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Response of foliar application of micronutrients and plant growth regulator on yield and economic feasibility of guava (*Psidium guajava* L.) CV. Shweta and Lalit

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Abstract
The present investigation entitled "Response of foliar application of micronutrients and plant growth regulator on yield and economic feasibility of guava (*Psidium guajava* L.)" was conducted on six-year-old guava plants grown in sodic soil condition at Main Experimental Station, Department of Fruit Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj Ayodhya (U.P) during the year 2019-20 to investigate the response of foliar application of micronutrients and plant growth regulators on yield and economic feasibility of guava. The experiment comprised of two foliar applications after flowering during August and at the pea stage during October of zinc sulfate 1.0% (N1) Borax 1% (N2), NAA 50ppm (N3), and Control (N0) on the two cultivars Shweta (V1) and Lalit (V2) with three replication. The data was recorded and analysed by using Factor Randomised block design (F.R.B.D). Under the investigation, guava fruits were studied for the parameter of number of flowers per plant, fruit set, fruit retention, number of fruits per plant, fruit yield per plant, fruit yield per hectare, gross income, net income, cost of cultivation and cost benefit ratio. During the investigation, the result revealed that the fruiting attributes as well as yield of guava was recorded significantly superior with treatment of N2V2 as compared to other treatments. However, the treatment N3V2 was recorded most beneficial in terms of economic return. Hence, concluded that application of FYM+NPK (400g: 300g: 250g) + Borax (1%) in cv. Lalit increase the fruiting and yield of guava while for the maximum economic return application of FYM+NPK (400g: 300g: 250g) + NAA 50 ppm in cv. Lalit and recommended to guava producers in the Eastern Uttar Pradesh..

Keywords: Guava, yield, borax, NAA, NPK, economic return, Shweta, Lalit, FYM

Introduction
Guava is fourth important fruit in area and production after mango, banana and citrus. It is cultivated throughout the tropical and subtropical region. Guava (*Psidium guajava* L.), is one of the most important tropical and sub-tropical fruit crop of India, which belongs to the family Myrtaceae. It is native of tropical America. It is cultivated in India since early 17th century and gradually become a crop of commercial significance. It is cultivated throughout the tropical and subtropical region. In northern India, guava flowers twice or sometimes thrice in a year. The spring flowering is called "Ambe Bahar", June or monsoon flowering is called "Mrig Bahar" and third flowering which come in October is called "Hast Bahar".

Ambe Bahar fruits ripen from July to September and Mrig Bahar fruits ripen from November to February however, Hast Bahar fruits ripen in spring season which is also known as summer season.

Guava is commercially grown in throughout the country particularly Maharashtra, Uttar Pradesh, Bihar, Orissa, Punjab, Uttrakhand, Gujarat, Madhya Pradesh, and west Bengal. Utter Pradesh is considered as the most important guava producing state of India, in which Allahabad (Prayagraj) region has the reputation of growing the best quality guava in the country as well as all over the world**.** It is cover around 3.7% (2.7 lakh ha) of total area under fruit crops and contributes 3.3% (41.07 MT) of total fruit production (NHB 2017-18).

Guava trees are prolific bearer and to maintain its vigour, growth and productivity for a long time, it needs proper nourishment. Without proper management, continuous fruit production reduces nutrient reserves in the soil and thus, affects crop growth and productivity adversely. Replenishment of lost quantities of the nutrients is, therefore, necessary to maintain the nutrients is, therefore, necessary to maintain the fertility status of the soil and to get good crop in the following years.

Therefore, a careful management is required to produce a profitable crop which includes cultural practices and obviously the fertilization and nutrition of orchard. Nutrition is most important factor affecting growth, yield and quality of a crop. Unless, it is maintained at an optimum level, higher yield and better fruit quality cannot be maintained. However, the increasing cost of fertilizers and their adverse effects on soil all over the world have made it necessary to think in terms of supplementing the soil with alternative sources which render soil more productive and gave higher yield and better quality.

Micronutrients such as zinc sulphate play important role in growth and development of fruit, vegetables and cereals. It is one of the essential element for the formation of chlorophyll and hence useful towards photo synthetic activity. It is also a constituent of some enzymes. Zinc activates enzymes that are responsible for the synthesis of certain proteins. It is used in the formation of chlorophyll and some carbohydrate, conversion of starches to sugars and its presence in plant tissue helps the plant to withstand cold temperatures. Zinc is essential in the formation of auxins, which helps with growth regulation and stem elongation.

