Original Research Article

"ASSESSMENT OF BIOEFFICACY BY USING BIOSTIMULANTS ON GROWTH, QUALITY, AND YIELD OF CHILLI (*Capsicum annum L.*)"

ABSTRACT

The field experiment entitled "Assessment of bioefficacy by using biostimulants on growth, quality and yield of chilli (capsicum annum l.)". was conducted during rabi season 2022 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj, (U.P).The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with 16 treatments including control which were replicated thrice. The results from the present investigation concluded that bio stimulant which is applied in T 8 Dollar 2.5ml / L was found superior in all aspects viz, Average Plant height (62.80), Average number of Primary branches (4.33),Average number of secondary branches (8.36), Plant surface area (56.62 cm2), No of days of flowering (52.81), Average number of flowers/cluster (12.42), Average number of flower/ plant (61.96), no of fruits/plants (73.66), Fruit length (12.26cm), fruit girth (2.85cm), Average Yield (612.81 gm), yield/kg (3.68 kg), Yield tonn/ha (22.68), Total soluble solids (^{0}Brix) (5.22), Ascorbic acid (118.52 mg/100g).Among the treatment maximum net profit in T8 (Dollar 2.5ml / L) @ Rs/ha is 314765.85 & B:C ratio is 3.26 were recorded significantly higher compared to other treatments.

Key words: *chilli; biostimulents; Growth; Yield and Fruit Quality*

1. INTRODUCTION

Chilli (Capsicum annum L.) is one of the most important vegetable cum spice crops in the Indian subcontinent. It has originated in Mexico, Southern Peru and Bolivia. In 2020, 36 million tonnes of green chilli peppers were produced worldwide. It seems that the genetic potentiality of the varieties to increase their production has already been reached saturation. Chilli belongs to the genus Capsicum which are members of the nightshade family Solanaceae, cultivated for their pungency. It is a diploid (2n=24) species and genetically self-pollinated and chasmogamous crop whose flowers open only after pollination. The numerous races of chillies are broadly divided in to two species: Capsicum annum L. and Capsicum frutescens L. **(Paul et al., 2013).** Chilli peppers are widely used in many cuisines as a spice to add "heat" to dishes. Capsicum and related compounds are known as carcinoids are the substances giving chilli peppers their intensity when ingested or applied totally. It is mainly cultivated for three constituents of fruits viz., capsaicin, capsanthin and oleoresin. Undoubtedly, chilli is a pungent stimulant, its pungency is due to the presence of a crystalline volatile alkaloid called “capsaicin” (C18 H28 NO3, 8-methyl-N-vanillyl-6- none amid) in the cross wall or septum of the fruits. Green chillies are rich in vitamin ‘A’ and ‘C’ and the seeds contain traces of starch **(saimbhi et al.,1997)** In addition, peppers are a good source of most B vitamins and vitamin B6 in particular. Regardless of the scale of the agricultural business, growers face issues affecting plant growth and crop yields. This constant problem prompts farmers to adopt new technology as the world changes. Some farmers have turned to biostimulants as advanced horticultural technology to help solve their plant growth and crop production problems. Experts claim that biostimulants reduce the need for plant inputs, like fertilizers and pesticides while maintaining an ideal quality and quantity of crop output. With less input and a constant or possibly higher output, any grower would naturally assess their options to improve their farming productivity **(Ruban S. J et al. ,2019)** Biostimulants are a new type of agricultural additive product that many European experts have observed to improve plant growth and crop yields. Biostimulants have no direct action against pests and therefore do not fall within the regulatory framework of pesticides. Biostimulants can improve food crop quality through biofortification,enhancing the plant’s nutritional composition, such as their sugar and protein content. Biostimulants are substances or microorganisms that can be applied to plants to enhance their growth, development, and productivity. They can stimulate plant growth by improving nutrient uptake, increasing stress tolerance, and enhancing plant metabolism. In chilli crop

