Improving Performance and Yield of Solanum Melongena L. through Growth Regulator Applications

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ABSTRACT
This study was conducted in an agricultural area located in Dharmabad, Nanded district, Maharashtra. The experiment followed a randomized design with three replications and involved the application of ten different growth regulator treatments. The findings indicated that foliar treatment significantly influenced the vigor of Brinjal plants and their yield-contributing features when compared to the control group. Specifically, the foliar application of Tricontanol and Gibberellic acid during the flowering and bud stages resulted in notable improvements in plant height, plant spread, number of branches, and number of fruits per plant. These treatments also demonstrated positive effects on various yield-contributing characteristics such as days to 25% flowering, fruit set, fruit length, and fruit diameter, as compared to the control group.

1. Introduction

Plant growth regulators (PGRs), also known as phytohormones, are organic substances produced spontaneously in higher plants that aren't nutrients and affect growth or other physiological activities at a location far from the source while being active in very small levels. PGRs, also known as biostimulants or bioinhibitors, work inside plant cells to stimulate or inhibit particular enzymes or enzyme systems and to control the metabolism of plants. They often only become active in plants at very low concentrations. Auxins, gibberellins, cytokinins, ethylene, growth inhibitors, and growth retardants are examples of plant growth regulators. The first hormones found in plants were auxins; later, gibberellins and cytokinins were also found.

Brinjal (Solanum melongena L.) belongs to the solanaceae family and is India's most important commercial spice and vegetable crop. India is the world's leading producer and exporter of Brinjal. Brinjal is a tropical and subtropical crop that demands a warm, humid atmosphere.

Brinjal production is determined by the cultivars' innate genetic yield potential, which is impacted substantially by environmental conditions and cultivation practices. The abrupt rise in air temperature causes hormonal imbalance. One of the most significant issues in Brinjal production is temperature. Poor fruitset is one of the key bottlenecks in Brinjal production, with severe weather conditions such as temperature and rainfall having a direct impact on productivity. Brinjal yield is sometimes boosted by reducing flower drop, and this problem is often managed by selecting breeding lines that preserve a high proportion of blooms or by using physiological manipulation such as spraying plant growth regulators. Chattopadhayay and Sen (1974), Minraj and Shanmugavelu (1987), Balraj et al., (2002), Joshi and Singh (2001, 2003) and Mutlu and Agan (2015).all report on the different responses of Brinjal to plant growth regulators (1999). Plant growth regulators are known to strengthen the source-sink interaction, increase photo assimilate translocation, and aid in the retention of flowers and fruits. Plant growth regulators cause plants to develop more quickly. Plant growth regulators are the next generation of agrochemicals after fertilizer's, insecticides, and herbicides. Stem elongation, germination, dormancy, flowering, fruit development, cell division, and root expansion are all aided by plant growth regulators. Fruit and blossom drop, which is produced by physiological and hormonal imbalance in plants in unfavorable situations such as excessively low or high temperatures, reduces Brinjal production (Murlidharan et al., 2002).

2. Materials and methods

The current study was carried out in the month of October 2021 on agricultural acreage in in Dharmabad, Nanded district, Maharashtra. using the popular Brinjal cultivar 'Jwala.' The randomized block design was used to lay out the experimental plot, which included 10 treatments and three replications. A total of 65 plants were planted in each plot at a spacing of 65× 25 cm. At the time of field preparation, a base dose of 60 kg N, 60 kg P_2O_5, and 60 kg K_2O per hectare was sprayed. DAP was sprayed at a rate of 110 kg per acre after seven days of transplanting. Intercultural activities and plant protection measures were carried out according to crop recommendations. Untreated check, Paclobutrazol, Chlormequat chloride, Mepiquat chloride, Triacontanol(2 treatments), Ethephon(2 treatments), Aminoacid, Gibberillic acid were among the ten treatments used in our research.

Plant Growth regulators and Retardants

Group	Examples
Auxins	IAA, NAA, IBA, 2,4-D, 4-CPA, 2,4,5-T
Gibberellins	GA3 (Gibberellic acid)
Cytokinins	Kinetin, Zeatin , Benzyladenine, BAP
Ethylene	Ethephon (Ethrel)
Abscissic acid	Dormins,Phaseic Acid
Flowering hormones	Florigen, Anthesin, Vernalin
Growth inhibitors (Antiauxins)	Clofibric acid, 2,3,5-TIBA, Mepiquat chloride
Growth inhibitors (AntiGA)	Chlormequat chloride
Ethylene inhibitors	Aviglycine (AVG), 1-methylcyclopropene
Growth retardants	Paclobutrazol, chlormequat, uniconazole
Growth stimulators	Brassinolide

The goal of the study was to find the optimum growth promoter for improving Brinjal growth characteristics.

