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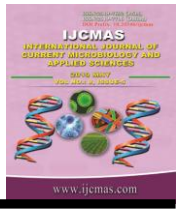

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A Review: Effect of Fertigation on Bell Pepper Grown under Protected Conditions

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A B S T R A C T

The Sweet pepper is one such vegetable known to possess many nutritional qualities and commercially being grown under the protected conditions. An important component of protected cultivation which influences productivity and quality of produce is application of fertilizers with the irrigation called fertigation. This is a regular and widely accepted practice under protected conditions. Fertigation also provides an opportunity to control the concentrates of individual nutrients in the form of soluble fertilizers to meet the crop need according to its stage of development and greenhouse environment. Hence, to obtain good quality produce and more production per unit area with efficient resource management, the practice of growing crops under protected conditions will be a boon to the small and marginal farmers. So cultivation of bell pepper under protected structure with fertigation leads to higher yield, better quality, higher benefit cost ratio. So will recommend the farmers to cultivate the bell pepper under protected conditions along with fertigation as it is going to increase their income many times.

Introduction

Vegetable crops are becoming an important alternative in diversification of agriculture and also playing a significant role in food, nutritional and health security of ever growing population in India. The Sweet pepper (*Capsicum annuum* L. var. grossum Send t; 2n = 24) also known as bell pepper, belonging to family Solanaceae and a native of Mexico with secondary center of origin in Guatemala (Heiser and Smith, 1953), is one such vegetable known to possess many nutritional qualities. Recently with the change in the food habits of the people of the country especially major cities, a scope for growing of many vegetables and their varieties which are generally consumed as raw and are very good source of nutrition, has emerged. These varieties are available in different colours which are nutritionally very rich especially in vitamins particularly A and C. (Anon., 2001). The cultivation of such varieties requires more advanced techniques for their improved production and good quality of the produce. Growing of these crops under protected conditions is one such specialized way of

farming. Such technology can also be utilized for control of environmental parameters such as temperature, relative humidity, light intensity, light reduction, CO_2 level, irrigation, nutrient supply and uptake, training stems, growing medium and controlling fertilization schedules that are essentially required for optimum plant growth and higher yields with good quality harvests (Baghel *et al.*, 2003).

The major agrotechnique which are largely important in greenhouse crop production is the optimum fertigation schedule. Important component of protected cultivation which influences productivity and quality of produce is application of fertilizers with the irrigation called fertigation. This is a regular and widely accepted practice under protected conditions. Fertigation also provides an opportunity to control the concentrates of individual nutrients in the form of soluble fertilizers to meet the crop need according to its stage of development and greenhouse environment. Hence, to obtain good quality produce and more production per unit area with efficient resource management, the practice of growing crops under protected conditions will be a boon to the small and marginal farmers.

Effect of fertigation on quantitative characters

Gowda *et al.*, (2002) observed that the maximum plant height, number of branches per plant, leaf area and dry matter production per plant were recorded in plant supplied with 75 per cent nitrogen, phosphorus plus 100 per cent potassium in addition to the inoculation of *Azotobacter, Azospirillum,* PSB and VAM. Besides, the same treatment recorded more number of fruits per plant, fruit length, fruit girth, number of seeds per fruit, dry weight of hundred fruits and higher yield of dry chillies. The maximum TSS, ascorbic acid, oleoresin and capsaicin content in dry chillies was also at this level. Application of bio-fertilizers along with reduced levels of chemical fertilizers has beneficial effects as compared to application of recommended NPK or bio-fertilizers alone.

Highest benefit

Cost ratio of 2.17 was reported by Tumbare and Bhoite (2002) when N, P, K water soluble fertilizers were applied as fertigation, through drip irrigation system in capsicum.

Studies on the application of different nitrogen and potassium doses on pepper crop grown under plastic tunnels and field conditions were carried out by Santos *et al.*, (2003) and the results showed that greenhouse plants exhibited 98, 278, 119, 67 and 92 % increase in height, leaf area, leaf dry matter, green fruit number and fruit production, respectively. The doses of water soluble fertilizers also influenced growth and fruit production.

Olaniyi and Ojetayo (2010) recorded the growth parameters such as plant height and number of leaves showed increasing response to all the treatments as the rates increased. The optimum yield of pepper was obtained from sole application of NPK at 250 kg NPK ha^{-1}.

Similarly, Ciba (2011) observed that drip fertigation with 100 per cent water soluble fertilizer along with Bio stimulants recorded highest plant height, number of primary and secondary branches, number of flowers/plant and yield and component characters. In 2011, Malik *et al.,* conducted an experiment and observed that the treatments comprising of N=150 kg/ha, P_2O_5 = 120 kg/ha, K_2O = 60 kg/ha with FYM = 40 t/ha proved better to improve the growth and yield attributing traits than other treatment combinations.. This treatment also exhibited higher vitamin C

(243.34 mg/100 g), dry matter content (9.93 g/100 g) and nitrogen (4.38 %), Phosphorus (0.46 %) and potassium (3.65 %) in fruit.

