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EFFECT OF FOLIAR APPLICATION OF ZINC AND BORON ON YIELD AND QUALITY OF POMEGRANATE (*Punica granatum* L.) CV. GANESH UNDER SUB-TROPICAL CONDITIONS OF GARHWAL HILLS

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ABSTRACT : An experiment was conducted on ten year old pomegranate trees cv. Ganesh at Horticultural Research Centre, Chauras, HNB Garhwal University, Srinagar Garhwal, Uttarakhand during summer season 2012 to find out the effect of foliar application of zinc and boron on yield and quality of pomegranate (*Punica granatum* L.) cv. Ganesh. The experiment was laid out in randomized block design with three replications. The treatment consisted of two foliar applications of Zinc sulphate and Boric acid with their combinations *viz.,* T_1 (Zn @ 0.4%), T_2 (Zn @ 0.5%), T_3 (Zn @ 0.6%), T_4 (B @ 0.4%), T_5 (B @ 0.5%), T_6 (B@ 0.6%), T_7 (Zn+B @ 0.4% each), T_8 (Zn+B @ 0.5% each), T_9 (Zn+B @ 0.6 % each) , and T_{10} (control). The findings revealed that the average values for fruiting percentage (67.83 %), weight of fruits (202.88 g), length of fruits (7.00 cm), volume of fruits (213.33 ml), fruit yield (35.16 kg/tree), acidity of fruits (0.34 %) and vitamin C content of fruits (48.00 mg/100g) were found to be the highest under the treatment T_7 (Zn+B @ 0.4 % each). The maximum fruit diameter (6.63 cm), specific gravity (0.98 g/cm^3) and vitamin A content (14.87 ìg/100g) were observed under the treatment T_5 (B @ 0.5%). The highest value for TSS content (13.33 °Brix) of fruits was recorded under treatment T_4 (B @ 0.4%). The treatment combination of boric acid and zinc sulphate @ 0.4 % each gave superior fruit yield and quality of pomegranate.

Key words : *Zinc sulphate, boric acid, pomegranate, quality, yield.*

The pomegranate (*Punica granatum* L.), a member of family Punicaceae, is an ancient and important fruit of tropical and subtropical region. The fruit is native to Iran and extensively cultivated in the Mediterranean countries like Spain, Morocco, Egypt, Iran, Afghanistan and Baluchistan. In India, it is grown to limited extend in selected locations in states like Maharashtra, Gujarat, Rajasthan, Uttar Pradesh, Haryana, Andhra Pradesh, Karnataka and Tamil Nadu. Micro-elements (Cu, Zn, B, Fe, Mn, Mo, Cl and Si) are the essential elements required by plants in minute quantities. These are vital to the growth and development of plant. Micro-element deficiencies often limit the productivity in many fruit crops. Boron is an important micro-nutrient governing many physiological and biochemical plant processes and its beneficial effects on horticultural crops have been reported (Dutta *et al.,* 3). It plays a significant role in flowering, fruiting, nitrogen metabolism, hormone movement and its action, and cell division. Its deficiency results in shoot dieback, cork spot and cracking of fruits. Boron increases fruit set of many species. Zinc is also an important nutrient element for growth, flowering and quality of fruits. It is involved in the biosynthesis of plant hormone Indole acetic acid. Zinc plays an important role in nucleic acid and protein synthesis and helps in the utilization of phosphorous and nitrogen. Favourable effects of zinc sprays on vegetative growth and health of fruit trees have been observed. (Ram and Bose, 9). Zinc and boron greatly vary from soil to soil in different climatic regions and thus commonly causing excess or deficiency in plants which adversely affecting production. Therefore, keeping in view the above facts, the present study was undertaken to standardize the optimum level of these elements individually or in combination in pomegranate cv. Ganesh through foliar application in subtropical conditions of Garhwal hills.

