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Efficiency of different bio stimulants on chilli crop under Prayagraj agro climatic conditions

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Abstract

The present investigation was carried out at the Central Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during *Kharif* 2022-23 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 Randomized block design with 15 treatments and 3 replications with different combination in Bio stimulants. Under this experiment, overall, 15 treatment was taken including control. Different bio stimulants used comprised of Caliber plus, Xomate, Trend, Virtue all four at different doses of 1.5 ml, 2 ml, 2.5 ml and mixed with cow urine each. From the above experimental finding it may be concluded that the T11 (Virtue-1.5 ml/L) was found to be best in the terms of growth, yield and quality.

Keywords: Bio stimulants, cow urine, Chilli

Introduction

Chilli (vernacular name: *Mirchi*), botanically known as *Capsicum annum* (L.) is one of the well-known plants belonging to Solanaceae. It is a diploid cross-pollinated dicot plant species with chromosome number $2n=2x=24$. Capsicum plants originated in modern-day Bolivia and have been a part of human diets since about 7,500 BC (Pickersgill, 1971) [11]. They are one of the oldest cultivated crops in the Americas. Origins of cultivating chili peppers have been traced to east-central Mexico some 6,000 years ago, although, according to research by the New York Botanical Garden press in 2014, chili plants were first cultivated independently across different locations in the Americas including highland Bolivia, central Mexico, and the Amazon. They were one of the first self-pollinating crops cultivated in Mexico, Central America, and parts of South America. As per National Institute of Nutrition (NIN, 2008), nutritional composition of beetroot constituted Moisture (85.7 g), Protein (2.9 g), Fat (0.6 g), Mineral (1.8 g), Carbohydrates (3.0 g), Calories (29 Kcal), Calcium (30 mg/100g), Phosphorus (80 mg/100g), Magnesium (24 mg/100 g), Oxalic acid (67 mg/100g), and Iron (1.20 mg), Sodium (6.5 mg/100 g), Potassium (217 mg), Sulphur (34 mg), Vitamin A (292 I.U.), Vitamin C (111 mg) per 100 g edible (Choudhary, 2013) [1]. Lycopene {water-soluble} gives the red colour of red Chilli. Chilli has a lot of worthwhile properties for the human body. It has antioxidant, anti-inflammatory, hepato-preventive, and anti-carcinogenic effects (Nemzer, 2011) [10]. In India Chilli is grown in Andhra Pradesh, Telangana, Madhya Pradesh, Karnataka, West Bengal, and Himachal Pradesh on large scale. The substances that give chili peppers their pungency (spicy heat) when ingested or applied topically are capsaicin (8-methyl-N-vanillyl-6-nonenamide) and several related chemicals, collectively called capsaicinoids. The quantity of capsaicin varies by variety, and on growing conditions. Water-stressed peppers usually produce stronger pods. When a habanero plant is stressed, by absorbing low water for example, the concentration of capsaicin increases in some parts of the fruit (Ruiz-Lao, 2011) [12]. The varieties of beetroot that are cultivated in India are Naga, Jwala, Guntur, Kanthari, Bhut Jolokia and many more. Application of bio stimulants (PGR) significantly increased the biochemical and physiological character in Chilli and yield parameters. The Bio Stimulants (PGR) are used to improve maximum number of fruits per plant in the crop. Thus, aim of the investigation is to evaluate the best concentration of Bio Stimulants (PGR) from which we can get better production of Chilli.

Material and Methods

The present investigation entitled was done to understand the plant growth, fruit yield and quality of fruit of different treatment combinations of bio-stimulants on Chilli variety TMPH-409. The details of the materials used, and the methods adopted in the investigation, which was carried out at Horticultural Research Farm (CRF), Department of

Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during the *Kharif* season of 2022. The different combination doses of bio-stimulants mentioned in table 1 and replicated thrice. Observations were recorded at different stages of growth periods. The data were statistically analysed by the method suggested by Fisher and Yates, 1963.

Table 1: Details of different doses of bio-stimulants used.

