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# Response of foliar fertilization of micronutrients on fruit growth and yield of low-chill peach cv. SHARBATI

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**ABSTRACT :** A field experiment was carried out during 2010 and 2011 seasons on seven year old Sharbati cultivar of peach, growing in clay loam soil. The experiment was laid out in randomized block designed to study the effect of foliar spraying of boron, zinc and iron and its combination on fruit growth pattern, yield and yield attributing characters of the low-chill peach. Boric acid (0.1%), zinc sulphate (0.5%) and ferrous sulphate (0.5%) were used as a source of boron, zinc and iron, respectively. All the trees were fertilized with same NPK dose as per recommendation. The spraying was done twice; during last week of February, *i.e.*, after petal fall stage and again at 15 days after the first spraying during both years in three replicates. The result revealed that foliar spraying of peach trees with 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5 % $FeSO_4$, $7H_2O$ was the promising treatment for improvement of fruit growth, fruit length, fruit diameter, fruit volume and firmness of the fruit. This treatment was also found best for maximum fruit retention, average fruit weight as well as the fruit yield.

**KEY WORDS :** Micronutrient, Fruit growth, Fruit yield, Low-chill peach

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Peach [*Prunus persica* (L.) Batsch] is a juicy fruit of excellent appearance and quality. It is distinct in its group (stone fruit) along with plum in having lower chilling requirement than other temperate fruits like apple, pear etc. It can be grown in lower elevations where most of the other temperate fruits do not succeed (Chanana, 2006). The cultivation of low-chill peaches confined to subtropical area of north India including U.P. (Meerut, Saharanpur, Muzzafarnagar and Bulandsahar), U.K (Udhamsingh Nagar and Nanital), Punjab and Haryana (Pathak and Pathak, 2001). Presently, Sharbati, Saharanpur Prabhat, Florada prince, Pratap, Shan-e- Punjab and Early grand are popular cultivar in this area (Tiwari *et al.*, 2004). However, the yield of the low-chill peaches is very low in this particular area. Foliar fertilization of micronutrients has advantage of low application rates, uniform distribution of fertilizer materials and quick responses to applied nutrients (Umer *et al.*, 1999). Application of micronutrients through foliage can be from 10 to 20 times as efficient as soil application (Zaman and Schumann, 2006). Foliar application of micronutrients like boron, zinc and iron seems to be an effective tool to correct the deficiency symptoms as well as increase the yield of the plant. It is also increased resistance to disease and insect pests and improved drought tolerance (Tariq *et al.*, 2007). Boron is an essential microelement required for normal growth of plant. Reduction in fruit set and yield in B deficient plant is reported in pear (Rease, 1989). Zinc deficiency has been reported to be most widespread micro nutritional disorder of the food crops in india as well as the world over. The available Zn content of Indian soil varied from trace to 22 mg $kg^{-1}$ (Nagaranjan *et al.*, 1981) and 47 per cent of Indian soil were to be deficient in Zn (Katyal and Sharma, 1991) Zinc nutrition is an important economic factor in cultivation of fruit trees, especially in peaches since it is considered as sensitive to Zn deficiency (Chapman, 1966). Tiwari *et al.* (2004) also recommended application of Zn for increasing the yield in peaches. Iron plays an important role in chlorophyll biosynthesis pathway (Abadía, 1992) thus deficiency of this element reduced the net photosynthesis (Molassiotis *et al.*, 2006) which causes huge reduction in fruit yield (Sanz *et al.*, 1997). Many reports have been published on effect of micronutrient in case of high-chill peaches. However, there is limited work done on effect of micronutrient spray on subtropical low-chill cultivars. Low-chill peaches have the ability to catch the market when there was no fruit availability in market of subtropical area. Therefore, it is necessary to evaluate the response of micronutrient application on low-chill peach under sub tropical condition. In view of the above facts, the present study was undertaken to investigate the response of different micronutrients supply mainly boron, zinc and iron on fruit growth and yield of Sharbati peach growing in clay loam soil.

