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Assess the effect of different levels of micronutrient on fruit set and yield of guava (*Psidium guajava* L.)” cv Allahabad Safeda

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Abstract
The present investigation was undertaken at the Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad (U.P) during two consecutive years 2015-16 & 2016-17. The experiments were laid out 4×4 Factorial in Randomised Block Design (RBD) with sixteen treatment combinations and three replications. The material used in the experiment was two micronutrients *viz.*, Zn (Zinc sulphate) & B (Boric acid) and their different combinations with levels *i.e*,0.0 %, 0.4%, 0.6% & 0.8 % as foliar spray was applied twice at before and after fruit set. The observations were recorded on different traits *viz.*, number of flowers per plant, number of fruits per plant, fruit weight (g), fruit weight per plant/ yield per plant (kg), fruit yield (q/ha), equatorial diameter of fruit (cm) and polar diameter of fruit (cm). The investigation revealed that the all characters were influenced significantly due to different levels of Zinc and boron during both the years. Foliar application of Z_3 (zinc sulphate @ 0.8 per cent) before fruit set and after fruit set resulted in higher yield, fruit weight, equatorial and polar diameter during both the years. The application B_3 (boric acid 0.8 %) produced maximum yield, yield attributing traits and quality parameters during both the years. Out of sixteen treatment combinations tried in this study, Z_3B_1 (0.8% zinc sulpahte + 0.4% boric acid) emerged as superior over all other treatment combinations in relation to physical characteristics and yield.

Keywords: Guava, Zinc, Boron, fruit yield

Introduction
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, stretching from Mexico to Peru and introduced in India by Portuguese. Guava has been growing from Mexico to Peru. In India it has been introduced in early 17th century and gradually become a commercial crop all over country particularly Maharashtra, Uttar Pradesh, Bihar, Orissa, Punjab, Uttrakhand, Gujarat, Madhya Pradesh, Karnataka and West Bengal. In Uttar Pradesh is extensively grown in Lucknow. The total cultivated area of guava fruits in India ranging from 268.2 thousand hectare with annual production ranging from 3667.9 thousand MT. (Anonymous, 2014-15) [1].

The fruit type of guava is a berry with large seedy core. The fruit may be smooth or ridge and waxy layer. Guava is shallow rooted shrub with spreading branches. The plant height is generally 4-5 meters but older trees may reach a height 9 meters. It can be grown in soils with pH ranging from 5.5-7.5 without any irrigation. It can stand maximum at above 460C temperature and lowest 12-14 0C. Guava fruits can be cultivated in saline, alkaline, waste and neglected lands where most of the horticultural crops cannot be grown.

Guava is fourth important fruit of India after mango, banana and citrus. It is cultivated throughout the tropical and subtropical region. The major Guava producing countries are South Asian countries of the world. Hawiion Island Cuba and India. (Mitra and Bose, 1985) [8]. in northern India guava plant bears flower 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 comes in October is called “Hast Bahar”. Ambe Bahar fruit ripen from July to September and Mrig Bahar fruit ripen from November to February, however, Hast Bahar fruit ripen in spring season, which also known as summer season crop. In North India including Uttar Pradesh there are two flowering season of guava April-May for rainy season and August - September for winter season crop.

The micro-nutrients play vital role in growth, development, retention and quality of fruits. The foliar feeding of micro-nutrients has gained much importance in recent years and comparatively more effective for rapid recovery of plants, as under high soil pH conditions, most of macro and micro-nutrients are unavailable. Various trials have been conducted on foliar feeding of micro-nutrients in different fruit crops and found effective in improving the vegetative growth, yield and quality of fruits (Sindhu *et al.*, 1994; Banik *et al.*, 1997 and Babu and Singh, 1998) [10, 3, 2].

Materials and Methods

The present investigation was carried out at the experimental orchard of Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad conducted during the two consecutive years 2015-16 & 2016-17.

Allahabad comes under subtropical climate zone prevailing in the winter and summer. It is situated at latitude of 25.85 ^{0}C N and longitude of 81.15 ^{0}E. The altitude of this place is 78 m from MSL. During the winter months, the temperature drops down as low as 1 ^{0}C while in the summer the temperature reaches above 45 ^{0}C. Hot desiccating winds are regular feature during summers whereas there may be occasional spell of frost during the winters. The average rainfall in this area is above 900 mm, mostly during the monsoon *i.e.* July to September with a few occasional showers during the winter months.

