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EFFECT OF NPK FERTILIZERS ON CAPSICUM PRODUCTION INSIDE LOW COST POLYHOUSE

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Abstract: Capsicum is an important cash crop of Himachal Pradesh fetching reasonably high market price during off season. Keeping in view the investigations entitled "Effect NPK fertilizers on capsicum production inside low cost polyhouse" were carried out at the research farm of the Department of Agricultural Engineering, CSKHPKV, Palampur (H.P) during summer seasons of 2005 and 2006. The study aimed to find out best combination of NPK as well as the effect of different NPK levels on growth, yield and yield contributing characters of capsicum under low cost polyhouse. The experiments were laid out in RBD (factorial) with three replications. Results of the study revealed that application of 50% more of the recommended dose recorded significantly higher plant height, fruit length, fruit breadth, fruits per plant and fruit yield per plant than other levels of NPK. These effects culminated in increased fruit yield/ha with increasing level of NPK. On an average, 50% more of the recommended dose of NPK recorded 96.10% higher yield over 50% less than recommended dose of NPK.
Keywords: Polyhouse, capsicim, nutrient, NPK.

INTRODUCTION

India is the second largest producer of vegetable crops in the world. However, the production is much less than the requirement if balanced diet is provided to every individual. To cater the future vegetable needs in India, the present production of 156.33 million tonnes is to be raised to 225 million tonnes by 2020 and 350 million tonnes by 2030 (Anonymous, 2011). There are different ways and means to achieve this target viz., bringing additional area under vegetable crops, using hybrid seeds and use of improved agro-techniques etc. Another potential approach to be emphasized is the perfection and promotion of protected cultivation of vegetable crops (Rajasekar et al. 2013).

Although, India has a wide range of diverse agro-climatic conditions, but vegetable cultivation practices have generally been restricted to regional and seasonal needs. In general, protected structures are used to overcome low temperature in temperate regions or high temperature in the countries having tropical climate. In India, the area under protected

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cultivation of horticultural crops is not more than 25000 hectares and is mainly confined to Maharashtra and Karnataka (Anonymous 2013). There is a lot of potential for increasing the area manifold under low cost greenhouses in peri-urban areas for production of high value low volume vegetables during off-season to take benefit of the high price of the produce (Phookan and Saikia 2003) and to setup the vegetable production and improve its quality. Protected cultivation has tremendous potential in increasing production, productivity and quality of vegetable crops like capsicum, coloured capsicum, tomato, cherry tomato, cucumbers, muskmelon and summer squash, some rare vegetables, medicinal and ornamental plants even under adverse agro-climatic conditions. Among vegetables, capsicum is one of the crops grown in polyhouses worldwide. It is relatively easy to grow compared to tomato and cucumbers and fruit yield can be very high under polyhouse conditions.

Capsicum (*Capsicum annuum* L. var. grossum), member of solanaceae family, is one of the most important vegetable crops grown throughout the world. Capsicum is native to tropical South America and was introduced in India by the Portuguese in the middle of sixteenth century.

Bell pepper has attained a status of high value crop in India in recent years and occupies a pride place among vegetables in Indian cuisine because of its delicacy and pleasant flavour. On the nutritional part, it is rich in Vitamin C (ascorbic acid) and zinc, the two nutrients which are vital for a strong and healthy immune system. It also has high content of Vitamin A (180 IU), rutin (a bioflavonoid), ß carotene, iron, calcium and potassium (Agarwal *et al*. 2007). It is also used in salad and soup preparation. 100 gram of edible portion of capsicum provides 24 Kcal of energy, 1.3 gram of protein, 4.3 gram of carbohydrate and 0.3 gram of fat (Anonymous 2006).

It also finds place in preparations like pizza stuffing's and burger with growing popularity of fast food. The high market price is attributed to the heavy demand from the urban consumers. There is a good demand for export too. The export market needs fruits with longer shelf life, medium size tetra lobed fruits with attractive colour, mild pungency with good taste. However, the supply is inadequate due to the low productivity of the crop (Sezen *et al*. 2006). Basically bell pepper is a cool season tropical crop and lacks adaptability to varied environmental conditions. Despite its economic importance, growers are not in a position to produce good quality capsicum with high productivity due to various biotic (pest and diseases), abiotic (rainfall, temperature, relative humidity and light intensity) and crop factors (flower and fruit drop). Due to the behaviour of weather, the crops grown in open fields are often exposed to fluctuating levels of temperature, humidity, wind flow *etc*. which ultimately affect the crop productivity adversely (Basavaraja et al. 2005). Besides this, limited availability of land for cultivation hampers the vegetable production. Hence to obtain a good quality produce and production during off season, there is a need to cultivate capsicum under protected condition such as green houses or polyhouses.