The foliar application of micronutrients and plant growth regulators plays a vital role in improving the quality and comparatively more effective for rapid recovery of plants. Kumar *et al*. (2004) advocated that foliar application of zinc (0.5 per cent, 1.0 per cent), boron (0.4 per cent, 0.6 per cent) and copper (0.5 per cent, 1.0 per cent) after flowering at pea stage significantly improved fruit length, fruit diameter and fruit weight in litchi cv. Dehradoon. Foliar application of Zinc sulphate and boric acid significantly increased fruit yield of guava Dashora *et al.* (2005) [5], Prasad *et al*. (2005) [17] reported that foliar application of borax (0.8 per cent) increased the number of flowers, fruit set, fruit retention and yield of guava cv. Allahabad Safeda. Maximum yield (94.5 kg/ tree) was recorded with application of 0.4% ZnSO4 by Samant *et al*. (2008) [15]. The foliar feeding of fruit tree has gained much importance in recent years, as micronutrients applied through soil are needed in higher quantity because some amount leaches down and some become unavailable to the plant due to complex soil reactions. The yield parameter like average fruit weight, number of fruits per tree and yield per tree are increased by the spray of micronutrients. Therefore, it has become imperative to find out influence of zinc and boron on leaf nutrient status of guava Response of Foliar Application of Micronutrients and Plant Growth Regulator on Yield and Economic Feasibility of Guava (*Psidium guajava* L.) cv. Shweta and Lalit.

Material and Methods

The present investigation was carried out at MES, Horticulture, Department of Fruit Science; Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) during year 2019-20 on 6 six year old guava plants which were planted at spacing 6x6

m. Geographically, It is situated at 26.47º North latitude, 82.12º East longitude and altitude of 113 meter from sea level. The site is located in typical saline alkaline belt of Gangetic plains of eastern Uttar Pradesh.

Factorial Randomized Block Design with three replication was applied in the layout of experimental trial in the month of May, 2019, with the allocation of eight treatment combinations from two factors (i) two varieties (Shweta (V1) and Lalit (V2)) (ii) Micronutrients (ZnSO4 (1%) (N1) and Borax (1%) (N2) and plant growth regulator (NAA 50ppm (N3)). Foliar spray was done twice in the month of August after flowering and in October at pea size stage. The observations were recorded for number of flowers per plant, fruit set, fruit retention, number of fruits per plant, fruit yield per plant, fruit yield per hectare, gross income, net income, cost of cultivation and cost benefit ratio.

Number of flowers per plant was calculated by count method from selected branches in each direction and in each treatment and their average was expressed as number of flowers per plant. Fruit set was calculated as number of fruits set, divided by number of flowers appeared. It was expressed in percentage.

$$\text{Fruit set (\%)} = \frac{\text{Number of fruits set}}{\text{Number of flowers appeared}} \times 100$$

Fruit retention was computed as number of fruits retained till maturity, divided by number of fruit set and expressed in percentage.

$$\text{Fruit retention (\%)} = \frac{\text{Number of fruits retained till maturity}}{\text{Number of fruit set}} \times 100$$

The number of fruits per plant was recorded at each harvest and total was calculated at last harvesting by summation of values of all pickings, yield per tree (kg) was calculated by total yield of fruits at each harvest was weighed for each tree on pan balance and yield per tree was computed by marking the summation of yield values at each harvest till the last harvest and the yield per hectare (q) was calculated by multiplying the value of yield/tree (kg) by total number of plants/hectare and dividing the result by 1000. The economics of the crop cultivation under different treatment of foliar application of micronutrients and plant growth regulators on guava was worked out on the basis of input-output analysis; Benefit: Cost (B:C) ratio was worked out by using formula of gross monetary returns (₹ ha-1)/cost of cultivation (₹ ha-1).

Statistical analysis of data obtained on different traits of experiment were subjected to statistically analyze as per suggested by Panse and Sukhatme (1985) and result were evaluated at 5% level of significance. The objective of present study was to determine best response of foliar application of micronutrient and plant growth regulars on the yield and economic return guava cv. Shweta and Lalit

Results and Discussion

An examination of the data presented in table- 1 showed that the number of flowers per tree was significantly influenced by both cultivars. The maximum number of flowers per tree (106.00) was noted in Lalit (V2) as compared to cv. Shweta (V1) (81.75). Nutrients were also found significant regarding flowers per tree. Maximum number of flowers per tree (111.00) was recorded with the nutrients borax 1% (N2) followed by NAA 50ppm (N3) which was found significantly superior over rest of the treatments while, minimum number of flowers per tree (69.17) was recorded in plant sprayed with water spray (N0). But the interaction between varities and nutrients was noted non-significant. Boron has significant involvement in pollen tube growth, transport, fusion or subsequent formation of pollen cell wall. Enhanced blooming through the application of boron also notified by Venu *et al.*