Technical Progrmme

Detail of treatments

The zinc was used in form of zinc sulphate and Boron in the form of Boric acid at the time of bud initiation stage by foliar application at 15 days interval.

1. Levels of Zinc (Z)
   Z0 0.0 %
   Z1 0.4 %
   Z2 0.6%
   Z3 0.8%
2. Levels of Boron (B)
   B0 0.0 %
   B1 0.4 %
   B2 0.6%
   B3 0.8%

Results and Discussion

Flower and fruit set parameters

The perusal of data Table 1 shows that maximum flowers per plant were obtained with zinc sulphate level Z_2 (0.6%) followed by flowers with Z_3 (0.8%) and the minimum flowers per plant was obtained with Z_0 (0.0%). Spray of boric acid B_3 (0.8%) recorded maximum number of flowers per plant followed by with B_0 (0.0%). Whereas, minimum flowers per plant were recorded in B_2 (0.6 %). As far as interaction between zinc sulphate and boric acid levels found significant. The highest flowers per plant were recorded with Z_2B_3 (0.6% zinc sulphate + 0.8% boric acid) followed by with Z_1B_0 (0.4% zinc sulphate + 0.0% boric acid) during both the years of experimentation. In Table 2 shows that maximum fruits per plant were obtained with zinc sulphate level Z_1 (0.4%) followed by 300.64 fruits with Z_0 (0.0%) and the minimum fruits per plant was obtained with Z_3 (0.8%). However, spray of boric acid B_3 (0.8%) recorded maximum number of fruits per plant followed by with application of B_0 (0.0%). Whereas, minimum fruits per plant were recorded in B_1 (0.4 %). As far as interaction between zinc sulphate and boric acid levels found significant. The highest fruits per plant was with Z_1B_3 (0.4% zinc sulphate + 0.8% boric acid) followed by with Z_1B_0 (0.4% zinc sulphate + 0.0% boric acid). . It is close conformity with the findings Suman *et al.* (2016) [12] who reported that the maximum number of fruits per plant with the application boric acid @ 0.3% + ferrous sulphate @ 0.4% + magnesium sulphate @ 0.7% + manganese sulphate @ 0.5% + zinc sulphate @ 0.5%) and Jawed *et al.* (2017) [6] reported that higher concentration of zinc sulphate 0.40% spray enhanced the number of fruits per plant.

Table 1: Effect of foliar application of Zinc, Boron and their interaction on number of flowers per plant of Guava (*Psidium guajava* L.) during winter seasons of 2015-16 & 2016-17

Number of flowers per plant Y_1 (2015-16)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	729.58	774.14	656.55	656.14	704.10
B_1 (0.4%)	686.30	768.59	659.84	659.66	693.60
B_2 (0.6%)	742.29	771.67	649.05	649.19	703.05
B_3 (0.8%)	638.50	805.67	766.02	766.17	744.09
Mean	699.17	780.02	682.86	682.79	711.21
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	16.207	33.099		
Boron (B)	S	16.207	33.099		
Interaction (Z x B)	S	32.414	66.199		

Number of flowers per plant Y_2 (2016-17)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	742.14	771.47	648.94	648.81	702.84
B_1 (0.4%)	686.22	806.85	659.86	659.63	703.14
B_2 (0.6%)	729.35	774.17	656.51	655.67	703.92
B_3 (0.8%)	638.44	805.76	766.09	766.13	744.11
Mean	699.04	789.56	682.85	682.56	713.50
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	16.309	33.307		
Boron (B)	S	16.309	33.307		
Interaction (Z x B)	S	32.617	66.614		

Table 2: Effect of foliar application of Zinc, Boron and their interaction on number of fruits per plant of Guava (*Psidium guajava* L.) during winter seasons of 2015-16 & 2016-17

Number of fruits per plant Y_1 (2015-16)					
Levels of Boron	Levels of Zinc				
	Z_0 (0.0%)	Z1 (0.4%)	Z_2 (0.6%)	Z_3 (0.8%)	Mean
B_0 (0.0%)	274.55	346.44	329.39	329.45	319.96
B_1 (0.4%)	295.11	330.49	283.73	283.65	298.25
B_2 (0.6%)	319.18	331.82	279.09	279.15	302.31
B_3 (0.8%)	313.72	332.88	282.32	282.14	302.76
Mean	300.64	335.41	293.63	293.60	305.82
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	6.969	14.233		
Boron (B)	S	6.969	14.233		
Interaction (Z x B)	S	13.938	28.465		