production, biostimulants can play a vital role in improving crop performance and yield. Biostimulants can enhance root growth and development, leading to improved nutrient uptake and water absorption. This can result in healthier plants with higher yields.Chilli plants can be subjected to various stresses, such as drought, high temperatures, and diseases. Biostimulants can help plants cope with these stresses by improving their resistance and resilience.Enhanced fruit quality can improve the quality of chilli fruits by increasing their size, color, and flavor. This can increase market value and profitability.Improved soil health can promote beneficial microbial activity in the soil, leading to improved soil health and fertility. This can create a more favorable environment for chilli crop growth. **(Baranowska. 2018)** There are various types of biostimulants that can be used in chilli crop production, including plant growth-promoting substances, humic substances, and beneficial microorganisms. The choice of biostimulant will depend on the specific needs of the crop and the growing conditions.Their use in chilli farming has become increasingly popular in recent years as farmers seek to improve crop yields and quality.The introduction of biostimulants in chili farming involves applying these substances at different stages of plant growth, such as seed germination, transplanting, and flowering. Biostimulants can be applied through foliar sprays, soil drenches, or seed treatments. An hypothesis concerning the function of biostimulants is that they enhance plant productivity as they interact with plant signaling processes and reduce the negative plant responses to non-lethal stress that all crop plants are experiencing to varying degrees. **(Aspasia Efthimiadou.2020)**. Biostimulants are compatible with the most advanced farming techniques used in integrated crop management. Natural plant biostimulants are important in sustainable crop production systems and to enhance nutrient use efficiency, abiotic stress tolerance and crop quality improving root development, enhancing plant growth and vigor, boosting stress tolerance, and improving yield and quality **(Hazra Dipak Kumar and Purkait Aloke,2020).** Biostimulants can also help reduce the use of synthetic fertilizers and pesticides, which can have negative impacts on the environment and human health.Overall, the introduction of biostimulants in chili farming offers a promising way to improve crop productivity and sustainability while reducing the use of harmful chemicals. In general, seaweed extracts, even at low concentrations, are capable of inducing an array of physiological, plant responses, such as promotion of plant growth, improvement of flowering and yield, and also enhanced quality of products, improved nutritional content of edible product as well as shelf life. **(Dhriti**

Battacharyya, Mahbobeh Zamani Babgohari, 2015). Plant biostimulants have contents that benefit the natural plant processes without necessarily providing additional nutrients for a plant. sea weed extracts containg , cytokinins, auxins, or other hormone-like compounds have been utilised in agriculture as soil conditioners or plant growth stimulators **(Hamza and suggars, 2001).** Biostimulants impact several metabolic activities such as respiration, photosynthesis, nucleic acid synthesis, and ion uptake.Biostimulants influence metabolic and enzymatic processes in plants, thus increasing their yield and quality.

Therefore, keeping the above facts in mind, the investigation was carried done to enlighten the assessment of bio-efficacy by using biostimulants on chilli crops.

2. MATERIALS AND METHODS

The experiment was conducted during rabi season 2022 in Departmental research field of Department of Horticulture and Sciences, Prayagraj. The area is situated on the south of Prayagraj on the right bank of Yamuna at Rewa Road at a distance of about 6 km from Prayagraj city. It is situated at 250.8ºN latitude and 810.50ºE longitudes on elevation of 98 meters from the sea level. This region has sub-tropical climate with extreme of summer and winter the temperature falls down to as low as 1ºC-2ºC during winter season especially in the month of December and January. The mercury rises up to 46ºC-48ºC during summer the average rain fall in this area is around 1013.4nm annually with maximum concentration during July to September with few showers and drizzles in winter also the soil type was sandy loam in nature with pH varies from 7.0-8.0 and low in organic carbon, nitrogen and phosphorus.

The experiment was carried out to Assessment of biostimulants on growth, quality, and yield by using variety NS 1701 DG (Namdhari Seeds Pvt. Ltd.) of (*Capsicum annum L.*) cultivated in open field and biostimulents were applied in the form of foliar spray by concentrated dosage. The randomized block design (RBD) was adopted, with 16 treatments and three replications, resulting in a total of 45 plots. The chilli plants were transplanted with a spacing of 60 cm x 45 cm. The experimental field measured 14 m in length and 7 m in width, providing a total area of 98 sq. m. Each plot had a size of 1.5 m x 1.5 m. Flood irrigation was employed, utilizing a sub-irrigation channel with a size of 0.5 and a main irrigation channel with a width of 1 m. the treatments were given with concentrations of Denim @ 2, 2.5 and 3.0 ml per litre, Rado @ 2, 2.5 and 3.0 ml per litre, Dollar @ 2, 2.5, and 3.0 ml per litre, Cobra @ 0.5, 1.0 and 1.5 ml per litre and R-cot @ 2, 2.5 and 3.0 ml per litre on 30, 60 and 90 days

after transplanting. whereas water was sprayed on control plants. All the package of practices were followed as per recommendations to raise a quality crop. A study was conducted to assess the impact of following a recommended package of practices on the quality of a crop. The practices were implemented accordingly, and observations on growth, yield, and quality parameters were recorded for five randomly selected plants from each treatment per replication. The data collected was analyzed using the analysis of variance (ANOVA) technique with a randomized block design. The level of significance was set at 5% ($p < 0.05$).