3. Results and discussion

The following are the findings of the study to determine the optimum growth promoter for improving Brinjal growth character: In Table no.1 shows the influence of several plant growth regulators on plant height, spread, number of branches, and days to 25% flowering.

The height of the plant grows with the age of the seedlings. There is a big increase. The application of Tricontanol 0.05 percent EC@1000ml/ha (71.77cm) in T_5 results in a considerable increase in plant height, followed by Paclobutrazol(25 percent w/v) SC @1000ml/ha (62.47cm) in T_2, and the least we found in T_1 (48.44cm) that is an untreated check. Murlidharan et al.(2002) had previously looked into the experimental findings (1985). Plant spread in the East-West and North-South directions was the second observation we made. The maximum plant spread in the East-West condition was achieved with Gibberellic acid 0.01 percent L@625ml/ha, T_{10} (48.38cm), followed by T_4, Mepiquatchloride 5 percent aqueous solution@625ml/ha (61.36cm), and the lowest in the untreated check (32.77 cm). In the North-South condition, the highest is achieved by applying Giberrellic acid 0.01 percent L@625ml/ha in T_{10} (45.27 cm), the next highest is achieved in T_2 by applying Paclobutrazol(25 percent w/v) SC @1000ml/ha (43.33 cm), and the lowest is achieved by leaving T_1 untreated (38.33 cm). The experimental results were based on Desia et al (1993). Gibberellic 0.01 percent L@625ml/ha produced the maximum number of branches in T_{10}. Observing in all replications at regular time intervals yielded 28.88 branches, and the administration of Mepiquat chloride 5 percent aqueous solution @625ml/ha yielded the second (26.66). Untreated check has the smallest number of branches (19.77). We also investigated the days leading up to 25% blossoming. T_9 is the highest we observed, which was achieved by applying aminoacid@1500ml/ha (65.00), followed by T_3 (65.66), which was achieved by applying Chlormequat chloride 50 percent SL@500ml/ha, and untreated check (71.66). The experimental results are consistent with Rego et al (2009).

Table no. 1: Effect of different plant growth regulators on growth attributes of Brinjal

S. No	Tr. No	Treatment details	Plant height (cm)	Plant spread (cm)		No. of branches	Days to 25 percent flowering
				East-West	North-South		
1	T_1	Untreated Check	48.44	32.77	38.33	19.77	71.66
2	T_2	Paclobutrazol(25% w/v) sc@ 1000ml/ha	62.47	36.94	43.33	25.22	68.33
3	T_3	Chlormequat chloride 50% SL@500ml/ha	53.50	43.09	42.29	25.22	65.66
4	T_4	Mepiquat chloride 5% Aqueous solution@625ml/ha	61.36	44.99	40.44	26.66	67.33
5	T_5	Triacontanol 0.05% EC@1000ml/ha	71.77	44.66	42.29	25.44	67.00
6	T_6	Triacontanol 0.05% EC@500ml/ha	54.41	42.27	41.11	21.93	66.33
7	T_7	Ethephon 39 SL(39%W/W)@375ml/ha	51.58	44.16	42.21	27.44	66.33
8	T_8	Ethephon 39 SL(39%W/W)@200ml/ha	57.77	43.16	41.66	27.33	66.00
9	T_9	Amino acid @ 1500ml/ha	50.27	38.11	39.44	21.88	65.00
10	T_{10}	Gibberelic acid 0.01% L @625ml/ha	69.33	48.38	45.27	28.88	68.00
		S.E.m±	0.85	2.39	2.62	1.52	2.03
		C.D. at 5%	2.53	7.11	N.S.	4.52	6.03

The effect of plant growth regulators on fruit set %, number of fruits per plant, fruit length, and fruit diameter is indicated in (Table no. 2).T_7, which uses Ethephon 39SL (39 percent w/w) @375ml/ha (85.37 percent), is followed by T_9, which uses aminoacid@1500ml/ha (84.47 percent), and check plot has the lowest fruit set percentage (72.03 percent). The experimental results are consistent with Khurana D.S et al (2004). We observed the highest number of fruits per plant (806.44) after applying Gibberellic acid 0.01 percent L @ 625ml/ha as T_{10}, which is almost identical to the result seen in T_5 after applying Tricontanol 0.05 percent EC @1000ml/ha (789.33), and the least fruit count observed in the untreated check (480.00). In terms of fruit length and diameter, we receive similar results. The application of Mepiquat chloride 5 percent aqueous solution @ 625ml/ha resulted in the highest T_4 (8.18 and 4.09 cms, respectively) and was followed by aminoacid @ 1500ml/ha as T_9. The experimental results are consistent with those of Balraj et al. (2002) and Mutlu and Agan (2015). In this treatment, the fruit length is 8 cm and the fruit diameter is 4.07 cm. Untreated check has the shortest fruit length (6.25cm) and the smallest diameter (3.36cm).

