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Review Article

A Review on Fertigation in Capsicum under Protected Conditions

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A B S T R A C T

Capsicum has become one of the most popular vegetables commercially grown under protected cultivation because of its adoptability in different protected structures. It is grown on large scale as an off season vegetable crop. Fertilizers and irrigation are the basic requirement of capsicum. Capsicum responds well to fertilizer applications and is reported to have a high demand for NPK. Efficient use of fertilizers and water is highly critical to sustain agricultural production. As fertilizers applied by traditional methods are generally not utilized efficiently by bell peppers, development of techniques and fertilizer regimes to improve efficiency is of paramount importance. Fertigation is the most effective way to supply water and nutrients to the plants which not only saves water but also increases yield of vegetable crops. As reported by different research workers of the world, adoption of drip fertigation in capsicum results in saving of fertilizers upto 25 per cent, water saving upto 40 percent with significant increase in yield, water use efficiency, saves labours and energy in application of fertilizer and gives better quality produce.

Keywords

Fertigation, Capsicum, Growth, Yield, Quality, Protected conditions

Introduction

India has the largest irrigation network in the world; however its irrigation efficiency has not been more than 40 per cent. Bringing more area under irrigation will largely depend upon efficient use of water. Micro irrigation plays most significant role to achieve not only higher productivity and water use efficiency but also to have sustainability with economic use and productivity. In fertigation, nutrient use efficiency could be as high as 90 per cent compared to 40 to 60 per cent in conventional methods (Solaimalai *et al.*, 2005). The amount of fertilizer lost through leaching can be as low as 10 per cent in fertigation whereas it is 50 per cent in the traditional system. Adoption of micro-irrigation systems may help to increase the irrigated area, productivity of crops and water use efficiency. Drip irrigation has proved its superiority over other methods owing to direct application of water in drip fertigation optimize the use of water and fertilizer enabling to harness high crop yield, simultaneously ensuring a healthy soil and environment. The drip fertigation technology encompasses the application of solid and liquid mineral fertilizers through drip irrigation system thus, supplying a nutrient containing irrigation water to crops. Capsicum being a high value vegetable crop needs supply of nutrients throughout its growth stages frequently. The information of standardization of exact quantity of nutrients for capsicum is lacking. Hence the efforts were made to collect the information on

various aspects of fertigation in capsicum in the form of review. This information will be useful for the students and scientists to work on this line.

Effect of fertigation on growth

While working on chilli Deolankar and Firake (1999) found that, plant height was significantly influenced by levels of fertilizers. The 125% RDSF registered significantly higher plant height (89.70 cm) followed by 100% RDSF (87.40 cm) which was at par with 75% RDSF (86.80 cm). Similarly highest plant spread (65.10 cm) was observed in 125% RDSF which was at par with 100% RDSF.

Chaudhary *et al.,* (2007) stated that the application of increased levels of nitrogen upto 200 kg N/ha, significantly improved plant growth of capsicum hybrid Indra. The application of 100per cent water soluble fertilizers under shade improved the growth parameters namely plant height, primary braches per plant, leaf area index and dry matter production at different stages of growth of tomato revealed Kavitha *et al.,* (2007).

During the assessment of capsicum growth under different levels of fertigation with 4 levels of N (0, 50, 100 and 150 kg/ha) and 3 levels of P (0, 30 and 60 kg/ha) Khan *et al.,* (2010) noticed that the maximum plant height at final harvest was obtained from N_2P_2 (100 kg N + 60 kg P ha^{-1}).

Maximum chlorophyll content of leaves and chlorophyll content of fruit in medium spacing S_2 (45x30 cm) and fertilizer level F_6 (150 kg each NPK/ha) +FYM (30 t/ha) observed by Shivakumar *et al.,* (2011). They further recorded that the leaf area index was maximum in spacing S_1 (45x45 cm) and fertilizer level F_6.

Favourable effects of the potassium on the growth, total yield and fruit parameters were reported by El-Bassiony *et al.,* (2012) when sweet pepper plants fertilized with 200 kg/fed in California wonder cultivar.

Effects of Nitrogen and Potassium on the growth and yield of capsicum with 4 levels of N (0, 25, 50 and 75 kg ha^{-1}) and 3 levels of K (0, 30 and 60 kg ha^{-1}) respectively) was assessed by Bhuvaneswari *et al.,* (2013) and found maximum plant height at final harvest from N3 K2 (75 kg N + 60 kg K ha^{-1}).

