International Journal of Environment and Climate Change

Volume 13, Issue 9, Page 191-197, 2023; Article no.IJECC.102067
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Effect of Different Biostimulants on Growth, Yield and Quality of Chilli (*Capsicum annuum L.*) under Prayagraj Agro Climatic Conditions

N. Suhaini [a++*], Devi Singh [b#] and C. John Wesley [c#]

[a] Department of Horticulture (Vegetable Science), Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India.
[b] Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India.
[c] Centre for Geospatial Technologies VIAET, SHUATS, Prayagraj, Uttar Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i92222

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/102067

Original Research Article

Received: 17/04/2023
Accepted: 20/06/2023
Published: 29/06/2023

ABSTRACT

An experiment was carried out to study the "Effect of different biostimulants on growth, yield and quality of chilli (*Capsicum annuum L*) under prayagraj agro climatic conditions" during August, 2022 to January 2023 at Horticulture Research Farm, Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences. The experiment had eleven treatments replicated thrice in a randomized block design. It was concluded that the application of biostimulants treatments rendered their significant effect on almost all the growth and yield characters as well as quality of chilli. Treatments were given with concentrations of biostimulant products such as Escort @ 1, 1.5, 2 and 2.5 ml per litre, Cheetha @ 2, 2.5 and 3 ml

---

[++] *M.Sc. Research Scholar;*
[#] *Associate Professor;*
**Corresponding author: E-mail: suhainiayath12345@gmail.com;*

per litre and Baanam @ 2, 2.5 and 3 ml per litre at 45 ,60 and 75 days after transplanting whereas water was sprayed on control plants. The treatment T7 i.e. application of biostimulant product Cheetha @ 3 ml/l was found superior in terms of plant height (64.39 cm), plant spread (61.5cm), number of branches (8.11), number of flowers per cluster (11.77), number of fruits per plant (79.33), fruit length (12.77cm), fruit girth (2.47cm), fruit weight(4.29g), fruit yield per plant(395.67g), fruit yield per plot(2.37 kg), fruit yield per hectare (14.67t/ha) ,Total Soluble Solids **(**^{o}Brix**)** (4.97),Ascorbic acid content (144.67 mg/100g) and minimum days taken for first flowering (51.67 days) and for 50% flowering(56.67 days). Among the different treatments, the highest Gross return (Rs/ha) (2,93,000), Net return (Rs/ha) (1,67,137), benefit cost ratio (2.32) was also obtained from treatment (T7), that is Cheetha @ 3 ml/l.

Keywords: Chilli; biostimulants; growth; yield; quality.

1. INTRODUCTION

Chilli (*Capsicum annuum L*) is one of the most important vegetables as well as a spice crop that belongs to the family Solanaceae, grown for its fruit. It is widely cultivated all over the world and is thought to be a native of Peru and Mexico. Chilli is famous for its pleasant aromatic flavour, pungency and high colouring substance, which is also a rich source of vitamin A and C with plenty of minerals [1-3]. The substance that is responsible for pungency in chilli is capsaicin and the bright red colour at the ripening stage is due to the pigment capsanthin. Capsaicin, a compound which has potential health benefits, including pain relief, improved digestion, and boosting metabolism. Chillies are one of the major spices exported by India. Heat and climate change can pose challenges for chilli cultivation, leading to problems such as fruit drops [4,5].

Biostimulants are substances or microorganisms that, when applied to plants or soil, enhance plant growth, stress tolerance and crop quality. They provide a complementary approach to conventional fertilizers and pesticides, promoting sustainable and environmentally friendly agricultural practices. Biostimulants work through multiple mechanisms, including promoting root development, improving nutrient availability, enhancing stress tolerance and stimulating beneficial microbial activity in the soil [6-9]. They do not provide direct nutrition to the plants, rather act as enhancers, stimulating various physiological and metabolic processes within plants. Biostimulants can positively influence the quality and marketability of agricultural products [10-14].

Biostimulants based on amino acids and humic acids have been applied in horticulture for many years [15-17]. Humic substances with their auxin activity induce hormonal effects on catalytic activity, cell permeability and increase nutrient uptake and dry matter yield (Eshwar *et al.*,2017). Amino acids play a vital role in plant nutrition by facilitating nutrient absorption, increasing nutrient availability and enhancing plant metabolism. Plant extract bio stimulants promote plant growth, development and overall health of plants [18-21].