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MARERIALS AND METHODS

The experiment was conducted on ten years-old-pomegranate fruits cv. Ganesh at the Horticultural Research Centre, HNB Garhwal University, Srinagar (Garhwal), Uttarakhand, during 2013-14. The experiment was laid out in randomized block design with three replications. The treatment consisted of two foliar applications of zinc sulphate, boric acid and their combination. These were T_1 (Zn@ 0.4%), T_2 (Zn@ 0.5%), T_3 (Zn@ 0.6%), T_4 (B@ 0.4%), T_5 (B@ 0.5%), T_6 (B@ 0.6%), T_7 (Zn+B @ 0.4% each), T_8 (Zn+B@ 0.5% each), T_9 (Zn+B@ 0.6%), and T_0 (control). The sprays of nutrients were applied in the mid of April, 2013. Various quantitative and qualitative parameters

of fruits, *viz.,* (A) Yield characters : fruiting %, weight of the fruit, fruit length (cm) and fruit diameter (cm), (B) Quality characters of fruits : fruit volume (ml), specific gravity (g/cm^3), T.S.S (°Brix), acidity (%) and vitamin C (mg/100g) and vitamin A (µg/100g) contents were recorded. Chemical parameters of fruits, *viz.,* Vit. C, Vit. A, acidity and TSS were determined following the methods as described by (Ranganna, 10). The total reducing sugar was estimated by Fehling solution method. The significance of variation among the treatments was calculated by applying analysis of variance (ANOVA) and critical difference (C.D) test at 5% probability level (Snedecor and Cochran 14).

RESULTS AND DISCUSSION

(A)Yield Characters

Analysis of variance showed significant difference amongst yield characters of the treatments (Table 1).The maximum fruiting percentage (67.83) was found under T_7 treatment (Zn+B@ 0.4% each), while, the minimum fruiting percentage (51.67) was shown by treatment T_0 (control) confirming the reports of Dixit *et al.* (2). The increase in fruit set with micro-nutrients might be due to an improvement in nutrient availability and auxin balance. Boron particularly helps in sugar translocation to target sites and is also known to improve stigma receptivity, thus resulting in better pollination and fruit set. Similar effects of boron application have been recorded in bael, litchi, sweet cherry and pears (Dutta *et al.,* 5). The maximum value for fruit weight (208.59g) was found with boron @ 0.5%). However, treatment T_3 (Zn@ 0.6%) was found to shown minimum fruit weight (82.89g).These findings are in accordance with Goswami *et al.* (6) and Rani and Brahmachari., 11). A favourable effect of foliar application of boron might be due to its role in cell division, cell elongation, sugar metabolism and accumulation of carbohydrates (Sourour. 15). Treatment T_7 (Zn+B@ 0.4% each) produced the maximum fruit length (7.00 cm) in pomegranate, the minimum fruit length (5.10 cm) was recorded under in T_3 (Zn 0.6%) treatment. Rani and Brahmachari. (11) also reported that the size of fruits was significantly influenced by the use of micronutrient spray. The maximum diameter of fruit (6.63 cm) was found best in T_5 treatment (B@ 0.5%), while minimum (4.84 cm) was found in the T_3 (Zn@ 0.6%). The increase in size of fruit as a result of foliar application of micronutrients in present investigation might be because it improved the internal physiology of developing fruit in terms of better supply of water, nutrients, and other compounds vital for their proper growth and development (Dutta and Banik, 5). Spray of boron (B@ 0.5% resulted in the maximum specific gravity (0.98 g/cm^3) being at par with and minimum specific gravity (0.92 g/cm^3) was found in T_3 treatment (Zn@ 0.6%). The maximum value for fruit volume (213.33 ml) was found with T_7 treatment (Zn+B@ 0.4%). Treatment T_3 (Zn@ 0.6%) exhibitied in minimum fruit volume (90.00 ml). Zinc has been identified as component of almost 60 enzymes and it has a role in synthesis of growth promoter hormone (auxin). It is directly associated with improvement of fresh weight of fruits (Shivanandam *et al.,* 13). The maximum fruit yield (35.16 kg) was found best in T_7 treatment (Zn+B@ 0.4%), while minimum fruit yield (9.91kg) was found in the T_4 treatment (B@

Table 1: Effect of foliar application of micronutrients on fruit yield of pomegranate cv. Ganesh

