

EFFECT OF MICRONUTRIENTS AND PLANT GROWTH REGULATORS ON GROWTH AND YIELD OF GUAVA (*PSIDIUM GUAJAVA* L.) IN RAJASTHAN

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Abstract: The field experiment was conducted at IHITC, Jaipur during the year 2018-19 and 2019-20. The experiment consisted of foliar spray of 24 treatment combinations comprising two levels each of Zn, B and Fe (0.2 and 0.4%) and two levels of NAA (50 and 100ppm) and CCC (500 and 1000ppm). Treatments were applied on foliage as foliar spray twice, 15 days before flowering and 20 days after fruit set at marble stage. This experiment was evaluated under Factorial Randomized Block Design with three replications. The results revealed that increasing levels of micronutrients (Zn, B and Fe) and PGRs (NAA and CCC) significantly increased the growth (gain in plant height and spread NS & EW), yield (per tree and per hectare). Interactions of 0.4% H₃BO₃ and 100ppm NAA gave best results in respect to growth and yield.

Keywords: Growth, Yield, Micronutrients, Plant growth regulators

INTRODUCTION

Guava (*Psidium guajava* L.) known as “Apple of the Tropics” and “Poor Man’s apple”, it belongs to the botanical family Myrtaceae, classified under genus *Psidium*, which contains about 150 species but only *Psidium guajava* has been exploited commercially. It is most important, highly productive, delicious and nutritious fruit which is grown commercially throughout tropical and sub-tropical regions of India.

Guava fruits are climacteric with a relatively short shelf life due to their rapid rate of ripening (Akamine and Goo, 1979; Brown and Wills, 1983). Guava fruits have superiority over several other fruits because of its commercial and nutritional values (Menzel, 1985). It is rich source of vitamin-C (2 to 5 times more than fresh orange juice) and pectin (a polysaccharide substance) (Agnihotri and Bhullar, 1962). It ranks third in vitamin-C content (260mg/100g) after Barbados cherry and *Aonla* (Phandis, 1970 and Rathore, 1979).

Guava fruits are available throughout the year except during the summer season. It occupies a pride place amongst the important fruits grown in country and claims to be the fourth most important fruit in terms of area and production after mango, banana and citrus (Ray, 2002).

Guava produces fruits round the year due to the availability of continuous heat and humidity under tropical and sub-tropical climatic conditions. However, in sub-tropical climate, there are three distinct periods of growth and fruiting that are *Ambabhar* (February to March flowering and fruit ripens in July-August), *Mrigbahar* (flowering in June to July and fruit ripens in October to December) and *Haste bahar* (flowering in October to November and

fruit ripens in February to April) (Shukla *et al.*, 2008).

Guava cultivation is drawing attention of the farmers because of the following specific facts, viz., (a) fruiting round the year (b) cultivation with low cost (c) high yielding (d) high in nutritive values (e) resistant to adverse climatic conditions (f) wider adaptability of plant (g) rich source of pectin (h) medicinal values and (i) suitability for preservation.

Micronutrients play a vital role in growth and development of guava plants. Guava plant responses well to Zn, B, Fe, K and Mo applications (Arora and Singh, 1970 and 1972; Singh and Chhonkar, 1983). The responses of guava plants to these nutrients may vary from region to region and pocket to pocket.

Guava suffers severely from deficiency of micronutrients specially boron which reduces the quality of fruits and hinder the development of fruits. Fruits will not grow into a big size even those reaching a fair size do not ripen properly and become hard with brown corky skin and cracking.

Boron is a heavy non-metal micronutrient which is absorbed by plant in the form of boric acid (H₃BO₃). It plays an important role in translocation of carbohydrates, auxin synthesis and increased pollen viability and fertilization.

Zinc is a metal component of enzymes or as a functional, structural or regulatory factor of large number of enzymes. Zinc increases the chlorophyll content of leaves and plays an important role in enzymatic activities and is necessary for growth and development.