Considering the significance of plant extract biostimulants in agriculture and horticulture, the goal of this study was to identify the significance of different biostimulants in improving the growth, yield and quality of chilli.

2. MATERIALS AND METHODS

A field experiment entitled “Effect of different biostimulants on growth, yield and quality of chilli (*Capsicum annuum L*) under prayagraj agro climatic conditions” was carried out in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences during 2022-2023. The experiment was laid out in a randomized block design with eleven treatments in three replications. Chilli (*Capsicum annuum L*) variety NS1701DG was grown in the open field and biostimulants were applied through a foliar application method. The experiment included application of biostimulant products having different dominant compositions, such as Escort (natural plant extract and oligosaccharides), Cheetha (humic acid and amino acid) and Baanam (carbonates)in chilli crop. Treatments were given with concentrations of Escort @ 1, 1.5, 2 and 2.5 ml per litre, Cheetha @ 2, 2.5 and 3 ml per litre and Baanam @ 2, 2.5 and 3 ml per litre at 45 ,60 and 75 DAT whereas water was sprayed on control plants. All the package of practices were followed as per recommendations to raise a quality crop. Five plants were selected randomly from each treatment per replication and

observations were recorded on growth, yield and quality parameters on these plants. Data on various parameters was recorded and stastically analysed by applying the technique of analysis of variance using randomized block design. The level of significance was kept at 5% ($p < 0.05$).

3. RESULTS AND DISCUSSION

Data in Table 1 indicates significant ($p \leq 0.05$) differences regarding the vegetative parameters like plant height, plant spread and number of branches treated with different concentrations of biostimulants.

Plants attained maximum height (64.39 cm) when treated with Cheetha @ 3 ml/l followed by that of 2.5 ml/l (62.5 cm) concentrations. Plants grown in control were (42.78 cm) tall. Cheetha is a biostimulant product which has a dominant composition of humic acid and amino acid. The increment in plant height may be due to enhancement in photosynthetic and other metabolic activities which promote various plant metabolites responsible for cell division and quicker multiplication of cells in the shoot apex due to the auxin type of activity of humic acid on plant growth. Similiar findings were also reported by Fathima *et al.,* (2013) in chilli and Kumar *et al.,* (2015) in Okra.

A similar trend was observed regarding the plant spread parameter where maximum plant spread (61.5 cm) was observed when Cheetha @ 3ml/l was applied, followed by that of 2.5 ml/l (59.67 cm) concentrations. Plants in control treatment were 43 cm. A significant increase in plant spread by the application of biostimulant might be due to humic acid, which stimulates plant growth by accelerating cell division, promotes synthesis of chlorophyll, sugar and amino acids in plants and enhances the uptake of nutrients which aid in photosynthesis. Similiar findings were also reported by Fathima *et al.,* (2013) in chilli, Kumar *et al.,* (2015) in Okra.

The maximum number of branches per plant (8.11) was counted in Cheetha @ 3 ml/l treatment followed by those of Cheetha @ 2.5 ml/l (7.55) concentrations. Plants with control treatment produced a minimum number of branches per plant (4.33). The possible reason could be that the foliar application of the commercial biostimulant product Cheetha, which is composed of humic acid, might influence vegetative growth by encouraging cell division and elongation and increased number of branches. Humic acid rises the chlorophyll and leaf N, P, K content and K concentration increased number of branches was also reported by Kazemi.M (2013) on cucumber. Similar findings were also reported by Fathima *et al*., (2013) in chilli, Kumar *et al.,* (2015) in Okra.

Minimum days to flower initiation were recorded in treatment T7 – Cheetha @ 3 ml/l (51.67) and followed by the treatment T6-Cheetha @ 2.5 ml/l (52.66) whereas the maximum days to flower initiation was recorded in T0 – Control (58.33). The humic acid present in the biostimulant is used to ameliorate or reduce the negative effect of stress.

Significant superiority over control might be due to increased photosynthetic activity, hormonal activity and uptake of nutrients resulting in early flowering as reported by Patel *et al.,* (2018) in bhindi. These findings are in conformity with those of Ghorbani (2010).

Minimum days to 50% flowering was recorded in treatment T7- Cheetha @ 3 ml/l (56.67) and followed by the treatment T6 – Cheetha @ 3 ml/l (58.66) whereas the maximum was in the treatment T0 – Control (66.67).