Treatment Symbols	Treatment combination	Treatment Symbols	Treatment combination
T0		Control (R.D.F.)	
T1	Caliber Plus - 1.5ml/l	T8	Trend -1.5ml/l
T2	Caliber Plus -2 ml/l	T9	Trend -2ml/l
T3	Caliber Plus -2.5ml/l	T10	Trend -2.5ml/l
T4	Caliber plus –cow urine 10%	T11	Virtue -1.5ml/l
T5	Xomate -1.5ml/l	T12	Virtue -2ml/l
T6	Xomate -2ml/l	T13	Virtue -2.5ml/l
T7	Xomate -2.5ml/l	T14	Virtue –cow urine 10%

Table 2: Performance of different treatment of bio-stimulants on growth and yield parameters studied for Chilli

Treatment Details with Notation		Survival percentage	Plant height (cm) [at Harvest]	No of branches/plant [at harvest]	Days to first flowering	Days to 50% flowering	Days to first harvest	Number of fruits/plant	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Average yield/plant (g/plant)	T.S.S. [°Brix]	Ascorbic acid (mg/100g)
T0	Control (R.D. F)	45.32	69.22	6.23	44.05	48.98	72.36	100.26	5.58	1.40	2.42	309.23	3.00	1.40
T1	Caliber plus - 1.5ml/L	81.01	73.09	7.72	39.16	43.71	67.24	204.06	7.36	2.71	2.68	548.11	3.03	1.41
T2	Caliber plus -2 ml/L	47.68	79.84	7.70	37.16	41.71	65.24	253.50	7.58	2.79	2.80	711.67	4.08	2.12
T3	Caliber plus -2.5ml/L	74.34	72.36	9.09	38.75	43.30	66.83	255.26	7.52	2.77	2.75	702.86	4.19	1.69
T4	Caliber plus –cow urine 10%	54.34	77.56	7.49	38.54	43.09	66.62	192.66	7.47	2.71	2.46	473.60	4.22	1.80
T5	Xomate -1.5ml/L	61.01	71.16	7.69	42.44	46.99	70.52	130.46	7.47	2.76	2.57	335.49	4.31	1.89
T6	Xomate -2ml/L	85.46	74.01	8.49	39.84	44.39	67.92	202.95	6.03	1.49	2.50	508.07	3.60	1.79
T7	Xomate -2.5ml/L	81.01	70.49	7.89	42.65	47.20	70.73	146.26	7.16	2.73	2.66	389.51	4.48	1.79
T8	Trend -1.5ml/L	74.01	72.57	7.09	43.82	48.37	71.90	119.06	7.35	2.71	2.61	311.14	4.52	1.87
T9	Trend -2ml/L	80.45	78.37	9.69	38.93	43.48	67.01	135.66	7.41	2.76	2.51	340.88	4.32	1.79
T10	Trend -2.5ml/L	93.68	73.56	8.69	41.32	45.87	69.40	124.06	7.45	2.74	2.68	333.28	4.56	1.67
T11	Virtue -1.5ml/L	93.01	79.21	9.72	36.72	41.27	64.80	261.66	7.62	2.80	3.09	809.62	4.62	2.15
T12	Virtue -2ml/L	82.95	76.79	8.47	41.13	45.68	69.21	196.68	7.36	2.07	2.46	482.62	3.80	1.87
T13	Virtue -2.5ml/L	85.14	77.17	9.28	43.21	47.76	71.29	210.17	5.98	2.05	2.95	620.61	3.78	1.84
T14	Virtue –cow urine 10%	85.90	71.36	8.00	41.35	45.90	69.43	101.66	6.67	1.81	3.27	332.63	3.69	1.67
F test		S	S	S	S	S	S	S	S	S	S	S	S	S
C.D. (5%)		2.41	3.24	0.87	1.40	1.40	1.40	3.35	0.77	0.63	0.25	144.93	0.51	0.41
S.E. (m±)		0.83	1.11	0.29	0.48	0.48	0.49	1.15	0.26	0.21	0.25	49.58	0.18	0.13
C.V.		1.85	2.55	6.07	2.05	1.85	1.21	1.10	6.35	14.89	16.03	17.42	7.45	13.21