Number of fruits per plant Y_2 (2016-17)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	274.53	346.48	329.42	329.44	319.97
B_1 (0.4%)	295.07	346.95	283.74	283.64	302.35
B_2 (0.6%)	319.12	331.73	279.04	278.99	302.22
B_3 (0.8%)	313.62	332.89	282.30	281.94	302.69
Mean	300.59	339.51	293.62	293.50	306.81
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	7.013	14.322		
Boron (B)	S	7.013	14.322		
Interaction (Z x B)	S	14.025	28.644		

Table 3: Effect of foliar application of Zinc, Boron and their interaction on fruit weight (g) of Guava (*Psidium guajava* L.) during Rabi Seasons of 2015-16 & 2016-17

Fruit weight (g) Y_1 (2015-16)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	89.80	106.55	127.80	130.33	113.62
B_1 (0.4%)	95.95	121.33	170.10	173.55	140.23
B_2 (0.6%)	97.00	132.85	161.80	165.00	139.16
B_3 (0.8%)	101.65	136.40	164.75	168.15	142.74
Mean	96.10	124.28	156.11	159.26	133.94
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	3.819	7.799		
Boron (B)	S	3.819	7.799		
Interaction (Z x B)	S	7.637	15.598		

Fruit weight (g) Y_1 (2016-17)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	93.40	110.80	132.90	135.55	118.16
B_1 (0.4%)	99.80	120.20	176.90	180.50	144.35
B_2 (0.6%)	100.90	138.20	168.30	171.70	144.78
B_3 (0.8%)	105.75	141.85	171.35	175.00	148.49
Mean	99.96	127.76	162.36	165.69	138.94
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	4.259	8.698		
Boron (B)	S	4.259	8.698		
Interaction (Z x B)	S	8.518	17.397		

Table 4: Effect of foliar application of Zinc, Boron and their interaction on fruit weight per plant/ yield per plant of Guava (*Psidium guajava* L.) during winter seasons of 2015-16 & 2016-17

Fruit weight per plant/ yield per plant (kg) Y_1 (2015-16)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	24.65	36.91	42.10	42.94	36.65
B_1 (0.4%)	28.32	40.10	48.26	49.23	41.48
B_2 (0.6%)	30.96	44.08	45.16	46.06	41.56
B_3 (0.8%)	31.89	45.40	46.51	47.44	42.81
Mean	28.96	41.62	45.51	46.42	40.63
	F - test	S. Ed. (±)	C. D. at 5%		

Zinc (Z)	S	0.63	1.28		
Boron (B)	S	0.63	1.28		
Interaction (Z x B)	S	1.25	2.55		

Fruit weight per plant/ yield per plant (kg) Y_2 (2016-17)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	25.64	38.39	43.78	44.66	38.12
B_1 (0.4%)	29.45	41.70	50.19	51.20	43.14
B_2 (0.6%)	32.20	45.85	46.96	47.90	43.23
B_3 (0.8%)	33.17	47.22	48.37	49.34	44.52
Mean	30.11	43.29	47.33	48.27	42.25
	F - test	**S. Ed. (±)**	**C. D. at 5%**		
Zinc (Z)	S	0.78	1.59		
Boron (B)	S	0.78	1.59		
Interaction (Z x B)	S	1.56	3.19		

Table 5: Effect of foliar application of Zinc, Boron and their interaction on fruit yield (q/ha) of Guava (*Psidium guajava* L.) during winter seasons of 2015-16 & 2016-17

Fruit yield (q/ha) Y_1 (2015-16)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	38.46	57.58	65.67	66.98	57.17
B_1 (0.4%)	44.17	62.55	75.29	76.80	64.70
B_2 (0.6%)	48.30	68.77	70.44	71.85	64.84
B_3 (0.8%)	49.75	70.83	72.56	74.01	66.79
Mean	45.17	64.93	70.99	72.41	63.38
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	0.98	1.99		
Boron (B)	S	0.98	1.99		
Interaction (Z x B)	S	1.95	3.98		

Fruit yield (q/ha) Y_2 (2016-17)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	40.00	59.89	68.30	69.66	59.46
B_1 (0.4%)	45.94	65.06	78.30	79.87	67.29
B_2 (0.6%)	50.23	71.52	73.26	74.73	67.43
B_3 (0.8%)	51.74	73.66	75.46	76.97	69.46
Mean	46.98	67.53	73.83	75.31	65.91
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	1.22	2.49		
Boron (B)	S	1.22	2.49		
Interaction (Z x B)	S	2.43	4.97		

