"Efficiency of different Bio Stimulants on Chilli Crop under Prayagraj Agro Climatic Conditions"

Notes: The words with red color words are meaning the words after correction.

Abstract

A present investigation was carried out with title "**Efficiency of different Bio Stimulants on Chilli Crop Under Prayagraj Agro Climatic Conditions**" at the central research farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during kharif, 2022 with a view to identify the effects of different doses bio stimulants and its role in growth, yield and quality of Chilli variety TMPH-409. The experiment was laid in the randomized block design with 13 treatments and 3 replications with different combination of bio stimulants. Under this experiment, overall, 13 treatments were taken including control. Different bio stimulants used comprised of Yalex, Leader, Jackpot and Robo, virtue all four at different doses of 0.5 ml, 1.0 ml, 1.5 ml, 2.0 ml, 2.5 ml and 3.0 ml and mix with water each. From the above experiment finding it may be concluded that the treatment of 3.0 ml L^{-1} Water

(Jackpot) was found to be best in the terms of growth viz, plant height, days to first flowering, days to 50% flowering, number of fruits per plant and in terms of yield viz, average fruit weight, Yield per plant, Yield per Hectare and in terms of quality viz, TSS and Ascorbic acid.

Keywords: TMPH -409, Stimulants, Yalex, Leader, Jackpot, Robo

1.Introduction

Chilli *(Capsicum annum)* are berries belonging to family Solanaceae, it is one of the most valuable commercial crops grown in India and consumed as green (as vegetable) and dry fruit (as spice). It has its center of origin in American tropics. It is used as spice in a variety of cuisines all over the world as a basic ingredient. Capsicum not only gives attractive colour and flavour to the foods but also provides vitamin C, vitamin A, vitamin B complex, vitamin E and minerals. Capsaicin present in chilli pepper is used as medicine for treatment of many human diseases like Lumbago, Neuralgia, Rheumatic disorders and non-allergic Rhinitis, etc. (**Muralidharan *et al.*, 2002).**

Chilli (*Capsicum annuum*L.) is an important spice crop grown extensively in most parts of Maharashtra. The fruits are available in the market throughout year since chillies are produced in all the seasons in one or other part of the state. The production of chilli is governed not only by the inherent genetic yield potential but it is greatly influenced by several environmental factors and management practices. The production of chilli is adversely affected due to flower and fruit drop which is caused by physiological and hormonal imbalance in the plants particularly under unfavorable environments, such as extremes of temperature i.e., too low or high temperatures **(Verma *et al.*, 2020).**

Vegetables play a major role in Indian agriculture and responsible in solving problems of malnutrition among human population. Growing vegetable crops generate greater employment potential in rural areas bringing national security. India is the second largest producer of vegetables after China and contributes about 12 percent of the world vegetable production **(Nayak *et al.*, 2016)**.

A large number of microorganisms present in rhizosphere have been considered to be important in sustainable agriculture because of their biocontrol potential and ability to promote plant growth. Bacteria that inhabit the rhizosphere and are beneficial to plants are termed **Plant Growth Promoting Rhizobacteria**

(PGPR). PGPR exhibit direct and indirect mechanisms as plant growth promoters and biological control agents. Direct mechanisms by PGPR include enhanced nutrient mobility, nitrogen fixation, denitrification, siderophore and phytohormone production. Indirect mechanisms of PGPR include production of antibiotics, *viz.* 2,4Diacetyl phloroglucinol (DAPG), phenazine, pyoluteorin and pyrrolnitrin against pathogenic fungi and bacteria, reduction of iron available to phytopathogens in the rhizosphere, synthesis of fungal cell wall lysing enzymes **(Jalili *et al*., 2012).**

2.Materials and Methods:

2.1 Experimental Site and Location: The experiment was conducted during kharif season of the year 2022 atHorticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The experimental site is located in the sub–tropical region which is located at 25^0. 271 N latitude, 81^0. 561 E longitude and 98 m above the mean sea level.

3.Table 1. Details of treatment combination

Treatment Symbol	Treatment Combinations
T1	Control (RDF)
T2	0.5 g L -1Water (Yalex)
T3	1.0 g L-1 Water (Yalex)
T4	1.5 g L-1 Water (Yalex)
T5	2.0 ml L -1 Water (Leader)
T6	2.5 ml L -1 Water (Leader)
T7	3.0 ml L -1 Water (Leader)
T8	2.0 ml L -1 Water (Jackpot)
T9	2.5 ml L -1 Water (Jackpot)
T10	3.0 ml L -1 Water (Jackpot)
T11	2.0 ml L -1 Water (Robo)
T12	2.5 ml L -1 Water (Robo)
T13	3.0 ml L -1 Water (Robo)

2.2 Climate Condition

The area of Prayagraj district comes under subtropical belt in the South east of Uttar Pradesh, which experience extremely hot summer and cold winter. The maximum temperature of the location reaches up to 46^0C – 48^0C and seldom falls as low as 4^0C – 5^0C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually. Prayagraj has a sub- tropical and semi- arid climate with rain mostly during July-September.