Results and Discussion

Growth Parameters

Survival percentage and Plant height (cm) [at first harvest]

The survival percentage significantly varied among different treatment combinations. The maximum survival percentage (93.68%) was observed with treatment T11 (Virtue-1.5 ml/L) followed by T2 (Caliber Plus-2.0 ml/L) with 93.01%. Minimum survival percentage (45.32%) was observed in T0 (Control). The height of plant significantly varied among different treatment combinations. The maximum plant height at first harvest (79.84 cm) was observed with treatment T11 (Virtue-1.5 ml/L) followed by T2 (Caliber plus-2.0 ml/L) with 79.21 cm. Minimum plant height at first harvest (69.22 cm) was observed in T0 (Control), while the remaining treatments were moderate in their growth habit. The application of bio stimulants might have improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plants which might have promoted the maximum vegetative growth leading to increase in plant height. Similar findings were reported by Jeevansab (2000) [4];

Shashidhara (2000) [13], Sharu and Meerabai (2001) [15]; Shashadhari and Shetty (2002) [16]; Nakliang *et al.*, (2019) [9]; Kumar *et al.*, (2020) [5]; Mondol *et al.*, (2020) [7]; Surendra *et al.*, (2020) [14], Kumar and Topno (2022) [6] in Chilli.

Number of primary branches per plant

There was significant difference between the treatments at among the treatments applied. It was also found that at first harvest, T11 (Virtue-1.5 ml/L) with maximum value i.e., 9.72 branches per plant followed by T2 (Caliber plus-2.0 ml/L) with 9.28 branches per plant whereas the minimum branches were observed in treatment T0 (Control) with 6.23 branches. Bio stimulants can lead to more branches in Chillies because of the consistent and balanced supply of nutrients throughout the plant's life cycle. Bio stimulants enhances soil fertility and structure, which leads to healthy root development and more lateral branching. Inorganic fertilizers provide an immediate source of nutrients that support rapid plant growth and development, ultimately leading to more lateral branching. Thus, the combination of both helps in increasing the branches of Chillies, resulting in a higher yield. Similar

findings were reported by Jeevansab (2000) [4]; Shashidhara (2000) [13], Sharu and Meerabai (2001) [15]; Shashadhari and Shetty (2002) [16]; Nakliang *et al.*, (2019) [9]; Kumar *et al.*, (2020) [5]; Mondol *et al.*, (2020) [7]; Surendra *et al.*, (2020) [14], Kumar and Topno (2022) [6] in Chilli.

Earliness parameter

Days to first flowering, days to 50% flowering and days to first harvest

Among the different applications of bio stimulants, the minimum days to first flowering was seen in T₁₁ (Virtue-1.5 ml/L) with 36.72 days, followed by T₂ (Caliber plus-2.0 ml/L) with 37.16 days whereas maximum days to first flowering 44.05 days was recorded in T₀ (Control). Among the different applications of bio stimulants, the minimum days to 50% flowering was seen in T₁₁ (Virtue-1.5 ml/L) with 41.27 days, followed by T₂ (Caliber plus-2.0 ml/L) with 41.71 days whereas maximum days to 50% flowering 48.98 days was recorded in T₀ (Control). Among the different applications of bio stimulants, the minimum days to first harvest was seen in T₁₁ (Virtue-1.5 ml/L) with 64.80 days, followed by T₂ (Caliber plus-2.0 ml/L) with 65.24 days whereas maximum days to first harvest 72.36 days was recorded in T₀ (Control). Bio stimulants can lead to earlier flowering in Chillies due to the balanced and varied supply of nutrients that this approach provides to the plants. Bio stimulants enhances soil health and fertility, providing essential nutrients that support plant growth and development. Inorganic fertilizers supplement any immediate nutrient deficiencies in the soil and support the rapid growth of the plants. This balanced and consistent supply of nutrients can lead to earlier flowering in Chillies. Similar findings were reported by Jeevansab (2000) [4]; Shashidhara (2000) [13], Sharu and Meerabai (2001) [15]; Shashadhari and Shetty (2002) [16]; Nakliang *et al.*, (2019) [9]; Kumar *et al.*, (2020) [5]; Mondol *et al.*, (2020) [7]; Surendra *et al.*, (2020) [14], Kumar and Topno (2022) [6] in Chilli.