Table 1.0 List of treatments

S. No	Treatments	Notation
1	Control (water spray)	T_0
2	Denim 2 ml / L	T_1
3	Denim 2.5 ml / L	T_2
4	Denim 3.0 ml / L	T_3
5	Rado 2 ml / L	T_4
6	Rado 2.5 ml / L	T_5
7	Rado 3.0 ml / L	T_6
8	Dollar 2 ml / L	T_7
9	Dollar 2.5 ml / L	T_8
10	Dollar 3.0 ml / L	T_9
11	Cobra 0.5 ml / L	T_{10}
12	Cobra 1.0 ml / L	T_{11}
13	Cobra 1.5ml / L	T_{12}
14	R-Cot 2ml / L	T_{13}
15	R-Cot 2.5 ml/ L	T_{14}
16	R-Cot 3.0 ml / L	T_{15}

3. RESULTS AND DISCUSSION

3.1 Assessment of bio-stimulants in chilli for growth and floral parameters.

The observations pertaining to chilli, as influenced by biostimulants, were recorded and statistically analyzed and furnished data in Table 2 indicates significant differences regarding the vegetative parameters like plant height, number of primary and secondary branches, plant spread,number of days for first flowering, number of flowers per cluster and number of flowers per plant treated with different concentrations of biostimulants.

The maximum plant height(cm) was recorded in T_8 (Dollar 2.5 ml/L) with (24.76cm, 42.47cm, 62.80cm at 30,60,90 DAT, respectively) followed by T9 (Dollar 3.0 ml/L) with (23.63cm, 41.80cm, 61.94cm). While the minimum plant height was recorded in T0 (Control -water spray) with (12.38cm, 31.71cm, 50.68cm at 30,60,90 DAT, respectively. the application of biostimulants can potentially lead to improved plant height due to increased cell division, cell elongation and presence of auxin or auxin like components such as amino acids, humic acids, seaweed extracts, and beneficial microorganism. These components can promote root growth and nutrients absorption, which can support overall plant development, including height.These findings are in similar line with **sarojinee et al. (2009)** in chilli**; Ruban et al. (2019)** in brinjal. .

The maximum number of primary and secondary branches was recorded in T8 (Dollar 2.5 ml/L) with 4.33cm and 8.36cm, followed by T9 (Dollar 3.0 mlml/ L) with 4.16cm and 8.27cm. While the lesser number of primary and secondary branches were registered in T0 (Control-water spray) with,2.68 and 5.85cm respectively. Increased branches could be due to influence of foliar application of biostimulents as biostimulents supply essential nutrients required for growth and development Seaweed extracts are rich in natural plant growth regulators, trace elements, and other beneficial compounds. They can enhance plant growth, root development, and branching. The findings of **sarojnee et al. (2009)** in hot pepper are in support of above results.

The maximum plant spread(cm) was recorded in T8 (Dollar 2.5 ml/L) with (16.58cm, 35.12cm, 56.62cm, at 30,60,90 DAT, respectively) followed by T9 (Dollar 3.0 ml 1/L) with (16.24cm, 34.14cm, 55.68cm). While the minimum plant spread was recorded in T0 (Control -water spray) with (10.99cm, 25.72cm, 47.75cm at 30,60,90 DAT, respectively). Seaweed-based biostimulants contain natural plant growth hormones, trace elements, and other beneficial compounds. They can enhance root development and stimulate lateral branching, resulting in increased plant spread ~~by~~ **Hatwar et al., (2003)** and **Hazra et al., (1987)**

The maximum days taken for first flowering was recorded in T8 (Dollar 2.5 ml/ L) with 57.05 followed by T9 (Dollar 3.0 ml/ L) with56.21. While the minimum days for first flowering was recorded in T0 (Control -water spray) with 52.09 respectively. Treatment by seaweed extract-based biostimulants having plant growth -promoting capacity and aiding in improving the overall plant resilience are highly desirable.Seaweed extracts also triggered early flowering, flower to fruit ratio. These increases in flower numbers and size, fruit set inevitably led to an improvement in yields