(2014) [24], Rajput *et al.* (2015) [19], Hada *et al.* (2014) [9] in guava. The fruit set per tree was significantly influenced by both CV. The maximum fruit set (84.08%) was noted with lalit (V2). The minimum fruit set (65.75%) was noted Shweta (V1). Nutrient were also significantly influence fruit set %. Maximum percentage of fruit set (89.67%) was recorded with the nutrients borax 1% (N2) followed by NAA 50ppm (N3) which was found significantly superior over rest of the treatments while, minimum percentage of fruit set per tree (52.83%) was recorded with nutrients (N0) control. The interaction between varieties, micronutrients and plant growth regulators on percentage of fruit set per tree was found non-significant. Fruit retention% is significantly different in both varieties Maximum percentage of fruit retention (71.67%) was noted with cv. Lalit (V2) and minimum percentage of fruit retention (55.00%) was noted with cv. Shweta (V1). Nutrients were also found significant. Maximum percentage of fruit retention (76.17%) was recorded with the nutrients borax 1% (N2) followed by NAA 50 ppm (N3) whereas, minimum percentage of fruit retention (42.67%) was recorded with ware spray (N0). The interaction between varieties, micronutrients and plant growth regulators on percentage of fruit retention was found significant. The maximum percentage of fruit retention (89.33%) was noted with FYM+NPK (400g: 300g: 250g) Borax (1%) cv. Shweta (N2V2). The improvement in fruit set and retention by the micronutrients and PGRs has also been reported by Bhatia *et al.*(2001), Prasad *et al.* (2005), Dutta & Banik (2007), Kacha (2014), Gaur *et al.* (2014) and Pal *et al.* (2008) [4, 17, 6, 10, 7,15], in different cultivars of guava.

Significant variation in the number of fruits per tree was also observed among the varieties. The maximum number of fruits per tree (96.58) was noted with cv. Lalit (V2) followed by cv. Shweta (V1). Nutrients were also found significant regarding fruits per tree. Maximum number of fruits per tree (103.00) was recorded with the nutrients borax 1% (N2) followed by NAA 50ppm (N3) which was found significantly superior over rest of the treatments however, interaction between varieties, micronutrients and plant growth regulators on number of fruits per tree was found non-significant. The findings of current investigation are in accordance with Waskela *et al.* (2013), Goswami *et al.* (2014) and Baranwal *et al.* (2017) [25,8, 3] in guava Varieties significantly varied the fruit yield per tree. The maximum fruit yield (9.16 kg) was noted with cv. Lalit (V2). The minimum fruit yield (7.08 kg) was noted with CV.

Shweta (V1). Nutrients were also found significantly influenced fruit yield (kg/tree). Maximum fruit yield (10.45kg) was recorded with the nutrients borax 1% (N2) followed by NAA 50 ppm (N3) whereas, minimum fruit yield (5.29kg) was recorded with spray of water spray (N0).Fruit yield per hectare was significantly influenced by both varieties. The maximum fruit yield (q h-1) (25.33 q h-1) was noted with cv. Lalit (V2). The minimum fruit yield (19.42 q h-1) was noted cv. Shweta (V1). Nutrients were also found significant regarding fruit yield (q h-1). Maximum fruit yield (28.83 q h-1) was recorded with the nutrients borax 1% (N2) followed by NAA 50 ppm (N3). Whereas, minimum fruit yield (14.50 q h-1) was recorded with water spray (N0).The interaction between cv. and nutrients on fruit yield (q h-1) was also found significant. The maximum fruit yield (31.00 q h-1) was noted with FYM+NPK (400g: 300g: 250g) Borax (1%) (N2V2). The minimum fruit yield (13.67 q h-1) was recorded with water spray in cv. Shweta (V1N0). The boron influence on the improvement in fruiting and high yield might be due to involvement of boron in the pollen germination and pollen tube growth which ultimately improves the fruit yield in guava. These results are also in agreement with the reporting of Dashora *et al.* (2004), Ashwani and Lal (2009), Rao *et al.* (2014) in ber, Tiwari and Lal (2014) and Singh *et al.* (2017) [5, 2, 21-23].

