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Effect of chemicals and plant growth regulator on yield and economics of capsicum under shadenet conditions

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Abstract
Capsicum (*Capsicum annuum* L.) is an important vegetable crop grown in India. Production and productivity of this crop is low because of high flower and fruit drop as well as infestation of pest and diseases. The present investigation was carried out to study the effect of different chemicals and plant growth regulator and to find out suitable chemicals and plant growth regulator. Four spray of Potassium nitrate @ 1% proved best for yield parameters in respect to average fruit weight, yield per plant, per square meter and per hectare whereas, NAA @ 60 ppm was found to be superior in respect of fruit set percent. In respect of economics, four spray of 1% KNO_3 recorded highest B:C ratio.

Keywords: Bell pepper, chemicals, plant growth regulator, yield, economics

Introduction
Capsicum (*Capsicum annuum* L. var. *grossum*) popularly known as Shimla mirch, bell pepper, sweet pepper, green pepper. From a nutritional prospective, bell pepper is rich in vitamins; chiefly, viatamin 'A' and 'C'. The produce is off-season to the plains and fetches a higher price to vegetable growers. However, productivity and quality of produce is low because of the fluctuating environment, deficiencies of micronutrient during its cultivation. Productivity of a crop is greatly affected by cultural and physiological factors. Auxins cause apical dominance, cell elongation by loosening of cell wall and, retard flower and fruit abscission. Micronutrients are usually required in minute quantities, nevertheless are vital to the growth of plant. Improvement in growth characters as a result of application of micronutrients might be due to enhanced photosynthetic and other metabolic activity which leads to an increase in various plant metabolites responsible for cell division and elongation. The present studies were, therefore, undertaken to study the effect of chemicals and plant growth regulator on yield and economics of capsicum under shadenet conditions.

Materials and Methods
The present studies were conducted at Instructional farm, Department of Vegetable Science, Dr. PDKV, Akola, Maharastra in a 50 per cent shadenet during October-March, 2019-20. The experiment was laid out in RBD with nine treatments and three replications *viz* T_1 (1% KNO_3), T_2 (1.5% KNO_3), T_3 (0.5% $ZnSo_4$), T_4 (0.75% $ZnSo_4$), T_5 (50 ppm NAA), T_6 (60 ppm NAA), T_7 (1% KNO_3 + 50 ppm NAA), T_8 (1% KNO_3 + 0.5% $ZnSO_4$), T_9 (Control). Chemicals and Plant growth regulator were applied through foliar spray at 15 days intervals on 30, 45, 60 and 75 days after transplanting. Seedlings were transplanted on 12th October, 2019-20 at a spacing of 45 x 30cm in raised beds of size 3m x 1m. Data was recorded on yield characters such as number of fruit per plant, average fruit weight, yield per plant, per square meter and per hectare**.** Standard cultural practices were followed to raise the crop as per the package of practices. Statistical analysis was done as per method suggested by Panse and Sukhatme during 1989 [4].

Table 1: Effect of chemicals and plant growth regulator on yield and economics of bell pepper

Treatments	Number of fruits per plant	Average fruit weight (g)	Yield per plant (kg)	Yield per square meter (kg)	Yield per hectare (t)
T_1	20.46	170.59	3.06	10.40	104.00
T_2	19.03	169.64	3.02	10.28	102.86
T_3	13.63	161.72	2.19	7.45	74.53
T_4	14.33	160.01	2.24	7.61	76.13
T_5	25.96	115.15	2.69	9.15	91.53
T_6	26.66	114.64	2.41	8.21	82.13
T_7	24.63	115.51	2.57	8.75	87.56
T_8	16.63	126.52	2.50	8.50	85.06
T_9	15.03	124.19	2.37	8.05	80.53
'F' Test	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.04	0.92	0.04	0.15	1.57
CD at 5%	1.42	2.77	0.13	0.47	4.73

Table 2: Effect of chemicals and plant growth regulator on yield and economics of bell pepper

Treatments	Yield per hectare (t)	B:C ratio
T_1	104.00	3.31
T_2	102.86	3.11
T_3	74.53	2.33
T_4	76.13	2.46
T_5	91.53	2.95
T_6	82.13	2.64
T_7	87.56	2.92
T_8	85.06	2.83
T_9	80.53	2.52
'F' Test	Sig.	Sig.
SE (m)±	1.57	0.01
CD at 5%	4.73	0.05

Results and Discussion

Data on number of fruits per plant, average fruit weight, yield per plant, per square meter and per hectare in Table 1 and Yield per hectare and B:C ratio is depicted in Table 2.

The yield attributing characters like number of fruits per plant (26.66), were recorded significantly maximum under the treatment T_6 (60 ppm NAA). Maximum number of fruit per plant was found in treatment T_6 (60 ppm NAA) due to the fact that more flower and fruit set induction with NAA application thus making the plants able to bear fruits early than other treatments. The main physiological change at this stage involves the diversion of inorganic and organic reserves to reproductive organs. An adequate supply of NAA has been found essential to secure a high rate of fruit set. It is possible that the level of endogenous auxins was insufficient and became optimal or beneficial only after receiving optimum NAA dose. These results are in confirmation with the findings of Tapdiya *et al.* (2018) [6] in chilli and Gare *et al.* (2017) [1] in chilli.

Yield parameters such as average fruit weight (170.59 g), fruit yield per plant (3.06 kg plant^{-1}), per square meter (10.4 kg) and hectare (104.00 t ha^{-1}) was significantly maximum in the treatment T_1 (1% KNO_3).

Amongst all treatments, maximum fruit weight, fruit yield per plant, per square meter and per hectare were observed in treatment T_1 (1% KNO_3) during the year of study. Potassium application shows a direct proportion with the size of fruits. An understanding could be developed by the phenomenon where during photosynthesis; carbon dioxide is converted into sugars which have to be transported to organs of the plant where it will store or used for growth and development. Potassium have crucial role in photosynthesis and metabolism of carbohydrates. An optimum potassium supply results in better sugar content of sink organs (Marschner, 1995). These results are in line with the findings of Kazemi, M. (2014) [3] and Kaur *et al.* (2021) [2] in tomato.

The benefit cost ratio (3.31) was found to be highest in the treatment T_1 (1% KNO_3). The benefit cost ratio was maximum in T_1 (1% KNO_3) due to maximum yield ha^{-1}. Moreover, most importantly the micronutrients are cheap in cost. Therefore, highest yield ha^{-1}, low rate of micronutrient and cheap cost of micronutrient are the major contributing for higher B:C ratio in T_1 (1% KNO_3) treatment. The above results are in agreement with Sreedhara *et al.* (2013) [5] in capsicum.

Conclusion

The yield contributing characters such as number of fruits per plant was maximum where 60 ppm NAA was applied and average fruit weight, yield per plant, per square meter and per hectare were found to be maximum with the application of 1% KNO_3. The benefit cost ratio was found to be highest (1:3.31) with the application of 1% KNO_3.

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