Similarly, Iron is an essential element and it has favorable influence on physicochemical composition of fruits, fruit weight, length and diameter (Thirupathaiah *et al.*, 2017).

The plant growth regulators (PGR) act as messengers and needed in small quantity at low concentration.

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Yadav (2002) studied that by the spray of PGRs the physical, chemical and yield parameters of guava fruit were improved. Foliar application of NAA and CCC affects the plant growth and yield.

MATERIALS AND METHODS

The experiment was conducted on guava orchard of International Horticulture Innovation and Training Centre (IHITC), Durgapura (Jaipur) during May to March months (Based on *Mrigbahar* flowering) of 2018-19 and 2019-20, respectively. Geographically this place is situated at 75°47' East longitude, 26°51' North latitude and at an altitude of 390 m above Mean Sea Level in Jaipur district of Rajasthan. This region falls under Agro-climatic Zone IIIa (semi-arid Eastern plain zone) of Rajasthan.

The experiment was laid out in factorial randomized block design with 24 treatment combinations and three replications. Each micronutrients (Treatment M₁- 0.2% ZnSO₄, M₂-0.4% ZnSO₄, M₃-0.2% H₃BO₃, M₄-0.4% H₃BO₃, M₅-0.2% FeSO₄ and M₆-0.4% FeSO₄) and plant growth regulators (P₁-50ppmNAA, P₂-100ppm NAA, P₃-500ppm CCC and P₄-1000ppm CCC) were used with their two concentrations. The spraying of micronutrients and plant growth regulators as per treatment was done 15

days before flowering and 20 days after fruit set at marble stage.

In growth parameters gain in plant height (m), gain in plant spread (m) EW and NS was determined. In yield parameters- yield per plant (kg) and yield per ha (q) were determined.

The experimental data was statistically analyzed as per the method suggested by Panse and Sukhatme (1985). The critical difference was worked out at 5 per cent (0.05) level of significance.

RESULTS AND DISCUSSION

The data recorded on gain in plant height (m), gain in plant spread (m) EW and NS presented in Table 1. The maximum gain in plant height (m) was recorded with treatment M₄ (0.59m, 0.62m and 0.61m) and P₂ (0.59m, 0.62m and 0.60m) during both the years and in pooled analysis, respectively. This result is in close conformity with the findings of Das *et al.* (2001), Balakrishnan (2001), Mehaisen and El-Sharkawy (2005), Jain and Dashora (2007), Abdollahi *et al.* (2010), Kumar *et al.* (2010), Khan *et al.* (2012), Bhoyar and Ramdevputra (2016) in guava. Foliar application of Fe, Zn and B increased height of phalsa plants (Jitendra *et al.*, 2017).

Table 1. Effect of micronutrients and plant growth regulators on gain in plant height (m)

Treatments	Gain in plant height (m)		
	2018-19	2019-20	pooled
Micronutrients			
M ₁ (ZnSO ₄ @0.2%)	0.50	0.52	0.51
M ₂ (ZnSO ₄ @0.4%)	0.58	0.61	0.60
M ₃ (H ₃ BO ₃ @0.2%)	0.53	0.56	0.55
M ₄ (H ₃ BO ₃ @0.4%)	0.59	0.62	0.61
M ₅ (FeSO ₄ @0.2%)	0.47	0.52	0.49
M ₆ (FeSO ₄ @0.4%)	0.55	0.57	0.56
SEm±	0.01	0.01	0.01
CD (p=0.05)	0.03	0.03	0.02
PGRs			
P ₁ (NAA@50ppm)	0.56	0.58	0.57
P ₂ (NAA @100ppm)	0.59	0.62	0.60
P ₃ (CCC@500ppm)	0.51	0.55	0.53
P ₄ (CCC@1000ppm)	0.49	0.53	0.51
SEm±	0.01	0.01	0.01
CD (p=0.05)	0.02	0.03	0.02
CV (%)	6.32	6.61	6.24

It is also clear from data presented in Table 2 that maximum gain in plant spread (m) EW was obtained

with the treatment M₄(0.69, 0.71 and 0.70) and P₂ (0.68, 0.70 and 0.69).The maximum gain in plant

spread (m) NS was obtained with treatment M₄ (0.59, 0.61 and 0.60) and P₂ (0.61, 0.63 and 0.62) (Table 3) during both the years and in pooled

analysis. Interaction of M₄ and P₂ was superior over rest of the treatments in respect to gain in plant height (m) and gain in plant spread (m) EW and NS.

