The Pharma Innovation Journal 2022; 11(5): 1875-1877

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 1875-1877

www.thepharmajournal.com
Received: 05-03-2022
Accepted: 07-04-2022

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Effect of foliar spray of micronutrients and plant growth regulators on growth and yield parameter of guava (*Psidium guajava* L.) cv. L-49

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Abstract
A field experiment was conducted during 2020-2021 at Horticulture Research Farm-1, BBAU, Lucknow on 11- year- old guava plants, Effect of foliar spray of Micronutrient and plant growth regulators on growth and yield parameter of guava (*Psidium guajava* L.) cv. L-49". When foliar spray done with Borax 0.5%+GA_3 40 ppm results revealed that significantly increase in maximum fruit set, fruit retention, fruit length, fruit width, fruit weight, fruit volume, fruit yield per plant (kg/plant) as compare to control.

Keywords: *Psidium guajava*, horticulture research, borax

Introduction
Guava (*Psidium guajava* L.), Botanically, guava belongs to the family Myrtaceae. Its basic chromosome number is 11 (2n 2x = 22) also known as "apple of the tropics" and poor man's apple, is the most important, highly productive, delicious and nutritious fruit, grown commercially throughout tropical and subtropical regions of India. Its fruits are available throughout the year except during the summer season. It occupies a pride place amongst the important fruits grown in the country and claims to be the fourth most important fruit in area and production after mango, banana and citrus. It is cultivated in India since early 17th century. Due to its wider adaptability in diverse soils and agro-climatic regions, low cost of cultivation, prolific bearing and being highly remunerative with nutritive values, it has gained more popularity among the fruit growers (Das *et al*., 1995). This fruit is a native of tropical America and extensively grown in South Asian countries. The leading guava growing states are Uttar Pradesh, Bihar, Madhya Pradesh and Maharashtra.

The important of guava is due to fact that it is hardy fruit and which can be grown in poor alkaline soil or poorly drained soil. It can be grown in soil with pH ranging 4.5-8.5 without any irrigation. It can stand above 46^0C temperature.

Guava does equally well under tropical and sub-tropical climatic conditions (Gaur *et al*., 2014a) [6]. However, guava crop have three distinct periods of flowering and fruiting. The three distinct flowering periods are Ambe (February-March), Mrig (June-July) and Hastabahar (October- November) and fruiting periods for these bahar are July-August, October-December and February-April, respectively (Shukla *et al*., 2009).

Foliar application is based on the principle that the nutrients are quickly absorbed by leaves and transported to different parts of the plant to fulfil the functional requirement of nutrition. This method is highly helpful for the correction of element deficiencies to restore disrupted nutrient supply, overcome stress factors limiting their availability and it plays important role in improving fruit set, productivity and quality of fruits and recovery of nutritional and physiological disorders in fruit trees.

Zinc is the important constitute of several enzyme systems which regulate various metabolic reaction associated with water relation in the plant. Zinc is essential for auxin and protein synthesis, seed production and proper maturity. It also increases fruit size as well as yield. Zinc is essential for improving the vegetative growth of guava trees obtained in terms of terminal shoots, shoot diameter and number of leaves per shoot (Price *et al*., 1972)

Among them, NAA induces more fruiting, promotes flowering, whereas, GA3 increases fruit retention. Ethrel a ripening hormone induces early and uniform ripening (Jensen *et al*., 1975). It has been seen that different nutrients in association of plant growth regulators increase economic yield facilitating harvesting (Pandey *et al*., 1988). It is therefore, necessary to standardize the most effective combination to increase yield of quality fruits in guava.

NAA is important growth regulator of auxin group, which helps to reduce fruit drop and improve fruit set and quality specially TSS. By the application of NAA, TSS and ascorbic – acid content of fruit are increased and acidity reduce. NAA reduce the number of seed of the fruits. It also induce heavier fruting and promoting flowering (Sharma and Tiwari 2015). Maximum yield during winter season due to heavy defoliation and deblossoming in the rainy season crop. It might be due to phytotoxic influence of higher concentrations of NAA ON The guava foliage which caused burning and defoliation thereby resulting in low accumulation of photosynthates responsible for the fruit growth.

