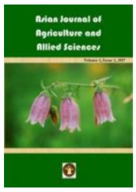
Asian Journal of Agriculture and Allied Sciences

5(1): 50-57, 2022



EFFECT OF APPLICATION OF GROWTH REGULATORS ON GROWTH AND FLOWER PERFORMANCE OF *Jasminum sambac*

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AUTHORS' CONTRIBUTIONS

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

Received: 05 July 2022
Accepted: 09 September 2022
Published: 15 September 2022

Original Research Article

ABSTRACT

Jasminum sambac is the oldest commercial flower belonging to the family Oleaceae. The crop has main flowering seasons, i.e. from March to October and an off-season from November to February. However, the seasonal nature of flowering is one of the serious problems that affect both jasmine growers and consumers. In addition to that the maximum and minimum productive seasons, which affect the price trends of jasmine greatly. At present, the use of growth regulators to develop and increase production has received the uttermost attention. In the light of this situation, current study was conducted at the Royal Botanical Gardens, Peradeniya, on the "Effects of application of growth regulators on growth and flower yield of *Jasminum sambac* (Geta pichcha)" during the years 2021-2022. The experiment was laid out in a Completely Randomized Design (CRD) with seven different treatments and six replications. Six-month-old *Jasminum sambac* plants were selected for investigation. Three growth regulators, GA_3, IAA, and Paclobutrazol, were selected at 150 ppm and 200 ppm intervals. Among the various treatments, application of IAA at 200ppm (T_4) recorded the highest plant height (49.08cm & 66.00cm at 60 and 120 DAP respectively), length of primary shoots (35.33cm & 57.50cm at 60 and 120 DAP respectively), number of leaves (23.91 & 44.13 at 60 and 120 DAP respectively), number of secondary shoots (3.51 & 8.08 at 60 and 120 DAP respectively) and length of flower buds (2.33cm). The maximum yield of flower buds per plant (241.00) and the highest number of primary shoots (7.00) were noticed in PBZ 200ppm (T_6). Earliness of flowering (22.92 days) was recorded by GA_3 at 200ppm (T_2). According to the findings of the preceding studies, IAA at 200ppm could be recommended for enhancing growth, and both PBZ at 200ppm and IAA at 200ppm were found effective for enhancing the yield and yield attributes of *Jasminum sambac.*

Keywords: *Jasminum sambac*; growth regulators; GA_3; IAA; Paclobutrazol.

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1. INTRODUCTION

Jasminum sambac is the oldest commercial flower belonging to the family Oleaceae, which is grown mainly for its fresh flowers that are used for making garlands, decorating the hair of women, religious offerings. In Sri Lanka, the fresh flowers of jasmine are highly valued and are used for religious and marriage ceremonies, making garlands and bouquets to decorate the hair of women. Sri Lanka frequently uses flowers in religious places such as Buddhist and Hindu temples. Sri Lanka imports jasmine flowers from India to conduct a jasmine flower ceremony (Pichcha Mal Pujawa) in the holy place of Buddhists at Anuradhapura, “Jaya Sri Maha Bodhi”. Subsequently, the Department of National Botanic Gardens and the Department of Agriculture jointly established a programme to cultivate jasmine in Sri Lanka to fulfill the demand [1]. Plant growth regulators are being used by commercial growers of ornamental plants as a cultural practice [2-4]. Plant growth regulators have quicker effects on growth as well as the flower yield of flowering crops [5-9]. Growth and flowering responses of ornamental plants on growth regulators have been intensively studied with a view to having compact plants with a greater number of flowers and also to hastening or delaying flowering according to the needs of the growers [10,11-13]. Hence, the research deals with the effect of plant growth regulators on the growth and flower yield of *Jasminum sambac* (Geta pichcha) in order to know its positive effect on growth and flower yield aspects [14-18]. One of the serious problems that affect both jasmine growers and consumers is that the flowering of jasmine plants is seasonal [19-21]. There are maximum and minimum productive seasons which affect the price trends of jasmine greatly [22-24]. At present, the use of growth regulators to develop and increase production has received the uttermost attention. Many researchers have studied the effects of various plant growth regulators on the growth and flower yield of *Jasminum sambac* [25-28]. Gibberellic acid increased the number of internodes, number of leaves per plant, earliness of flowering, maximum flowering duration, and significant increase in flower yield per plant [29]. Paclobutrazol retarded the growth of jasmine plants and increased the flower production of *Jasminum sambac*. (Masyhudi et al., 1999). However, work has not been done to exploit the potential benefits obtained from the application of plant growth regulators like GA_3, IAA, and Paclobutrazol in different concentrations for better growth and flowering of *Jasminum sambac.* Therefore the effects of the application of plant growth regulators (PGRs) on the growth and flower yield of *Jasminum sambac* will be evaluated. However, research has not been done to exploit the potential benefits obtained from applying plant growth regulators like $GA_{3,}$ IAA, and Paclobutrazol for better growth and flowering of *Jasminum sambac*. Further optimum concentration of suitable growth regulators on the growth and flowering of *Jasminum sambac* will also be investigated.