Table no 2: Effect of different growth regulators on yield attributing parameters

S. No	Tr. No	Treatment details	Fruit set (%)	No. of fruits per plant	Fruit length (cm)	Fruit diameter (cm)
1	T_1	Untreated Check	72.03 (58.21)	12.00	6.25	3.36
2	T_2	Paclobutrazol(25% w/v) sc@ 1000ml/ha	74.22 (59.59)	12.12	6.72	3.90
3	T_3	Chlormequat chloride 50% SL@500ml/ha	79.12 (63.18)	13.78	6.84	4.04
4	T_4	Mepiquat chloride 5% Aqueous solution@625ml/ha	80.69 (63.96)	15.70	8.18	4.09
5	T_5	Triacontanol 0.05% EC@1000ml/ha	75.14 (60.10)	19.73	7.27	3.98
6	T_6	Triacontanol 0.05% EC@500ml/ha	75.08 (60.21)	18.66	7.14	3.98
7	T_7	Ethephon 39 SL(39%W/W)@375ml/ha	85.37 (67.53)	18.13	7.10	3.94
8	T_8	Ethephon 39 SL(39%W/W)@200ml/ha	77.97 (62.04)	17.71	6.98	3.94
9	T_9	Amino acid @ 1500ml/ha	84.47 (67.66)	17.68	8.00	4.07
10	T_{10}	Gibberelic acid 0.01% L @625ml/ha	74.31 (59.60)	20.16	7.23	4.01
		S.E.m±	2.22	15.47	0.06	0.11
		C.D. at 5%	4.66	45.98	0.18	0.32

4. Conclusion

The optimal treatments for enhanced plant growth and yield were proposed based on the above observations acquired from our investigation. T_4(Mepiquat chloride 5% Aqueous solution@625ml/ha) had the best outcomes among the treatments in terms of fruit length and diameter, therefore it's a good for higher yields. The T_5(Triacontanol 0.05% EC@1000ml/ha) treatment performs best in terms of plant height, which aids in the production of massive branching. T_7(Ethephon 39 SL (39%W/W)@375ml/ha)showed the best results in terms of fruit set, which will be beneficial to farmers in terms of high yields. The T_9(Amino acid @ 1500ml/ha) treatment produces the most flowering, which is another factor that will help farmers achieve the optimum harvests. Finally, the T_{10}(Gibberelic acid 0.01% L @625ml/ha) treatment is demonstrated to be the most effective in terms of plant spread, producing the most branches and fruits per plant. These treatments can be suggested for improved crop development and maximum yields.

References

[1] Balraj R, Kurdikeri M.B and Revanappa(2002). Effect of growth regulators on growth and yield of chilli(Capsicum annuum L.) at different pickings. Indian J. Hort. 59 (1): 84-88.
[2] Chattopadhyay T.K and Sen S.K(1974). Studies on the effect of different growth regulators on reproductivephysiology and morphology of chilli (Capsicum annuum L.). Veg. Sci. 1: 42-45.
[3] Desai, B. B., V. B. Patil and U. D. Chayan. 1993. Effects of synthetic plant growth regulators on the chemical composition of some promising chilli cultivars. J. Maharastra Agri. Univ. 18 (2): 292-293.
[4] Joshi N.C, Singh D.K and Jain S.K(1999). Response of plant bioregulators on growth and yield of chilliduring summer season. Adv. Hort. &Fores. 7: 95-99.
[5] Joshi, N. C. and D. K. Singh. 2001. Effect of plant bioregulators on chilli. Veg. Sci. 28 (1): 74-75.
[6] Joshi, N. C. and D. K. Singh. 2003. Effect of pant bioregulators on growth and yield of chilli (Capsicum annuum L.).

Prog. Hort. 35 (2): 212-215.

[7] Khurana D.S, Manchanda D and Singh K (2004). Influence of naphthalene acetic acid on growth and fruit yield of chilli. Haryana J Hort. Sci 33(3/4):274-275.

[8] Minraj N and Shanmugavelu K.G(1987). Studies on the effect of triacontanol on growth, flowering, yield,quality and nutrient uptake in chillies (Capsicum annuum L.). S. Indian Hort. 35 (4): 362-366.

[9] Murlidharan, R., A. Saravanan and P. Muthuvel. 2002. Effect of plant growth regulators on yield and quality of chilli (Capsicum annuum L.). S. Indian Hort. 50 (1-3): 254-257.

[10] Mutlu SS &Agan E (2015). Effects of paclobutrazol and pinching on ornamental pepper. Hort Technol25(5): 657-664.

[11] Rego ER,Rego MM, Finger FL, Cruz CD &Casali VWD (2009). A diallel study of yield components and fruit quality in chilli pepper (Capsicum baccatum). Euphytica 168:275-287.