## RESEARCH METHODS

### Plant material and experiment design:

This investigation was conducted during 2010 and 2011 season in Horticultural Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar (U.K.) on low-chill peach cultivar, Sharbati planted at 5 x 5 m apart under basin irrigation system. Trees were healthy, similar in vigor and subjected to the same horticultural practices during the experiment period. The NPK were supplied to the trees as per recommendation given by Tiwari *et al.* (2004). The micronutrients were sprayed alone and in combinations during last week of February in both year *i.e.*, after petal fall stage and again 15 days after the first spraying. The micronutrients were boron as $H_3BO_3$, zinc as $ZnSO_4$, $7H_2O$ and iron as $FeSO_4$, $7H_2O$. Eight foliar treatment were arranged in a Complete Randomized Design with three replicates (1 replicate= 2 trees) per treatment (*i.e.*, 3x8= 24trees). The details of the treatment composition were $T_1$= 0.1 % $H_3BO_3$, $T_2$= 0.5 % $ZnSO_4$, $7H_2O$, $T_3$= 0.5 % $FeSO_4$, $7H_2O$, $T_4$= 0.1 % $H_3BO_3$+0.5 % $ZnSO_4$, $7H_2O$, $T_5$=0.1 % $H_3BO_3$+0.5% $FeSO_4$, $7H_2O$, $T_6$= 0.5 % $ZnSO_4$, $7H_2O$ + 0.5% $FeSO_4$, $7H_2O$, $T_7$= 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5 % $FeSO_4$, $7H_2O$, $T_8$= Water spray (Control).

### Initial soil status:

The soil analysis of the experiment plot containing peach trees was determined before treatment application (December 2009). For this composite soil samples were collected from the several points between the rows of the experimental trees. Three soil samples, of 100g each were drawn from the soil collected and pooled from the three different depths *viz.*, 0-20 cm, 21-40 cm and 41-60 cm. The collected sample were dried in shade, gently powdered with a wooden mallot and sieved through 2 mm sieve and the samples were analyzed for physical and chemical properties of the soil which is presented in Table A.

**Table A : Physical and chemical properties of the soil samples obtained from the experimental plot**

| Properties | Different depths | | |
|---|---|---|---|
| | 0-20 cm | 20-40 cm | 40-60 cm |
| Soil texture | Clay loam | Clay loam | Clay loam |
| Soil pH | 7.7 | 8.1 | 8.1 |
| Soil organic carbon (%) | 1.68 | 1.26 | 0.79 |
| Soil N (kg/ha) available | 177 | 165 | 151 |
| Soil P (kg/ha) available | 62.96 | 52.39 | 37.93 |
| Soil K (kg/ ha) available | 328.28 | 238.27 | 229.49 |
| Zinc (ppm) | 0.60 | 0.52 | 0.49 |
| Iron (ppm) | 7.50 | 6.35 | 5.51 |
| Boron (ppm) | 1.25 | 1.02 | 0.85 |

### Fruit growth:

The data on fruit growth (cm) was recorded at weekly intervals starting from 1$^{st}$ week of March and 1$^{st}$ week of June during both years.

### Fruit physical characters:

A 15 fruit sample from each replicate was taken to determine fruit weight (g), length (mm), diameter (mm), fruit volume (mL) and fruit firmness (Ib inch$^2$).

### Yield estimation:

The fruit were harvested at the first week of June in both years and average yield in kilograms; numbers of fruit per tree and fruit retention per tree were recorded. The statistical analyses of pooled data of both the years were carried out as per the method prescribed by Panse and Sukhatme (1985).

## RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

### Fruit growth pattern:

The fruit growth data of the peach cv. Sharbati on the basis of length and diameter during both the years are represented as Table 3 and 4. Initially, the length of the fruit was increased at an increasing rate upto 4th week of March during both the years (Stage I). Then the rate of increase in fruit length was quite low upto 3rd week of April (Stage II). Again the rate of increase in fruit length was recorded at increasing rate after the 3rd week of April to 1st week of June (Stage III). These type findings were quite similar during both the years for fruit length. The increase in diameter followed the same trend as in case of fruit diameter during both the years Table 5 and 6. Where, the stage I period completed during 3rd week of March and Stage II during 2$^{nd}$ week of April. The only difference recorded in study of the increase in fruit length and diameter at weekly interval was that the stage I and stage II period completed by the fruit diameter one week in advance than the fruit length. The treatment $T_7$ recorded maximum increase in fruit length and diameter in every week intervals over control. These findings clearly established that the growth pattern of peach followed the double sigmoid growth curve. Double sigmoid growth of low-chill peach was also reported in low-chill peach cv. Shan-e-Punjab (Babu and Yadav, 2002).