These findings are in conformity with those of **Omar Ali (2021).**

The maximum number of flowers per cluster was recorded in T8 (Dollar 2.5 ml/ L) with 12.42 followed by T9 (Dollar 3.0 ml/ L) with 11.35. While the minimum flower per cluster was recorded in T0 (Control -water spray) with 5.36 respectively. Seaweed-based bio-stimulants have been found to have positive effects on promoting flower clusters in plants. These bio-stimulants contain humic acid compounds that can influence the flowering and fruiting processes through various metabolic activities, including photosynthesis. This enhanced nutrient availability and utilization contribute to the development of healthier and more abundant flower clusters in chili plants. similar reference are denoted by **Fathima PS, Denesh GR (2013)** in chilli

The maximum number of flowers per plant was recorded in T8 (Dollar 2.5 ml/L) with 61.96 followed by T9 (Dollar 3.0 ml/L) with 60.71. While the minimum no of flowers per plants was recorded in T0 (Control -water spray) with 52.59 respectively. Biostimulant application enhances the number of fruits per plant in chilli by stimulating flower initiation, improving pollination and fertilization, and increasing fruit set. Bio stimulants,such as seaweed, along with promote flower bud differentiation, enhance flower viability, and ultimately contribute to an increased yield of fruits per plant in chilli crops.Similar conclusions were inferred by **Shubha *et al.*, (2019)**~~;~~ in potato.

3.2 Assessment of bio-stimulants in chilli for yield and quality parameters.

The observations pertaining to chilli, as influenced by biostimulants, were recorded and statistically analyzed ~~and furnished data~~ in Table 3 ~~indicates~~ significant differences regarding the yield and quality parameters like number of fruits per plant, fruit length, fruit girth, fruit yield per plant, fruit yield per plot, fruit yield per hectare, total soluble solids and ascorbic acid content.

The maximum number of fruits per plant was recorded in T8 (Dollar 2.5 ml/L) with 73.66 followed by T9 (Dollar 3.0 ml/L) with 72.44. While the minimum fruits per plant was recorded in T0 (Control -water spray) with 58.00 respectively. Biostimulents, along with seaweeds, play a significant role in enhancing more fruits in chilli crops. biostimuents with their small particle size ensure efficient nutrient absorption and uptake, providing essential elements for fruit development. These results are in close conformity with the findings of **shubha et al., (2019); mehdi abd baharan *et al.*, (2014)** in brinjal.

The maximum fruit length(cm) was recorded in T8 (Dollar 2.5 ml/L) with 12.26 followed by T9

(Dollar 3.0 ml/L) with 12.06. While the minimum fruit length was recorded in T0 (Control -water spray) with 9.85 respectively. Biostimulants along with seaweeds, enhances fruit length, biostimuents with their small particle size ensure efficient nutrient absorption and uptake, providing essential elements for fruit development. Their balanced application in seaweed form enhances nutrient availability, leading to improved fruit length and quality in chili crops, thereby increasing overall yield potential. These results are in close conformity with the findings of **shehata et al(2019)** in sweet pepper, **Sarojnee et (2021)** in tomato, **Sarhan (2011)** in potato, **fathima and denesh (2013)** in chilli.

The maximum fruit grith(cm) was recorded in T8 (Dollar 2.5 ml/L) with 2.85 followed by T9 (Dollar 3.0 ml/L) with 2.77. While the minimum plant height was recorded in T0 (Control -water spray) with 1.54 respectively. fruit girth is influenced by genetic factors, environmental conditions, and cultural practices. While biostimulants can enhance plant growth and productivity, they may not necessarily directly increase fruit girth. However, by improving overall plant health and vigor, biostimulants may indirectly contribute to fruit development and potentially result in larger fruit. Similar reference is denoted by **Fathima and Denesh (2013) and sarhan (2011) and Versha Kumari *et al*., (2017)** in chilli.

The maximum average yield per plant(gm) was recorded in T8 (Dollar 2.5 ml/L) with 612.81 followed by T9 (Dollar 3.0 ml/L) with 566.5. While the minimum yield was recorded in T0 (Control -water spray) with 309.26 respectively. When seaweed biostimulants are applied to chilli plants, they can stimulate root growth, leading to increased nutrient absorption and improved water uptake. This can result in enhanced overall plant vigor and productivity. similar reference denoted by **B. Sakthivel and k. Manivannan (2021)** biostimulants on growth, yield and quality parameters of chilli.