2.5 Statistical analysis the statistical analysis of the data was carried out using STATISTICA (7.0) software.

3. Results and Discussion Growth parameters

Crop growth parameters in chilli were measured in terms of days to germination plant height (cm), Plant spread at 30, 60, 90 DAT and at Harvest are shown in Table 2. The maximum number of days taken to germination of plants with the treatment T_2 (0.5 g L 1Water (Yalex) was 6.80 days and the minimum number of days to germination was found the treatment (control). The application of bio stimulants might have improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plant which might have promoted the early germination. Similar Finding were reported **(Kumar *et al.*, 2020).**

Maximum height was reported in 3.0 ml L^{-1} Water (Jackpot) with an average height of 104.40 cm followed by 3.0 ml L^{-1} Water (Robo) (T_{13}) with an average height recorded 101.87 cm which was significantly higher from rest of treatments. All the treatments significantly increase plant height as compared to control. Minimum plant height 95.90 cm was recorded (T_1). The present study was in line with **Choudhary *et al.*, (2012)** who studied the effect of plant growth regulators on physiological parameters, soil temperature, picking patterns and yield in capsicum and reported that chili plants had higher plant height.

The highest number of primary branches per plant at 90 DAS was observed in 3.0 ml L^{-1} Water (Jackpot) (T_{10}) (8.73) which were statistically at par with all other treatments. All the bio stimulants had the positive effect on generating and retaining higher number of branches per plant. Least number of primary branches per plant was recorded in control (T_1) (5.67). Favorable weather and moisture of the soil are the important parameters affecting the number of branches per plant. It was concluded that a greater number of branches were recorded in bio stimulants treated plots as compared to control. It might be due to favorable microclimatic conditions and soil moisture conservation with the use of bio stimulants which results in better vegetative growth leads to increase in number of branches per plant. The present study finds support of (**Singh *et al.*, 2017).**

The leaf area index of 186.91 was recorded with the 3.0 ml L^{-1} Water (Jackpot) (T_{10}) application which was significantly higher as compared to rest of treatments. Minimum value of leaf area index 163.12 was reported (T_1) which was significantly lower from rest of treatments.

It took about 82.53 days after transplanting which was significantly earlier from rest of treatments days after transplanting. Among bio stimulants treatments minimum number of days taken to flower initiation was observed (T_{10}) (82.53) followed by 3.0 ml L $^{-1}$ Water (Robo) (T_{13}) (82.13) and the further perusal of the data revealed application the maximum number of days were taken by plant to reach days to 50 % flowering by the application 3.0 ml L $^{-1}$ Water (Jackpot) (T_{10}) took 89.47 days followed by 3.0 ml L $^{-1}$ Water (Robo) (T_{13}) 89.40 days after transplanting. Consistency in availability of nutrients through bio stimulants means might have supplemented the additional nutrient requirement caused due to early flowering coupled with concomitant increase in flower number and consecutive fruit development. **(Khalil and Shinwani 2020).**

The observation regarding flowering viz., fruit length (cm), fruit Weight (g), fruit girth (cm), fruit diameter (cm), number of fruits per plant, yield per plant (g), yield per ha (q), TSS and Ascorbic acid were shown in Table 3.Maximum fruit length was observed in 3.0 ml L $^{-1}$ Water (Jackpot) (T_{10}) (7.96 cm), Maximum fruit Weight was observed in 3.0 ml L^{-1} Water (Jackpot) (T_{10}) 2.74cm and minimum Weight observed with control treatment (2.12 cm), Maximum fruit girth was observed in 3.0 ml L^{-1} Water (Jackpot) (T_{10}) 2.06 cm and minimum fruit girth observed with control treatment (1.85 cm) and Maximum fruit diameter was observed in 3.0 ml $^{L\ -1}$ Water (Jackpot) (T_{10}) (0.62 cm). The reason of maximum fruit length might be due to increase in the production of leaves, ultimately in photosynthesis, higher amount of carbohydrates production and translocation from source (leaves) to sink (reproductive parts) resulted increase in fruit length observed by **Saraswathi *et al.*, (2003)**.

