

## Effect of micronutrients on plant growth and fruit yield parameters of bell pepper (*Capsicum annuum* L.) grown under mid hill conditions of Himachal Pradesh

GD Dubey, AS Parmar, HS Kanwar, SC Verma and DK Mehta

Received : February, 2013 / Accepted : June, 2013

Bell pepper (*Capsicum annuum* L.) member of family Solanaceae and belongs to genus capsicum is one of the most important vegetable crops grown extensively in sub-temperate climate throughout the world. Himachal Pradesh is the leading supplier of high quality fresh fruits to the plains during summer and rainy seasons which bring lucrative returns to the farmers (Joshi and Shukla, 1997). However, the productivity of bell pepper is still low as compared to China, Japan and some European countries which may be due to various factors like genetic, environmental as well as supply of nutrients. Among the nutrients, the micronutrients play an important role in increasing the production of bell pepper. Though, the micro-nutrients are required in the minute quantities by the plants, but each of these play a specific role in the physiology of the plants. An economic nutrients approach involving chemical fertilizers and micro-nutrients plays a significant role in building of soil fertility and productivity of crops, because the system supplies all the nutrients judiciously to increase the fruit and good quality seed. Therefore, it is essential to adopt a strategy of nutrients management in vegetable production by using judicious combination of macro and micro-nutrients. Information available on the use of micronutrients on bell pepper production is scanty, therefore, the present investigation have been planned to assess the effect of foliar sprays of micronutrients in combination with soil application of macronutrients on bell pepper cv. California Wonder under open field conditions.

The experiment was conducted during two consecutive years i.e. in Kharif 2008 and 2009 at Research Farm of Seed Technology and Production Centre, Dr YS Parmar

University of Horticulture & Forestry, Nauni, Solan, Himachal Pradesh situated at 30°-15'N latitude and about 77°11'E longitude. The elevation of the farm is 1270 m above mean sea level, which falls under mid hill zone of Himachal Pradesh. There were 12 treatments including control and each treatment was replicated thrice. The treatments were T<sub>1</sub> (Control i.e. soil application of recommended dose of NPK and FYM), T<sub>2</sub> (T<sub>1</sub> + Zinc), T<sub>3</sub> (T<sub>1</sub> + Boron) T<sub>4</sub> (T<sub>1</sub> + Copper), T<sub>5</sub> (T<sub>1</sub> + Manganese), T<sub>6</sub> (T<sub>1</sub> + Zinc + Boron), T<sub>7</sub> (T<sub>1</sub> + Zinc + Copper), T<sub>8</sub> (T<sub>1</sub> + Zinc + Manganese), T<sub>9</sub> (T<sub>1</sub> + Boron + Copper), T<sub>10</sub> (T<sub>1</sub> + Boron + Manganese), T<sub>11</sub> (T<sub>1</sub> + Copper + Manganese) and T<sub>12</sub> (T<sub>1</sub> + Zinc + Boron + Copper + Manganese). The crop was raised following all the recommended package of practices. The observations were recorded on five randomly selected plants for various growth and yield characters.

The present studies revealed that height of bell pepper plants was significantly increased (75.53 cm) with the application of borax (T<sub>3</sub>) as compared to other treatments and control (Table-1). The beneficial effect of boron on this parameter might be due to its significant role in metabolic processes of the plant such as cell differentiation, cell division, nitrogen metabolism, active soil absorption and photosynthesis. Singh and Verma (1991) observed maximum height of tomato plants receiving 2 kg borax per hectares and concluded that boron is associated in the development of cell wall and in the process of cell differentiation and hence help in root elongation and shoot growth of plant. The beneficial effect of boron on this parameter was also reported by Sharma (1999) on this crop.

