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Efficacy of Plant Growth Regulators on Quality and Yield of Cucumber cv. Malini under Shade Net Conditions

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Authors' contributions

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

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ABSTRACT

An investigation was conducted to study the effect of different plant growth regulators on quality and yield of cucumber cv. Malini under shade net conditions. The experiment was carried out with 10 treatments GA3 at 75 ppm, 150 ppm and 250 ppm, Ethrel at 100 ppm, 200 ppm and 300 ppm, Salicylic acid at 75 ppm, 150 ppm and 250 ppm and control (water spray) in 3 replications. The quality parameters like total soluble solids, texture of the fruit, Physiological loss in weight (PLW%) after harvesting and total yield harvested (q/ha) etc. were significantly influenced by plant growth regulators. Among all treatments GA3 at 250 ppm recorded with maximum fruit yield (165.17 t/ ha), Whereas for quality parameters treatment GA3 at 150 ppm found superior for total soluble solids

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(5.88° Brix) and minimum physiological loss in weight after harvesting (1 DAH, 5 DAH and 10 DAH) was recorded in GA3 at 250 ppm. And the fruits with ethrel treatment were found with smooth texture and the remaining were with rough texture.

Keywords: Cucumis sativus; horticultural techniques; plant growth regulators; pollination.

1. INTRODUCTION

"Cucumber (*Cucumis sativus* L.) is one of the most important cross pollinated and popular vegetable crop belonging to the family Cucurbitaceae having chromosome number 2n=14. Basically, it is an annual plant species and found to be day neutral; however, under protected conditions three crops in a year can be grown. Cucumber is a monoecious climbing vine having hirsute or scabrous stems with leaves in triangular ovate shape with curves, leaf axils with unbranched lateral tendrils" [1]. "As the lateral branches develop, at each leaf axils clusters of flowers appear and form warty and cylindrical fruits. However, enhancement in yield and quality are important factors for getting higher returns in any crop, which will be improved by different horticultural techniques. Among these, use of different plant growth regulators at appropriate concentration increases the quality and yields of any crop [2-4]. The practical use of plant growth regulators can be exploited in monoecious crop like cucumber grown under protected conditions for increasing femaleness and effective pollination thereby improving yield and quality". [5] Whereas, the knowledge about application of plant growth regulators and their proper dosage is less among farmers to get the expected results.

2. MATERIALS AND METHODS

The present investigation was carried out during the late *rabi* season of the year 2018–19 in completely randomized design (CRD) by application of different concentrations of plant growth regulators with the objective of to find out the effect of different plant growth regulators on quality and yield of cucumber cv. Malini the College of Horticulture, Mojerla.

"The experiment was laid out in Completely Randomized Design (CRD) with three replications. The experiment comprised of 10 treatments of different concentrations of GA3, Ethrel and salicylic acid along with water spray (control). Seeds were sown on the well prepared beds two seeds per hill during early days of December month on beds with dimensions of 100 x 40 x 50 cm (width, height & distance between two beds) and size of the plot was 21m. Plant growth regulators were applied after 20 and 35 days of sowing" [5]. The data on various quality and yield parameters *viz*, Total soluble solids (TSS %), Texture of fruit (by visual observation), Physiological loss in weight (PLW %), and Fruit yield (t/ha) was recorded from the five randomly selected plants and the means were calculated and mean values were subjected to statistical analysis as per Panse and Sukhatme [6].

3. RESULTS AND DISCUSSION

3.1 Quality Parameters

Pertaining Treatment GA3 at 150 ppm found superior for the maximum total soluble solids (5.89° Brix) and the minimum was recorded in control (2.40° Brix). A possible reason for increase in T.S.S is that the actual increase in leaf area surface and increased photosynthetic activity increases the source to sink ratio which results in increased assimilation of photosynthates in fruits which might result in increased T.S.S. These findings are in agreement with the results reported by Hidayathullah et al. [7] who suggested that GA_3 has significantly increased T.S.S. in cucumber. The fruits treated with ethrel treatment were found with smooth texture and the remaining was found with rough texture. More smoothness in ethrel treatment is due to the effect of ethrel which increases the rate of respiration which in result makes the tissue smooth and it might be due to its inherent characteristics of the different effect of plant growth regulators on treatments. The findings are in close conformity with the findings of Bradon et al. [8] who reported that ethylene increased the rate of respiration in cucumber. Maximum physiological loss in weight (1 DAH, 5 DAH and 10 DAH) was recorded in fruits treated with ethrel at 300 ppm treatment due to owing to the role of ethrel which increase the rate of respiration thus cause the deterioration of food reserves and increase the physiological loss in weight compared with the other treatments and mean while fruits from the plants treated with Gibberellic Acid showed

somewhat hard rind compared with the other treatments which helps in reduced respiration and reduced the rate of moisture loss thus reduced the physiological loss in weight. These findings are in line with the results reported by Bradon et al. [8] in cucumber.