**Table 1 : Response of foliar fertilization of micronutrients on final fruit length (cm), final fruit diameter (cm), fruit volume (mL) and fruit firmness (lb inch$^{-2}$) of low chill peach cv. SHARBATI**

| Treatments | Final fruit length (cm) | | Final fruit diameter (cm) | | Fruit volume (ml) | | Fruit firmness (lb inch$^{-2}$) | |
|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 |
| NPK +0.1% $H_3BO_3$ | 5.58 | 5.17 | 4.84 | 4.38 | 42.18 | 41.18 | 11.09 | 10.85 |
| NPK+0.5%$ZnSO_4$,7$H_2$0 | 5.46 | 4.9 | 4.87 | 4.37 | 42.88 | 42.13 | 11.27 | 10.61 |
| NPK +0.5%$FeSO_4$, 7$H_2O$ | 5.48 | 5.13 | 4.82 | 4.42 | 41.03 | 42.45 | 10.89 | 11.02 |
| NPK+0.1%$H_3BO_3$+0.5%$ZnSO_4$,7$H_2$0 | 5.68 | 5.28 | 4.93 | 4.45 | 43.14 | 43.20 | 12.29 | 11.23 |
| NPK+0.1%$H_3BO_3$+0.5%$FeSO_4$,7$H_2O$ | 5.69 | 5.44 | 4.82 | 4.51 | 43.57 | 44.19 | 13.00 | 11.24 |
| NPK+0.5%$ZnSO_4$,7$H_2$0+0.5%$FeSO_4$,7$H_2O$ | 5.47 | 5.02 | 4.99 | 4.36 | 42.08 | 42.98 | 11.78 | 10.79 |
| NPK+0.1%$H_3BO_3$+0.5%$ZnSO_4$,7$H_2$0+0.5%$FeSO_4$,7$H_2O$ | 5.73 | 5.46 | 5.10 | 4.65 | 44.48 | 44.66 | 13.28 | 11.38 |
| Control | 5.43 | 4.81 | 4.61 | 4.05 | 39.74 | 39.78 | 10.42 | 10.28 |
| C.D. (P=0.05) | 0.01 | 0.13 | 0.05 | 0.09 | 0.43 | 0.53 | 1.11 | 0.30 |

**Table 2 : Response of foliar fertilization of micronutrients on fruit retention (%), average fruit weight (g), number of fruits per tree and fruit yield (kg per tree) of low-chill peach cv. SHARBATI**

| Treatments | Average fruit weight (g) | | Fruit retention (%) | | Number of fruit per tree | | Fruit yield (kg per tree) | |
|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 |
| NPK +0.1% $H_3BO_3$ | 51.67 | 38.72 | 66.91 | 47.5 | 346.2 | 447.8 | 18.20 | 17.34 |
| NPK+0.5%$ZnSO_4$,7$H_2$0 | 50.53 | 40.38 | 55.00 | 59.6 | 380.6 | 448.3 | 20.78 | 18.10 |
| NPK +0.5%$FeSO_4$, 7$H_2O$ | 52.27 | 42.23 | 62.48 | 57.6 | 348.2 | 476.3 | 21.04 | 20.11 |
| NPK+0.1%$H_3BO_3$+0.5%$ZnSO_4$,7$H_2$0 | 53.94 | 43.85 | 68.75 | 63.2 | 433.8 | 521.3 | 23.22 | 22.86 |
| NPK+0.1%$H_3BO_3$+0.5%$FeSO_4$,7$H_2O$ | 54.61 | 44.58 | 71.00 | 72.6 | 449.4 | 530.4 | 23.78 | 23.65 |
| NPK+0.5%$ZnSO_4$,7$H_2$0+0.5%$FeSO_4$,7$H_2O$ | 48.50 | 41.53 | 46.68 | 55.0 | 420.9 | 515.2 | 17.49 | 21.39 |
| NPK+0.1%$H_3BO_3$+0.5%$ZnSO_4$,7$H_2$0+0.5%$FeSO_4$,7$H_2O$ | 56.51 | 46.68 | 74.00 | 74.3 | 453.6 | 521.5 | 24.47 | 24.34 |
| Control | 48.50 | 38.48 | 42.02 | 42.0 | 340.2 | 429.9 | 16.50 | 16.54 |
| C.D. (P=0.05) | 0.73 | 0.31 | 1.06 | 10.19 | 5.08 | 19.84 | 0.43 | 0.85 |