Maximum number of branches per plant was obtained with mixture of zinc sulphate, borax, copper sulphate and manganese sulphate (T<sub>12</sub>) as micronutrients are well known for development of proteins and enzymes, which act as catalyst in plant metabolism and ultimately

**Table 1:** Effect of micro-nutrients on growth and yield characters in bell pepper cv. California Wonder under open field conditions (pooled data for the year 2008 -2009)

Treatment	Days to 50% flowering	Days to first picking of fruits	Primary branches/plant	Plant height (cm)	Marketable fruits/plant	Fruit size (cm <sup>2</sup> )	Yield/ha (q)
T <sub>1</sub>	33.53	<u>72.17</u>	4.63	67.50	5.60	32.25	101.00
T <sub>2</sub>	33.73	82.50	3.86	65.73	6.20	31.78	105.60
T <sub>3</sub>	<u>28.90</u>	107.50	5.30	<u>75.53</u>	<u>9.50</u>	34.36	<u>167.50</u>
T <sub>4</sub>	35.43	118.70	3.60	65.00	6.43	29.22	90.50
T <sub>5</sub>	33.33	98.50	4.83	68.53	6.60	31.29	99.89
T <sub>6</sub>	33.73	85.17	4.03	66.53	6.76	31.61	103.30
T <sub>7</sub>	35.90	87.50	3.53	64.17	5.36	29.43	84.97
T <sub>8</sub>	34.00	81.50	4.16	65.97	5.80	31.16	91.58
T <sub>9</sub>	34.27	105.00	4.36	66.90	6.96	30.15	98.88
T <sub>10</sub>	33.17	96.00	4.96	67.73	7.20	32.37	123.80
T <sub>11</sub>	34.60	98.33	4.53	67.10	6.96	29.78	88.14
T <sub>12</sub>	32.93	76.00	<u>5.60</u>	68.10	7.60	<u>37.89</u>	150.50
CD ( p=0.05)	2.28	7.34	0.47	5.27	0.70	2.30	12.10

contribute towards the growth of the plant. Baloch *et al.* (2008) also observed highest number of branches per plant in chilli after combined application of micronutrients.

The minimum number of days to flower was recorded when the bell pepper plants were sprayed with borax i.e. T<sub>3</sub> which was at par with the application of mixture of zinc sulphate, borax, copper sulphate and manganese sulphate (T<sub>12</sub>). The beneficial effect of boron to first flowering can be attributed to the appropriate utilization of nitrogen in the process of protein synthesis resulting in rapid cell division and synthesis of native auxin. Similar results were also reported by Sood and Sharma (2004) in bell pepper.

Maximum number of fruits per plant was produced with the application of borax (T<sub>3</sub>), which was statistically different with other treatments. Sood and Sharma (2004) also inferred an increase in number of fruits per plant with the usage of borax in bell pepper. The maximum fruit length, fruit width and fruit size was recorded with the application of mixture of micronutrients i.e. zinc sulphate, borax, copper sulphate and manganese sulphate (T<sub>12</sub>). The increased fruit size by the application of boron and zinc sulphate, manganese and copper sulphate can be attributed to the proper utilization of nitrogen and synthesis of amino acids.

The highest yield per plant or per plot or per hectare was obtained with the application of borax (T<sub>3</sub>) followed by T<sub>12</sub> i.e. mixture of zinc sulphate, borax, copper sulphate and manganese sulphate. The plants sprayed with borax had early flowering, greater vegetative

growth, more number of fruits per plant and hence reflected more yield. Another possible reason for getting maximum yield with borax spray may be due to balanced nutrition to the crop from early stage of vegetative growth which ensured healthy plants, more tolerant to the attack of various diseases and pests and bear more fruits. The results are in accordance with Sharma (1999) and Sood and Sharma (2004) in bell pepper.

Finally it can be concluded that foliar application of borax (T<sub>3</sub>) @ 0.5% followed by T<sub>12</sub> i.e. mixture of zinc sulphate, borax, copper sulphate and manganese sulphate was found effective in improving plant growth and fruit yield parameters of bell pepper grown under mid hill conditions of Himachal Pradesh.

## References

- Baloch QB, Chachar QL and Tareen MN (2008) Effect of foliar application of macro and micronutrients on production of green chillies. *Journal of Agricultural Technology* 2: 177-184.
- Joshi AK and Shukla YR (1997) Diversification of vegetable crops in the temperate regions of India. *A Model Punjab Vegetable Grower* 32: 24-27.
- Sharma SK (1999) Effect of boron and calcium on seed production of bell pepper. *Veg Sci* 26: 87-88.
- Singh SS and Verma SK (1991) Influence of potassium, zinc and boron on growth and yield of tomato. *Veg Sci* 18: 122-129.
- Sood R and Sharma SK (2004) Growth and yield of bell pepper (*Capsicum annuum* var. *grossum*) as influenced by micronutrient spray. *Indian J of Agri Sci* 74: 557-559.