The number of flowers per cluster was recorded with significant differences between different treatments. The number of flowers per cluster due to the influence of different concentrations of biostimulants was recorded at the maximum in T7-Cheetha @ 3 ml/l (11.77) followed by those of Cheetha @ 3 ml/l (11) concentrations. Plants in control treatment produced a minimum number of flowers per cluster (6.66). The improvement in the number of flowers per cluster as a result of the application of biostimulant might be due to the presence of humic acid which enhanced photosynthetic and other metabolic activities. It promotes hormonal activity, promoting the growth of more flowers in each cluster. These findings are in conformity with those of Fathima *et al.,* (2013) in chilli, Kumar *et al.,* (2015) in Okra.

The data regarding yield parameters like number of fruits per plant, fruit length, fruit girth, fruit weight, fruit yield per plant, fruit yield per plot, fruit yield per hectare are shown in Table 2. The maximum number of fruits per plant was recorded in treatment T7- Cheetha@ 3 ml/l (79.33) and followed by the treatment T6 – Cheetha @ 2.5 ml/l (76.33) whereas the minimum number of fruits per plant was recorded

in the treatment T0 – Control (54.33). This might be due to the accumulation of more photosynthates, amino acids and nitrates in the treated plants that resulted in making the plants resistant to pests and diseases, and subsequently producing a greater number of fruits per plant. These findings are comparable with that of Halime *et al.,* (2011) on cucumbers. Similar results were also reported by Fathima *et al.,* (2013) in chilli, Manas *et al.,* (2014) in chilli and Singh *et al.,* (2017) in capsicum.

Fruit length was recorded with significant variations between different treatments. The maximum fruit length was recorded in treatment T7- Cheetha@ 3 ml/l (12.77 cm) and followed by the treatment T6 – Cheetha @ 2.5 ml/l (11.72 cm) whereas the shortest fruit length was recorded in the treatment T0 – Control (9.33 cm). This might be due to the effect of humic acid, which promotes root growth and development, leads to better nutrient absorption and also promotes cell elongation and cell division, which leads to larger and longer fruits. These findings are in line with those of Ali *et al.,* (2013) in tomato, Manas *et al.,* (2014) in chilli and Kumar *et al.,* (2015) in Okra.

Maximum fruit girth was recorded in treatment T7- Cheetha @ 3 ml/l (2.47 cm) and followed by the treatment T6 – Cheetha @ 2.5 ml/l (2.23 cm) whereas the shortest fruit girth was recorded in the treatment T0 – Control (1.02 cm). This might be due to the effect of humic acid in the biostimulant applied that caused rapid multiplication of cells in the reproductive organs and more accumulation of photosynthates in fruits than compared to absolute control. These findings are similar to those of Ali *et al.,* (2013) in tomato, Dubey *et al.,* (2013) and Manas *et al.,* (2014) in chilli.

Fruit weight (g) was recorded with significant variations between different treatments. The maximum fruit weight was recorded in treatment T7- Cheetha @ 3 ml/l (4.29 g) and followed by the treatment T6– Cheetha @ 2.5 ml/l (4.14 g), whereas the shortest fruit weight was recorded in the treatment T0 – Control (2.74 g). This might be due to humic acid leading to increased fruit weight through positive physiological effects such as the impact of metabolism of plant cells, photosynthesis and increasing the concentration of leaf chlorophyll (Sure *et al*.,2012) in cucumber. These findings are in close conformity with Shehata *et al.,* (2012) in cucumbers, Ali *et al.,* (2013) in tomato, Manas *et al.,* (2014) in chilli and Singh *et al.,* (2017) in capsicum.

Fruit yield per plant recorded in the treatment T7 – Cheetha @ 3 ml/l (395.67g) was significantly higher than other treatments followed by the treatment T6– Cheetha @ 2.5 ml/l (363.67g) whereas control has lower fruit yield per plant (185.33 g). This might be due to the application of a biostimulant which has a dominant composition of humic acid to create favourable conditions to facilitate nutrient uptake by roots, causing an increase in fruit weight (El-Nemr, 2012). Similar results were reported by Dubey *et al.,* (2013), Fathima *et al.,* (2013) in chilli and Singh *et al.,* (2017) in capsicum.

