AJH
eISSN- 0976-724X

THE ASIAN JOURNAL OF HORTICULTURE
Volume **11** | Issue 1 | June, 2016 | 146-150
Visit us -*www.researchjournal.co.in*

RESEARCH PAPER

DOI : 10.15740/HAS/TAJH/11.1/146-150

Article history :
Received : 16.01.2016
Revised : 28.04.2016
Accepted : 08.05.2016

Response of guava to boron and growth regulators spray

■ **BINDHYACHAL RAM, BIPUL KR. MANDAL[1], UDIT KUMAR[2], RAVINDRA KUMAR[3] AND P. KUMAR[3]**

Members of the Research Forum

Associated Authors:
[1]Ranjendra Agricultural University, PUSA (BIHAR) INDIA

[2]Department of Horticulture, Birsa Agricultural University, PUSA (BIHAR) INDIA

[3]Krishi Vigyan Kendra, AURANGABAD (BIHAR) INDIA

Author for correspondence :
BINDHYACHAL RAM
Krishi Vigyan Kendra,
AURANGABAD (BIHAR) INDIA

ABSTRACT : The effect of foliar spray of salicylic acid (SA) and boron along with traditional growth regulators like GA_3, NAA and ethephon on growth, flowering and yield of guava variety Arka Amulya was investigated. Salicylic acid 100ppm recorded maximum increase in shoot length, number of leaves and leaf area over control. The minimum day for initiation of flowering (24.33) was taken by ethephon 100 ppm spray followed by SA 200 ppm (25.33). Concerning the effect of chemicals on number of fruits per shoot and fruit set per cent, maximum numbers of fruit (3.18) per shoot and fruit set per cent (74.16) were registered in S A 100 ppm which was statistically comparable to NAA 20 ppm. However, minimum fruit set percentage (35.57) was recorded in control. GA_3 50ppm and ethephon 100 ppm increased fruit length and fruit breadth, respectively over other treatments. Maximum yield (12 .30 kg) per plant was registered under treatment SA (100ppm) which found statistically comparable to NAA 20 ppm. The highest TSS and vitamin C content were registered under 20 ppm and boron 200 ppm, respectively. While, the highest B: C ratio (11.18) was recorded from the plant treated with SA 100 ppm.

KEY WORDS : Plant growth regulators, Growth, Yield, Guava

HOW TO CITE THIS ARTICLE : Ram, Bindhyachal, Mandal, Bipul Kr., Kumar, Udit, Kumar, Ravindra and Kumar, P. (2016). Response of guava to boron and growth regulators spray. *Asian J. Hort.*, **11**(1) : 146-150, **DOI : 10.15740/HAS/TAJH/11.1/146-150.**

Guava (*Psidium guajava* L.) is the most important highly productive, delicious and nutritious fruit of tropical as well as sub-tropical regions. There is hardly any other fruit crop which can compete with guava for its wide adaptability to varied types of soil and climatic conditions. Pre-harvest flower and fruit drop is a wide spread problem in various fruit species. Guava tree also suffer badly from this menace causing total yield loss affecting a great economic loss to the growers. In the present era of scientific advancement, growth regulative substance and mineral nutrients particularly micronutrients as boron have very important role in improving the produce and benefiting fruit growers. Application of the micro-nutrients and plant growth substances are known to control or stimulate the physiological processes and also help in better expression of genetic ability under different environmental regimes by bringing about a change in nutritional and hormonal status of the plant (Brian *et al*., 1962; Paleg, 1965; Arbind *et al.*, 1988; Kalian *et al.*, 1993 and Klessing and Malamy, 1994). Boron is required for successful completion of plant life cycle (Warington, 1923 and Gauch and Duggar, 1954). It's beneficial effects on improving panicle growth, fruit set and their retention at maturity, yield and quality of horticultural crops have been reported by Dutta *et al.* (2000) and Rani and Brahamachari (2001) in litchi and Dutta (2004) in mango. Similarly, a number of growth regulatory compounds like auxin, gibbrellins and ethaphon

have been extensively used for improvement of fruit crops (Tripathi and Shukla, 2006 in strawberry; Amilkar *et al.*, 2006 in citrus group and Singh *et al.*, 2007 in Aonla). Salicylic acid (SA) is a new plant growth regulator belongs to an extra ordinary diverse group of plant phenolic compound induce flowering in plant (Raskin 1992a and b and Gaffney *et al.*, 1993). In view of above, an investigation was conducted to find out the effect of plant growth substances and boron for improvement in growth, fruiting, yield and quality of guava (cv. ARKA AMULYA) through foliar feeding.

