Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(3): 3093-3095
Received: 08-03-2018
Accepted: 12-04-2018

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Effect of zinc sulphate and gibberellic acid on physical characters and yield attributes of winter season guava (*Psidium guajava* L.) CV. Allahabad Safeda

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Abstract
The present investigation was carried out at the Effect of Zinc sulphate and Gibberellic acid on Physical characters and yield attributes of Winter Season Guava (*Psidium guajava* L.) Cv. Allahabad Safeda" at the Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during the year 2015-2016.
The experiment was conducted in randomized block design with seven treatments and replicated in three times, considering one plant as a unit. The observations were recorded for vegetative growth and yield attributing characters of guava fruits. The maximum fruit size, fruit weight, fruit volume and specific gravity were recorded with foliar application of GA_3@150ppm. The fruit yield was also recorded maximum with the combined spray of GA_3@150ppm. Overall it can be concluded that application of GA_3@150ppm judged the best for vegetative growth and yield attributing characters of guava.

Keywords: Zinc sulphate, gibberellic acid, fruit set, fruit retention, and yield

Introduction
Guava (*Psidium guajava* L.), "the apple of the tropics", is one of the most common fruits in India. The guava belongs to the family 'Myrtaceae'. It is originated from tropical America and is a subtropical, hardy, evergreen fruit tree. The Guava covers an area of 2.20 Lac ha. Bihar has largest area covering about 29.2 thousand ha. followed by Uttar Pradesh (39.9 thousand ha.) and Karnataka (7.2 thousand ha.) The average productivity of guava is 12 mt/ha. The productivity is higher in M.P i.e. 29 mt/ha (Mishra and Singh, 2005) [9]. Guava produced in Allahabad region of U.P. is best in the quality in the world (Chadha, 2001) [2]. It is highly tolerant to alkaline and saline soils and it can be grown successfully even upto pH 8.5, it can withstand to the maximum temperature at 46 ^{0}C, even with scantly rainfall of less than 25 cm. Guava in one of the cheapest and good source of Vitamin-C and pectin. The ripe its contain 86.9% moisture, 19.3% dry matter, 0.76% ash, 0.40% crude fat, 1.13% crude protein and 6.2% crude fiber but its composition varies widely with cultivars, stage of maturity and season (Ghosh and Chattopadhyay, 1996) [3]. They also content 8.2 to 10.5 ^{0}Brix total soluble solids, 4.9 to 10.1 per cent total sugar content, 0.22 to 0.39 per cent acidity and 260mg/ 100g of fruit pulp content ascorbic acid with good amount of iron, calcium and phosphorus. In northern India, guava flowers mainly twice in a year, April-May which provides the crop in. rainy season, whereas, August-September flowering gives the winter season crop. In Maharashtra and Tamil Nadu, there is a third crop produced with flower appearing in October-November. The natural fruits setting in guava are quite high (80-86%) of which only 34-36% fruit reach maturity. Guava fruits are consumed either fresh or processed in the form of product like jam, jelly, nectar and good quality RTS beverages. The rainy season crop of guava is rough, insipid, poor in quality, less nutritive and it is attacked by several insect-pest and diseases. On the other hand, winter season crop is superior in quality, free from the pest and diseases, having long storage life. It further needs improvement in nutritive value, market value and demand so that it fetches more prices in market as compared to the rainy season crop. Recently it was observed that foliar application of plant growth regulator (GA_3) exerted favorable effect on the physico-chemical characters of guava fruits at harvest (Kher *et al.* 2005) [6]. Micronutrients such as Zinc play important role in growth and development of fruits, vegetables and cereals. It is one of the essential elements for the formation of chlorophyll and hence useful towards photosynthetic activity. Zinc is a constituent of some enzymes and possibly takes part in synthesis on Indol Acetic Acid in plant.

