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Effect of fertigation on morpho-physiological traits and yield and yield components of capsicum under polyhouse condition

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Abstract
The experiment was conducted during the Rabi season year 2018-2019 at the department of plant physiology, Agricultural Biochemistry, Medicinal and Aromatic Plant under polyhouse, Indira Gandhi Krishi Vishwavidyalya, Raipur, Chhattisgarh. Six treatments of *Capsicum* cv. Indra were grown in a CRD with three replications. The plants are transplanted in polyhouse at the distance of 60 centimeter for row to row and 50 centimeter plant to plant, fustigation and other cultural package of practices were adopted for better crop growth. 5 aggressive flora have been randomly selected from each plot to report remark on different attributes. The average value of each attributes was calculated on the basis of five plants for each treatment in every replication. Observation were taken Plant height, number of leaves,leaf area,chlorophyll content, chlorophyll fluorescence vitamin and yield. The treatment T_4 exhibited better performance among the treatments.

Keywords: Fertigation, efficiency, physiological, nutrient and riboflavin

Introduction
Bell pepper also known as capsicum, sweet pepper or shimla mirch is one among the most popular vegetables grown in polyhouses worldwide. *Capsicum* is an annual herb and all the species in the genus has n=12. It is found in different shape, colour, size and degree of pungency. The bell pepper fruits are available in different attractive colours and they have great demand in markets. Bell pepper is rich in proteins, vitamin A, ascorbic acid, riboflavin, thiamin, niacin and minerals like potassium, magnesium and calcium being a cool season crop, year round production of quality bell pepper fruits is not possible in open field condition. Crops are more vulnerable to weather fluctuations in open with more pests and diseases incidence leading to low productivity as well as quality. Protected cultivation techniques can be effectively utilized for the production of good quality produce with high productivity. 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. Fertigation schedule can be adjusted to supply the nutrients according to the varying crop needs at different physiological stages. Indeterminate growth habit and overlapping of vegetative and reproductive stages in capsicum requires supplementation of nutrients up to and throughout the fruit ripening stage. Therefore, timely application of nutrients through fertigation may be particularly effective in capsicum production under protected conditions. Fertilizer use efficiency has been brought to the forefront mainly to minimize negative environmental impacts. The management of feed solution and its delivery to the crop has to be relatively flexible to meet its changing needs. It is best to start with moderate amounts of nutrients early in the season and increased concentrations as the plant grows and to change according to the growth stages of the crop with fertigation program being adjusted during the growing season to suit the plant development However, relatively little is documented on fertigation at different physiological stages, therefore, the present study investigated its effect on nutrient uptake, fertilizer use efficiency as well as on growth and yield of capsicum.

Materials and Methods
The experiment was conducted during the Rabi season year 2018-2019 at the department of plant physiology, Agricultural Biochemistry, Medicinal and Aromatic Plant under polyhouse,

Indira Gandhi krishi Vishwavidyalya, Raipur, Chhattisgarh. Six treatments of *Capsicum* cv. Indra were grown in a CRD with three replications. The transplanting of experimental material was done on 5st October 2018. The plants are transplanted in polyhouse at the distance of 60 centimeter for row to row and 50 centimeter plant to plant, fustigation and other cultural package of practices were adopted for better crop growth. 5 aggressive flora have been randomly selected from each plot to report remark on different attributes. The average value of each attributes was calculated on the basis of five plants for each treatment in every replication.

Observation were taken Plant height, number of leaves, leaf area, chlorophyll content, chlorophyll fluorescence vitamin and yield.

Table 1: Effect of Biozyme on Morpho-Physiological, Biochemical and Yield of Capsicum

Treatments	Plant height	No. of leaves/plant	Dry matter production	Chlorophyll content (SPAD Value)	Fruit diameter	No. of fruit /Plant	Fruit weight	Yield /ha
T_1 (control)	52.25	35.15	79.71	52.62	6.12	5.12	102.33	17.87
T_2 (10ppm)	64.13	52.58	84.37	58.23	6.78	6.52	105.33	25.80
T_3 (15ppm)	65.58	57.03	87.18	61.64	6.83	8.35	105.71	33.33
T_4 (20ppm)	67.89	58.56	86.30	57.05	7.12	8.44	108.83	35.13
T_5 (25ppm)	65.27	53.53	83.16	5636	6.72	7.31	104.03	26.33
T_6 (30ppm)	60.37	49.06	82.82	56.82	6.42	6.32	103.76	25.51
SEm±	1.25	2.52	1.56	3.58	1.56	2.85	4.12	3.21
CD(P=0.05)	3.84	7.59	5.45	12.54	4.85	8.56	12.36	9.70