Treatments	Fruiting %	Fruit wt (g)	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (ml)	Specific gravity (g/cm^3)	Fruit yield/tree (kg)	Fruit yield/ha (q)
T_1 (Zn 0.4%)	59.00	137.04	6.23	5.48	145.00	0.95	15.49	3160.12
T_2 (Zn 0.5%)	58.33	146.02	6.03	5.76	150.00	0.97	23.06	4704.92
T_3 (Zn 0.6%)	60.00	82.89	5.10	4.84	90.00	0.92	10.60	2163.08
T_4 (B 0.4%)	61.67	126.51	5.67	5.45	130.00	0.97	9.91	2024.36
T_5 (B 0.5%)	51.67	208.59	6.53	6.63	212.33	0.98	14.87	3032.80
T_6 (B 0.6%)	60.33	152.11	6.20	5.94	160.00	0.94	34.92	7123.68
T_7 (Zn+B 0.4%)	67.83	202.88	7.00	6.31	213.33	0.95	35.16	7172.64
T_8 (Zn+B 0.5%)	58.67	137.89	5.87	5.63	141.00	0.97	11.68	2383.40
T_9 (Zn+B 0.6%)	61.00	131.80	6.20	5.72	130.00	0.96	16.43	3353.08
T_0 (control)	58.33	150.34	6.17	5.94	150.00	0.98	30.32	6167.60
CD (P=0.05)	1.56	51.20	0.83	0.80	53.21	0.39	1.43	292.45

Table 2: Effect of foliar application of micronutrients on fruit quality of pomegranate cv. Ganesh

Treatments	T.S.S (^{0}Brix)	Acidity (%)	Vitamin C (mg/100g)	Vitamin A (ìg/100g)
T_1 (Zn 0.4%)	11.33	0.23	24.00	14.03
T_2 (Zn 0.5%)	12.83	0.26	31.00	12.37
T_3 (Zn 0.6%)	12.33	0.23	47.00	13.77
T_4 (B 0.4%)	13.33	0.18	50.00	11.53
T_5 (B 0.5%)	12.33	0.19	22.00	14.87
T_6 (B 0.6%)	12.50	0.26	40.00	12.37
T_7 (Zn+B 0.4%)	13.16	0.34	48.00	9.87
T_8 (Zn+B 0.5%)	11.00	0.15	42.00	12.30
T_9 (Zn+B 0.6%)	10.83	0.19	44.00	14.03
T_0 (control)	11.16	0.21	34.00	13.20
CD (P=0.05)	1.27	0.11	15.58	0.96

0.4%). The better fruit yield with boron and zinc treatments might be due to two reasons *i.e.* of better fruit retention and increase in the fruit weight. Improvement in the fruit yield due to micro-nutrients has also been reported by Kumar *et al.* (8). The present findings are also in agreement with Goswami *et al.* (6) in guava and Kumar *et al.* (7) in apple.

(B) Quality Characters

The maximum total soluble solids in fruit (13.33°Brix) was found best in T_4 treatment (B@ 0.4%), while minimum total soluble solid (10.83°Brix) was observed in T_9 treatment (Zn+ B@ 0.6%) (Table 2). The improvement in the TSS might be due to better translocation of sugars from leaves to developing fruits. The present findings are in agreement with Dutta *et al.,* (3) in litchi and Dutta (4) in mango. The enhancement in quality of fruit could be due to the catalytic action of micronutrients particularly at higher concentration. the results are in consonance with reports of Chaturvedi *et al.* (1) and Hence the maximum acidity in fruit (0.34%) was found under T_7 treatment (Zn+ B@ 0.4%) and minimum acidity (0.15%) was noted in T_8 treatment (Zn+ B@ 0.5%). The maximum vitamin C in fruit (50.00 mg/100g) was observed in T_7 treatment (Zn+ B, 0.4%), while minimum vitamin C content (22.00 mg/100g) was recorded in under T_5 (B@0.5%). These results are in closed conformity with the findings of Rawat *et al.* (12) and Yadav *et al.* (16) in guava fruits. The maximum vitamin A in fruit (14.87 ìg/100g) was estimated under T_5 treatment (B@ 0.5%) while, the minimum vitamin A (9.87 ìg/100g) was shown by treatment T_7 (Zn+B@ 0.4%).