Fruit yield per plot was recorded with significant variations between different treatments. The highest fruit yield per plot was recorded in treatment T7- Cheetha @ 3 ml/l (2.37 kg) and followed by the treatment T6 – Cheetha @ 2.5 ml/l (2.11 kg), whereas the lowest fruit yield per plot was recorded in the treatment T0 – Control (1.16 kg). This might be due to sufficient enhancement in fruit attributes like weight of fresh fruits, length and girth of fresh fruits, fruit yield per plant and the ultimate result was the maximum yield of chilli per plot. Similar findings were reported by Fathima *et al.,* (2013), Manas *et al.,* (2014) in chilli and Singh *et al.,* (2017) in Capsicum.

Fruit yield per hectare was recorded with significant variations between different treatments. The highest fruit yield per hectare was recorded in treatment T7- Cheetha @ 3 ml/l (14.65 t/ha) and followed by the treatment T6 – Cheetha @ 2.5 ml/l (13.46 t/ha) whereas the lowest fruit yield per hectare was recorded in the treatment T0 – Control (6.86 t/ha).

The data regarding quality parameters like total soluble solids, ascorbic acid and the economics of different treatments are shown in Table 3.

TSS and Ascorbic acid are important characters which decide the quality of chilli for commercial cultivation. The highest TSS was recorded in treatment T7- Cheetha @ 3 ml/l (4.97) and followed by the treatment T6 – Cheetha @ 2.5 ml/l (4.88) whereas the lowest TSS was recorded in the treatment T0 – Control (3.82). This might be due to healthy growth of plants by the application of a biostimulant having a dominant composition of humic acid, which might have promoted the accumulation of sugars and organic acids, leading to increased TSS levels and improved the fruit quality. Similar findings

were also reported by Aminifard *et al.,* (2012) in chilli and Kazemi *et al.,* (2013) in tomato.

Ascorbic Acid was recorded with significant variations between different treatments. The maximum ascorbic acid content (mg/100g) was recorded in treatment T7- Cheetha @ 3 ml/l (144.67) and followed by the treatment T6 – Cheetha @ 2.5 ml/l (143.33) whereas the minimum ascorbic acid content was recorded in the treatment T0 – Control (130.33). The increase in ascorbic acid content by the application of a biostimulant composed of humic acid might be due to the role of humic acid as a nutrient availability enhancer which, improves the availability of phosphorus and potassium contents (Aghanifard *et al.,* 2016). Similar results were also reported by Abdellatif *et al.,* (2017) in tomato.

In the case of economic parameters, Cheetha @ 3ml/l gained maximum gross returns (Rs/ha) (2,93,000), net return (Rs/ha) (1,67,137) and Benefit: Cost ratio (2.32).

Table 1. Effect of different biostimulants on vegetative growth and flowering parameters of chilli under Prayagraj agro climatic conditions

	Growth parameters			Flowering parameters		
Treatments	**Plant height (cm)**	**Plant spread (cm)**	**No. of branches**	**Days to flower initiation**	**Days to 50% flowering**	**No. of flowers per cluster**
T0 – Control	42.78	43	4.33	58.33	66.67	6.66
T1- Escort @ 1 ml/l	59.77	55.67	6.67	54.11	60.33	9.66
T2- Escort @ 1.5 ml/l	56.17	53	5.89	55	62.11	9.11
T3- Escort @ 2 ml/l	56.05	52.67	5.67	55.11	62.89	8.99
T4- Escort @ 2.5 ml/l	55.39	51.83	5.44	55.33	63.44	8.89
T5- Cheetha @ 2 ml/l	60.66	57.17	7.11	53.33	59.67	10.55
T6- Cheetha @ 2.5 ml/l	62.5	59.67	7.55	52.66	58.66	11
T7- Cheetha @ 3 ml/l	64.39	61.5	8.11	51.67	56.67	11.77
T8- Baanam @ 2 ml/l	54.27	50.33	5.33	56.11	63.78	8.66
T9 -Baanam @ 2.5 ml/l	53.33	48.5	4.78	56.89	64.33	8.22
T10- Baanam @ 3ml/l	58.33	53.67	6.33	54.33	61.66	9.44
F-Test	S	S	S	S	S	S
S.Ed	0.83	1.52	0.41	0.86	0.70	0.49
CD @ 5%	1.73	3.18	0.87	1.81	1.46	1.03

Table 2. Effect of different biostimulants on yield parameters of chilli under Prayagraj agro climatic conditions

