

Original Research Article

Effect of Different Plant Growth Regulators on Growth and Phenological Parameters of Cucumber (*Cucumis sativus*L.) c.v. Punjab Naveen

ABSTRACT

An experiment was conducted during the season from March 2018 – June 2018 at the Horticulture farm of Lovely Professional University, Phagwara (Punjab). The three replications of the experimental trial using a randomised block design. Eleven alternative approaches were used in the trial. Based on the findings of the experimental trial, it was possible to draw the conclusion that the treatment T₈ GA₃(100ppm) had a significant impact on the growth and phenological parameters of the cucumber, including the number of branches, leaf area, days to the first flowering, and days to 50% flowering. The longest vine and the greatest internodal distance, however, were seen in treatment T₇ GA₃(50ppm).

Keywords: GA₃, NAA, MH, Growth, Phenological, Cucumber and Punjab Naveen

1. INTRODUCTION

Cucumber (*Cucumis sativus* L.) belonging to Cucurbitaceae family is a broadly cultivated plant. It is an annual, dioecious crawling vine that grows up trellises or other supports, covering around them vine is thin, spiral tendrils. The plant has broad size of leaves that cover hole the fruit. Cucumber fruit is generally tube shape and prolong with ends.

Generally, cucumber used in a pickle and salad purpose but also make a vegetable because content of chlorine is low. Tender leaves are also used as vegetables. Fruits help in the cure of constipation, jaundice and indigestion. Seeds have a number of ayurvedic uses. Seeds and fruit hold cooling properties, hence utilize as astringent and medicinal use.

Cucumber is widely consumed both fresh and as a processed food. Based on use it may be three types as; salad type, pickling type and cooking type. Cucumber is grown mainly for its fruits both in India and abroad. Cucumber grow in many types of soil like sandy, sandy loam, clay loam and silt loam successfully. In case of higher yield in loam, silt loam and clay loam soil in used. In case of desire early crop then grown in sandy & sandy loam soil. It grows better in soil having pH 5.5-6.7. The soil should be well- drained. The role of PGR has been well known to modify various physiological processes in cucurbitaceous crops (Thomps 2008).

Applications of GA₃ with NAA have prompted the metabolic activities in plants due to enhancing in vegetative growth, Hilliet *al.*, (2010). Presence of exogenous application of chemicals (Gibberellic acid and NAA at different doses) at 2-4 true leaf stages, has a direct effect on sex expression and its inferred that combined application of GA₃ and NAA on cucumber plant takes part in the metabolic activities. Substance of NAA slow down the cell elongation and cell division in meristematic shoot with different tissue and regulated the tallness of plant without change in the physiology and morphology of plant (Hilliet *al.*, 2010) in ridge gourd.

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Growth regulators advanced the female flower initiation in the present study, which might be due to increase the metabolization of auxin substances in plants and also reduce sugar thereby bringing a change in the membrane permeability. These results are in conformity with the **Baruah and Sharma (2015)**.

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2. MATERIAL AND METHODS

The research experiment was carried out at the Horticulture farm of Lovely Professional University, Phagwara (Punjab). It was carried during the season from March 2018 – June 2018. The experimental trial conducted in Randomized Block Design with three replications. The experiment included eleven different treatments viz., T₁(NAA @50ppm), T₂(NAA @100ppm), T₃(NAA @150ppm), T₄(MH @200ppm), T₅(MH @ 250ppm), T₆(MH @300ppm), T₇(GA₃ @50ppm), T₈(GA₃ @100ppm), T₉(GA₃ @150ppm), T₁₀(NAA @100ppm + GA₃ @100ppm + MH @250ppm), T₁₁(Control). Each experimental unit was defined and layout was drawn as per plan. Punjab Naveen was the cultivar of cucumber which was planted at spacing of 2.5 m × 0.6 m during the experimental trial.

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2.1 Parameters of Study

Growth Parameters

2.2.1 Vine length: Randomly selected three plants in each plot. Vine length measure in (cm). Measure the length of vine from cotyledon node to the growing tip. Taken the observation at 15, 30 and 45 DAS.

2.2.2 Number of Branches Per Plant: Randomly selected three plants in each plot and counted period wise until the last harvesting completed. Calculate average value for selected plants.

2.2.3 Inter-Nodal Distance (cm): Measure the inter-nodal distance by distance between nodes using a scale. Calculated the mean value.

2.2.4 Leaf Area (cm²): Measured the leaf area on leaf-area-meter (manufactured by Systronics Ltd.) and average leaf area of a single leaf was worked out and expressed in cm². Observations were taken at 15, 30 and 45 DAS.

