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Foliar application of micronutrients influenced vegetative growth, yield and quality traits of strawberry (*Fragaria* x *ananassa* Duch.) cv. Chandler

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Abstract
Among the fruit crops, Strawberry is the one of the important fruit crop. An experiment was conducted at research field, Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology and Science, Naini, Allahabad, during the year 2014-2015, the experiment was laid out in a Randomized Block Design having ten treatments of micronutrients at different levels and one micronutrient combination with three replications. The observations were recorded on vegetative growth and yield related traits. The result revealed that treatment T_6 was found to be best in terms of maximum plant height (20.11cm), plant spread (30.33cm), number of leaves (30.33), petiole length (16.83 cm), number of flowers per plant (32.34), number of fruits per plant (30.26), fruit yield per plant (474.34 g), and benefit cost ratio (2.71) whereas T_7 registered maximum fruit set (93.47%) and T_4 recorded for maximum fruit weight (16.54g).

Keywords: Strawberry, micronutrients, growth, yield and quality

Introduction
The area under fruit production in India is 7136 thousand hectares with a production of 84411 thousand million tons (NHB, 2013-14). Strawberry (*Fragaria x sp.*) is native of temperate regions, but varieties are available which can be cultivated in subtropical climate. Strawberry is a delicious fruit taken fresh in several ways. The fresh ripe fruits of strawberry are rich source of vitamins and minerals. Among vitamins it is a fairly good source of vitamin-A (60 IU) and vitamin-C (30-120 mg/100g of edible portion) (Jain *et al.*, 2017). It is a soft and a highly perishable fruit, often shipped in frozen condition in Western countries. Strawberry thrives best in temperate climate. It is a short day plant; the varieties grown in milder subtropical climate do not require chilling and continue to make some growth during winter.
The quality and yield of fruits depends on different attributes which are closely associated with nutrient uptake by the plant. The supply of nutrients to the plants should be balanced, ensuring not to over or under-fertilize. In addition to NPK, micronutrients have a great bearing in influencing the yield attributes and fruit production. Micronutrients are involved in all metabolic and cellular functions. Micronutrients are essentially as important as macronutrients to have better growth, yield and quality in plants. In the past, there was no need of micronutrients because these trace elements were naturally supplied by soil. But due to intensive cultivation, increase in salinity and soil pH in most of soils, these nutrients are present but are not available to plants (Ahmad *et.al*, 2010). Zinc is effective in plant nutrition for the synthesis of plant hormones and balancing intake of P and K inside the plant cells. Boron is essential for plant growth, new cell division in meristematic tissue, translocation of sugar, starch, nitrogen, phosphorus, certain hormones, synthesis of amino acids and protein, regulations of carbohydrate metabolism, development of phloem etc. Copper is essential for photosynthesis and mitochondrial respiration, for carbon and nitrogen metabolism. Iron act as catalyst in synthesis of chlorophyll molecule and helps on the absorption of other elements. It is a key element in various redox reactions of respiration, photosynthesis and reduction of nitrates and sulphates (Wallihan *et al.*, 1958; Zende, 1996).

Materials and methods
The present experiment was conducted at pomology section, Department of Horticulture, SHIATS, Allahabad, during 2014-2015, in a randomized block design replicated with thrice, the experimental site is situated at a latitude of 20º and 15º North and longitude of 60º 3` East and at an altitude of 98 meters above mean sea level (MSL).

Minimum temperature ranged from 4° -5° C (during Oct - Feb) and maximum temperature ranged from 45° -48° C (during March - June). One cultivar with uniform sized strawberry runners were planted during November 2014, maintaining a spacing of 45 X 30 cm. The micronutrients solutions were prepared as per the requirement and sprayed to each treatments and replication at 30 days intervals and observations recorded. The recommended package of practices was followed for raising the successful crop. Data on plant growth yield and quality of strawberry characters were recorded when the plants were fully grown. Treatments [T_0 – Control, T_1 -B (0.1%), T_2 -Fe (0.2%),T_3 -Cu (0.2%), T_4 -Zn (0.2%), T_5 -B (0.2%), T_6 -Fe (0.4%), T_7 -Cu (0.4%), T_8 -Zn (0.4%), T_9 -(B+Fe+Zn+Cu)(1.0%)].