2. MATERIALS AND METHODS

2.1 Experimental Site

The present study was carried out in the form of a pot experiment in the Royal Botanical Gardens, Peradeniya to study the “Effects of application of growth regulators on growth and flower yield of *Jasminum sambac* (Geta pichcha)” from August 2021 to February 2022.

2.2 Treatments

Growth regulators, i.e. Gibberallic acid (GA_3), Indole acetic acid (IAA) and Paclobutrazol were used in the treatments as given below (Table 1).

Table 1. Treatment structure

No.	Treatment	Concentration
1	T_1 - GA_3	150 ppm
2	T_2 - GA_3	200 ppm
3	T_3 - IAA	150 ppm
4	T_4 - IAA	200 ppm
5	T_5 - Paclobutrazol	150 ppm
6	T_6 - Paclobutrazol	200 ppm
7	T_7 - Control	Water spray

2.3 Experimental Design and Layout

The design for the experiment was a completely randomized design (CRD) with 6 replications and 7 treatments. Treatments were allocated randomly to each replication. Each treatment consists of 12 plants. And one replication has two plants.

T2 R3	T5 R4	T6R 6	T6 R1	T4 R1	T7 R1	T4 R3	T3 R4	T1 R4	T1 R3	T5 R6	T1 R6	T4 R6	T5 R3	T1 R1	T5 R2	T6 R2	T3 R1	T2 R5	T4 R4	T7 R6
T6 R5	T7 R2	T7R 5	T3 R6	T5 R1	T3 R2	T3 R4	T2 R2	T4 R5	T1 R5	T3 R3	T7 R4	T6 R3	T6 R4	T7 R3	T2 R6	T2 R1	T2 R4	T4 R2	T1 R2	T5 R5

2.4 Planting Materials

Six month old *Jasminum sambac* plants were collected from Dry Zone Botanical Gardens, Hambantota. Healthy, disease-free plants were planted in prepared plastic pots and irrigated. Planting was done on the 29th of July 2021.

2.5 Preparation of Pots

The potting medium was prepared by mixing equal ratios of dry cow dung, top soil, and sand (1:1:1). Plastic pots (12 in. x 11 in.) were selected for establishing plants, and the pots were labeled prior to filling with medium. A few brick pieces were placed at the bottom of the pots, and a layer of dry leaves was added to facilitate the irrigation. Plastic pots were filled with the prepared medium.

2.6 Cultural Operations

The normal cultural practices such as pruning, application of fertilizers, irrigation and weeding measures that are followed are briefly described here. The experiment started in the last week of July 2021.

2.7 Preparation of Stock Solutions from Growth Regulators

- 18 mg of *Gibberallic Acid (GA_3)* was dissolved in 2-5ml of 1N NaOH & the final volume was made up to 120 ml by adding distilled water.
- 18 mg of *Indole -3 Acetic Acid (IAA)* was dissolved in 2-5ml of 1N NaOH & the final volume was made up to 120 ml by adding distilled water.
- 18 mg of Paclobutrazol was dissolved in 2-5ml of distilled water & the final volume was made up to 120 ml by adding distilled water.

2.8 Application of Plant Growth Regulators

The plant growth regulators were sprayed twice, at 15 days & 45 days intervals after pruning. The sprays were given with a hand sprayer in the morning. The approximate volume of spray for each plant at a time was 10 ml.

Number of applications	Days after pruning
1st application	15 days
2nd application	45 days

2.9 Measurements

In order to understand the growth & development of plants, growth parameters, and yield & yield attributes were recorded. The growth parameters and yield & yield attributes were recorded from twelve plants from each treatment.

2.10 Statistical Analysis

Data obtained were analyzed statistically by ANOVA (Analysis of variance) with the help of Minitab 19 computer package. Tukey pairwise comparison was performed to compare the differences among the treatment means at p=0.05.

3. RESULTS AND DISCUSSION

3.1 Effects of Plant Growth Regulators on Vegetative Growth of *Jasminum sambac*

3.1.1 Plant height

Both concentrations of Indole Acetic Acid (IAA) recorded a significant increase in the plant height compared to other growth regulators. The highest plant height was recorded in IAA 200ppm (T_4) at different intervals (60 DAP- 49.08cm, 120 DAP- 66.00cm), followed by IAA 150ppm (T_3) (60 DAP – 48.92cm, 120 DAP – 63.92cm). Paclobutrazol (PBZ) registered the lowest plant height. The lowest plant height was recorded in Paclobutrazol 200ppm (T_6) at different intervals (60 DAP – 39.92cm, 120 DAP- 46.08cm) followed by Paclobutrazol 150ppm (T_5) (60 DAP- 40.50cm, 120 DAP- 49.33cm). Though Gibberellic acid (GA_3) gave a higher height in comparison with Paclobutrazol and the water spray (control- T_7), it is not significantly higher. GA_3 200ppm (T_2) recorded 44.58cm & 55.67cm at 60 & 120 DAP. GA_3 150ppm (T_1) gave a lower height than GA_3 200ppm (60 DAP- 43.25cm, 120 DAP- 53.42cm).

