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Effect of different Biozyme concentration for maximum yield potential in *Capsicum annum* L.

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Abstract
The present experiment was conducted in Department of Plant Physiology, Agricultural Biochemistry and Medicinal and Aromatic Plant" during Rabi in 2019-20. Experiment entitled "Effect of different biozyme concentration for maximum yield potential in *Capsicum annum* L." Under the polyhouse. The experiment laid out in Completely Block Design with Six treatments and three replications and the *Capsicum* variety is "Indra" were given at different concentration of Biozyme *viz.*, Biozyme @ 5ppm, Biozyme @ 10ppm, Biozyme @ 15ppm, Biozyme @ 20ppm, Biozyme @ 25ppm"were applied along with control (Water Spray).
Among Different concentration of biozyme, the minimum day for first flower initiation, Days to 50% flowering (37 days), Days to first fruit initiation, Days to 50% fruiting and Days to first picking of fruits was recorded in T_3 (Biozyme @ 10ppm). Similarly the treatment T_3 (Biozyme @ 10ppm) was found to be effective for Number of flower per plant, Number of fruit per plant, Total number of picking per plant, Number of seeds per plant, Fruit length, Fruit weight, Stalk length, Fruit diameter, Yield per plant, Yield per ha. Was recorded in T_3 (Biozyme @ 10ppm).

Keywords: *Capsicum annum* L., Biozyme, growth stages, phenological, fruit weight

Introduction
Capsicum annuum L. that comes from the genus 'Capsicum,' belonging to the 'Solanaceae' family. *Capsicum* is derived from the Greek word "Kapsimo" meaning "to bite." *Capsicum* is a annual herb and All the species in the genus has n=12. It is found in different shape, colour, size and degree of pungency. *Capsicum* leaves are ovate in shape and tapering to the sharp point and length is 15 cm. Dark green on the top and green on the bottom. The flowers are white, small and are carried singly or in groups of 2 or 3 in the axils of leaves. Normally, pollen in the genus of *Capsicum* occurs autogamous, but there are also cross pollination conditions (sometimes 75% of species with small, standing fruit Bell pepper flowers often abort) their pollination depends on light intensity, temperature, irregularities organic synthesis, and storage, which impairs auxin synthesis and distribution.
Foliar application of micronutrients has produced a very high amount of fruit plant^{-1}, dry fruit yield, benefit cost ratio and net income. Enhancing the rate of zinc application from three to four times does not increase the number of *Capsicum* fruit plant^{-1}. It was observed that production of crop was being negatively affected in different areas due to micronutrients deficiency. Deficiency of micronutrients has increased dramatically because of vigorous planting, loss of topsoil by soil erosion, liming of soil, loss of micronutrients by leaching and low accessibility and use of farm yard manure. Micronutrients are generally required in small quantity; however they are important for plant growth. The development of growth factors due to the application of micronutrients may be increase the rate of photosynthesis and other metabolic activities which leads to raise in various plant metabolites which is responsible for cell division and cell elongation and also Photosynthesis is enhanced in the presence of zinc and boron.
Biozyme is an eco-friendly non-toxic profitable growth stimulant that contributes to the plant physiological system at lower concentration and is known to be rich in precursor of auxin and cytokinins, an enzyme and hydrolyzed protein is a storehouse of natural nutrients found in the *Ascophyllum nodosum* Norwegian seaweed (Kumar *et al.*, 2000) [34].