The maximum average yield per plot(kg) was recorded in T8 (Dollar 2.5 ml/L) with 3.68 followed by T9 (Dollar 3.0 ml/L) with 3.39. While the minimum plant height was recorded in T0 (Control -water spray) with 1.89 respectively. When seaweed-based biostimulants are applied to crops, they can improve in every aspect of nutrient uptake, root development, stress tolerance, and overall plant health. This leads to enhanced productivity and increased yield per plot. Similar reference denoted by **B. N. Gare*, p. U. Raundal and a. V. Burli (2017)** in growth and yield of rainfed chilli.

The maximum yield per hectare(tones) was recorded in T8 (Dollar 2.5 ml/L) with 22.68 followed by T9 (Dollar 3.0 ml/L) with 20.95

While the minimum plant height was recorded in T0 (Control -water spray) with 11.45 respectively. This might be due to better availalability of nutrience with the application of biostimulents which contain seaweed, protein hydrolysate and aqua which promote yield as per quality traits. Similar results were reported by **Fathima and Denesh (2013) in chilli; Osman and Gawad (2014)** in brinjal.

The maximum T.S.S (0Brix) was recorded in T8 (Dollar 2.5 ml/L) with 5.22 followed by T9 (Dollar 3.0 ml/L) with 5.19. While the minimum T.S.S was recorded in T0 (Control - water spray) with 3.3 respectively. The application of seaweed-based biostimulants can indeed increase the synthesis of secondary metabolites, including capsaicinoids—the compounds responsible for the pungency of chili pepper. **Fathima and Denesh (2013) and Sarojnee et al (2009) in chilli and Sarhan (2011)** in potato reported similar results.

The maximum ascorbic acid content was recorded in T8 (Dollar 2.5 ml/L) with 118.52 followed by T9 (Dollar 3.0 ml/L) with 117.84.While the minimum ascorbic acid was recorded in T0 (Control -water spray) with 110.58 respectively. The biostimulants balanced application in liquid form improves seaweed availability, leading to increased ascorbic acid levels in chilli fruits. This enhancement in ascorbic acid contributes to improved nutritional value and quality of chili crops. Similar inferences were also concluded by **shubha et al., (2019), Parani and Nanthini (2021); manas *et al.*, 2014** in chilli.

3.3 Assessment of bio-stimulants on economical analysis in chilli.

The observations pertaining to chilli, as influenced by biostimulants, were recorded and statistically analyzed and ~~furnished~~ data in Table 4 indicates significant differences of data regarding the economics of different treatments. The economic analysis of biostimulants in chilli cultivation included the costs of various agricultural practices, protection measures, land rent, labor, and farm machinery. The total fixed cost of cultivation amounted to INR 1,25,578. The total yield of chilli was multiplied by the market price to calculate the gross return. After deducting the total cost of cultivation and middleman margins from the gross return, the net return was determined. T8 (Dollar 2.5 ml/L) had the highest gross return per hectare at INR 4,53,600, followed by T9 at INR 4,19,000. T0 had the lowest gross return per hectare at INR 2,29,000. Similarly, T8 had the highest net return per hectare at INR 3,14,765.85, followed by T9 at INR 2,79,417.08. T0 had the lowest net return per hectare at INR 1,03,422. The cost-benefit ratio was highest for T8 at 3.26, followed by T9 at 3.05, and lowest for T0 at 1.82.

Table 2. Assessment of different biostimulants on vegetative growth and flowering parameters of chilli.