Table 6: Effect of foliar application of Zinc, Boron and their interaction on Equatorial diameter of fruit of Guava (*Psidium guajava* L.) during winter seasons of 2015-16 & 2016-17

Equatorial diameter of fruit (cm) Y_1 (2015-16)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	5.15	5.98	6.24	6.36	5.93
B_1 (0.4%)	5.31	6.04	7.91	8.06	6.83
B_2 (0.6%)	5.60	6.87	7.14	7.28	6.72
B_3 (0.8%)	5.83	7.22	7.43	7.57	7.01
Mean	5.47	6.53	7.18	7.32	6.62
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	0.19	0.39		
Boron (B)	S	0.19	0.39		
Interaction (Z x B)	S	0.38	0.78		

Equatorial diameter of fruit (cm) Y_2 (2016-17)					
Levels of Boron	**Levels of Zinc**				
	Z_0 (0.0%)	**Z_1 (0.4%)**	**Z_2 (0.6%)**	**Z_3 (0.8%)**	**Mean**
B_0 (0.0%)	5.25	6.10	6.36	6.49	6.05
B_1 (0.4%)	5.42	6.16	8.06	8.23	6.97

B_2 (0.6%)	5.72	7.01	7.28	7.43	6.86
B_3 (0.8%)	5.94	7.36	7.57	7.73	7.15
Mean	5.58	6.66	7.32	7.47	6.76
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	0.20	0.40		
Boron (B)	S	0.20	0.40		
Interaction (Z x B)	S	0.39	0.80		

Table 7: Effect of foliar application of Zinc, Boron and their interaction on polar diameter of fruit of Guava (*Psidium guajava* L.) during winter seasons of 2015-16 & 2016-17

Polar diameter of fruit (cm) Y_1 (2015-16)					
Levels of Boron	Levels of Zinc				
	Z_0 (0.0%)	Z_1 (0.4%)	Z_2 (0.6%)	Z_3 (0.8%)	Mean
B_0 (0.0%)	4.71	5.60	5.84	5.96	5.53
B_1 (0.4%)	5.32	5.62	7.67	7.82	6.61
B_2 (0.6%)	5.53	6.63	6.92	7.05	6.53
B_3 (0.8%)	5.80	6.97	7.33	7.48	6.89
Mean	5.34	6.20	6.94	7.08	6.39
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	0.18	0.37		
Boron (B)	S	0.18	0.37		
Interaction (Z x B)	S	0.36	0.73		

Polar diameter of fruit (cm) Y_2 (2016-17)					
Levels of Boron	Levels of Zinc				
	Z_0 (0.0%)	Z_1 (0.4%)	Z_2 (0.6%)	Z_3 (0.8%)	Mean
B_0 (0.0%)	4.85	5.76	6.02	6.14	5.69
B_1 (0.4%)	5.48	5.79	7.90	8.06	6.81
B_2 (0.6%)	5.69	6.83	7.12	7.27	6.73
B_3 (0.8%)	5.98	7.17	7.55	7.70	7.10
Mean	5.50	6.39	7.15	7.29	6.58
	F - test	S. Ed. (±)	C. D. at 5%		
Zinc (Z)	S	0.20	0.40		
Boron (B)	S	0.20	0.40		
Interaction (Z x B)	S	0.40	0.81		

Physical parameters

The present results revealed that the foliar application of boron, Zinc and in combination with these significantly improves the physical parameters (fruit weight, fruit yield and equatorial and polar diameter) of guava.

The data presented in Table 3 shows that maximum fruit weight was obtained with zinc sulphate level Z_3 (0.8%) which was statistically at par with Z_2 (0.6%) and remaining treatments produced significantly lesser fruit weight. While, the minimum fruit weight was obtained with Z_0 (0.0%). Spray of boric acid B_3 (0.8%) recorded maximum fruit weight which was statistically at par with B_1 and B_2, the minimum was with B_0 (0.0%). The interaction between zinc sulphate and boric acid levels was found significant and maximum fruit weight was with Z_3B_1 (0.8% zinc sulphate + 0.4% boric acid) followed by with Z_2B_1 (0.6% zinc sulphate + 0.4% boric acid) and the minimum remained with Z_0B_0 (Control) during both the years.