3.2 Yield Parameters

From the results it was observed that GA3 at 250 ppm had the highest fruit yield (165.17 t). This is mainly due to gibberellins' increased metabolic activity of plants which resulted in the enhancement of reproductive phase which results in prolonged days of harvesting and this prolonged harvesting remains as crux in reaping out higher yields. The main reason associated with increased fruit weight is that treated plants with gibberellins remain more active physiologically and build up sufficient food for developing fruits which results in the increased fruit weight. Increase in size of individual fruits with application of GA_3 also reported by Vadigeri et al. [9] in cucumber and Nagamani et al. [10] who reported that application of GA_3 significantly enhanced fruit weight in bitter gourd.

3.3 Economic Analysis

Among all treatments GA_3 at 75 ppm (T_1) recorded the highest gross return (Rs.16, 51,700), highest net return (Rs.11, 27,783.22) and best benefit cost ratio (2.15) followed by GA_3 at 250 (T_3) with benefit cost ratio (2.13), whereas the lowest benefit cost ratio (1.62) was recorded in water spray (control) (T_{10}). This might be due to the positive effect towards other yield attributing characters and lower cost of chemicals due to lower concentration compared to T_2 and T_3.

Table 1. Effect of plant growth regulators on total soluble solids (TSS%) and texture of fruit (by visual observation) of cucumber (Cucumis *sativus* L.) cv. Malini

Treatment No.	Treatment details	Total soluble solids (˚Brix)	Texture of fruit (by visual observation)
T_1	GA_3 75 ppm	4.06^{b}	Rough
T_2	GA_3 150ppm	5.89^{a}	Rough
T_3	GA_3 250 ppm	4.26^{b}	Rough
T_4	Ethrel 100 ppm	2.95^{cd}	Smooth
T_5	Ethrel 200 ppm	3.30^{c}	Smooth
T_6	Ethrel 300 ppm	3.27^{c}	smooth
T_7	Salicylic acid 75 ppm	2.95^{cd}	Rough
T_8	Salicylic acid 150 ppm	2.69^{de}	Rough
T_9	Salicylic acid 250 ppm	2.81^{de}	Rough
T_{10}	Water spray (control)	2.40^{e}	Rough
	SEm±	0.14	
	CD at 5%	0.43	

Table 2. Effect of plant growth regulators on physiological loss in weight (PLW%) after harvesting of cucumber (Cucumis *sativus* L.) cv. Malini

Treatment No.	Treatment details	Physiological loss in weight (PLW%)		
		1 DAH	5 DAH	10 DAH
T_1	GA_3 75 ppm	3.62^{g}	10.64^{e}	13.47^{d}
T_2	GA_3 150ppm	2.64^{c}	9.27^{bc}	12.46^{c}
T_3	GA_3 250 ppm	1.74^{a}	7.74^{a}	11.13^{a}
T_4	Ethrel 100 ppm	3.49^{fg}	10.86^{ef}	13.75^{de}
T_5	Ethrel 200 ppm	3.56^{g}	11.12^{f}	14.32^{e}
T_6	Ethrel 300 ppm	4.12^{h}	11.36^{f}	14.49^{e}
T_7	Salicylic acid 75 ppm	3.49^{fg}	10.85^{e}	12.89^{cd}
T_8	Salicylic acid 150 ppm	3.15^{de}	9.79^{c}	12.34^{bc}
T_9	Salicylic acid 250 ppm	3.21^{ef}	10.36^{de}	12.68^{c}
T_{10}	Water spray (control)	2.56^{bc}	9.66^{bc}	12.36^{c}
	SEm±	0.11	0.19	0.34
	CD at 5%	0.33	0.55	1.00

Table 3. Effect of plant growth regulators on fruit yield (t/ha) of cucumber (Cucumis *sativus* L.) cv. Malini

Treatment No.	Treatment details	Fruit yield(t/ha)
T_1	GA_3 75 ppm	165.17[a]
T_2	GA_3 150ppm	157.16[b]
T_3	GA_3 250 ppm	164.73[a]
T_4	Ethrel 100 ppm	147.78[c]
T_5	Ethrel 200 ppm	149.26[c]
T_6	Ethrel 300 ppm	150.84[bc]
T_7	Salicylicacid 75ppm	154.47[bc]
T_8	Salicylicacid 150ppm	154.56[bc]
T_9	Salicylicacid 250ppm	153.84[bc]
T_{10}	Water spray (control)	136.95[d]
	SEm±	2.36
	CD at 5%	6.98

4. CONCLUSION

It could be concluded from the present investigation that plant growth regulators had significant influence on quality parameters and of cucumber cv. 'Malini' under shade net conditions. Among different plant growth regulator treatments, plants treated with GA_3 at 75 ppm showed positive effect growth, phenological, yield and quality parameters and resulted in maximum gross returns, net returns and best B: C ratio over other treatments**.**

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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