RESEARCH METHODS

The study was made at Horticulture garden, Department of Horticulture, Birsa Agricultural University, Ranchi (Jharkhand) on 5 years old uniform and well managed bearing plant of guava cv. ARKA AMULYA planted at a distance of 5x5m during the year 2010-2011 on winter season fruiting. Altogether there were eleven treatments with three replications using single plant as a treatment unit in Randomized Block Design. Two concentrations each of boron (200 and 400ppm), NAA (10 and 20 ppm), GA_3 (25 and 50ppm), ethaphon (50 and 100 ppm) and SA (100 and 200 ppm) level used along with one control (No spray).Two spraying was done, first before new shoot initiation and the second after fruit set. All the cultural practices were adopted during course of study. The observations on growth, flowering, fruiting and physical characters were recorded by applying standard practices. Particularly, leaf area of leaves on each shoot was measured with the help of an 'integrator'. The area of each leaf was recorded separately. The chemical composition of ripe fruit also assessed.

RESEARCH FINDINGS AND DISCUSSION

The data on growth, flowering, fruiting and yield as influenced by spraying of various plant growth regulators and boron at different concentration on winter season guava cv. ARKA AMULYA are presented in Table 1 and 2.

Growth and flowering :

Data presented in Table 1 clearly indicated that the different treatments significantly improved vegetative growth as expressed as final increase in shoot length, maximum number of leaves and leaf area. Concerning to the effect of substances, the highest average increase in shoot diameter (21.63 cm), maximum number of leaves (19.66) and leaf area (89.25 sq.cm) were recorded with salicylic acid 100 ppm followed by salicylic acid 200 ppm and NAA 20 ppm over control. Increase in vegetative growth might be because of salicylic acid imparting an important role in regulating a number of plant physiological processes including increase in cell metabolic rate and for the synthesis of auxin and/or cytokinin (Matwally *et al.*, 2003). Similar effect of increase in vegetative growth as a result of NAA application was also recorded by Jain and Dashora (2007) in Sardar guava. The minimum days taken to initiation of flowering (24.33) was recorded at 100 ppm ethaphon followed by salicylic acid 200ppm. The similar results of earliest and promoted flowering due to ethaphon was reported by Brahamachari *et al.* (1997) in guava and Joshi *et al.* (2009) in pomegranate while Sen *et al.* (1973) in mango.

Fruiting and yield :

Data for number of fruits per shoot and fruit set per cent are presented in Table 1 indicated that remarkable influence of salicylic acid 100 ppm was observed on maximum number of fruits per shoot (3.18) and fruit set per cent (74.16) as compared to control. Similar beneficial effect of salicylic acid on number of fruits per shoot and fruit set were also recorded by Nicholas and Embree (2004) and Liao *et al.* (2006) in apple and citrus, respectively, which supports the present results. The improvement in number of fruits per shoot and fruit set could be explained as a result of increased pollen tube elongation and fertilization either through controlling pollen germination on the stigma or growth of pollen tube through style.

Similarly, the data in Table 2 revealed that GA_3 50 ppm gave the maximum of fruit length (6.92cm) which was closely followed by salicylic acid 100 ppm (6.65cm) and NAA 20 ppm (6.32cm) whereas maximum of breadth (6.94) was recorded in ethaphon 100 ppm which was statistically at par with GA_3 50ppm and salicylic acid 100 ppm. However, the minimum size of fruit (5.32 x 5.65cm) was registered in control. The exogenous application of GA_3 and ethaphon might have increased the indigenous level of growth promoting substances, which is turn stimulated cell division and elongation and consequently, rate of growth and development of fruit was enhanced. The present results are in corroboration with observation made by Maurya *et al.* (1973) in

Dashahari mango with GA_3 while, Gupta and Kaur (2007) in Sutlaj pumple plum with ethaphon.