Results and discussion

Growth parameters

The mean performance of the treatments for growth parameters like plant height, plant spread, numbers of leaves per plant and petiole length have been presented in table no.1 showing significant differences for growth parameters. Vigorous maximum plant height was observed with T_6 (20.11 cm) followed by T_4 (19.84 cm) and also T_5 (19.05 cm). Minimum plant height was observed with T_0 (16.27 cm), other treatments showed moderate plant height. Maximum plant spread in treatment T_6 (30.33 cm), followed by T_4 (29.11 cm) and T_5 (28.81 cm). The plant spread was lowest in the T_0 (23.44 cm). The remaining treatments recorded medium plant spread with significantly. Number of leaves per plant was noticed in the range of 23.44 to 30.33. At this stage treatment T_6 had the maximum number of leaves (30.33), followed by treatment T_4 (29.11) and T_5 (28.81). The least number of leaves was observed in the treatment T_0 (23.44). Maximum Petiole length in treatment T_6 (16.83 cm), followed by T_4 (15.23 cm) and T_5 (14.33 cm). The Petiole length was lowest in the T_0 (12.42 cm). These increases may be due to application of micronutrients. Similar results reported by Chaturvedi *et al.* (2005) and Usha and Singh (2002).

Flowering and fruiting characters

The data pertaining to the flowering and fruiting characters like number of flowers per plant, number of fruits per plant, percent of fruit set and fruit yield per plant was recorded under one cultivar of strawberry and ten treatments presented in table no. 1 Maximum number of flowers per plant (32.34) was observed in treatment T_6 followed by treatment T_4 (29.74) and treatment T_5 (27.54). Minimum number of flowers per plant (18.46) was observed in treatment T_0. Maximum number of fruits per plant (30.26) was observed in treatment T_6 followed by treatment T_4 (25.73) and treatment T_5 (23.46). Minimum number of fruits per plant (16.84) was observed in treatment T_0. Maximum fruit set (93.47 %) was observed in treatment T_7 followed by treatment T_0 (91.34 %) and treatment T_4 (90.04 %). Minimum fruit set (74.73) was observed in treatment T_1. Significantly maximum fruit weight (16.54g) was observed in treatment T_4 followed by treatment T_1 (15.93g) and treatment T_9 (15.58g). Minimum fruit weight (10.51g) was observed in treatment T_0, whereas maximum fruit yield per plant (474.34 g) was observed in treatment T_6 followed by treatment T_4 (424.77g) and treatment T_9 (363.80 g). Minimum fruit yield per plant (177.05 g) was observed in treatment T_0. Similar results observed by Chaturvedi *et al.* (2005), Ozuygur *et al.* (2000) and Usha and Singh (2002).

Maximum benefit cost ratio (2.71) was recorded under treatments T_6 (Fe – 0.4%). Minimum benefit cost ratio (1.11) was recorded in treatment T_0 (control). However, better qualities of fruits obtained from the cultivar during winter season may be attributed due to application of different micronutrients. Similar results observed by Abd El-Wahab *et al.* (2002), Chaturvedi *et al.* (2005), Ozuygur *et al.* (2000), Taghavi *et al.* (2006) and Usha and Singh (2002).

Table 1: Micronutrients influences on strawberry cv. chandler on Growth, Flowering and fruiting and quality of strawberry fruit.