Result and discussion

The results related to plant height has been presented in table no. 1 All the treatments were found significant at all the stages, among the treatments T_4 (biozyme@ 20ppm) resulted maximum plant height. Followed by, T_3(biozyme@ 10ppm) and Minimum plant height found under the T_1 control The increase in plant height by foliar application of biozyme can also involve in cell division and cell enlargement which helps in growth processes. Biozyme also contains primary and secondary nutrients (Mg, Fe, B, Mn, Zn, Cu and Mo) provide nourishment required for healthy plant development. These nutrients are naturally chelated and readily assimilated by plants to improve cell division and enlargement. Similar result found by Rathor *et al.* (2009), Abd El-Gawad *et al*., (2014) and Karanja *et al*.,(2013) [1, 6].

The results related to Number of leaves per plant has been presented in table 1. All the treatments were found significant among the treatments T_4 resulted maximum number of leaves per plant at all the stages. Followed by $T_3$and Minimum number of leaves per plant found under the T_1 control. Biozyme also contain Macro nutrients (N, P, K) and Nitrogen and phosphorus are + the + most important nutrients for crop production. The nitrogen contributes to the*structural*component, generic and metabolic compounds in a plant cell. Nitrogen is mainly an essential part of chlorophyll, the compound in plants that is responsible for photosynthesis process. Which help in increasing number of leaves in plants. Low nitrogen concentrationin plant leaves has been described as a limiting factor for reducing number of leaves which resulting in reducing photosynthesis processes. Similar result was found by Crouch *et al*. (1991) [2].

The data relevant to dry matter production (g) from each treatment are presented in Table 1. Different concentration of biozyme found significantly different in relation to dry matter production. Highest dry matter production was observed in T_4 followed by T_3 While the minimum dry matter production was recorded in T_1. The enhance in dry matter production might be due to the enhance in sink strength macro and micro nutrient and growth promoting hormone boost dry matter content through production of photo-assimilates via leaves which is the centre of plant growth 8 during vegetative stage and later distribution of assimilates to the reproductive organs. Similar result was found by Crouch *et al*., (1992) [2].

The data relevant to SPAD value from different concentration of biozyme are presented in table. 1 there were significant difference found among all the treatments in relation to SPAD value. Highest SPAD value recorded in T_4 followed by T_4 While minimum SPAD value was found in T_1 Control. The increase in SPAD value might due the essential nutrient present in biozyme solution. Similar result obtained by Eris *et al*., (1995) and Karanja *et al*., (2013) [3, 6]. Similar result that in the leaf tissue treated with low concentration of Biozyme liquid fertilizer increases chlorophyll content may be due to the presence of betaine were reported by Blunden and Liu yan (1997).

The maximum fruit diameter was observed under the treatment T_4 followed by T_3 While, minimum diameter was showed by T_1 - Control presented in Table 01. It may be due to the role of growth stimulating hormones for enhancing pollen germination, fertilization, cell division and elongation after pollination. Similar result observed by Eris *et al*., (1995) [3]. The increase in fruit diameter might be due to the effect of Gibberellin which affect cell elongation.Fruit diameter significantly increased with the increase seaweed extract treatment in pepper.

The result on the fruit weight presented in Table 01 there was no significant difference in different concentration of biozyme in relation to fruit weight. The maximum fruit weight was recorded in T_4Followed by T_3 Minimum fruit weight was observed in T_1- control.

However there is no any significant difference among different concentration of biozyme treatment in relation to Fruit weight. The maximum no. of fruit per plant was observed under the treatment T_4), followed by T_3 While, minimum number of fruit per plant was showed by T_1 - Control (5.11) presented in are the It might be due the macronutrient and growth regulating substance present in biozyme. The maximum number of fruit per plant might be due to foliar application of biozyme on the number, size, and yield of eggplant fruits. Similar result found by Abd El-Gawad, Osman *et al*., (2014) and Heuvelink and Körner *et al*., (2001) [1].

The maximum yield was observed under the treatment T_4 followed by T_3 While, minimum yield was showed by T_1 – Control presented in Table 4.5.4 and depicted in Fig. 01.The increase in yield might be due the efficient use of macro and micronutrient and other growth stimulating substance present in biozyme. Similar results obtained by Mondal *et al*., (2007), Manna *et al*., (2012) and Karanja *et al*., (2013) [7, 6].

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