Concerning the effect of chemicals on plant yield, data in Table 2 showed that among the various plant growth regulators and boron treatments attempted the mean highest yield (12.30 kg/plant) was recorded at 100 ppm salicylic acid which was found statistically comparable to 200 ppm NAA which in turn, at par with 50 ppm GA_3, 200 ppm SA and 400 ppm boron spray. However, the mean lowest yield of guava fruit 2.04 kg per plant was obtained at control. The results accorded to the same extent with Karlidag *et al.* (2009) in strawberry by salicylic acid application while Pandey (1999) in ber with NAA and GA_3; Yadav (2002) in guava with NAA application. Improvement in yield due to salicylic acid might be the result of enhanced assimilatory power of leaves to synthesize more organic metabolites (Seagel *et al.*, 2008). Further, increased fruit set percentage resulting in more fruit per plant which in turn was favorable in enhancing the fruit yield per plant (Gharib, 2007).

All the plant growth regulators and boron at different concentrations augmented TSS and vitamin "C" content of fruits. These have been reported to divert more solids towards developing fruits and might have also enhanced the conversion of complex polysaccharides into simple sugars. In present investigation the maximum TSS content 12.20 ^{0}brix was noted with 50 ppm GA_3 followed by NAA 40ppm. These findings are in accordance with Iqbal *et al.* (2009) in guava and Dutta *et al.* (2008) in carambola.

The vitamin "C" content of fruits also increased with application of PGRs and boron. Maximum increase was shown by spray application of boron 200 ppm and 400 ppm. The prospective increase in ascorbic acid might be due to boron which facilitated sugar transport within

Table 1 : Effect of boron and PGRs on growth and fruit setting of guava cv ARKA AMULYA

Treatments	Increase in shoot diameter (cm)	Number of leaves	Leaf area (cm^2)	Initiation of flowering (days)	Number of fruits/shoot	Fruits set
Boron 200 ppm	16.26	15.50	70.13	29.66	2.16	56.43
Boron 400 ppm	14.28	12.95	59.25	28.66	1.80	46.83
NAA 10 ppm	14.37	13.00	63.31	31.00	2.05	53.66
NAA 20 ppm	16.65	15.20	74.20	30.00	2.76	70.83
GA_3 25 ppm	14.46	14.00	65.45	32.66	1.86	49.49
GA_3 50 ppm	15.44	14.50	67.36	33.00	2.50	62.66
Ethephon 50 ppm	13.80	10.80	48.56	25.66	1.64	45.33
Ethephon 100ppm	13.57	8.16	46.08	24.33	1.56	39.43
SA 100 ppm	21.63	19.66	89.25	26.33	3.18	74.16
SA 200 ppm	19.59	18.50	83.40	25.33	2.36	60.23
Control	10.02	7.56	39.71	36.66	1.16	35.57
C.D. (P=0.05)	3.53	3.29	12.97	1.92	0.71	7.61

Table 2 : Effect of boron and PGRs on yield parameters and bio-chemical characters of guava cv. ARKA AMULYA

Treatments	Fruit length (g)	Fruit breadth (cc)	Seed (kg/plant)	T.S.S. (^{0}Brix)	Vitamin C (mg/100g)	B:C Ratio
Boron 200 ppm	6.08	5.88	8.26	10.40	173.42	7.03
Boron 400 ppm	5.88	6.00	6.82	10.20	151.80	5.44
NAA 10 ppm	5.92	6.17	7.65	10.80	126.10	6.64
NAA 20 ppm	6.32	6.20	10.80	11.60	144.66	9.77
GA_3 25 ppm	5.97	6.23	7.25	11.80	130.23	3.21
GA_3 50 ppm	6.92	6.66	9.35	12.20	139.42	2.83
Ethephon 50 ppm	6.01	5.92	6.36	9.80	108.47	5.11
Ethephon 100ppm	5.86	6.94	6.11	9.60	101.47	4.64
SA 100 ppm	6.65	6.51	12.30	11.00	125.00	11.18
SA 200 ppm	6.16	6.08	8.76	10.00	120.36	7.60
Control	5.32	5.65	5.39	9.10	86.87	4.39
C.D. (P=0.05)	0.44	0.57	2.04	1.76	15.16	