Phenological Parameters

2.2.1 Days Taken To 1st Flowering: Recorded the date of induce 1st flower in each plot. counting the no. of days from DAS.

2.2.2 Days Taken To 50% Flowering: Noted the date for 50% flowering in each plot. Counting the no. of days from DAS. Calculate the average value.

2.2.3 Number of Male Flowers PerVine: Recorded the male flowers at the stage of flowering. Counted the appearance of 1st flower until the last flower from selected plants.

2.2.4 Number of Female Flowers per Vine: Recorded the Female flowers at the stage of flowering. Counted the appearance of 1st flower until the last flower from selected plants.

2.2.5 Male and Female Ratio: Recorded the male and female flower at the stage of flowering. Counted the appearance of 1st flower until the last flower from selected plants.

3. Result and Discussion

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The data on various growth and Phenological attributes were statistically analysed and showed the significant result on cucumber.

Growth Parameters

Vine length (cm): The treatment showed the significant effect on vine length at 15, 30 and 45 days after sowing. Treatment T₉ (GA₃ @ 150ppm) recorded maximum vine length (25.69cm) at 15 DAS and treatment T₁₁(Control) exhibited minimum (15.54 cm). Vine length at 30 DAS, treatment T₇ (GA₃ @ 50ppm) recorded the maximum vine length (61.24cm) and treatment T₁₁ (control) exhibited minimum (43.22). Vine length at 45 DAS, treatment T₇ (GA₃ @50ppm) recorded maximum (81.01) and minimum in treatment T₁₁ (61.37).

Number of Branches Per Plant: Significantly maximum number of branches per plant (4.06) was recorded under exogenous application of the treatment T₁ (NAA @50 ppm) at 15 DAS while the minimum branches per plant was recorded in the treatments T₁₁ (control) valued 2.96. Treatments T₅(MH@250ppm) are statistically at par with NAA @50 ppm (T₁). At 30 DAS, the significantly maximum branches per plant was recorded in the treatment T₁-NAA @50 ppm valued 6.43 while, the minimum branches per plant was recorded in the treatment T₁₁-Control (water spray) valued 5.37. At 45 days after sowing, the maximum branches per plant were recorded in the treatments T₁-NAA @50ppm valued 7.98while, the minimum branches per plant was noted in treatment T₁₁ - control valued 7.40.

Inter-Nodal Distance (cm): The plant growth regulators have significant effect on increasing and decreasing of inter-nodal length of vine as compare to control. Significantly maximum inter-nodal distance of 5.11 cm was recorded in the treatment T₇ (GA₃ @50ppm) whereas minimum of 4.60cm was recorded in the treatment T₁₁ (Control). The treatments T₃ (NAA @150ppm), T₅ (MH @250ppm) and T₁ (NAA @50ppm) were statistically at par with GA₃ @50ppm (T₇).

Leaf Area(cm²): The leaf area was recorded at 15 days after sowing, the significantly maximum leaf area was recorded under the treatment T₁-NAA @ 50ppm valued 29.35cm²whereas minimum leaf area was recorded in the treatment T₁₁ (Control) of 19.64cm². Treatments T₂, T₅ and T₇ were statistically at par with each other. At 30 days after sowing, the significantly maximum leaf area was recorded under the treatment T₅-MH @250ppm valued 106.21.65cm² whereas minimum was recorded in the treatment T₁₁ (control) valued 88cm². At 45 days after sowing, the significantly maximum leaf area was recorded under the treatment T₉- GA₃ @150ppm valued 187.46cm² whereas minimum leaf area was recorded in the treatment T₁₁ (control) valued 165.76 cm².

Phenological Parameters

Days Taken to First Flowering: The minimum days 20.4 taken to first flowering was recorded in the treatment T₈ (GA₃ @100ppm) as compared to maximum (32.44) in treatment T₁₁ (control).

Days Taken To 50% Flowering: The minimum days taken to 50% flowering was recorded in the treatment T₈- GA₃ @100 ppm valued 24.28 compared to treatment T₁₁ (control) valued 37.33. However, the treatments T₇, T₉ and T₁₀were found statistically at par with T₈ (GA₃ @100 ppm).

Number of Male Flowers Per Vine: plant growth regulators play an important role in decreasing the number of male flowers per vine as compared to control. The number

of male flowers per vine was minimum (19.39) under the treatment T₃ (NAA @150ppm as compared to maximum T₇(GA₃ @50ppm).