Treatments	**No. of fruits per plant**	**Fruit length (cm)**	**Fruit girth (cm)**	**Fruit weight (g)**	**Fruit yield per plant (g/plant)**	**Fruit yield per plot(kg)**	**Fruit yield per ha(t/ha)**
T0- Control	54.33	9.33	1.02	2.74	185.33	1.16	6.86
T1- Escort @ 1 ml/l	71.67	10.89	1.81	3.83	302.33	1.8	11.19
T2-Escort @ 1.5 ml/l	67	10.5	1.57	3.56	288	1.73	10.66
T3-Escort @ 2 ml/l	65.33	10.27	1.56	3.43	281	1.69	10.40
T4- Escort @ 2.5ml/l	63.33	10.16	1.54	3.31	273.33	1.67	10.12
T5-Cheetha@ 2ml/l	73.67	11.11	1.98	4.07	340	2.04	12.59
T6-Cheetha@2.5ml/l	76.33	11.72	2.23	4.14	363.67	2.11	13.46
T7-Cheetha@3ml/l	79.33	12.77	2.47	4.29	395.67	2.37	14.65
T8-Baanam@2ml/l	61	10.11	1.41	3.26	267.5	1.62	9.90
T9-Baanam@2.5ml/l	59.33	10	1.28	3.22	261	1.56	9.66
T10-Baanam@3ml/l	70	10.44	1.60	3.75	294	1.77	10.88
F-Test	S	S	S	S	S	S	S
S.ED	1.82	0.3	0.21	0.19	2.66	0.03	0.10
CD @ 5%	3.8	0.63	0.44	0.40	5.55	0.07	0.20

Table 3. Effect of different bio stimulants on quality parameters and economics of chilli under Prayagraj agro climatic conditions

	Quality parameters		Economics		
Treatments	**TSS (^{0}Brix)**	**Ascorbic acid (mg/100g)**	**Gross returns(Rs/ha)**	**Net returns(Rs/ha)**	**Benefit Cost ratio**
T0- Control	3.82	130.33	137200	20592	1.17
T1- Escort @ 1 ml/l	4.7	139.67	223800	104107	1.86
T2-Escort @ 1.5 ml/l	4.40	138.67	213200	91967	1.75
T3-Escort @ 2 ml/l	4.37	138.33	208000	85222	1.69
T4- Escort @ 2.5ml/l	4.14	138.17	202400	78077	1.62
T5-Cheetha@ 2ml/l	4.71	142.67	251800	129022	2.05
T6-Cheetha@2.5ml/l	4.88	143.33	269200	144877	2.16
T7-Cheetha@3ml/l	4.97	144.67	293000	167137	2.32
T8-Baanam@2ml/l	3.97	137.83	198000	75222	1.61
T9-Baanam@2.5ml/l	3.88	137.33	193200	68877	1.55
T10-Baanam@3ml/l	4.58	139	217600	91737	1.72
F-Test	S	S			
S.ED	0.14	1.34			
CD @ 5%	0.29	2.79			

4. CONCLUSION

From the present study it may be concluded that the treatment T7 i.e. application of Cheetha @ 3 ml/l which has a dominant composition of humic acid and amino acid, proved to be superior to other treatments in regarding all vegetative, flowering, yield and quality parameters like plant height, plant spread, number of branches, number of flowers per cluster, number of fruits per plant, fruit length, fruit girth, fruit weight, fruit yield per plant, fruit yield per plot, fruit yield per hectare, TSS, Ascorbic acid and economics. Earliness in flowering is also observed in the treatment (T7), that is Cheetha @ 3 ml/l.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Chandramohan Reddy G, Hebbar SS, Nair AK, Raghupathy HB, Mallikarjuna Gowda AP, Umesha K. Growth and yield performance of hybrid hot pepper, chilli (Capsicum annuum L.) as influenced by fertigation and polyethylene mulching; Journal of Horticultural Science, 201711(2):151-155.
2. Diksha Pundir, Suneeta Singh, Anil Kumar Saxena. Response of plant growth regulators (NAA) and (GA3) on growth and yield attributes of chilli (*Capsicum annuum* L) at Dehradun valley region. International Journal of Chemical Studies. 2020;8(5):556-559.
3. Fathima PS, Denesh GR. Influence of humic acid spray on growth and yield of chilli (*Capsicum annuum L*). International Journal of Agricultural Sciences. 2013;9(2):542-546.
4. Anbarasi D, Venkatraman M. Effect of plant growth regulators on growth, yield and quality characters of chilli (*Capsicum annuum L*). Annala of Plant and Soil Research. 2022;24(4):543-546.
5. Chethan Kumar S, Sahu GS, Tripathy P, Banshidhar Pradhan, Sunil Kumar Dash. Studies on genetic variability in chilli (*Capsicum annuum L*) Germplasm. Journal of Pharmacognosy and Phytochemistry. 2019;8(2):1992-1994.
6. Gudapati Ashoka Chakravarthy, Krishna Mohan K. Effect of bio stimulants on growth, development and yield of chilli (*Capsicum annuum L*.). International Journal of Plant & Soil Science. 2023;35(6):172-176.
7. Holbesappa Kumbar, Chandini Raj A, Hore JK. Effect of bio fertilizers and inorganic fertilizers on growth and yield of chilli *(Capsicum annuum L*.). International Journal of Current Microbiology and Applied Sciences. 2017;6(7):1564-1568.
8. Katheek Bharadwaza R, Prasad VM, Adinarayana M, Narayana Swamy G Evaluation of chilli (*Capsicum annuum L.)* genotypes for yield and yield attributes in Allahabad Agro-Climatic Conditions. International Journal of Current