plant and it was also reported that borate reacted with sugar to form sugar borate which was more easily able to transverse (Gauch and Duggar 1954).

Perusal of Table 2 remarked that the highest benefits : cost ratio 11.18 (SA 100 ppm) followed by 9.77 (NAA 20 ppm) was obtained.

REFERENCES

Amilkar, M.M., Luis, A.G., Dujarte, V.M., Rosa, M., Consujelo, N., Vicente, G., Sergio, M., Nebauer, P. and Jose-luis, G. (2006). Long term effect of GA spray and auxin application on crop value of "Clausellina" Satsuma. *J. Amer. Soc. Hort. Sci.*, 1**3**(5): 586-592.

Arbind, K., Rao, K.K.V. and Rao, K.V.N. (1988). Studies on growth of activity of photosynthetic enzyme in sorghum as influenced by micronutrients. *Pre Indian Natural Sci. Acad. Bull.,* **54**: 75-79.

Brahamachari, V.S., Kumar, N. and Kumar, Rajesh (1997). Effect of foliar applications of calcium, potash and growth regulators on yield and quality of guava. *Haryana J. Hort. Sci.,* **26** : 169-173

Brian, P.W., Grove, J.F., Hemming, H.G., Mulholland, J.P.C. and Radley, M. (1962). Relative activity of the gibberellins. *Nature*, **193**: 945.

Cleland, C.F. and Ajami, A. (1974). Identification of the flower-inducing factor isolated from aphid honeydew as being salicylic acid. *Plant physiol.,* **54** : 904-906.

Dutta, P. (2004). Effect of foliar application of boron on panicle growth, fruit retention and physico-chemical parameter of mango cv. HEMSAGAR. *Indian J. Hort.,* **61**(3): 265-266.

Dutta, P., Banik, A. and Dhua, S. (2000). Effect of boron of fruit set, fruit retention and fruit quality of litchi cv. BOMBIA; *Indian J. Hort.,* **57**(4): 287-290.

Dutta, P., Singh, S., Kandu, S. and Das, B.C. (2008). Effect of PGRs on physicological qualities of carambola (sweet type) *Orissa. J. Hort.,* **46**(1) : 44-48.

Gaffney, T., Friedrich, L. ,Vernooij, B., Negrotto, D., Nye, G. , Uknel, S., Ward, E., Kessmann, H. and Ryals, J. (1993). Requirements of salicylic acid for the induction of sestemic required resistances. *Sci.,* **261**: 7543-756.

Gauch, H.G. and Duggar, W.M. (1954). The role of B in the translocation of sucrose. *Plant Physiol.,* **28**: 457-466.

Gharib, F.A.E.L. (2007). Effect of salicylic acid on the growth, metabolic activities and oil content of Basil and Marjoram *Internat. J. Agric.* & *Biol.,* **9** (2) : 294-301.

Gupta, M. and Kaur, H. (2007). Effect of growth regulators on pre-harvest fruit drop in plum cv. SATLUJ PURPLE. *Indian J. Hort.,* **64** (3): 278-281.

Iqbal, M., Qasimkhan, M., Jalal-Ud-Din, Rahman K. and Munir, M. (2009). Effect of foliar application of NAA on fruit drop, yield and physico-chemical characteristics of guava cv. RED FLESHED. *J. Agric. Res.,* **47**(3) : 259-269.

Jain, M.C. and Dashora, L.K. (2007). Growth, flowering, fruiting and yield of guava cv. Sardar as influenced by various PGRs. *Internat. J. Agric. Sci.,* **3**(1) 4-7.