Ascophyllum nodosum is a large, brown algae or cold seawater in the Fucaceae family, being the only species of the genus *Ascophyllum*. It is that seaweed that only grow in the northern Atlantic Ocean, known in areas as Norwegian kelp, rockweed, eggs wrack, kelp knot or wrack knot. It is common on the north-western coastal area of Europe including east Greenland and the North-Eastern coastal area of North America, its range further south of these latitudes being restricted by warmer ocean waters and it containts both macronutrient(N, P and K) and micronutrients (Ca, Mg, S, Cu, Mn, Zn, Fe, etc.). It also contains auxin, cytokinins like gibberellins, polysaccharides, betaines, mannitol, organic acids, proteins and amino acid, all of which are highly valuable and extensively used in agriculture. It contains nutrients in a naturally chelated form which helps to improve cell division and cell enlargement resultant into better chlorophyll content and increase production. It also help in improving plants natural self defence system, which results in healthier crop with low pest stress. *Capsicum* is one of the most important vegetable plants grown in the whole country. Biozyme is an suitable plant growth regulator that contains macro and micro nutrients, cytokinins, abscisic acid, auxins, amino acids and vitamins that promote cellular growth in plants treated with improved fruit yielding and post-harvest quality features. The properties of Biozyme hydrolysis proteins that increase complex uptake of unavailable nutrients to be used in plants.

Material and Methods

The course of investigation entitled Effect of different biozyme concentration for maximum yield potential in *Capsicum annum* L." experiment was conducted during the Rabi season year 2019-20 at the department of plant physiology, Agricultural Biochemistry, Medicinal and Aromatic Plant under polyhouse, College of Agriculture, Indira Gandhi Krishi Vishwavidyalya, Raipur, Chhattisgarh, India. Six treatments of *Capsicum* cv. Indra were grown in a complete block design with three replications. The transplanting of experimental material was done on 31st October 2019. The plants are transplanted in polyhouse at the distance of 60 centimeter for row to row and 45 centimeter plant to plant, fertigation and other cultural package of practices were adopted for better crop growth. The application of different treatments is given in Table.1. Different treatments is given in Table.1. Observation were recorded on five randomly selected plants in each treatment i.e. Phenological parameters: Days to first flower initiation, Days to 50% flowering, Days to first fruit initiation, Days to 50% Fruiting and Days to first picking of fruits., Yield and Yield attributes: No. of flower" per plant, "No. of fruits per plant, total numbers of picking per plant, Fruit length (cm), Stalk length (cm),"Number of seeds per plant, "fruit diameter (cm), fruit weight (g), fruit yield per plant (kg), yield" t/hac.of fruits were analyezed at Maturity Stage.

Table 1: Different concentration of biozyme used

S.N	Treatments	Biozyme foliar spray@ppm
1.	T_1	Control
2.	T_2	5ppm
3.	T_3	10ppm
4.	T_4	15ppm
5.	T_5	20ppm
6.	T_6	25ppm