Treatment	Plant Height (cm)	Plant Spread (cm)	Number of Leaves	Petiole Length (cm)	Number of Flowers Per Plant	Number of Fruits Per Plant	Fruit Set (%)	Fruit Yield Per Plant (gm)	Fruit Weight (gm)	Cost Benefit Ratio
T_0	16.27	23.44	23.44	12.42	18.46	16.84	91.34	177.05	10.51	1:1.11
T_1	17.56	26.55	26.55	12.93	25.37	18.92	74.73	301.49	15.93	1:1.39
T_2	16.37	26.33	26.33	12.84	23.86	20.43	85.76	261.75	12.81	1:1.45
T_3	16.87	26.83	26.83	13.23	24.46	20.77	84.83	266.42	12.82	1:1.79
T_4	19.84	29.11	29.11	15.23	29.74	25.73	90.04	424.77	16.54	1:2.13
T_5	19.05	28.81	28.81	14.33	27.54	23.46	86.56	351.29	14.96	1:2.05
T_6	20.11	30.33	30.33	16.83	32.34	30.26	85.07	474.34	15.67	1:2.27
T_7	18.01	27.43	27.43	12.83	25.17	22.65	93.47	295.34	13.03	1:1.69
T_8	18.38	27.17	27.17	12.73	25.36	21.75	84.15	293.20	13.49	1:1.72
T_9	17.93	28.57	28.57	13.45	26.84	23.35	86.94	363.80	15.58	1:1.98
F - test	S	S	S	S	S	S	S	S	S	1:1.11
SE.d	0.32	0.02	0.02	0.02	0.03	0.02	0.03	9.08	0.22	1:1.39
CD(5%)	0.68	0.04	0.04	0.05	0.05	0.05	0.05	19.07	0.47	1:1.45

Conclusion

On the basis of present investigation it is concluded that the treatment T_6 [Iron (Fe) at 0.4%] was found to be the best treatment for growth, quality, yield of strawberry and maximum cost benefit ratio.

References

1. Abd El-Wahab A, Wafa M, Samira Mohamed, Gihan AM. Effect of foliar application of some mineral elements on fruit set, yield, leaf and fruit mineral contents and storage ability of "Anna" apple fruits I- effect on fruit set, yield as well as leaf and fruit mineral contents. J Agric. Sci., Mansoura Univ. 2005; 24(12):7547-7557.
2. Ahmad I, Aslam Khan M, Qasim M, Ahmad R, Randhawa AM. Growth, yield and quality of Rosa hybrid L. as influenced by various micronutrients. Pak J Agric Sci. 2010; 47(1):5-12.
3. Chaturvedi OP, Singh AK, Tripathi VK, Dixit AK. Effect of zinc and iron on growth, yield and quality of strawberry cv. chandler. Acta Hort. (ISHS), 2005;

696:237-240.
4. Jain N, Mani A, Kumari S, Kasera S, Bahadur V. Influence of INM on yield, quality, shelf life and economics of cultivation of strawberry (*Fragaria* × *ananassa* Duch.) cv. Sweet Charlie. Journal of Pharmacognosy and Phytochemistry. 2017; 6(5):1178-1181.
5. Ozuygur M, Paydas Kargi S, Kafkas E. Investigation on yield, fruit quality and plant characteristics of some local, european and american strawberry varieties and their hybrids. Agriculturae Conspectus Scientificus. 2010; 71(4):175-180.
6. Taghavil Toktam Sadat, Mesbah Babalar, Ali Ebadi, Hasan Ebrahimzadeh, Mohammad Ali Asgari. Effects of Nitrate to Ammonium Ratio on Yield and Nitrogen Metabolism of Strawberry (Fragaria x Ananassa cv. Selva). Int. J of Agri. & Bio. 2004; 1560-8530/06-6-994-997.
7. Usha K, Singh B. Effect of macro and micro-nutrient spray on fruit yield and quality of grape Vitis vinifera L. cv. Perlette. *Acta Horticulturae*, Leuven, 2002; 30(594):197-202.
8. Wallihan EF, Embleton TW, Wilma Printy. Zinc deficiency in avocado. Calif gric. 1958; 12(6):4-5.
9. Zende GK. Integrated nutrient supply in relation to micronutrients for sustainable agriculture. Micronutrient News. 1996; 10(11):1-9.