Similarly, Sabli *et al.,* (2012) observed that fertigation with N and K gradually increasing from 126.10 to 265.21 and finally 385.32 mg/L (treatment 1) increased fruits of Bell Pepper significantly by 8 % over the control. Higher yield in treatment 1 was associated with the higher leaf area, total dry matter production, number of fruits/plant and higher fertilizer use efficiency.

Bhuvneshwari *et al.,* 2013 studied the effect of nitrogen and potassium on growth and yield of capsicum and observed maximum plant height from 75kg N and 60 Kg K per ha.

Biwalkar *et al.,* (2015) studied the performance of coloured sweet pepper and observed that treatment combination (fertigation 120%and irrigation 100%) recorded the maximum fruit length, fruit width and pericarp thickness.

Effect of fertigation on yield contributing components

Studies on the application of different nitrogen and potassium doses on pepper crop grown under plastic tunnels and field conditions were carried out by Santos *et al.,* (2003) and the results showed that greenhouse plants exhibited 67 and 92 % increase in green fruit number and fruit production, respectively. The doses of water soluble fertilizers also influenced fruit production.

Similarly, an experiment was carried out by Mantur *et al.,* in 2007 the results revealed that among nutritional sources, N_2 recorded significantly higher average fruit weight (86.80g and 95.60g), fruit yield per plant (750.50g and 937.10g) and fruit yield per m^2 (3.04kg and 3.78kg) compared to N_1 and N_3 during summer and kharif respectively. The TSS of capsicum fruits did not differ significantly.

An experiment was also conducted by Shetty and Manohar in 2008 and observed that the application of 25% N through Pongamia cake+75% RDF+25t /ha farmyard manure + 5 g Azotobacter/plant significantly increased the growth parameters, i.e. plant height (64.72, 127.34 and 225.93 cm), number of branches per plant (12.47, 18.21 and 20.57) and plant spread (448.24, 981.31 and 1250.10 cm^2) when observed at 60, 90 and 120 days after transplanting, respectively. The capsicum plants responded significantly to the integrated nutrient supply.

Similarly, Khan *et al.,* conducted a field experiment during 2010 and observed that Plant height, number of branches and number of fruits per plant increased significantly with increasing nitrogen doses up to 100 kg N /ha. However, plant height and number of branches at final harvest increased significantly up to 150 kg N/ ha (N_3 treatment). On the other hand, plant height and number of branches at first harvest increased significantly with increasing levels of P up to the treatment P_1 (30 kg P/ ha), whereas plant height and number of branches at final harvest and number fruits per plant enhanced significantly with the treatment P_2 (60 kg P/ha). Considering the combined effect of nitrogen and phosphorus, the maximum plant height at final harvest were obtained from N_2P_2 (100 kg N + 60 kg P /ha). On the other hand, maximum number of fruits per plant were found in the treatment combination N_3P_1 (150 kg N + 30 kg P/ ha).

In 2010, Gupta *et al.,* also conducted a study on capsicum var Nishat 1 and the results revealed that there was significant improvement in yield, quality, water and fertilizer use efficiencies of capsicum under

drip irrigation and fertigation. The combined effect was found superior than individual effects. The treatment combination of 80 % ET through drip and 80 % recommended NPK through fertigation registered maximum fruit yield (336.48 q/ha).

Obidiebube *et al.,* (2012) recorded that The Red pepper cultivar was significantly different from other cultivars in yield with the value of 256g/plant followed by cultivar, 40 FNHVIA with 168g/plant. Cultivar, 52 Zugande performed better than other cultivars for the number of seeds per fruit. Similarly, significant interaction effects between fertilizer levels and cultivars of pepper were observed for yield parameters. The interaction of cultivar Red pepper and 360kg/ha level of fertilizer produced the highest number of fruits and the largest fresh weight per plant. Red pepper proved to be superior over other cultivars used and it may be recommended to farmers in this agroecological zone.

Vinod Sharma (2016) recorded that application of 50 % more of recommended dose recorded significantly recorded higher plant height fruit length fruit breadth fruits per plant and fruit yield per plant than other level of NPK. Rekha *et al.,* (2017) recorded the combined variance analysis indicated that experimental season were not significantly different but irrigation interval and nutrient level both influenced the growth parameter and total capsicum yield.

Mohamed Shahein *et al.,* (2018) studied the Impact of bio- and sources of organic fertilizers on sweet pepper vegetative growth, yield and quality under protected cultivation condition. And observed that the Bio fertilization gave significantly higher values of vegetative growth, NPK concentration in leaves and fruits and yield. Using organic fertilizer leaded to the greater values of vegetative growth, NPK concentration in leaves and fruits, early yield, total yield, total number of fruits per plot, and fruit length and diameter as compared to the other sources of organic manures The combined treatment between compost and bio fertilization gave the highest significant increase in vegetative growth, NPK concentration in leaves and fruits and yield whereas vitamin C and fruit firmness were decreased by using compost, bio fertilization alone or in combination.

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