**Table 3 : Effect of foliar fertilization of micronutrients on fruit growth (length basis) of low-chill peach cv. SHARBATI during 2010-11**

| Treatments | March | | | | April | | | | May | | | | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week |
| $T_1$ | 0.94 | 1.81 | 2.11 | 2.09 | 2.29 | 2.51 | 2.71 | 3.06 | 3.59 | 4.01 | 4.38 | 4.74 | 5.17 |
| $T_2$ | 0.75 | 1.97 | 2.23 | 2.26 | 2.33 | 2.62 | 2.81 | 2.94 | 3.58 | 3.91 | 4.29 | 4.73 | 4.90 |
| $T_3$ | 0.87 | 1.70 | 2.08 | 2.46 | 2.40 | 2.61 | 2.68 | 3.02 | 3.34 | 3.92 | 4.46 | 4.77 | 5.13 |
| $T_4$ | 1.01 | 2.03 | 2.48 | 2.63 | 2.70 | 2.64 | 2.92 | 3.20 | 3.61 | 4.02 | 4.57 | 4.86 | 5.28 |
| $T_5$ | 1.03 | 2.03 | 2.70 | 2.72 | 2.72 | 2.65 | 2.99 | 3.23 | 3.87 | 4.07 | 4.60 | 4.87 | 5.44 |
| $T_6$ | 0.94 | 1.91 | 2.04 | 2.33 | 2.62 | 2.45 | 2.62 | 3.01 | 3.61 | 3.98 | 4.46 | 4.85 | 5.02 |
| $T_7$ | 1.11 | 2.11 | 2.82 | 3.01 | 2.85 | 2.91 | 3.03 | 3.33 | 4.13 | 4.40 | 4.64 | 4.93 | 5.46 |
| $T_8$ | 0.68 | 1.68 | 1.96 | 2.08 | 2.25 | 2.37 | 2.50 | 2.85 | 3.22 | 3.85 | 4.20 | 4.66 | 4.81 |
| C.D. (P=0.05) | 0.08 | 0.18 | 0.24 | 0.17 | 0.16 | NS | 0.17 | 0.21 | 0.18 | 0.23 | NS | 0.12 | 0.13 |

Note: $T_1$ = NPK + 0.1 % $H_3BO_3$, $T_2$ = NPK + 0.5 % $ZnSO_4$, 7$H_2O$, $T_3$ = NPK + 0.5 % $FeSO_4$, 7$H_2O$, $T_4$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, 7$H_2O$, $T_5$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $FeSO_4$, 7$H_2O$, $T_6$ = NPK + 0.5 % $ZnSO_4$, 7$H_2O$ + 0.5% $FeSO_4$, 7$H_2O$, $T_7$ = NPK + 0.5 % $H_3BO_3$ + 0.5 % $ZnSO_4$, 7$H_2O$ + 0.5 % $FeSO_4$, 7$H_2O$, $T_8$ = Control

**Final fruit length and final fruit diameter:**

The data for final fruit length and final fruit diameter in both years are presented in Table 1. As for the length and diameter of fruit, a significant maximum enhancement was observed in both years trees sprayed with the treatment comprised of 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5 %

**Table 4 : Effect of foliar fertilization of micronutrients on fruit growth (length basis) of low-chill peach cv. SHARBATI during 2009-10**