The area under capsicum in the world is 1.72 million hectares with an annual production of about 27.46 million metric tonnes (Anonymous 2007), whereas in India, this crop occupies an area of 0.885 million hectares with an annual production of about 0.9 million tonnes with a productivity of 1266 kg per hectare (Sreedhara et al. 2013). In Himachal Pradesh, capsicum is extensively grown as cash crop in mid hills in an area of about 2447 hectares, producing 31810 tons including hot peppers (Anonymous 2013).

Very few attempts have been made to work out the optimum fertilizer schedules for capsicum especially under protected cultivation. It is well established fact that macro nutrients such as nitrogen, phosphorus and potassium have profound effect on crop productivity and quality. Among these three essential nutrients, nitrogen is an integral part of chlorophyll, protoplasm, proteins and nucleic acids. Consequently its deficiency checks the growth and reduces the yield significantly. Phosphorus on the other hand, participates in energy transfer, early and prolific flowering, stimulates root growth, seed and fruit development, whereas, potassium is essential for number of biological reactions. It also helps in translocation of food material to different parts of plant as well as it enhances disease and drought tolerance. Application of adequate amount of these nutrients in conformity with soil conditions and economics is a pre – requisite for exploiting the maximum genetic potential of the crop to earn maximum profit. An efficient and economic use of nutrients, ultimately helps in decreasing the input costs for raising a bumper crop. However, the farmers are unaware of fertilizer management of capsicum especially when grown under greenhouse conditions.

Keeping the above facts in view, the present investigation was undertaken during summer seasons of 2005 and 2006 to ascertain the optimum dose of N P K for exploiting the yield potential of capsicum.

MATERIAL AND METHODS

A field experiment was conducted inside low cost polyhouse at Research Farm, Department of Agricultural Engineering, CSK HPKV, Palampur situated at an elevation of 1,280 meters above mean sea level during summer seasons of 2005 and 2006. Treatments comprising five combinations of N P K viz. F_1 (50% less than recommended dose of NPK), F_2 (75% less than recommended dose of NPK), F_3 (recommended dose of NPK i.e. 100 kg N/ha, 75 kg P/ha and 75 kg K/ha), F_4 (25% more than recommended dose) and F_5 (50% more than recommended dose) were compared in randomized block design with three replications. The soil of the experimental field was clay loam in texture having pH 5.4, high in organic carbon 91.38%), low in available nitrogen (245 kg N/ha) and phosphorus (8.5 kg p/ha) and medium in potassium (260.6 kg K/ha). 1/3rd of nitrogen and full dose of phosphorus and potassium were applied at the time of transplanting. Remaining nitrogen was applied in two equal splits at 30 and 60 days after transplanting. Rest of the management practices were in accordance with the recommended package of practices of the crop. The data were recorded on four randomly selected plants in each plot for plant height (cm), days to 50% flowering, fruit length (cm), fruit breadth (cm), fruits per plant and fruit yield/plant (g). The marketable fruit yield was recorded on plot basis and was converted into quintals/ha.

RESULTS AND DISCUSSION

Application of higher dose of NPK combination significantly influenced the yield of capsicum (table 1) during both the years. Amongst different levels of NPK, application of 50% more of the recommended dose recorded significantly higher plant height, fruit length, fruit breadth, fruit per plant and fruit yield per plant than other levels of NPK. The higher level of nitrogen have a tendancy to increase protein synthesis, which subsequently cause an increase in cell size and number leading to more plant height. Theses results are in conformity with those of Montag (1999). Days to 50% flowering delayed with the increasing levels of NPK combinations from 25% less than recommended dose of NPK/ha (55.3 days) to 50% more than recommended dose of NPK 965.4 days) by 10.1 days. Delayed maturity at a higher fertility level was understandable because high nutrition, particularly N fertilization would have extended the vegetative phase. These results are in conformity with those of Bar-yosef (2001). Increased fruit length, fruit breadth, fruits per plant and fruit yield per plant due to increased application of NPK (50% more of the recommended dose of NPK) may probably be due to increase in the sufficient amount of food material manufactured by the foliage. These effects culminated in increased fruit yield/ha with increasing level of NPK. On an average, 50% more of the recommended dose of NPK recorded 96.10% higher yield over 50% less than recommended dose of NPK. These results are in agreement with those of Patel and Rajput (2000).

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Table 1. Effect of NPK levels on growth, yield attributes and yield of capsicum (Pooled data)

Treatment	Plant height (cm)	Days to 50% flowering	Fruit length (cm)	Fruit breadth (cm)	Fruit/plant	Fruit yield/plant (g)	Fruit yield (q/ha)
50% less than recommended dose	50.4	55.3	5.6	5.7	6.5	312.4	205.3
75% less than recommended dose	55.1	56.5	6.3	6.5	8.2	402.7	285.4
Recommended dose	60.5	59.7	7.8	8.2	9.4	518.2	345.5
25% more than recommended dose	63.4	63.6	8.4	8.7	10.8	815.3	390.7
50% more than recommended dose	67.5	65.4	9.2	9.4	12.6	940.6	402.6
CD (P=0.05)	1.2	0.78	0.19	0.18	0.45	10.5	16.2