars.

Acidity :

The maximum reduction in acidity (0.52 %) was noted in 0.2 per cent boron + GA_3 90 ppm, which was at par with the 0.2 per cent boron + GA_3 60 ppm. This finding is in agreement with the results of Kher *et al*. (2005). They reported in their study that lowest acidity was recorded with 90 ppm GA_3 in guava due to either speedily converted into sugars and their derivatives by reactions involving reverse glycolytic pathways or might have been used in respiration or both.

Table 3 : Effect of boron and plant growth regulators on net realization and cost benefit ratio in guava (*Psidium guajava* L.)

Treatments	Fruit yield (kg/ha)	Gross realization (Rs./ha)	Total cost of cultivation (Rs./ha)	Net realization (Rs./ha)	CBR
0.2% Boron + GA_3 3O ppm	19444	194440	27276	167164	1:6.0
0.2% Boron + GA_3 6O ppm	19481	194810	28622	166188	1:5.7
0.2% Boron + GA_3 90 ppm	19685	196850	29868	166982	1:5.9
0.2% Boron + NAA 100 ppm	19454	194540	26152	168388	1:6.3
0.2% Boron + NAA 150 ppm	19907	199070	26263	172807	1:6.6
0.2% Boron + NAA 200 ppm	19722	197220	26374	170846	1:6.4
0.2% Boron + Ethrel 500 ppm	14815	148150	58305	89845	1:1.5
0.2% Boron + Ethrel 750 ppm	14268	142680	74492	68188	1:0.9
0.2% Boron + Ethrel 1000 ppm	13907	139070	90680	48390	1:0.5
0.2% Boron + GA_3 6O ppm+ NAA 150 ppm+ Ethrel 750 ppm	19259	192590	77517	115073	1:1.4
0.2% Boron	17592	175920	25930	149990	1:5.7
Control (water spray)	11944	119440	25750	93690	1:3.6

Price of guava - @ Rs. 10/kg, Boric acid- @ Rs. 0.43/g, GA_3 - @ Rs. 131/g, Ethrel - @ Rs. 0.43/ml NAA - @ Rs. 4.25/g

Ascorbic acid (mg/100g) :

The highest ascorbic acid content (189.33 mg/100g pulp) was observed in 0.2 per cent boron + GA_3 90 ppm, which was at par with the 0.2 per cent boron + GA_3 60 ppm and 0.2 per cent boron + GA_3 30 ppm. This finding is in consonance with the result of Kher *et al*. (2005). They recorded the maximum ascorbic acid (mg/100g pulp) with 90 ppm GA_3 in guava, due to the possible catalytic influence of this gibbrellic acid on biosynthesis of ascorbic acid from sugar or inhibition of oxidative enzymes or both.

Yield (kg/tree and kg/ha) :

The application of 0.2 per cent boron + NAA 150 ppm gave maximum yield per tree (71.67 kg) and yield per hectare (19907.41 kg) as compared to other treatments. The cumulative effect of boron and NAA has helped to increase the fruit size and fruit weight and thereby increase the fruit yield. Similar results are also found by Dubey *et al*. (2002) in their study.

Net realization :

The net realization was worked out from the yield of guava by taking into consideration the prevailing prices of guava fruit and inputs used during the experimentation. The data revealed that the treatment of NAA gave highest net realization. The treatment 0.2 per cent boron + NAA 150 ppm gave maximum net realization of Rs. 1,72,807 per hectare followed by treatment 0.2 per cent boron + NAA 200 ppm, *i.e.*, 1,70,846 Rs./ha. The treatment combination with ethrel were found superior over control (water spray) in obtaining higher yield and best quality, but due to higher cost it is not economical.

Cost benefit ratio :

The data indicated that the foliar spray of NAA, increased cost benefit ratio in guava. The treatment 0.2 per cent boron + NAA 150 ppm gave highest (1:6.6) cost benefit ratio as compared to other treatments and found to be most economical.

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