Maximum cost of cultivation 44595 ha-1 was computed under with the application of (N2V2) FYM+NPK (400g: 300g: 250g) + Borax (1.0%) cv. Lalit followed by treatment (N1V2) FYM+NPK (400g: 300g: 250g) + Zinc sulphate cv. Lalit. The minimum cost of cultivation Rs.41825 ha-1 control in nutrients (N0) and cv. (V1) Shweta. The gross return were maximum (Rs.155000 ha-1) in (N2V2) FYM+NPK (400g:300g:250g) + Borax (1%) cv. Lalit. The Minimum gross return (Rs.68350 ha-1) was noted in control (N0) and cv. Shweta (V1). Maximum net return (Rs.110405 ha-1) was estimated under (N2V2) FYM+NPK (400g: 300g: 250g) cv. Lalit + Borax 1% followed by (N3V2) FYM+NPK (400g: 300g: 250g) + NAA@ (50ppm) cv. Lalit. The minimum net return (Rs.26525 ha-1) was estimated in control (N0) and cv. Shweta (V1). Maximum Cost: Benefit ratio (1:3.62) was computed in treatment (N3V2) FYM+NPK (400g: 300g: 250g) NAA@ (50ppm) cv. Lalit. Followed by (N2V2) FYM+NPK (400g: 300g: 250g) Borax (1%) cv. Shweta. The minimum cost: Benefit ratio (1:1:63) was Computed under control (N0) and cv. (V1) Shweta. The results are in close conformity with Meena *et al.* (2013) [12] in phalsa, Rajput *et al.* (2015) [19] in guava cv. L-49 and Abhijith *et al.* (2018) [1] in aonla cv. NA-7.

Table 1: Response of foliar application of micronutrients and PGR on fruiting of guava cv. Shweta and Lalit

Treatment	Number of Flowers/ tree	Fruit set (%)	Fruit retention (%)	Number of fruits/ tree
N0	69.17	52.83	42.67	63.17
N1	95.00	74.67	61.33	88.33
N2	111.00	89.67	76.17	103.33
N3	100.33	82.50	73.17	91.83
Sem±	5.379	3.60	2.47	3.51
Cd at 5%	11.94	7.99	5.50	7.79
V1	81.75	65.75	55.00	76.75
V2	106.00	84.08	71.67	96.58
Sem±	3.80	2.54	1.75	2.48
Cd at 5%	8.44	5.65	3.89	5.51
N0 v1	63.33	49.33	40.33	58.67
N0 v2	75.00	56.33	45.00	67.67
N1 v1	87.00	69.33	57.00	82.00

N1 v2	103.00	80.00	65.67	94.67
N2 v1	95.00	76.67	63.00	90.67
N2 v2	127.00	102.67	89.33	116.00
N3 v1	81.67	67.67	59.67	75.67
N3 v2	119.00	97.33	86.67	108.00
Sem±	7.60	5.09	3.50	4.96
Cd at 5%	Ns	Ns	7.78	Ns

Table 2: Response of foliar application of micronutrients and PGR on yield of fruit guava cv. Shweta and Lalit

Treatment	Fruit yield/ tree (kg/tree)	Fruit yield/ Hectare (q/ha)
N0	5.29	14.50
N1	8.28	22.67
N2	10.45	28.83
N3	8.46	23.50
SEm±	0.52	1.43
CD at 5%	1.17	3.17
V1	7.08	19.42
V2	9.16	25.33
SEm±	0.37	1.01
CD at 5%	0.83	2.24
N0 V1	5.01	13.67
N0 V2	5.57	15.33
N1 V1	7.56	20.67
N1 V2	8.99	24.67
N2 V1	9.63	26.67
N2 V2	11.27	31.00
N3 V1	6.12	16.67
N3 V2	10.79	30.33
SEm±	0.74	2.02
CD at 5%	NS	4.48

Table 3: Response of foliar application of micronutrients and PGR on economic feasibility of guava cv. Shweta and Lalit

Treatment	Yield (q/ha)	Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net return (Rs)	Cost: Benefit ratio
N0 V1	13.67	41825	68350	26525	1:1.63
N0 V2	15.33	41825	76650	34825	1:1.83
N1 V1	20.67	42932	103350	58755	1:2.36
N1 V2	24.67	42932	123350	80418	1:2.87
N2 V1	26.67	44595	133350	88755	1:2.99
N2 V2	31.00	44595	155000	110405	1:3.47
N3 V1	16.67	41874.68	83350	41473.32	1:1.99
N3 V2	30.33	41874.68	151650	109775.32	1:3.62

Conclusion

Based on the results, It may be concluded from the results obtained in present investigation that Lalit cv. (V2) and nutrients in (N2) (Borax (1%) was found to be most effective to improve number of flowers per plant, fruit set, fruit retention, number of fruits per plant, fruit yield per plant, fruit yield per hectare. Among the over treatment cv. Lalit (V2) and nutrients in (N3) (NAA 50ppm) gave best economic return. Therefore, Lalit cv. (V2) and nutrients in (N2) Borax (1%) and (N3) NAA 50ppm can be recommended to obtained higher yield and economic return production of guava fruit in the Indo-Gangetic plains of eastern Uttar Pradesh.

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