Joshi, V.R., Masalkar, S.D., Kulkarni, S.R. and Patil, S.D. (2009). Effect of different chemicals on leaf shedding of pomegranate. 2nd International symposium on "Pomegranate and Minor including Mediterranean fruits" June 23-27, Univ. of Agril. Sciences, Dharwad, KARNATAKA (INDIA).

Kalian, R.R., Sree Devi, V., Satyanarayana, N.V. and Madhva Rao, K.V. (1993). Effect of foliar spray of boron on crop growth and yield of pegion pea. *Indian J. Plant Physiol.,* **36** : 223-226.

Karlidag, H., Yieldrim, E. and Turan, M. (2009). Exogenous applications of salicylic acid affect quality and yield of strawberry grown under antifrost heated green house conditions. *J. Plant Nutri. & Soil Sci.,* **172**(2): 270-276.

Klessing, D.F. and Malamy, J. (1994). The salicylic acid signal in plants. *Plant Mol..Biol,* **26**: 1439-1458.

Liao, H.L., Chen, H. and Chung, K.R. (2006). Plant hormone inhibitors for reducing post bloom fruit drop of citrus. *Proc. Fla. State. Soc.,* **119** : 78-81.

Matwally, A., Finkemeier, I., Georgi, J.M. and Dietz, K.J. (2003). Salicylic acid alleviates the cadmium toxicity in barley seedlings. *Pl. Physiol.,* **132** : 272-281.

Maurya, A.N., Singh, S.M. and Singh A.R. (1973). Effect of plant growth regulator on fruit retention and quality of Dashehari, mango. *Punjab Hort. J.,* **13**(2&3): 117-121.

Nicholas, D. and Embree, C. (2004). Blossom and fruit let thinners affected affect crop load, fruit weight, seed number and return bloom of 'Northern Spy' Apple. *Hort. Sci.* **39**(6): 1309-1312.

Paleg, L.C. (1965). Physiological effects of gibberellins. *Ann. Rev. Plant Physiol.*, **16** : 291-322.

Pandey, V. (1999). Effect of NAA and GA3 spray on fruit retention, growth, yield and quality of ber (*Zizyphus mauritiana* Lamk.) cv. BANARASI KARAKA. *Orissa J. Hort.,* **27**: 69-73.

Rani, R. and Brahamchari, V.S. (2001). Effect of foliar application of calcium, zinc and boron cracking and physico-chemical compostion of litchi. *Orissa J. Hort.,* **29**(1): 50-54.

Raskin, I. (1992a). Salicylate, a new plant hormone. *Plant Physiol.*, **99**: 799-803.

Raskin, I. (1992b) .Role of salicyclic acid in plant. Ann. *Rev.*

Plant. Physiol & Plant Mol. Biol., **43** : 439-463.

Seagel, C.F., Guihong, B., Fuchigami, L.H. and Regan, R.P. (2008). Role of nitrogen application during the growing season and spraying plant with urea in the autumn alters uptake of other nutrients by Delicious grown Rhodo Dendron cultivars. *Hort. Sci,* **43** (5): 1569.

Sen, P.K., Bandhopadhyay, M., Roy, S.S. and Basu, R.N. (1973). Use of ethrel in controlling non-uniform bearing mango. *Indian Agric.,* **18**: 285-288.

Singh, N.K., Prasad, J. and Singh, H.K. (2007). Effect of micronutrients and PGR_S on yield and physico-chemical characteristics of aonla fruits in cv. NA-10. *Indian J. Hort.,* **64**(2): 216.

Tripathi, V.K. and Shukla, P.K. (2006). Effect of plant bioregulator on growth, yield and quality of strawberry cv. CHANDAR. *J. Asian Hort.,* **2**(4): 260.

Warington, R. (1923). Effect of boric acid and borax on broad bean and certain other plants. *Ann. Bot.,* **37**: 629-672.

Yadav, P.K. (2002). Effect of urea, borax and NAA on yield parameters of guava variety L-49. *Prog. Agri.,* **2**(2): 195-196.