Treatments	Growth parameters								Floral parameters		
	Plant height (cm)			Number of branches		Plant spread (cm^2)			Number of days for 1st flowering	Number of flowers/ clusters	Number of flowers/ plants
	30 DAT	60 DAT	90 DAT	primary	secondary	30 DAT	60 DAT	90 DAT			
Control (water spray)	12.38	31.71	50.68	2.68	5.85	10.99	25.72	47.75	52.09	5.36	52.59
Denim 2 ml / L	13.19	32.70	51.74	2.77	6.21	11.27	26.97	48.67	52.81	6.15	53.72
Denim 2.5 ml / L	15.47	35.86	54.67	3.53	6.75	12.79	28.64	50.48	53.70	7.48	55.69
Denim 3.0 ml / L	14.79	34.41	53.79	3.48	6.57	12.57	28.73	49.19	53.55	7.05	54.59
Rado 2 ml / L	18.69	38.58	56.70	3.67	7.57	13.53	30.84	52.83	55.00	8.85	57.64
Rado 2.5 ml / L	20.81	39.48	58.81	3.78	7.64	14.67	32.53	53.68	55.34	9.18	58.77
Rado 3.0 ml / L	17.73	37.36	56.62	3.62	7.25	13.85	30.29	52.79	54.11	8.34	56.77
Dollar 2 ml / L	22.36	41.28	60.54	3.94	8.17	15.70	33.96	54.84	56.06	10.55	59.84
Dollar 2.5 ml / L	24.76	42.47	62.80	4.33	8.36	16.58	35.12	56.62	57.05	12.42	61.96
Dollar 3.0 ml / L	23.63	41.80	61.94	4.16	8.27	16.24	34.14	55.68	56.21	11.35	60.71
Cobra 0.5 ml / L	16.58	36.55	55.68	3.56	7.1	13.66	30.03	51.32	54.11	8.15	56.65
Cobra 1.0 ml / L	19.74	39.08	57.72	3.71	7.53	14.69	31.83	53.25	55.13	9.14	58.18
Cobra 1.5ml / L	21.71	40.78	59.92	3.83	7.95	14.82	32.89	54.69	55.68	9.65	59.12
R-Cot 2ml / L	13.80	33.56	52.62	2.88	6.26	11.49	27.47	48.84	53.05	6.38	54.49
R-Cot 2.5 ml/ L	14.79	34.45	52.94	3.42	6.34	12.74	27.92	49.09	53.41	6.88	54.48
R-Cot 3.0 ml / L	15.48	35.23	54.91	3.58	6.84	13.27	29.95	50.80	53.72	7.84	55.78
F-Test	S	S	S	S	S	S	S	S	S	S	S
C.D. at 5%	0.57	0.70	1.11	0.09	0.14	0.24	0.57	0.87	0.96	0.17	1.04
CV	1.91	1.13	1.18	1.44	1.15	1.06	1.12	1.01	1.06	1.17	1.09
SE(d)	0.28	0.34	0.54	0.0.04	0.07	0.12	0.28	0.43	0.47	0.08	0.51