Number of Female Flowers Per Vine: The maximum number of female flowers (17.03) Was recorded under the treatment T₇(GA₃ @50ppm) and minimum of T₁₁ under control. However, the treatment T₄ and T₈ respectively were statistically at par with treatment T₇.

Male and Female Ratio: foliar application of growth regulators has significant effect on narrowing or reducing the male and female ratio in cucumber as compared to control. A narrow sex ratio of 1.92 was recorded under the treatment T₁ (NAA@50ppm) as compared to wider sex ratio of T₁₁ under control. However, the T₉ treatments and T₁₀ respectively were statistically at par with the treatment T₁.

Discussion

The vine length increased significantly with the increase in crop growth stages (15, 30 and 45 DAS). The T₇-GA₃@ 50ppm was found significantly superior as compared to the rest of the treatments. Wherever the minimum was recorded in treatment T₁₁-Control. The promotion of growth either in terms of increase in the vine length or the leaf area and leaf number has been thought to be by increasing plasticity of the cell wall followed by hydrolysis of starch to sugars which lowers the water potential of cell, resulting in the entry of water into the cell causing elongation. Among treatments 20 ppm Gibberellic acid recorded that the significantly maximum length of vine and no. of leaves 61.1 cm and 46, respectively (**Geeta et al., 2010**). **Arun et al., (1997)** noted that the doses of 200 ppm Gibberellic acid was showed in highest height of plant followed by seed soaking with @15 ppm Gibberellic acid in Brinjal cv Pusa Purple Long. The doses of 500 ppm Gibberellic acid enlarged the Vine length in muskmelon. In summer squash various doses of GA₃ (25 ppm) and Naphthalene acetic acid (50 ppm) encouraged the elongation the length of main vine. Similarly, the doses of (25 ppm) Gibberellic acid at 2-4 leaf stage showed the extra vine length as comparison to water spray in bitter-gourd. (**Arora et al. 1982 and 1985**). It was observed that the doses of Naphthalene acetic acid at 2-4 leaf stage enlarge length of crop vine in watermelon variety sugar baby (**Shinde et al., 1994**).

In number of branches per plant, data was recorded 15,30 and 45 days after sowing the cucumber. Generally recorded maximum no. of branches in T₈- GA₃@100ppm while found the minimum no. of branches in T₁₁- (control). The variation in number of branches per vine might have been due to its PGR's effect and also due to vine length, inter-nodal length and environmental factor that confirming to reports of **Hilliet al. (2010)** suggested that maximum number of branches @ GA₃(4.60) has been recorded, **Mehadiet al. (2012)** and **Momin et al. (2014)**.

In leaf area, data was recorded 15,30 and 45 days after sowing the cucumber. Generally recorded maximum leaf area in T₉- GA₃ @150ppm while found the minimum leaf area in T₁₁- (control). **Merentoshi (2016)** reported that GA₃ @ 50 ppm recorded maximum leaf area at all the stages. **Sure et al. (2012)** this had proved GA₃ influencing a range of developmental processing in stem elongation, germination, flowering, sex expression, enzyme induction and can improve the seedling vigor. Applications of GA₃ with have prompted the metabolic activities in plants due to enhancing in vegetative growth.

In inter nodal-data distance was recorded the cucumber. Generally recorded maximum inter-nodal in T₇- GA₃@50ppm while found the minimum in T₁₁- (control). The doses of Gibberellic acid increased the growth of stem and the impact was more at larger concentrations. In summer squash various doses of GA₃ (25 ppm) and Naphthalene acetic acid (50 ppm) encouraged the elongation the length of main vine. Similarly, the doses of (25 ppm) Gibberellic acid at 2-4 leaf stage showed the extra vine length as comparison to water spray in bitter-gourd. (**Arora et al. 1982 and 1985**). It was observed that the doses of Naphthalene acetic acid at 2-4 leaf stage enlarge length of crop vine in watermelon variety sugar baby (**Shinde et al., 1994**).

In treatment T₈GA₃ (@100ppm recorded minimum day taken to flowering whereas maximum day taken flowering in T₁₁- control. Due to effect of PGR reason for variation of day taken to flowering. Uses of conc. Of GA₃ @25ppm and 50ppm to give the early flowering in watermelon according to Dixit et al., (2001). In bitter gourd use of GA₃ @5ppm beneficial for total no. of flower according to **Akhter and Rahman (2010)**.

The significantly maximum days taken to 50% flowering was recorded in treatment T₁₁- Control (37.33), while, minimum was noted in treatment T₈- GA₃@100ppm (24.28). The variation in the days taken to 50% flowering be due to effect of PGR's on different treatments. These findings agree with the results reported by **Thappa et al. (2011)**.