Material and Methods

The present investigation entitled "Effect of foliar application of micronutrient and plant growth regulators on Growth, yield and quality of guava (*Psidium guajava* L.) was carried out at the Horticultural Research Farm-1 of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Rae Bareli Road, Lucknow-226025 (U.P.), India during the year 2020-2021.

The information of methodology adopted in this experiment has been presented below: 3.1 Climatic conditions: Geographically, Babasaheb Bhimrao Ambedkar University, (A Central University), Vidya Vihar, Rae Bareli Road, Lucknow (U.P.), India situated at 80055' East longitude and 26046' North latitude and 123 meter above MSL (mean sea Level). The climate of Lucknow is characterized by sub-tropical with hot, dry summer and cool winters. This region received an average annual rainfall of 650-750 mm, which is distributed over a period of more than 100 days with peak period during January-June. It also received scattered showers during summer months. In general, the temperature ranges from 5.50 to 250. The average relative humidity is 60% in different seasons of the year. The soil of the experimental field was medium black with good drainage and uniform texture with medium NPK status. The details of the treatment were T_1- Control ,T_2- $ZnSO_4$ 0.5% , T_3- Borax 0.5% , T_4- NAA 40 ppm , T_5- GA_3 40 ppm , T_6- $ZnSO_4$ 0.5%+Borax 0.5%, T_7- $ZnSO_4$ 0.5%+NAA 40 ppm , T_8- $ZnSO_4$ 0.5%+GA_3 40 ppm , T_9- , T_{10} - Borax 0.5%+GA_3 40 ppm T_{11} - $ZnSO_4$ 0.5% + Borax 0.5% + NAA 40 ppm, T_{12} - $ZnSO_4$ 0.5% + Borax 0.5% + GA_3 40 ppm. Experiment was laid out in Randomized Block Design with three replications.

Result and discussion

Fruit set (%)

The data derived on per cent fruit set were subjected to statistical analysis. It is obvious from the Effect of foliar application of micronutrient and plant growth regulators proved significantly effective in improving the per cent fruit set. The maximum fruit set was noted in Borax 0.5%+GA3 40 ppm (T_{10}) followed by was noted in ZnSO4 0.5%+GA3 40 ppm (T_8). The plant under control showed minimum fruit set in (T_1). Similar result were also found by Jawed *et al*., (2016) [9] in guava. Shreekant and kumar (2017).

Fruit retention (%):

The data recorded on fruit retention were processed statistically. It is obvious from data indicated in application of various treatments significantly influenced the percentage of fruit retention over the control (T_1). Maximum fruit retention was noticed in Borax 0.5%+GA3 40 ppm (T_{10}) followed by ZnSO4 0.5%+GA3 40 ppm (T_8). The minimum fruit retention was found in control (T_1). Similar result were also found by Jawed *et al.*, (2016) [9] and same result also found by Yadav *et al*. (2011)

Fruit length (cm)

The data recorded on length of fruits were analyzed statistically. The data presented in all treatments increased the fruit length (8.68 cm) was obtained with the spray of Borax 0.5%+GA3 40 ppm (T_{10}) followed by (8.46 cm) was noted in ZnSO4 0.5%+GA3 40 ppm (T_8). The minimum fruit length (7.16cm) was recorded under control (T_1). Similar result was also found by Rajput and Chand (1976), Singh *et al*. (2004), and Pal *et al*. (2008) in guava.

Width of fruit (cm)

The recorded on width of fruit were analysed statistically. It is evident from the data portrayed in Table 4.4 and Fig 4.4 that all treatments increased the fruit width was obtained with the spray of Borax 0.5%+GA3 40 ppm (T_{10}) followed by as noted in ZnSO4 0.5%+GA3 40 ppm (T_8).The minimum fruit width was recorded under control (T_1). Similar results were also found by Rajput and Chand (1976), Singh *et al*. (2004), and Pal *et al*. (2008) in guava.