| Treatments | March | | | | April | | | | May | | | | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week |
| $T_1$ | 1.37 | 2.54 | 3.04 | 2.79 | 2.97 | 3.00 | 3.18 | 3.62 | 4.01 | 4.40 | 4.96 | 5.23 | 5.58 |
| $T_2$ | 1.41 | 2.51 | 2.59 | 2.86 | 2.80 | 3.09 | 3.15 | 3.60 | 3.77 | 4.41 | 4.66 | 5.18 | 5.46 |
| $T_3$ | 1.27 | 2.35 | 2.74 | 2.58 | 2.80 | 3.19 | 3.15 | 3.48 | 3.97 | 4.54 | 4.95 | 5.20 | 5.48 |
| $T_4$ | 1.55 | 2.54 | 2.76 | 3.10 | 3.14 | 3.24 | 3.36 | 3.68 | 4.15 | 4.56 | 5.15 | 5.40 | 5.68 |
| $T_5$ | 1.56 | 2.54 | 3.16 | 3.21 | 3.36 | 3.30 | 3.50 | 3.75 | 4.16 | 4.61 | 5.15 | 5.46 | 5.69 |
| $T_6$ | 1.49 | 2.41 | 2.66 | 3.04 | 3.14 | 2.98 | 3.18 | 3.59 | 3.97 | 4.43 | 5.14 | 5.31 | 5.47 |
| $T_7$ | 1.60 | 2.64 | 3.16 | 3.51 | 3.47 | 3.54 | 3.57 | 3.79 | 4.29 | 4.69 | 5.38 | 5.47 | 5.73 |
| $T_8$ | 1.26 | 2.12 | 2.44 | 2.58 | 2.77 | 2.78 | 3.04 | 3.06 | 3.65 | 4.23 | 4.49 | 5.08 | 5.43 |
| C.D. (P=0.05) | 0.03 | 0.03 | 0.05 | 0.06 | 0.12 | 0.08 | 0.03 | 0.04 | 0.11 | NS | 0.05 | 0.06 | 0.07 |

Note: $T_1$ = NPK + 0.1 % $H_3BO_3$, $T_2$ = NPK + 0.5 % $ZnSO_4$, $7H_2O$, $T_3$ = NPK + 0.5 % $FeSO_4$, $7H_2O$, $T_4$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$, $T_5$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $FeSO_4$, $7H_2O$, $T_6$ = NPK + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5% $FeSO_4$, $7H_2O$, $T_7$ = NPK + 0.5 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5 % $FeSO_4$, $7H_2O$, $T_8$ = Control

**Table 5 : Effect of foliar fertilization of micronutrients on fruit growth (diameter basis) of low-chill peach cv. SHARBATI for 2010-11**

| Treatments | March | | | | April | | | | May | | | | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week |
| $T_1$ | 0.52 | 1.66 | 2.04 | 2.22 | 2.34 | 2.34 | 2.84 | 3.25 | 3.46 | 3.66 | 3.97 | 4.30 | 4.38 |
| $T_2$ | 0.63 | 1.34 | 2.08 | 2.13 | 2.25 | 2.25 | 2.77 | 3.23 | 3.53 | 3.76 | 4.11 | 4.35 | 4.37 |
| $T_3$ | 0.59 | 1.61 | 1.98 | 2.17 | 2.27 | 2.27 | 2.87 | 3.27 | 3.48 | 3.68 | 4.14 | 4.37 | 4.42 |
| $T_4$ | 0.74 | 1.69 | 2.25 | 2.27 | 2.38 | 2.38 | 2.88 | 3.27 | 3.55 | 3.85 | 4.15 | 4.43 | 4.45 |
| $T_5$ | 0.81 | 1.86 | 2.25 | 2.30 | 2.40 | 2.40 | 2.88 | 3.28 | 3.55 | 3.86 | 4.20 | 4.45 | 4.52 |
| $T_6$ | 0.63 | 1.64 | 2.08 | 2.26 | 2.24 | 2.24 | 2.86 | 3.19 | 3.48 | 3.72 | 4.05 | 4.35 | 4.36 |
| $T_7$ | 0.99 | 1.87 | 2.34 | 2.35 | 2.43 | 2.43 | 3.06 | 3.29 | 3.62 | 3.93 | 4.26 | 4.64 | 4.65 |
| $T_8$ | 0.49 | 0.96 | 1.98 | 2.13 | 2.23 | 2.23 | 2.65 | 3.06 | 3.46 | 3.56 | 3.96 | 4.02 | 4.05 |
| C.D. (P=0.05) | 0.26 | 0.32 | 0.12 | 0.03 | 0.03 | 0.03 | 0.12 | 0.04 | 0.03 | 0.06 | 0.04 | 0.06 | 0.09 |