Table 2. Effect of micronutrients and plant growth regulators on gain in plant spread (m) (EW)

Treatments	Gain in plant spread (m) EW		
	2018-19	2019-20	Pooled
Micronutrients			
M ₁ (ZnSO ₄ @0.2%)	0.58	0.61	0.59
M ₂ (ZnSO ₄ @0.4%)	0.64	0.67	0.65
M ₃ (H ₃ BO ₃ @0.2%)	0.62	0.65	0.63
M ₄ (H ₃ BO ₃ @0.4%)	0.69	0.71	0.70
M ₅ (FeSO ₄ @0.2%)	0.49	0.52	0.51
M ₆ (FeSO ₄ @0.4%)	0.63	0.66	0.64
SEm±	0.01	0.01	0.01
CD (p=0.05)	0.03	0.03	0.02
PGRs			
P ₁ (NAA@50ppm)	0.61	0.64	0.62
P ₂ (NAA @100ppm)	0.68	0.70	0.69
P ₃ (CCC@500ppm)	0.58	0.61	0.59
P ₄ (CCC@1000ppm)	0.56	0.60	0.58
SEm±	0.01	0.01	0.01
CD (p=0.05)	0.02	0.02	0.02
CV (%)	6.32	6.61	6.24

Table 3. Effect of micronutrients and plant growth regulators on gain in plant spread (m) (NS)

Treatments	Gain in plant spread (m) NS		
	2018-19	2019-20	Pooled
Micronutrients			
M ₁ (ZnSO ₄ @0.2%)	0.55	0.56	0.56
M ₂ (ZnSO ₄ @0.4%)	0.58	0.60	0.59
M ₃ (H ₃ BO ₃ @0.2%)	0.57	0.58	0.58
M ₄ (H ₃ BO ₃ @0.4%)	0.59	0.61	0.60
M ₅ (FeSO ₄ @0.2%)	0.53	0.55	0.54

M ₆ (FeSO ₄ @0.4%)	0.57	0.59	0.58
SEm_±	0.01	0.01	0.01
CD (p=0.05)	0.02	0.03	0.02
PGRs			
P ₁ (NAA@50ppm)	0.58	0.59	0.59
P ₂ (NAA @100ppm)	0.61	0.63	0.62
P ₃ (CCC@500ppm)	0.55	0.56	0.55
P ₄ (CCC@1000ppm)	0.53	0.55	0.54
SEm_±	0.01	0.01	0.00
CD (p=0.05)	0.02	0.02	0.01
CV (%)	5.56	5.56	5.37

Foliar application of 0.4% H₃BO₃ (60.09, 61.15 and 60.62) and 100ppm NAA (60.96, 62.08 and 61.52) recorded maximum fruit set per cent during both the years and in pooled analysis (Table 4). Similarly, the maximum fruit retention percent was obtained with treatment M₄ (52.93, 58.58 and 55.75) and P₂ (54.14,

59.70 and 56.92). Interaction of treatment M₄ and P₂ was found to be the best in respect to these parameters over rest of the treatments. These findings are in agreement with the findings of Fujiwara and Tsutsumi(1962) and Mehaisen and EL-Sharkawy (2005).