The maximum number of fruits (118.02) was recorded in (T_{10}) which was significantly higher from rest of the treatments. Among the rest of treatments number of fruits differ significantly which was as 3.0 ml L $^{-1}$ Water (Jackpot) (T_{10}) (118.02) and 3.0 ml L $^{-1}$ Water (Robo) (T_{13}) (88.82). The minimum number of fruits per plant i.e., 49.64 recorded in the control treatment which was lower significantly. Maximum fruit yield per plant i.e., 242.23 g was obtained in 3.0 ml L $^{-1}$ Water (Jackpot) (T_{10}) which was significantly higher from rest of the treatments followed by 3.0 ml L $^{-1}$ Water (Robo) (T_{13}) (182.34 g), and 2.5 ml L $^{-1}$ Water (Jackpot) (T_9) (164.33 g). The minimum fruit yield per plant i.e., 104.55 g recorded from the plot which was kept control (T_1) and it was significantly lower from rest of treatments. The data showed that maximum yield of 89.72 (q/ha) with the treatment (T_{10}) was reported using bio stimulants were followed by treatment(T_{13}) with the value of 67.54 (q/ha). Minimum fruit yield of chili was recorded in weedy check (T_1) (38.72) which was significantly lower from rest of treatments.

The popularity of bio stimulants in agriculture is associated with the possibility of obtaining higher yields without the need to discontinue the production of ecological crops. According to numerous scientific studies, bio stimulants have a positive effect on yielding plants. The yield is usually determined as the amount of fruit obtained from one plant or plot. The yield depends on the type of bio stimulant used, the dose, the method of application, and the plant variety. Increased yield is often associated with improving the quality of vegetables or fruit. This is particularly important in organic farming, where artificial fertilizers cannot be used **(Kumari *et al.*,2016).**

Among the various treatments, application 3.0 ml L^{-1} Water (Jackpot) (T_{10}) maximum increase in ascorbic acid content of 143.62 mg/100g. The Followed by ascorbic acid content of (T_{13}) 141.97 mg/100g. Similar finding of using these bio stimulants, fruit taste values improved significantly, as evidenced by the increase in the level to an average of Ascorbic acid content. **(Rouphael *et al.*, 2018).**

. Among the treatment used T_{10} treatment with (4.57) and have highest TSS ^{0}Brix which were significantly superior than T_1 (Control) and other treatment. The maximum TSS value in Chilli was recorded in T_{10} with 4.57 ^{0}Brix and the minimum was recorded in T_1 (Control) with 3.87 ^{0}Brix. Bio stimulants can affect a number of the chemical properties of fruits and vegetables, including dry mass, acidity or vitamin content. The chemical composition of the fruit directly affects their palatability. It is assumed that fruits with a content of dissolved solids (SSC) above 12^0 Brix are characterized by an excellent taste. In the first year of using bio stimulants containing the biopolymers of polysaccharides, humic and fulvic acids as well as carboxylic acids, the average value of SSC in apricots stood at 10.7^0 Brix. In the second year of using these bio stimulants, fruit taste values improved significantly, as evidenced by the increase in the SSC level to an average of 14.1^0 Brix. **(Rouphael *et al.*, 2018)**

Table 2: Effect of different bio stimulants on plant growth regulators of chilli (*Capsicum annum* L.)

Sr no.	Treatments	Days to Germination	Plant height (cm)				Number of branches		Leaf area index	Days to Ist flowering	Days to 50% flowering
			30 DAT	60 DAT	90 DAT	At HARVEST	60 DAT	90 DAT			
T_1	Control (RDF)	6.00	**16.4**	**42.93**	**70.70**	**95.90**	**4.20**	**5.67**	**163.12**	**80.13**	**86.4**
T_2	0.5 g L -1Water (Yalex)	6.80	17.00	43.07	71.00	98.53	4.40	5.73	166.25	80.4	87.07
T_3	1.0 g L-1 Water (Yalex)	6.40	17.20	43.33	73.13	98.60	4.40	5.73	170.33	80.47	87.2
T_4	1.5 g L-1 Water (Yalex)	6.67	17.40	43.80	74.00	100.13	4.67	6.27	173.29	81.00	88.00
T_5	2.0 ml L -1 Water (Leader)	6.47	17.27	43.40	73.47	99.40	4.47	6.00	171.70	80.60	87.40
T_6	2.5 ml L -1 Water (Leader)	6.13	17.60	45.53	74.47	100.93	5.07	6.67	176.51	81.40	88.40
T_7	3.0 ml L -1 Water (Leader)	6.00	17.87	46.13	74.87	101.00	5.20	6.73	177.08	81.47	88.87
T_8	2.0 ml L -1 Water (Jackpot)	6.67	17.60	45.20	74.33	100.73	4.73	6.60	175.55	80.20	88.13
T_9	2.5 ml L -1 Water (Jackpot)	6.53	21.47	49.47	76.20	101.40	5.33	6.87	179.11	81.73	88.93
T_{10}	3.0 ml L -1 Water (Jackpot)	6.60	**27.20**	**56.67**	**80.07**	**104.40**	**7.07**	**8.73**	**186.91**	**82.53**	**89.47**
T_{11}	2.0 ml L -1 Water (Robo)	6.20	17.60	43.93	74..20	100.20	4.73	6.4	173.73	81.27	88.07
T_{12}	2.5 ml L -1 Water (Robo)	6.40	21.40	47.00	75.67	101.27	5.27	6.73	178.13	81.47	88.87
T_{13}	3.0 ml L -1 Water (Robo)	6.20	23.73	54.93	77.73	101.87	6.13	7.87	183.61	82.13	89.40
F-Test		**NS**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S. Ed. ±	**0.57**	**0.52**	**1.92**	**2.17**	**1.92**	**0.37**	**0.38**	**4.51**	**0.86**	**0.84**
CD at 5%	**1.18**	**1.07**	**3.97**	**4.48**	**3.97**	**0.77**	**0.79**	**9.31**	**1.77**	**1.73**
CV	**10.91**	**3.30**	**5.06**	**3.56**	**2.35**	**9.04**	**7.11**	**3.15**	**1.29**	**1.17**