The findings of this investigation are indicative of beneficial effects of combined foliar application of micronutrients (Zn+B@ 0.4%) at full bloom stage on physico-chemical properties of pomegranate fruits cv. Ganesh. The overall qualitative assessment of fruits, it can be concluded that the spray of zinc sulphate, boric acid and their combination at 0.4% enhances the TSS, total weight of the fruits, total yield, fruiting percentage and vitamin C and vitamin A contents of the fruits.

REFERENCES

1. Chaturvedi, O.P., Singh, A.K., Tripathi, V. K., Dixit, A. K. (2005). Effect of zinc and iron on growth, yield and quality of strawberry cv. Chandler. *Acta Hort.,* **696** : 237-240.
2. Dixit, A., Shaw, S.S. and Pal. V. (2013). Effect of micronutrients and plant growth regulators on fruiting of litchi. *HortFlora Res.* Spectrum, **2**(1) : 77–80.
3. Dutta, P., Banik, A. and Dhua, R. S. (2000). Effect of boron on fruit set, fruit retention and fruit quality of litchi cv. Bombai. *Indian J Hort.,* **57** : 287-90.
4. Dutta, P. (2004). Effect of foliar boron application on panicle growth, fruit retention and physio-chemical characters of mango cv. Himsagar. *Indian J. Hort.,* **61** : 265-266.
5. Dutta, P. and Banik, A. K. (2007). Effect of foliar feeding of nutrients and plant growth regulators on physico-chemical quality of sardar guava grown in red and lateritic tract of West Bengal. *Acta Hort.,***735** (6) : 214-220
6. Goswami, A.K., Shukla, H.S., Kumar, P. and Mishra, D.S. (2012). Effect of preharvest application of micronutrients on quality of guava (*Psidium guajava* L.). *HortFlora Res. Spectrum,* **1**(1) : 60-63

7. Kumar, J., Rehalia, A. S., Rana, S, S. and Chandel, J. S. (2002). Effect of pre and post bloom sprays of urea and boric acid on growth, fruit set, yield and fruit quality of apple cv. Starking Delicious. *Prog. Hort.,* **34** : 22-26.
8. Kumar, R. , Chauhan, S. K. and Sharma, S. (1988). A note on the effect of zinc sulphate on berry set, panicle drying and quality of grapes cv. Gold. *Haryana J. Hort Sci.,* **20** : 133-35.
9. Ram, R. A. and Bose, T. K. (1994) Effect of foliar sprays of urea and zinc on growth and yield of mandarin orange (*Citrus reticulata* Blanco.) *Indian J. Hort.,* **57** : 266-271.
10. Ranganna, S. (1986). *Handbook of Analysis and Quality Control for Fruit and Vegetable Products.* 2nd eds. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, p 11-12.
11. Rani, R. and Brahmachari, V.S. (2001). Effect of foliar application of calcium, zinc and boron on cracking and physio-chemical composition of litchi. *Orissa J. Hort.,* **29** : 50-54.
12. Rawat, V., Tomar, Y. K. and Rawat, J.M.S. (2010). Influence of foliar application of micronutrients on the fruit quality of guava cv. Lucknow-49. *J. Hill Agri.,* **1** (I):63-66
13. Shivanandam, V. N., Pradeep, S. L., Rajanna, K. M. and Shivappa. (2007). Effect of zinc sulphate on growth and yield of mango varieties and hybrids. J. Soil Crops., **17** : 225-229.
14. Snedecor, G. W. and Cochran, W. G. (1968). *Statistical Methods.* 6th edn, Allied Pacefic Pvt Ltd, Bombay 557p.
15. Sourour, M. M. (2000). Effect of foliar application of some micronutrient forms on growth, yield, fruit quality and leaf mineral composition of Valencia orange trees grown in North Sinai. *Alexandria J. Agri. Res.,* **45** (1) : 269-285.
16. Yadav, H. C., Yadav, A. L., Yadav, D. K. and Yadav, P. K. (2011). Effect of foliar application of micro-nutrients and GA_3 on yield and quality of rainy season guava (*Psidium guajava* L.) cv. L-49. *Plant Arch.* **11** (1): 147-149.

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