Materials and Methods

The present investigation was under taken at Main Experimental Station, Horticulture, N.D.U.A.&T., Kumarganj, Faizabad (U.P.) India during summer season of 2016- 17. Geographically, it is situated in typical saline alkali belt of Indo-gangetic plains of eastern U.P. at 26.47 N latitude, 88.12 ^{0}E longitudes and at an altitude of 113 meter from mean sea level. The region enjoys sub humid and subtropical climate receiving a mean annual rainfall of about 1215 mm out of which about 85% is concentrated from mid June to end of September with an average annual rainfall of 764.01mm and relative humidity of 66.76 per cent. The winter months prevails from November to March with mild to severe cool temperature ranging from 17.9 to 33.1^{0}C. The severe cold temperature 17.9^{0}C was recorded in the month of January and occasionally winter rains and frost was also noticed. The summer months occur from April to June with an average temperature of 39.2 to 41.4 ^{0}C. The dry and hot wind waves were also noticed in the months of mid May and June. The experiment was conducted with seven treatments consists three levels of each mineral nutrients and plant growth regulator. Zinc sulphate ($ZnSO_4$) (0.5%, 1.0 % and 1.5%), Gibberellic Acid (GA_3) (50ppm, 100ppm and 150ppm), and plants sprayed with water served as the control in R.B.D. with three replication. Above solution, with different concentrations were sprayed by foot sprayer in the morning hours and the selected plants were fully drenched and the control plants sprayed with water only which were applied after fruit set at walnut stage. The observations were recorded on Length of fruit (cm), Diameter of fruit (cm), fruit weight (g), Volume of fruit (cm^3), Specific gravity and Yield (Kg/Tree), Statistical analyses of the data obtained in the different sets of experiments were calculated, as suggested by Panse and Sukhatma (1989).

Results and Discussion

Data pertaining to per cent fruit size significantly recorded due to foliar application of Zinc sulphate and Gibberellic Acid at different fruit development stages showed in Table. In the present investigation, it is observed that the fruit size (length and diameter) was significantly increased. The maximum (6.30 cm) fruit length and diameter (6.87 cm) were recorded with spray of GA_3 150ppm. However, the application of GA_3 100ppm and 50ppm were also effective to increase fruit size. The reason for increase in fruit size due to spraying of zinc sulphate and plant growth regulator might be attributed to move efficient absorption and consequently more luxuriant vegetative growth in the initial stage, which influenced the more activity of metabolism in plant, was attributed to better development of fruits. These results are in close conformity with the finding by Jonson *et al.* (2001) [5] obtained application of GA_3 resulted in improved berry size of grapes. Kher *et al.* (2005) [6] observed that application of GA_3 (30, 60, 90 and 120ppm) increased the fruit size of guava. Rao (1997) [12] reported that application of 100ppm GA_3 increased the size of banana fruits.

The present findings show that impact of spray of mineral nutrient and plant growth regulator with reference to the weight and volume of fresh fruit proved significant. The spray of mineral nutrients and plant growth regulators increased weight and volume of fresh fruit significantly. Observations clearly indicated that application of GA_3 150ppm was found to be significant increase of fruit weight followed by $GA_3$100ppm, whereas minimum (72.67 g) fruit weight was observed in control. Almost similar pattern was also noted with respected to increase in volume of fruit by foliar spray of $ZnSO_4$ and GA_3.The reason for increase in fruit weight and volume due to spray of $ZnSO_4$ and GA_3 may have due to improve synthesis of more photosynthetic and their translocation to the fruit which ultimately improved the weight and volume of fruit. Similar results were also noted by Brahmachari *et al.* (1995) [1] observed that application of GA_3 (50 or 100ppm) enhanced the fruit weight of guava cv. Sardar. The foliar application of 150ppm GA_3 significantly improved the weight and volume of guava fruits cultivar- Allahabad Safeda (Kumar *et al.* 1998) [7]. Goswami *et al.* (2012) [4] reported that foliar application of $ZnSO_4$ improved the length, diameter and volume of guava fruit. The data on specific gravity of guava fruits are presented in Table-1 and shown in Fig-1, it may be observed that different treatments of $ZnSO_4$ and GA_3 failed to show any significant impact in respect of specific gravity. However, the maximum (0.998) specific gravity was noted with the spray of 150ppm GA_3 treatment and the minimum (0.987) with control treatment. These results are in line with the findings of Panday *et al.* (1990) [10] in ber fruit.