Note: $T_1$ = NPK + 0.1 % $H_3BO_3$, $T_2$ = NPK + 0.5 % $ZnSO_4$, $7H_2O$, $T_3$ = NPK + 0.5 % $FeSO_4$, $7H_2O$, $T_4$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$, $T_5$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $FeSO_4$, $7H_2O$, $T_6$ = NPK + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5% $FeSO_4$, $7H_2O$, $T_7$ = NPK + 0.5 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5 % $FeSO_4$, $7H_2O$, $T_8$ = Control

**Table 6 : Effect of foliar fertilization of micronutrients on fruit growth (diameter basis) of low-chill peach cv. SHARBATI for 2009-10**

| Treatments | March | | | | April | | | | May | | | | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week | 2nd week | 3rd week | 4th week | 1st week |
| $T_1$ | 1.14 | 1.86 | 2.56 | 2.64 | 2.78 | 3.09 | 3.16 | 3.70 | 3.97 | 4.19 | 4.67 | 4.76 | 4.84 |
| $T_2$ | 1.26 | 2.15 | 2.59 | 2.73 | 2.75 | 3.08 | 3.35 | 3.74 | 4.05 | 4.22 | 4.63 | 4.72 | 4.87 |
| $T_3$ | 1.19 | 2.17 | 2.49 | 2.68 | 2.86 | 3.04 | 3.38 | 3.77 | 4.02 | 4.18 | 4.67 | 4.74 | 4.82 |
| $T_4$ | 1.32 | 2.20 | 2.77 | 2.78 | 2.89 | 3.14 | 3.39 | 3.76 | 4.07 | 4.37 | 4.49 | 4.84 | 4.93 |
| $T_5$ | 1.36 | 2.36 | 2.77 | 2.80 | 2.91 | 3.14 | 3.39 | 3.79 | 4.07 | 4.38 | 4.72 | 4.87 | 4.82 |
| $T_6$ | 1.04 | 2.14 | 2.59 | 2.77 | 2.76 | 3.14 | 3.38 | 3.79 | 3.99 | 4.27 | 4.57 | 4.81 | 4.99 |
| $T_7$ | 1.50 | 2.38 | 2.85 | 2.86 | 2.94 | 3.37 | 3.56 | 3.79 | 4.14 | 4.43 | 4.77 | 5.08 | 5.10 |
| $T_8$ | 0.71 | 1.47 | 2.49 | 2.64 | 2.74 | 2.98 | 3.16 | 3.57 | 3.97 | 4.08 | 4.48 | 4.54 | 4.61 |
| C.D. (P=0.05) | 0.28 | 0.025 | 0.020 | 0.016 | 0.017 | 0.020 | 0.019 | 0.017 | 0.04 | 0.027 | 0.021 | 0.03 | 0.05 |

Note: $T_1$ = NPK + 0.1 % $H_3BO_3$, $T_2$ = NPK + 0.5 % $ZnSO_4$, $7H_2O$, $T_3$ = NPK + 0.5 % $FeSO_4$, $7H_2O$, $T_4$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$, $T_5$ = NPK + 0.1 % $H_3BO_3$ + 0.5 % $FeSO_4$, $7H_2O$, $T_6$ = NPK + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5% $FeSO_4$, $7H_2O$, $T_7$ = NPK + 0.5 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5 % $FeSO_4$, $7H_2O$, $T_8$ = Control

$FeSO_4$, $7H_2O$. All other treatments were also significantly increased fruit width during both years over control. The maximum fruit length [2010(5.73 cm), 2011(5.46 cm) and diameter [2010(5.10 cm), 2011(4.65 cm) during both years might be due to greater supply of nutrient and photosynthates to the fruit from this treatment combination. These results are in line with those reported by Singh *et al*. (2003) in mango. In addition, Rana and Sharma (1979) also obtained increased berry length and diameter with the application of 0.5% ferrous sulphate in grape.

**Fruit volume and fruit firmness:**

The fruit volume and firmness expressed a significant difference among the treatments (Table 2). The maximum value of both recorded in $T_7$ and the minimum was observed in control plants. The increase in fruit volume might be due to increase in cell size and intercellular space (Baker and Davis, 1951). Cronje *et al.* (2009) also reported similar results when litchi fruit was sprayed by micronutrients (Zn, B and Cu) and potassium nitrate.