Table 4. Effect of micronutrients and plant growth regulators on fruit set (%), fruit retention (%)

Treatments	Fruit set per cent			Fruit retention per cent		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Micronutrients						
M ₁ (ZnSO ₄ @0.2%)	53.91	55.02	54.46	46.61	55.55	51.08
M ₂ (ZnSO ₄ @0.4%)	59.56	60.59	60.07	51.34	57.15	53.72
M ₃ (H ₃ BO ₃ @0.2%)	56.79	57.48	57.14	49.03	55.34	52.18
M ₄ (H ₃ BO ₃ @0.4%)	60.09	61.15	60.62	52.93	58.58	55.75
M ₅ (FeSO ₄ @0.2%)	52.56	53.79	53.17	42.61	48.75	45.68
M ₆ (FeSO ₄ @0.4%)	57.93	57.65	57.79	49.17	56.11	53.16
SEm_±	0.59	0.68	0.43	1.00	0.63	0.58
CD (p=0.05)	1.69	1.93	1.22	2.86	1.80	1.64
PGRs						
P ₁ (NAA@50ppm)	58.01	58.34	58.17	48.41	55.88	52.15
P ₂ (NAA @100ppm)	60.96	62.08	61.52	54.14	59.70	56.92
P ₃ (CCC@500ppm)	54.67	55.54	55.11	46.58	53.19	49.88
P ₄ (CCC@1000ppm)	53.58	54.48	54.03	45.33	52.22	48.77
SEm_±	0.48	0.55	0.35	0.82	0.52	0.48
CD (p=0.05)	1.38	1.58	0.99	2.34	1.47	1.34
CV (%)	5.50	6.07	5.79	7.16	5.51	6.00

Foliar application of micronutrients and plant growth regulators significantly increased the fruit yield per tree (Kg) and fruit yield per hectare (q) (Table 5). The best results was obtained with treatment M₄ (41.63, 44.52 and 43.08 Kg) and P₂ (41.58, 44.53 and 43.06 Kg) during both the years and in pooled analysis. Maximum yield per ha was also obtained with treatment M₄ (115.31, 123.33 and 119.32q) and

P₂ (115.17, 123.35 and 119.26q) during both the years and in pooled analysis. Combination of M₄ and P₂ was best over rest of the treatment combinations. Guava fruit yield increased due to the effect of B, Zn and Fe (Sarolia *et al.*, 2007 & Kumar *et al.*, 2015). Present findings were in agreement with the findings of Shukla *et al.* (2008) and Abhijith *et al.* (2018) in guava.

Table 5. Effect of micronutrients and plant growth regulators on yield per tree (Kg) and per hectare (q)

Treatments	Yield per tree (kg)			Yield per hectare (q)		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Micronutrients						
M ₁ (ZnSO ₄ @0.2%)	33.84	36.76	35.30	93.74	101.84	97.79
M ₂ (ZnSO ₄ @0.4%)	39.96	43.37	41.67	110.68	120.14	115.41
M ₃ (H ₃ BO ₃ @0.2%)	37.21	39.87	38.54	103.06	110.45	106.76
M ₄ (H ₃ BO ₃ @0.4%)	41.63	44.52	43.08	115.31	123.33	119.32
M ₅ (FeSO ₄ @0.2%)	31.84	34.80	33.32	88.20	96.41	92.31
M ₆ (FeSO ₄ @0.4%)	37.65	40.55	39.10	104.28	112.33	108.31
SEm±	0.50	0.56	0.36	1.43	1.55	1.02
CD (p=0.05)	1.41	1.59	1.01	4.07	4.42	2.85
PGRs						
P ₁ (NAA@50ppm)	38.77	41.67	40.22	107.39	115.43	111.41
P ₂ (NAA @100ppm)	41.58	44.53	43.06	115.17	123.35	119.26
P ₃ (CCC@500ppm)	34.89	37.73	36.31	96.65	104.51	100.58
P ₄ (CCC@1000ppm)	32.84	36.00	34.42	90.97	99.72	95.34
SEm±	0.40	0.46	0.29	1.17	1.26	0.83
CD (p=0.05)	1.15	1.30	0.82	3.33	3.61	2.33
CV (%)	5.64	5.15	5.40	5.15	5.16	5.18

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