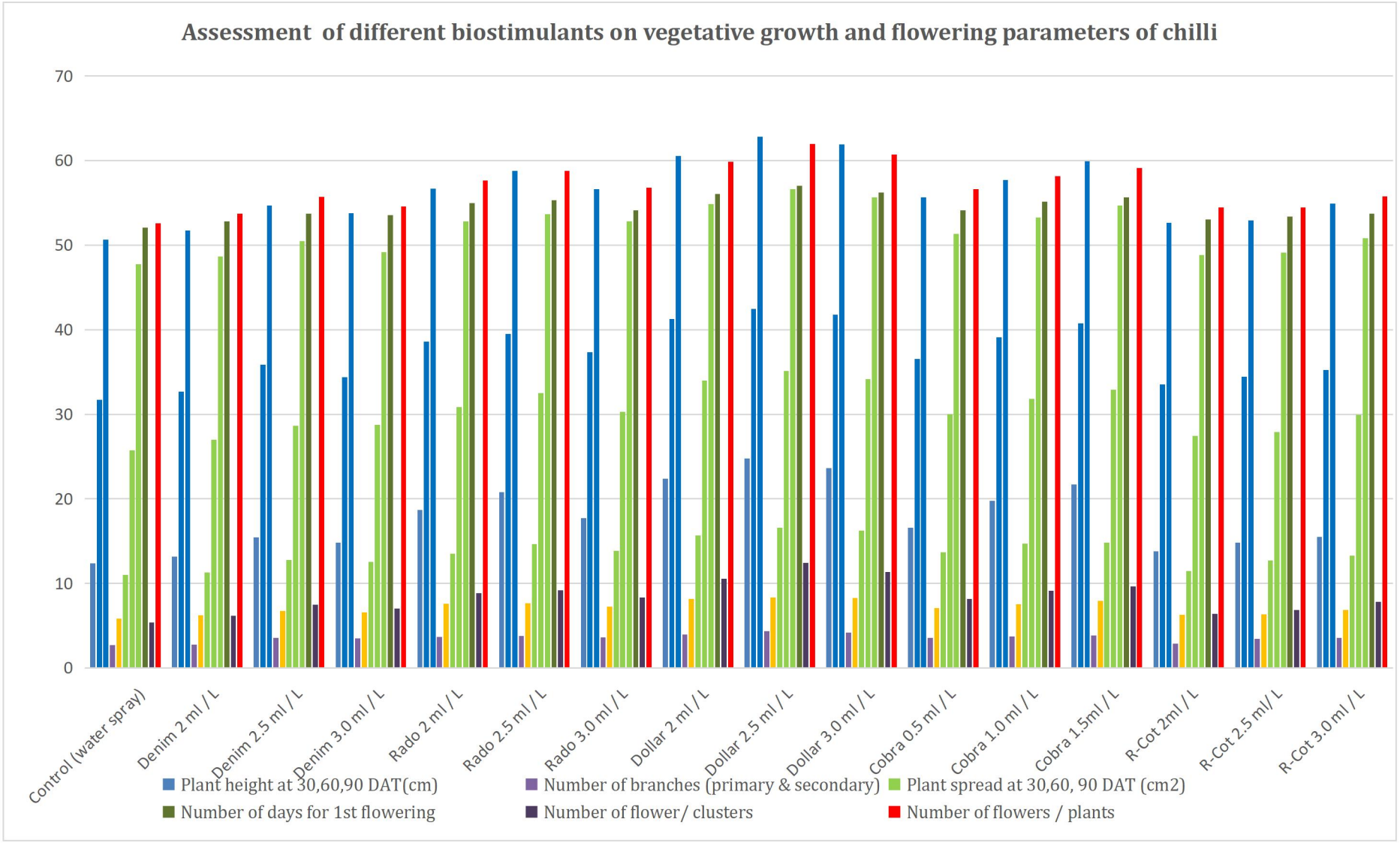

Fig 1. Assessment of different biostimulants on vegetative growth and flowering parameters of chilli

Table 3. Assessment of different biostimulants on yield and quality parameters of chilli

Treatments	Yield parameters						Quality parameters	
	Number of fruits/plant	Fruit length(cm)	Fruit girth (cm)	Yield/plant (gm)	Yield/plot (kg)	Yield/hectare (T)	T.S.S (0Brix)	Ascorbic acid (mg/100g)
Control (water spray)	58	9.85	1.54	309.26	1.89	11.45	3.3	110.58
Denim 2 ml / L	61.88	10.23	1.66	333.77	2.04	12.34	3.6	111.01
Denim 2.5 ml / L	63.66	10.57	1.97	413.78	2.52	15.3	3.87	113.69
Denim 3.0 ml / L	62.88	10.98	1.84	409.44	2.45	15.14	3.62	113.11
Rado 2 ml / L	67.22	10.99	2.44	426.48	2.55	15.77	4.21	114.67
Rado 2.5 ml / L	67.55	10.35	2.65	432.52	2.62	15.99	4.59	115.41
Rado 3.0 ml / L	66.11	11.80	2.24	420.97	2.52	15.55	4.17	114.81
Dollar 2 ml / L	71.88	12.02	2.73	561.8	3.42	20.78	4.92	117.26
Dollar 2.5 ml / L	73.66	12.26	2.85	612.81	3.68	22.68	5.22	118.52
Dollar 3.0 ml / L	72.44	12.06	2.77	566.5	3.39	20.95	5.19	117.84
Cobra 0.5 ml / L	65.77	10.77	2.13	420.58	2.55	15.55	4.14	114.32
Cobra 1.0 ml / L	67.33	10.93	2.56	426.84	2.56	15.77	4.42	115.23
Cobra 1.5ml / L	68	11.38	2.73	449.59	2.69	16.62	4.91	116.10
R-Cot 2ml / L	62.66	10.76	1.74	337.8	2.08	12.5	3.11	112.22
R-Cot 2.5 ml/ L	62.77	10.97	1.81	339.76	2.07	12.56	3.44	112.67
R-Cot 3.0 ml / L	65.33	11.46	2.05	417.55	2.5	15.44	4.3	113.74
F-Test	S	S	S	S	S	S	S	S
C.D. at 5%	1.55	0.84	0.04	123.75	0.75	4.58	0.09	2.66
CV	1.42	4.52	1.10	17.26	17.03	17.28	1.28	1.39
SE(d)	0.76	0.41	0.02	60.59	0.37	2.24	0.04	1.30

Table 4. Assessment of different biostimulants on the economics of chilli.