Microbiology and Applied Sciences. 2018; 7:773-776.
9. Madhu Singh, Ameta KD, Dubey RB, Pareek S, Meena NL, Somendra Meena, Shankar Lal. Effect of humic acid and micronutrients on growth and yield of polyhouse grown capsicum, Chemical Science Review and Letters. 2017; 6(22):1189-1193.
10. Sam Ruban J, Priya MR, Barathan G, Suresh Kumar SM. Effect of foliar application of bio stimulants on growth and yield of brinjal (*Solanum melongena*). Plant Archives. 2019;19(2):2126-2128.
11. Saritha Sahu, Vijay Kumar, Sharma HG. Effect of plant growth regulators on growth and yield of chilli. Journal of Pharmacognosy and Phytochemistry. 2019;8(6):21222132.
12. Shailaja Nimmala, Kolape SS, Archana Tathe. Effect of levels of fulvic acid through foliar sprays on yield and quality of green chilli. International Journal of Chemical Studies. 2021;9(1): 793-797.
13. Saraswathi T, Praneetha S. Effect of bio stimulants on yield and quality in tomato. Journal of Horti. Science. 2013;8(1):107-110.
14. Surendar P, Sekar K, Sha K, Kannan R. Effect of plant growth regulators on growth of chilli (*Capsicum annuum L*). Plant Archives. 2020; 20:1544-1546.
15. Thouti pavani, Deshmukh P Wand, Oguboyana Srikanth Yadav. Effect of foliar application of humic acid on yield parameters and quality of chilli. Journal of Pharmacognosy and Phytochemistry. 2022;11(3):235-239.
16. Yatagiri N, Sanap PB Telugu RK. Growth, flowering, behaviour and physical fruit parameters of chilli (*Capsicum annuum L*) genotypes in coastal Maharashtra. International Journal of Current Microbiology and Applied Sciences. 2017;6(7):2230-2237.
17. Pankaj Kumar, Rana DK, Vivek Singh, Naseeruddin Shah KH. Effect of humic acid on growth, yield and quality of okra (*Abelmoschus Esculentus (L.) Moench*) cv. Arka Anamika under subtropical conditions of Garhwal Himalaya. International Journal for Innovative Research in Science and Technology. 2015; 1:2349-6010.
18. Pankaj Maida, Bisen BP, Umesh Dhakad. Effect of different irrigation levels on growth and yield of chilli (*Capsicum annuum L*). Bulletin of Environment, Pharmacology and Life Sciences. 2020; 9(5):18-22.
19. Prayaga Singh, Jain PK, Manoj Kumar Ahirwar. Evaluation of different chilli genotypes for growth, phenological behaviour and physical fruit parameters in Kymore plateau region of Madhya Pradesh. The Pharma Innovation Journal. 2019;8(10):264267.
20. Sakthivel and Manivannan K. Effect of foliar application of bio stimulants on growth, yield and quality parameters B of chilli (*Capsicum annuum L).* Research Journal of Agricultural Sciences. 2021; 12(2):466-469.
21. Shankwar B, Nigam AK, Vasure N, Vishwakarma D. Effect of different plant growth regulators on growth of chilli (*Capsicum annuum L*) cv. Pusa Jwala; Agriculture Update. 2017;1187-1189.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/102067