Fruit weight (g)

The data recorded on weight of fruit were analyzed statistically. The data presented in Table 4.5 and Fig 4.5 showed that , the maximum fruit weight was obtained with the spray of Borax 0.5%+GA3 40 ppm (T_{10}) followed by as noted in ZnSO4 0.5%+GA3 40 ppm (T_8). The minimum fruit weight was recorded under control (T_1). Similar result were also found by Kumar *et al.*, (2013), average fruit weight, and reduced the seed percent and seed pulp ratio which ultimately increased the yield per tree.

Volume of fruit (ml)

The data derived on volume of fruit were subjected to statistical analysis. It is obvious from the mean values displayed in Table 4.6 and Fig. 4.6 that application of various treatments significantly increased the volume of fruit over control (T_1).The maximum fruit volume was obtained with the spray of Borax 0.5%+GA3 40 ppm (T_{10}) followed by as noted in ZnSO4 0.5%+GA3 40 ppm (T_8).While, minimum fruit volume was found in control (T_1). Similar result were also found by Kanpure *et al.*, (2016) [10].

Yield (kg/tree)

The data recorded on yield of fruits were analyzed statistically and the mean values presented in Table 4.7 and Fig 4.7 revealed that all treatments increased the fruit yield over the control. The maximum fruit yield was obtained with the spray of Borax 0.5%+GA3 40 ppm (T_{10}) followed by as noted in ZnSO4 0.5%+GA3 40 ppm (T_8).While minimum fruit yield was found in control (T_1).The observations also indicated that all treatments enhanced the yield with greater degree with higher concentrations. Similar result were also found by Balakrishnan (2000) [3] applied foliar applications of Zn as $ZnSO_4$, Fe as $FeSO_4$, Mg as $MgSO_4$ and borax on 6 years old guava.

Conclusion

Foliar spray done with Borax 0.5%+GA_3 40 ppm results

revealed that significantly increase in maximum fruit set, fruit retention, fruit length, fruit width, fruit weight, fruit volume, , fruit yield per plant (kg/plant) as compare to control.

Table 1: The data derived on volume of fruit were subjected to statistical analysis

Treatments	Fruit set %	Fruit retention (%)	Fruit length(cm)	Fruit width (cm)	Fruit weight(gm)	Fruit volume (ml)	Fruit Yield (kg/tree)
T_1 Control	46.41	39.50	7.16	6.12	104.87	95.07	47.33
T_2 $ZnSO_4$ 0.5%	56.74	52.71	7.87	6.19	116.32	107.53	53.14
T_3 Borax 0.5%	57.23	55.07	8.10	6.70	125.40	111.36	57.12
T_4 NAA 40 ppm	59.03	56.21	8.24	6.39	113.60	105.00	54.39
T_5 GA_3 40 ppm	55.18	52.06	8.04	6.56	120.66	115.44	53.92
T_6 $ZnSO_4$ 0.5%+Borax 0.5%	57.94	58.45	7.93	6.23	129.86	120.55	58.09
T_7 $ZnSO_4$ 0.5%+NAA 40 ppm	65.10	56.04	8.06	7.19	128.38	117.67	57.47
T_8 $ZnSO_4$ 0.5%+GA_3 40 ppm	68.85	57.91	8.46	7.39	133.07	123.03	59.27
T_9 Borax 0.5%+NAA 40 ppm	61.24	53.98	8.11	6.61	119.65	121.12	56.11
T_{10} Borax 0.5%+GA_3 40 ppm	70.28	61.35	8.68	7.83	139.96	125.80	64.85
T_{11} $ZnSO_4$ 0.5% + Borax 0.5% + NAA 40 ppm	63.39	58.73	8.11	6.3	122.57	119.37	56.29
T_{12} $ZnSO_4$ 0.5% + Borax 0.5% + GA_3 40 ppm	58.27	52.65	8.30	6.88	130.50	117.50	58.33
S.Em. ±	0.64	0.35	0.42	0.07	0.77	0.40	0.26
C.D. at 5%	1.89	1.05	0.14	0.23	2.27	1.18	0.77

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