Treatments	Gross returns @rs/ha	Net profit @rs/ha	Benefit: cost ratio
Control (water spray)	229000	103422	1.82
Denim 2 ml / L	246800	111110.9	1.81
Denim 2.5 ml / L	306000	167783.13	2.21
Denim 3.0 ml / L	302800	162055.35	2.15
Rado 2 ml / L	315400	179710.9	2.32
Rado 2.5 ml / L	319800	181583.13	2.31
Rado 3.0 ml / L	311000	170255.35	2.20
Dollar 2 ml / L	415600	279417.08	3.05
Dollar 2.5 ml / L	453600	314765.85	3.26
Dollar 3.0 ml / L	419000	277514.61	2.96
Cobra 0.5 ml / L	311000	182338.67	2.41
Cobra 1.0 ml / L	315400	183655.34	2.39
Cobra 1.5ml / L	332400	197572.01	2.46
R-Cot 2ml / L	250000	114310.9	1.84
R-Cot 2.5 ml/ L	251200	115510.9	1.85
R-Cot 3.0 ml / L	308800	168055.35	2.19

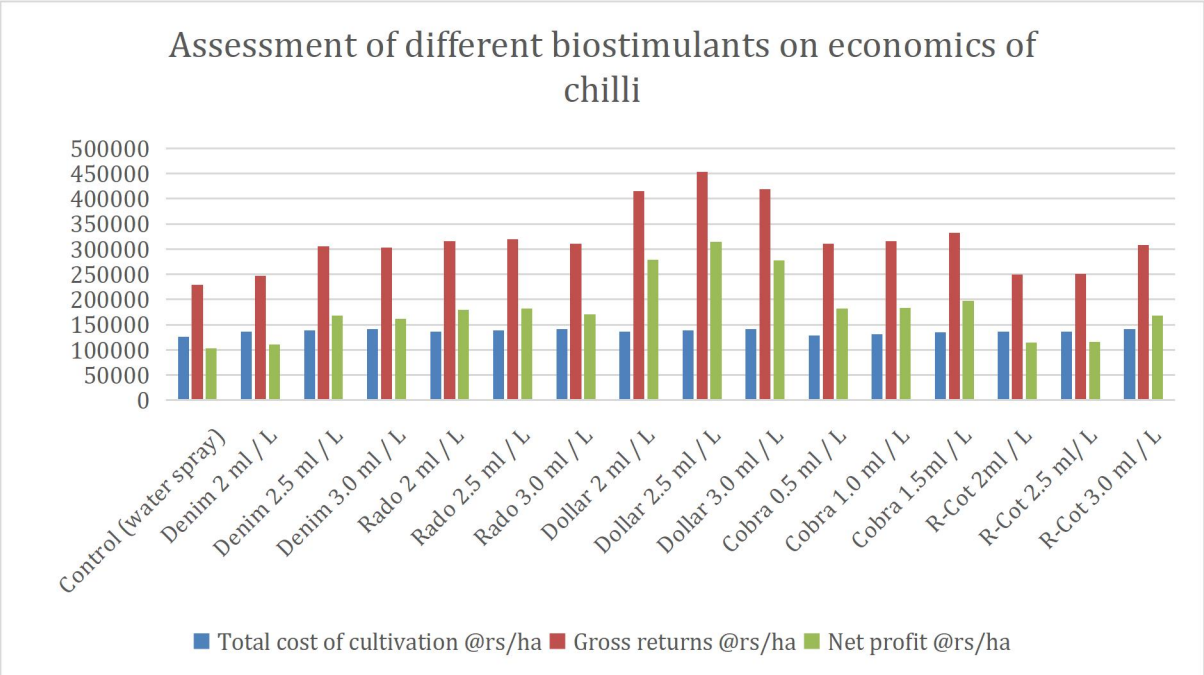

Fig 2. Assessment of different biostimulants on economics of chilli

4. CONCLUSION

The results from the present investigation concluded that bio stimulant which is applied in T_8 Dollar 2.5ml/L was found superior in all aspects like Average Plant height, Average number of branches, Plant surface area (cm2), No of days of flowering, Average number of flowers/cluster, Average number of flower/ plant, Fruit length (cm), fruit girth (cm), Average Fruit weight/plot (gm), Average Yield /plant (gm), yield/kg, Yield/hectare (tone) Total soluble solids, & Ascorbic Acid (mg/100g) .The dollar is only a supplement and not a substitute for fertilizers, compatible with all commonly used insecticides/ fungicides. The composition of the dollar is protein hydrolysate 15.0%, seaweed extracts 15.0% aqua 70.0% and total composition is 100.0%. Due to the composition of Protein hydrolysate contains essential amino acids, micronutrients, and growth factors that stimulate plant yield and quality.It enhances nutrient uptake, improves root development, increases stress tolerance, and enhances overall plant vigor. Dollar highly works as a bio-stimulant for better growth and yield of chilli plants and is followed by cobra instead of Denim, Rado, and R-Cot. Among the treatment maximum net profit in T8 (Dollar 2.5ml/L) @ Rs/ha is 314765.85 & B:C ratio is 3.26.

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