**Fruit retention percentage and average fruit weight:**

It is clear from the data presented in Table 3 that the percentage of fruit set and fruit weight in 2011 were somewhat similar as obtained during previous season and spraying of different micronutrients caused significant increase in fruit set percentage and fruit weight .Tree received treatments with 0.1 % $H_3BO_3$ + 0.5 % $ZnSO_4$, $7H_2O$ + 0.5 % $FeSO_4$, $7H_2O$ showed the highest fruit retention values [2010(74.00%), 2011(74.30%)] in both year study which might be to increase of available boron nutrient and their uptake. It plays important role in pollen germination, pollen tube growth in deciduous fruits (Thompson and Batjer, 1950). In addition, Nason and McElroy, (1963) reported that application of zinc could be promoted the auxin synthesis in the plant system which might delayed the formation of abscission layer during early stages of fruit development. Dorochor *et al*. (1984) also obtained higher bunch setting with the application of 0.15 % TUR chloromequat [minor element complex (0.02% Zn + 0.01% B + 0.01% Fe)] in grape. The increase in the fruit retention by application of micronutrient has also been reported in many fruits like almond (Sotomayor and Castro, 1997) and Aonla (Shukla, 2011). The increase in fruit weight with the application of boron, zinc and iron might be due to its role in cell division, cell elongation, sugar metabolism and accumulation of carbohydrates and other photosynthates (Crane and Brown, 1950). This type of result was also reported in orange (Sourour, 2000) and strawberry (Chaturvedi *et al*., 2005).

Number of fruits per tree and yield: Number of fruits and fruit yield per tree during both the year were significantly affected by foliar treatments (Table 3). The maximum number of fruits [2010(453.6), 2011(521.5)] and fruit yield [2010 (24.47), 2011(24.34)] were recorded in $T_7$ and the minimum found in control. This may be ascribed to higher fruit set in this treatment combination. The combination of all the applied micronutrients helped in increase the number of fruits per tree and fruit yield of the plants might be due to the beneficial roles of boron in pollination (Rease, 1989), zinc in growth promoting substances (Cakmak *et al*., 1989) and iron in electron transport chain (Molassiotis *et al*., 2006). Tripathi and Shukla (2010) found same trends in yield of strawberry with the application of boric acid (0.1% and 0.2%) and zinc sulphate (0.2% and 0.4%).

## REFERENCES

**Abadía, A. (1992).** Leaf responses to iron deficiency: A review. *J. Plant Nutri.,* **15** (1) : 1699-1713.

**Babu, K.D. and Yadav, D.S. (2002).** Fruit growth and development of peach cv. Shan-e-Punjab under edaphic and environmental condition of Meghalaya. *Indian J. Hort.,* **59**(1): 44-48.

**Baker, G.A. and Davis, I.D. (1951).** Growth of the cheek diameter of peaches, *Proc. Amer. Soc. Hort. Sci.,* **57** : 104-110.

**Cakmak, I., Marschner, H. and Bangerth, F. (1989).** Effect of zinc nutritional status on growth, protein metabolism and levels of indole-3-acetic acid and other phytohormones in bean (*Phaseolus vulgaris* L.). *J. Exp. Bot.,* **40**(3): 405-412.

**Chanana, Y.R. (2006).** Stone fruits for subtropical region. In: K.L. Chadha (eds.) *Handbook of horticulture*, 313-323. Directorate of information and publications of agriculture, ICAR, PUSA, New Delhi (INDIA).

**Chapman, H.D. (1966).** *Zinc diagnostic criteria for plants and soils*. Univ. Calif., Div. Agri. Sci. Berkeley, 484-499.

**Chaturvedi, O.P., Singh, A.K., Tripathi, V.K. and Dixit, A.K. (2005).** Effect of zinc and iron on growth, yield and quality of strawberry cv. Chandler. *Acta Hort*., **696** : 237-240.

**Crane, J.C. and Brown, J.G. (1950).** Growth of fig (*Ficus carica*) fruit var. Mission. *Proc. Amer. Soc. Hort. Sci.,* **56** : 93-97.

Cronje, R.B., Sivakumar, D., Mostert, P. G. and Korsten, L. (2009). Effect of different preharvest treatment regimes on fruit quality of litchi cultivar 'Maritius'. *J. Plant Nutri.,* **32**(1): 19-29.

**Dorochor, B.L., Abdulrachmanor, N.A. and Daniliv, V.L. (1984).** Physiological basis for regulating grape vine yield. *Sadovodstvo-Vinogradasistvo-I-vinodelie-moldavii,* **6** : 54-57.