Yield Parameter

Number of fruits per plant, fruit length (cm), fruit girth (cm), fruit weight (g) and fruit yield per plant (g/plant)

The maximum Number of fruits per plant 261.66 fruits were recorded in treatment T₁₁ (Virtue-1.5 ml/L) followed by T₂ (Caliber plus-2.0 ml/L) i.e., 255.26 fruits and the minimum number of fruits per plant 100.26 fruits were observed in T₀ (Control). The maximum fruit length 7.62 cm were recorded in treatment T₁₁ (Virtue-1.5 ml/L) followed by T₅ (Caliber plus-2.0 ml/L) i.e., 7.58 cm and the lowest fruit length (5.58 cm) were observed in T₀ (Control). The maximum fruit girth 2.80 cm were recorded in treatment T₁₁ (Virtue-1.5 ml/L) followed by T₂ (Caliber plus-2.0 ml/L) i.e., 2.79 cm and the lowest fruit girth (1.40 cm) were observed in T₀ (Control). The maximum fruit weight 3.27 g were recorded in treatment T₁₁ (Virtue-1.5 ml/L) followed by T₂ (Caliber plus-2.0 ml/L) i.e., 3.07 g and the minimum fruit weight (2.42 g) were observed in T₀ (Control). The maximum average yield per plant (809.62 g/plant) were recorded in treatment T₁₁ (Virtue-1.5 ml/L) followed by T₂ (Caliber plus-2.0 ml/L) i.e., 711.67 g/plant and the lowest average yield per plant (309.23 g/plant) were observed in T₀ (Control). Bio-stimulants played an important role in improving productivity and quality of fruit. Doses of bio stimulants increased the vigour of plants, assimilating area, size of fruit, thereby resulting into higher weight of fruit and ultimately yield. These results are in close conformity with the findings of Jeevansab (2000) [4];

Shashidhara (2000) [13], Sharu and Meerabai (2001) [15]; Shashadhari and Shetty (2002) [16]; Nakliang *et al.*, (2019) [9]; Kumar *et al.*, (2020) [5]; Mondol *et al.*, (2020) [7]; Surendra *et al.*, (2020) [14], Kumar and Topno (2022) [6] in Chilli.

Quality parameter

TSS [°Brix] and Ascorbic acid content (mg/100g)

The data contained in the table reveals that the TSS was significantly influenced by application of fertilizers and organic nutrients and their interaction. The maximum TSS (4.62 °Brix) were recorded in treatment T₁₁ (Virtue-1.5 ml/L) followed by T₂ (Caliber plus-2.0 ml/L) i.e., 4.56 °Brix and the lowest TSS (3.00 °Brix) were observed in T₀ (Control). The data contained in the table reveals that the ascorbic acid content was significantly influenced by application of fertilizers and organic nutrients and their interaction. The maximum ascorbic acid content (2.15 mg) was recorded in treatment T₁₁ (Virtue-1.5 ml/L) followed by T₂ (Caliber plus-2.0 ml/L) i.e., 2.12 mg and the lowest ascorbic acid content (1.40 mg) were observed in T₀ (Control). Bio-stimulants allows for the benefits of both approaches to be utilized. The bio stimulants help to improve soil health and nutrient availability over time, while the inorganic fertilizer provides immediate nutrients to the plants. This combination can result in higher crop yields, better quality produce, and improved TSS and ascorbic acid content in chillies. These results are in close conformity with the findings of Jeevansab (2000) [4]; Shashidhara (2000) [13], Sharu and Meerabai (2001) [15]; Shashadhari and Shetty (2002) [16]; Nakliang *et al.*, (2019) [9]; Kumar *et al.*, (2020) [5]; Mondol *et al.*, (2020) [7]; Surendra *et al.*, (2020) [14], Kumar and Topno (2022) [6] in Chilli.

Summary and Conclusion

From the above experimental finding it may be concluded that the T₁₁ (Virtue-1.5 ml/L) was found to be best in the terms of growth, yield and quality.

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