Table 3: Effect of different bio stimulants on plant growth regulators of chilli (*Capsicum annum* L.)

Sr no.	Treatments	Fruit length (cm)	Fruit Weight (cm)	Fruit Diameter (cm)	Fruit Girth (cm)	No. of fruit/plant	Yield/plant (gm)	Yield/ha. (q/ha)	Ascorbic acid (mg/100gm)	TSS (^{0}Brix)
T_1	Control (RDF)	**7.06**	**2.12**	**1.85**	**0.57**	**49.64**	**104.55**	**38.72**	**133.08**	**3.87**
T_2	0.5 g L -1Water (Yalex)	7.10	2.16	1.89	0.58	62.40	130.37	48.29	136.26	3.88
T_3	1.0 g L-1 Water (Yalex)	7.12	2.16	1.90	0.59	65.27	136.10	50.41	136.49	3.90
T_4	1.5 g L-1 Water (Yalex)	7.19	2.20	1.91	0.59	70.84	145.75	53.98	136.95	4.15
T_5	2.0 ml L -1 Water (Leader)	7.14	2.18	1.90	0.58	68.53	139.74	51.76	136.90	4.14
T_6	2.5 ml L -1 Water (Leader)	7.27	2.27	1.92	0.59	75.07	155.37	57.55	139.19	4.26
T_7	3.0 ml L -1 Water (Leader)	7.28	2.30	1.92	0.59	76.27	158.46	58.69	139.60	4.30
T_8	2.0 ml L -1 Water (Jackpot)	7.24	2.25	1.92	0.59	73.07	151.77	56.21	138.30	4.23
T_9	2.5 ml L -1 Water (Jackpot)	7.35	2.32	1.94	0.58	80.80	166.33	61.61	140.51	4.42
T_{10}	3.0 ml L -1 Water (Jackpot)	**7.96**	**2.74**	**2.06**	**0.62**	**118.02**	**242.23**	**89.72**	**143.62**	**4.57**
T_{11}	2.0 ml L -1 Water (Robo)	7.20	2.21	1.92	0.59	71.64	149.75	55.47	138.26	4.19
T_{12}	2.5 ml L -1 Water (Robo)	7.31	2.31	1.94	0.59	78.94	164.53	60.94	140.27	4.33
T_{13}	3.0 ml L -1 Water (Robo)	7.64	2.38	1.96	0.59	88.82	182.34	67.54	141.97	4.48

F-Test	S	S	S	S	S	S	S	S	S
S. Ed. ±	0.16	0.05	0.005	0.01	1.31	2.87	1.06	2.08	0.13
CD at 5%	0.32	0.11	0.01	0.02	2.69	5.92	2.19	4.30	0.27
CV	2.62	2.85	1.14	0.70	2.12	2.25	2.25	1.84	3.82

CONCLUSION

From the above experiment finding it may be concluded that the treatment of T10- 3.0 ml L^{-1} Water (Jackpot) was found to be best in the terms of growth viz, plant height, days to first flowering, days to 50% flowering, number of fruits per plant and in terms of yield viz, average fruit weight, Yield per plant, Yield per Hectare and in terms of quality viz, TSS and Ascorbic acid. The treatments T_{10}, T_{13}, T_9, T_{12}, T_7, T_6, T_8, T_{11} in the terms of the economics give better result in comparing with the remaining one that is T_1, T_2, T_3, T_5, T_4 these treatments don't give good result in comparing with the other treatments. From above all the treatments T_{10} was the best treatment in all the perspective.

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