Results and Discussion

The minimum days to first flowering (33.00 days) was observed under the treatment T_3 (biozyme @ 10 ppm) followed by T_2 (biozyme @ 5 ppm) (34.67 days) While, maximum number of days to first flowering was showed by T_1- Control (37.33 days)*presented*in Table 2. The*early*flowering*and*fruiting*in*the*treated plants might be due to the fact that such*plants*were*able to build suitable carbohydrate reserves eafmrly. Similar results observed by Arthur *et al*. (2003) [7] The earliest*days*to 50% flowering (37.00 days) was observed under the treatment T_3 (biozyme@10ppm), which was significantly superior over other treatments followed by T_2 (37.33 days) While, the maximum number of days to 50% flowering was showed by T_1 - Control (41.67 days).*Presented*in the Table 2. Phosphorus and potassium play important role in the plant breathing and is essential for flower formation. Similar results found by Arthur *et al*., (2003) [7]. The earliest days to first fruiting (46.67 days) was observed under the treatment T_3 (biozyme 10 ppm), which was*significantly*superior*over*other*treatments followed*by T_2 (biozyme @ 5 ppm) (47.33 days) While, maximum*number*of*days*to*first*fruiting*was showed by T_1 - Control (51.66 days)*presented*in*Table2. The flowering intensity as well as pollination effectiveness*are directly correlated with tomato, pepper, and eggplant yield.*Fruiting*in*the*treated*plants*might*be*due to the fact that such plants were able to build suitable carbohydrate reserves early. Similar result obtained by Arthur *et al*., (2003) [7]. The earliest days to 50% fruiting (55.33 days) was observed under the treatment T_3 (biozyme@10ppm), which was significantly superior over the other treatments followed by T_4 (biozyme@15ppm) (57.33 days) While, maximum number of days to 50% fruiting was showed by T1 - Control (60.67 days)*presented*in*the* (Table 2). Similar results were found by Arthor *et al*., (2003), Stirk *et al*., (2003) [7] and Van staden *et al*., (2003). The earliest days to first picking of fruits (66.67days) was observed under the treatment T_3 (biozyme @ 10 ppm), which was significantly superior over other treatments followed by T_2 (biozyme 5 ppm) (68.67 days) While, maximum number of days to 50% fruiting was showed by T_1 - Control (72.66 days)*Presented*in the Table 2. Similar results were observed by Arthor *et al*., (2003), Stirk *et al*., (2003) [7] and Van staden *et al*., (2003) [7]. The result related to number of flowers per plant as influenced by different concentration of Biozyme has been presented in Table. 3. The result showed that the flower formation in *Capsicum* affected significantly. Maximum*number*of* flower*per*plant*observed under the treatment T_3 (13.13), followed by T_5 (12.26) and minimum number of flowers per plant recorded under the treatment T_1 (10.23). The*maximum*number*of*flowers*per*plant*might*be due to the macro and micro nutrient that contribute the growth of flower in plant. Similar*result*was*reported by Gore *et al*., (2007). The maximum no. of fruit per plant (8.33)*was*observed*under*the*treatment T_3 (biozyme @ 10 ppm), followed by T_4 (biozyme @ 15 ppm) (7.46) While, minimum number of fruit per plant was showed by T_1 - Control (5.11)*presented*in*are*the*(Table 3). 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) [2] and Heuvelink and Körner *et al*., (2001). The maximum Total number of picking per plant (3.10) was observed under the treatment T_3(biozyme @ 10 ppm) followed by T_4 (biozyme @ 15ppm) (3.00) while the minimum total number of picking per plant observed in T_1- control (2.20) presented in (Table 3). The maximum number of seeds per fruits (123.63) was observed under the treatment T_3 (biozyme @ 10ppm) followed by T_6 (biozyme @ 25 ppm) (122.33) while minimum number of seeds per fruits observed in T_1 - control (118.16)*presented*in*(Table 3).However, the effect of different*concentration*of biozyme on number of seeds per fruits was not significant. The result on the fruit length (cm)*presented*in*Table*3. There*was*no significant *difference in different concentration of biozyme in relation to Fruit length. The maximum fruit length (7.10 cm) was recorded in T_3 (biozyme @ 10 ppm). Followed by T_6 (biozyme @ 10 ppm) (6.87). Minimum fruit length was observed in T_1 control (5.93). However there is no any significant difference among different concentration of biozyme treatment in relation to Fruit length. The result on the fruit weight*presented*in*Table*.3.*there was no significant difference in different concentration of biozyme in relation to fruit weight. The maximum fruit weight (104.71 g) was recorded in T_3 (biozyme@10ppm). Followed by T_2 (biozyme @ 5 ppm) (104.33 g). Minimum fruit weight was observed in T_1- control (101.33 g).However there is no any significant difference among different concentration of biozyme treatment in relation to Fruit weight. The result on the stalk length (cm)*presented*in*Table 3. There was no significant difference in different concentration of biozyme in relation to stalk length. The maximum stalk length (3.77cm) was recorded in T_3 (biozyme @ 10 ppm). Followed by T_5 (biozyme @ 20 ppm) (3.70 cm). Minimum stalk length was observed in T_1 control (3.23 cm). However there is no any significant difference among different concentration of biozyme treatment in relation to stalk length. The*maximum*fruit*diameter (6.86 cm) was observed under the treatment T_3 (biozyme @ 10 ppm) followed by T_4 (biozyme @ 15 ppm) (6.77 cm) While, minimum diameter was showed by T_1 - Control (6.03 cm) presented in Table 3. 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) [23]. 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 maximum yield per plant (0.87 kg) was observed under the treatment T_3 (biozyme @ 10 ppm), followed by T_4 (biozyme @ 15 ppm) (0.76 kg) While, minimum yield was showed by T_1 – Control (0.51 kg). Presented in Table 2. The maximum yield (32.34t ha $^{-1}$) was observed under the treatment T_3 (biozyme @ 10 ppm), followed by T_4 (biozyme @ 15 ppm) (28.14 t ha $^{-1}$) While, minimum yield was showed by T_1 – Control (18.88 t ha $^{-1}$)*presented*in*Table*3. 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) [42], Manna *et al*., (2012) [41] and Karanja *et al*., (2013) [33]. The higher yield in this study might be due to the efficient absorption of nutrient and other elements which raise the production and translocation of dry matter from source to sink. It helps to increase the number of fruit per plant and control the dropping of fruit. Similar result was reported by Navrot *et al*., (1976) [43]. However, the effect of different concentration of biozyme on*total*number*of picking*per*plant*was*not*significant.