Zinc is essential for auxin and protein synthesis, seed production and proper maturity of fruit while boron has a key role in cell division and elongation, thus effecting increase in weight of fruit. The higher fruit weight due to combined application of zinc and boron may be attributed to their stimulatory effect on plant metabolism. These results are in conformity with the results reported by El-Sherif *et al*. (2000), Das *et al*. (2000) [4], Singh *et al*. (2004) [11] and Rawat *et al*. (2010) [9].

Table 4.4 shows that maximum fruit yield per plant, fruit weight per plant, fruit yield was obtained with zinc sulphate level Z_3 (0.8%) which was statistically at par with Z_2 (0.6%) and remaining treatments produced significantly lesser fruit yield per plant. While, the minimum fruit yield per plant was obtained with Z_0 (0.0%). Spray of boric acid B_3 (0.8%) recorded maximum fruit yield per plant which was statistically at par with B_2, the minimum was with B_0 (0.0%). The interaction between zinc sulphate and boric acid levels was found significant and maximum fruit yield per plant was with Z_3B_1 (0.8% zinc sulphate + 0.4% boric acid) followed by with Z_2B_1 (0.6% zinc sulphate + 0.4% boric acid) and the minimum remained with Z_0B_0 (Control). Zinc constituent several enzyme systems, which regulate various metabolic reactions in the plant, associated with water uptake and water relation in the plant. It is essential for auxin and protein synthesis, seed production and proper maturity. Boron is constituent of cell membrane and essential for cell division. It acts as a regulator of potassium calcium ratio in the plant, helps in nitrogen absorption and translocation of sugars in the plant. It is also essential for membrane integrity; cell wall development, cell division and cell elongation, which is required for the proper growth of pollen tube and for the process of reproduction. The fruit yield increased by the combined application of both the nutrients was due to significant increase in the fruit length, fruit diameter and diameter of the seed cavity might be attributed to their stimulatory effect of plant metabolism and production of auxins. These results are more or less in conformity with the findings reported by Kundu and Mitra (1999) [7], El-Sherif *et al.* (2000), Singh *et al.* (2004) [11] and Rawat *et al.* (2010) [9].

Table 4.6 shows that maximum equatorial diameter of fruit (7.32 cm) was obtained with zinc sulphate level Z_3 (0.8%) which was statistically at par with Z_2 (0.6%) and remaining treatments produced significantly lesser Equatorial diameter of fruit. While, the minimum Equatorial diameter of fruit (5.47 cm) was obtained with Z_0 (0.0%). Spray of boric acid B_3 (0.8%) recorded maximum Equatorial diameter of fruit (7.01 cm) which was statistically at par with B_1 (6.83 cm) and B_2 (6.72 cm), the minimum (5.93 cm) was with B_0 (0.0%). The interaction between zinc sulphate and boric acid levels was found significant and maximum Equatorial diameter of fruit (8.06 cm) was with Z_3B_1 (0.8% zinc sulphate + 0.4% boric acid) followed by 7.91 cm with Z_2B_1 (0.6% zinc sulphate + 0.4% boric acid) and the minimum (5.15 cm) remained with Z_0B_0 (Control).

Table 4.7 shows that maximum polar diameter of fruit (7.08 cm) was obtained with zinc sulphate level Z_3 (0.8%) which was statistically at par with Z_2 (0.6%) and remaining treatments produced significantly lesser polar diameter of fruit. While, the minimum polar diameter of fruit (5.34 cm) was obtained with Z_0 (0.0%). Spray of boric acid B_3 (0.8%) recorded maximum polar diameter of fruit (6.89 cm) which was statistically at par with B_1 (6.61 cm) and B_2 (6.53 cm), the minimum (5.53 cm) was with B_0 (0.0%). The interaction between zinc sulphate and boric acid levels was found significant and maximum polar diameter of fruit (7.82 cm) was with Z_3B_1 (0.8% zinc sulphate + 0.4% boric acid) followed by 7.67 cm with Z_2B_1 (0.6% zinc sulphate + 0.4% boric acid) and the minimum (4.71 cm) remained with Z_0B_0 (Control).

The higher polar and equatorial diameter of fruit due to combined application of zinc and boron may be attributed to their stimulatory effect on plant metabolism because boron plays key role in cell division and elongation, whereas, zinc is an essential micronutrient for auxin and protein synthesis, seed production and proper maturity of fruit thereby effecting increase in the polar and equatorial diameter of fruit. These results are in close conformity with the finding reported by Das *et al.* (2000) [4], Singh *et al.* (2004) [11] and Rawat *et al.* (2010) [9].

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