The present study reveals that foliar spray of $ZnSO_4$ and GA_3 gave higher yield of guava fruit in cv. Allahabad Safeda as compare to control. The fruit yield (kg/tree) was recorded due to foliar spray of different concentration of $ZnSO_4$ and GA_3 and presented in Table-1 and Fig-1. The highest fruit yield (80.19 kg/ tree) was recorded with foliar spray of 150ppm GA_3 followed by T_6 100ppm GA_3. Treatment T_5 50ppm GA_3 were found to at par with T_7 (150 ppm GA_3). The lowest fruit yield (50.15kg/tree) was recorded in control. The earlier reports available confirm the present finding that foliar spray of plant growth regulator proved helpful in increasing yield of fruits. The increased fruit yield due to more uptake of nutrients because efficient absorption and consequently more luxuriant vegetative growth to the initial stage which later on resultant more metabolites for developing fruits. Various worker reported increase in the yield with GA_3, urea and super phosphate applied in winter season guava (Singh and Singh 1995) [13], also found that spraying of calcium ammonium nitrate (CAN)+150ppm GA3 was significantly improved the yield of guava cv. Allahabad safeda. Jonson *et al.* (2001) [5] reported that trunk girdling along with brushing of bunches in combination with gibberellic acid resulted in improved the quality and yield grape. Singh *et al.* (2012) observed that the spray of Boric acid (0.5%) and ZnSO4 (0.6%) increased the fruit yield in guava fruit. The yields were found to be significantly maximum by GA3 at 30ppm on ber fruit. Kumar *et al*. (2014) [8] were also recorded significantly maximum yield with foliar application of GA_3 @ 20ppm + NAA @ 50ppm + ZnSO4 @ 0.4% + Urea @ 2% in phalsa fruit.

Table 1: Effect of zinc sulphate and gibberellic acid on physical characters and yield attributes of guava (*Psidium guajava* L.)

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume(cm^3)	Specific gravity	Yield(kg/tree)
T_1 : Control	4.70	4.78	72.67	73.61	0.987	50.15
T_2 : $ZnSO_4$ (0.5%)	4.78	5.10	82.53	83.38	0.989	57.51
T_3 : $ZnSO_4$ (1.0%)	4.97	5.21	87.78	88.52	0.991	60.22
T_4 : $ZnSO_4$ (1.5%)	5.06	5.77	90.48	90.97	0.994	64.34

T_5 : GA_3 (50ppm)	5.98	5.91	95.24	95.65	0.995	70.25
T_6 : GA_3 (100ppm)	6.10	6.49	98.48	98.72	0.997	74.62
T_7 : GA_3 (150ppm)	6.30	6.87	110.21	110.35	0.998	80.19
S.Em. ±	0.169	0.135	0.629	0.236	0.912	0.242
C.D. at 5%	0.514	0.418	1.936	0.733	0.008	0.744

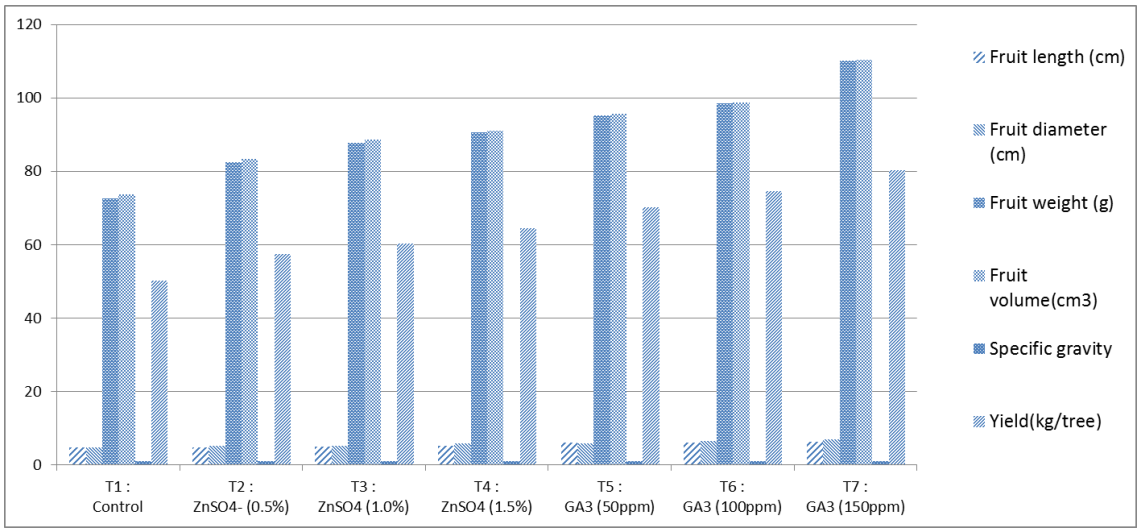

Fig 1: Effect of zinc sulphate and gibberellic acid on physical characters and yield attributes of guava (*Psidium guajava* L.)

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