Table 2: Effect of different concentration of biozyme on Phenological parameters of *Capsicum annum* L

Treatment details	Days to first flower initiation	Days to 50% flowering	Days to first fruit initiation	Days to 50% fruiting	Days to first picking of fruits
T_1(control)	37.33	41.67	51.66	60.67	72.66
T_2(Biozyme @5ppm)	34.67	37.33	47.33	57.33	68.67
T_3(Biozyme@10ppm)	33.00	37.00	46.67	55.33	66.67
T_4(Biozyme@15ppm)	36.66	38.33	47.66	57.66	69.33
T_5(Biozyme@20ppm)	35.33	37.66	48.33	58.33	69.66
T_6(Biozyme25ppm)	35.66	38.67	48.67	58.66	70.00
S.Em±	0.69	0.38	0.97	0.78	1.01
CD (P=0.05)	2.16	1.19	3.02	2.43	3.17
CV (%)	3.39	1.73	3.47	2.33	2.53

Table 3: Effect of different concentration of biozyme on Yield and yield attributes of *Capsicum annum* L

Treatment details	Number of flower per plant	Number of fruit per plant	Total Number of picking per plant	Fruit length (cm)	Number of seeds per fruit	Fruit Weight (g)	Stalk length (cm)	Fruit Diameter(cm)	Yield per plant(kg)	Yield per ha.(t)
T_1(control)	10.23	5.11	2.20	5.93	118.16	101.33	3.23	6.03	0.51	18.88
T_2(Biozyme @5ppm)	10.93	6.50	2.66	6.03	119.50	104.33	3.46	6.76	0.67	24.81
T_3(Biozyme@10ppm)	13.13	8.33	3.10	7.10	123.63	104.71	3.77	6.86	0.87	32.34
T_4(Biozyme@15ppm)	12.16	7.46	3.00	6.50	121.33	102.83	3.67	6.77	0.76	28.14
T_5(Biozyme@20ppm)	12.26	7.33	2.33	6.56	121.67	103.03	3.70	6.70	0.74	27.32
T_6(Biozyme25ppm)	11.60	6.33	2.66	6.87	122.33	102.76	3.53	6.43	0.65	24.50
S.Em±	0.55	0.33	0.25	0.48	2.95	1.66	0.13	0.08	0.04	1.13
CD (P=0.05)	1.71	1.04	NS	NS	NS	NS	NS	0.27	0.14	3.53
CV (%)	8.13	8.51	16.45	12.78	4.23	2.78	6.34	2.28	11.26	7.55

Conclusion

It can be concluded that Biozyme spray was the best option for crop growth and Yield of *Capsicum annum* L. and in increasing the yield because it regulate physiological process. The findings revealed that treatment T_3(biozyme@10ppm) spray recorded the maximum Days to 50 percent flowering, Days to first flowering, Days to first fruiting, Days to 50 percent fruiting, Days to first picking of" fruits, No. of

flower" per plant, "No. of fruits per plant, total numbers of picking per plant, Fruit length (cm), Stalk length (cm),"Number of seeds per plant, "fruit diameter (cm), fruit weight (g), fruit yield per plant (kg), yield "t/hac.

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