**Katyal, J.C. and Sharma, B.D. (1991).** DTPA extractable and total Zn, Cu, Mn and Fe in Indian soils and their association with soil properties. *Geoderma*., **49** (1-2) : 165-179.

**Molassiotis, A., Tanou, G., Diamantidis, G., Patakas, A. and Therios, I. (2006).** Effects of 4-month Fe deficiency exposure on Fe reduction mechanism, photosynthetic gas exchange, chlorophyll fluorescence and antioxidant defense in two peach rootstocks differing in Fe deficiency tolerance. *J. Plant Physiol.,* **163**(2): 176-185.

**Nagarajan, R., Ramanathan G. and Devarajan, R. (1981).** Delineation of regions for micronutrient deficiency for Southern states. Paper presented In National Seminar on Micronutrients in Agriculture held on Jan 7 and 8, at TNAU, Coimbatore. P. 12.

**Nason, A. and McElroy, W.D. (1963).** *Modes of action of the essential mineral elements in plant physiology: A treatise*. F.C. Steward. (Ed.) Vo. III, Academic Press. New York. 451-521.

**Panse, V.G. and Sukhatme, P.V. (1985).** *Statistical methods for agricultural workers.* ICAR, New Delhi (INDIA).

**Pathak, R.K. and Pathak, R.A. (2001).** Peaches. In: Temperate Fruits. S.K. Mitra, T.K. Bose and D.S. Rathore (eds.). Horticulture and Allied Publishers, 27/3 Chakraberia Lane, Kolkata. pp. 179-232.

**Raese, J.T. (1989).** Physiological disorders and maladies of pear fruit. *Hort. Rev.,* **11**: 357–411.

**Rana, R.S. and Sharma, H.C. (1979).** Effect of iron sprays on growth, yield and quality of grapes. *Punjab Hort. J.,* **19**(1-2): 31-34.

**Sanz, M., Pascual, J. and Machin, J. (1997).** Prognosis and correction of iron chlorosis in peach trees: influence of fruit quality. *J. Plant Nutri*., **20** : 1567-1572.

**Shukla, A.K. (2011).** Effect of foliar application of calcium and boron on growth, productivity and quality of Indian gooseberry *(Emblica officinalis). Indian J. Agri. Sci.,* **81**(7): 628–632.

**Singh, Y.P., Tiwari, J.P. and Misra, K.K. (2003).** Effect of micronutrients on fruit yield and physico-chemical characters of mango cv. DASHEHARI. *Prog. Hort.,* **35**(1): 34-37.

**Sotomayor, C. and Castro, J. (1997).** The influence of boron and zinc sprays at bloom time on almond fruit set. *Acta Hort.,* **470** : 402-405.

**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.

**Tariq, M., Sharif, M., Shah Z. and Khan, R. (2007).** Effect of foliar application of micronutrients on the yield and quality of sweet orange (*Citrus sinensis* L.). *Pak. J. Biol. Sci*., **10**(11): 1823-1828.

**Thompson, A.H. and Batjer, L.P. (1950).** The effect of boron in germinating medium on pollen germination and pollen tube growth for several deciduous fruit trees. *Proc. Amer. Soc. Hort. Sci*., **56** : 227-230.

**Tiwari, J.P., Mishra, N.K., Mishra, D.S., Bisen, B., Singh, Y.P. and Rai, R. (2004).** Nutrient requirement for subtropical peaches and pear for Uttaranchal; An Overview. *Acta Hort.,* **662**: 199-204.

**Tripathi,V.K. and Shukla, P.K. (2010).** Influence of plant bio-regulators, boric acid and zinc sulphate on yield and fruit character of strawberry cv. Chandler. *Prog. Hort.,* **42**(2): 186-189.

**Umer, S., Bansal, S., Imas, K.P. and Magen, H. (1999).** Effect of foliar fertilization of potassium on yield, nutrition, quality and nutrient uptake of groundnut. *J. Plant. Nutri.,* **22** (11) : 1785-1795.

**Zaman, Q. and Schumann, A.W. (2006).** Nutrient management zones for citrus based on variation in soil properties and tree performance. *Precision Agric.,* **7** (1) : 45-63.

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