The significantly maximum male and female ratio was recorded in treatment T₁-NAA @50ppm (1.92:1), while, minimum was noted in T₁₁- Control (1.40:1). It is concluded that the reason for male and female ratio is effect of PGR's on treatment. These findings are in agreement with the results reported by the principle in sex modification in cucurbits lies in altering the sequence of flowering and sex ratio. The smaller sex ratio by the joint application of Naphthalene acetic acid and GA₃ is maybe due to the fact that these substances are informed to compatibility besides reducing the embryo abortion in plants and increase functional female organs. Similar results were obtained in bitter gourd by **Banerjee and Basu(2003)**. **Choudhary and Phatak (1981)** considered the effect of doses of Maleic hydrazide, 2, 4-D Naphthalene acetic acid and Indole acetic acid and on the sex expression & also effect the sex ratio of cucumber.

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Table 1 Effect of Different Plant Growth Regulators on Growth and Phenological Parameters of Cucumber (*Cucumis sativus*L.) c.v. Punjab Naveen

Sr. No.	Treatments	Vine Length (cm)			Number of Branches Per Plant			Leaf Area (cm ²)			Inter-Nodal Distance (cm)	Days Taken to First Flowering	Days Taken To 50% Flowering	Number of Male Flowers Per Vine	Number of Female Flowers Per Vine	Male Female Ratio
		15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS						
1.	T ₁ NAA (50ppm)	21.34	55.29	75.27	3.50	5.72	7.65	29.15	96.99	181.05	4.87	31.00	34.83	25.75	13.44	1.92:1
2.	T ₂ NAA (100ppm)	19.57	53.44	75.45	3.12	5.66	7.63	27.85	95.86	179.62	4.37	30.22	35.67	20.81	12.66	1.63:1
3.	T ₃ NAA (150ppm)	20.46	53.41	73.40	3.11	5.85	7.75	26.34	93.90	171.72	4.95	29.47	35.08	19.39	12.77	1.52:1
4.	T ₄ MH (200ppm)	22.42	50.45	71.84	3.37	6.14	7.05	27.50	100.63	183.98	4.65	25.22	32.26	32.00	15.78	1.71:1
5.	T ₅ MH (250ppm)	22.07	50.33	69.77	3.47	5.96	7.85	26.91	106.21	182.24	4.85	25.54	32.62	29.00	16.55	1.74:1
6.	T ₆ MH (300ppm)	19.33	49.39	70.88	3.13	6.23	7.61	25.32	95.89	178.13	4.49	23.45	31.15	25.81	14.33	1.79:1
7.	T ₇ GA ₃ (50ppm)	22.48	61.24	81.01	3.63	5.72	7.59	26.61	97.46	181.35	5.11	21.36	25.46	30.00	17.03	1.76:1
8.	T ₈ GA ₃ (100ppm)	24.48	59.51	79.47	4.28	6.56	8.03	24.11	96.23	186.42	4.85	20.04	24.28	26.25	15.44	1.71:1
9.	T ₉ GA ₃ (150ppm)	25.69	58.54	80.83	3.75	6.33	7.95	23.19	97.11	187.46	4.76	20.32	26.92	28.36	15.44	1.82:1
10.	T ₁₀ NAA (100 ppm) + GA ₃ (100 ppm) + MH (250 ppm)	21.37	53.51	71.39	3.77	6.19	7.63	22.76	94.78	177.76	4.15	26.14	30.81	23.95	13.30	1.81:1
11.	T ₁₁ (control)	15.54	43.22	61.37	3.02	5.34	7.30	19.64	88.00	165.76	4.60	32.44	37.33	22.89	16.33	1.40:1
	SEm(±)	0.553	0.626	0.617	0.032	0.024	0.038	0.527	2.538	1.437	0.087	0.352	0.416	2.096	1.064	0.009
	C.D. at 5% of Level	1.643	1.861	1.833	1.588	0.695	0.860	1.566	7.539	4.270	0.257	1.046	1.237	6.227	3.161	0.026

Conclusion

Based upon the results recorded in the experimental trial it could be concluded that the treatment T₈ GA₃(100ppm) showed the significant results in terms of growth and phenological parameters of cucumber viz., number of branches, leaf area, days taken to 1st flowering and days taken to 50% flowering. However, treatment T₇GA₃(50ppm) showed the maximum vine length and inter-nodal distance. While the minimum results recorded under the control treatment. So, it is advised to cucumber growers to spraying GA₃(100ppm) for obtaining better of cucumber.

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