Performance of coloured sweet pepper (*Capsicum annuum* L. var. grossum) under naturally ventilated greenhouse was evaluated by Biwalkar *et al.,* (2015) and reported that different levels of fertigation and irrigation had significant effect on plant parameters, yield, WUE, FUE and quality parameters.

Effect of fertigation on yield and yield attributing characters

A case study on fertigation in India by comparing fertigation with NPK over farmers' fertilizer practice with conventional fertilizers in terms of yield, quality and monetary returns by Bachachhav (1995) revealed that fertigation at weekly intervals was found more convenient and economically profitable for the farmers.

While studying the effect of fertigation on chilli and compared the sources and levels of fertilizers, Veeranna *et al.,* (2000) reported that fertigation was found significantly superior over the conventional methods of fertilizer application in the soil in respect of yield.

Investigation by Tumbare and Bhoite (2002) on the effect of solid soluble fertilizer applied through fertigation on yield of chilli

and revealed that significantly higher yield was recorded in drip irrigation with 100 per cent recommended dose of fertilizer than the soil application with surface irrigation.

During the field experiment

Brahma *et al.,* (2010) noticed that fertigation with 100% recommended N and K recorded 61.09% increased yield over conventional fertilization in capsicum.

Khan *et al.,* (2010) assessed yield of capsicum under different levels of fertigation with 4 levels of N (0, 50, 100 and 150 kg /ha) and 3 levels of P (0, 30 and 60 kg/ ha) and noticed that maximum number of fruits per plant was found in the treatment combination N3 P1 (150 kg N + 30 kg P ha^{-1}).

Sanchita *et al.,* (2010) concluded that fertigation with 100 % recommended N and K recorded 61.09% increased yield over conventional fertilization in capsicum. Regarding quality parameters, significantly highest ascorbic acid content were recorded by 100% fertigation level. They further stated that 100% recommended N and K (120: 60 kg/ha) as fertigation improved the growth, yield and quality of the crop with highest cost benefit ratio (1: 1.72).

Response of sweet pepper (*Capsicum annum* L.) to plant density and nitrogen fertilizer under field conditions was assessed by Mohammad Hossein *et al.,* (2012) and observed that fertilization with 50 kg N/ha resulted in the highest fruit volume and plant yield.

Nagre *et al.,* (2013) reported that the Module 7, i.e. Soil: compost: sand as substrate, 20 k Pa irrigation regime, basal dose of 50 kg/ha NPK with straight fertilizers + fertigation @ 150:150:150 kg/ha NPK with straight fertilizers, black polythene mulch and variety Indra recorded significantly maximum number of fruits per plant (88.66), average fruit weight (72.48 g) and the fruit yield per plant (5.70 kg) and was observed to be the best package for high yield and better quality.

Biwalkar *et al.,* (2015) reported that Syngenta yellow variety produced maximum yield (168.74 ton ha^{-1}) under the treatment F_1I_1 (Fertilization 120 per cent and Irrigation 100 per cent).

Effect of fertigation on quality attributing characters

Kanthasamy *et al.,* (2004) concluded that fertigation with water soluble fertilizers (250: 250: 250 kg ha^{-1} NPK) exhibited better results in respect with quality and physiological parameters for the tomato hybrid SH 7611 under greenhouse.

During field experiments on sweet pepper plants cv. California wonder El-Bassiony *et al.,* (2012) found that fruit length, average fruit weight and vitamin C content, as well as leaves chemical composition (N, P, K and total chlorophyll) were increased with increasing potassium fertilization rate.

Roy *et al.,* (2011) assessed nitrogen and phosphorus efficiency on the fruit size and yield of capsicum and reported that length and width of fruit increased significantly with increasing nitrogen doses up to 100 kg N /ha.

Fertilization with 50 kg N/ha resulted to the highest fruit volume and plant yield as reported by Mohammad Hossein *et al.,* (2012) in capsicum. There were significant differences between fruit volume and fruit weight by interaction between plant density and nitrogen treatments.

In an investigation undertaken by Kanwar *et al.*, (2013) it has been reported that 100% of RDF through fertigation with black polyethylene mulch was moderately effective for fruit length (cm) in sweet pepper.

The performance of coloured sweet pepper (*Capsicum annuum* L. var. *grossum*) under naturally ventilated greenhouse was assessed by Biwalkar *et al.*, (2015) and revealed that Syngenta Red variety produced better quality parameters under the treatment F1I1 (Fertilization 120 percent and Irrigation 100 percent).The fruit length (10.37 cm), fruit width (9.20 cm), fruit girth (32.13 cm) and pericarp thickness (0.84 cm) were also found maximum in Syngenta Red.

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