Table 2. Effect of plant growth regulators on plant height of *Jasminum sambac*

Treatment	60 DAP	120 DAP
T1 - GA_3 @ 150ppm	43.25^{ab}	53.42^{b}
T2 - GA_3 @ 200ppm	44.58^{ab}	55.67^{b}
T3 - IAA @ 150ppm	48.92^{a}	63.92^{a}
T4 - IAA @ 200ppm	49.08^{a}	66.00^{a}
T5 - PBZ @ 150ppm	40.50^{b}	49.33^{bc}
T6 - PBZ @ 200ppm	39.92^{b}	46.08^{c}
T7 - Control	42.83^{ab}	52.83^{bc}

Means with the same letter/s are not significantly different at p=0.05

Spraying Paclobutrazol at 200ppm (T_6) was the most effective treatment in reducing the plant height at different intervals. Paclobutrazol at 150ppm (T_5) also recorded very appreciable plant height retardation.

The height of a plant is an important parameter in determining the vigour of the plant. The data on the height of the plant are presented in Table 2. The foliar application of IAA had a significant effect on the height of the plant. Application of IAA (200ppm) treatment (T_4) resulted in maximum height at 60 and 120 days after pruning, which was followed by T_3 (IAA at 150ppm). Application of Paclobutrazol leads to the reduction of plant height, and the height of plants goes on decreasing with higher concentrations of Paclobutrazol. The increase in height in IAA treated plants might be due to rapid elongation and cell enlargement, which would have increased internodal distance. And the reduced height in PBZ might be due to a reduction of internodal length. The findings are supported by results reported by Kumar et al. [30], which found in Carnation that sprayed with IAA at 100ppm, 200ppm & 300ppm resulted in maximum plant height compared to their respective controls. Tammam [31] found in *Glebionis coronaria* that a 50 & 200mg/kg application of IAA increased the plant height. Similarly, Menhenette (1979) observed in Chrysanthemum that application of IAA significantly increased the plant height.

3.1.2 Number of shoots formation

Paclobutrazol 200ppm treated plants produced a significantly greater number of primary shoots followed by 200ppm Indole Acetic Acid (IAA) treatment. Paclobutrazol 200ppm (T_6) treated plants produced the maximum number of primary shoots at different intervals (60 DAP- 4.75, 120 DAP- 7.00) followed by IAA 200ppm (60 DAP- 4.5, 120 DAP- 6.58). GA_3 at 150ppm (T_1) registered the lower number of primary shoots at different stages of growth of the plant (3.92 & 5.08), followed by water spray (T_7-control) (4.0 & 5.17) and GA_3 at 200ppm (4.17 & 5.25). Water spray (T_7- control) is statistically at par with GA_3 at 200 ppm. All the other treatments (T_3- IAA 150ppm & T5 PBZ 150ppm) recorded a greater number of shoots than them (Table 3).

Table 3. Effect of plant growth regulators on primary shoots formation of *Jasminum sambac*

Treatment	60 DAP	120 DAP
T1 - GA_3 @ 150ppm	3.92^a	5.08^b
T2 - GA_3 @ 200ppm	4.17^a	5.25^b
T3 - IAA @ 150ppm	4.58^a	6.17^{ab}
T4 - IAA @ 200ppm	4.50^a	6.58^a
T5 - PBZ @ 150ppm	4.33^a	6.00^{ab}
T6 - PBZ @ 200ppm	4.75^a	7.00^a
T7 - Control	4.00^a	5.17^b

Means with the same letter/s are not significantly different at p=0.05

The results of the present study indicated that the maximum number of primary shoots per plant was recorded in T_6 (PBZ 200ppm) followed by T_4 (IAA 200ppm). Minimum number of shoots were recorded in treatment T_1 (GA_3 150ppm). It was observed that the number of shoots per plant increased as the height of a plant decreased. The findings are supported by results reported by Mertens (1992), which observed that PBZ 200ppm showed the maximum number of branches per plant in Rhododendron. Swaminathan et al. [32] found that spraying of PBZ at 20ppm in *Jasminum sambac* increased the number of branches. Similarly, Kumar [30] and Widurugewatte [33] found that the application of plant growth regulators resulted in the maximum number of axillary shoots formation in ornamental plants.

3.1.3 Length of primary shoots

The plants treated with IAA registered a significant increase in the length of primary shoots at different intervals. The highest length of primary shoot was noticed in IAA 200ppm (T_4) at different intervals (60 DAP- 35.33cm & 120 DAP- 57.50cm), followed by 200ppm GA_3 (T_2) (60 DAP- 35.25cm & 120 DAP – 56.33cm), while both concentrations of Paclobutrazol (200ppm & 150ppm) recorded the lowest length of primary shoot. Spraying with PBZ 200ppm (T_6) was the most effective treatment in reducing the length of primary shoots at different intervals (60 DAP- 27.42cm & 120 DAP- 39.67cm), followed by 150ppm PBZ (T_5) at different intervals (60 DAP- 28.08cm & 120 DAP- 40.83cm). GA_3 at 150ppm (T_1) recorded shoot length at different intervals of 60 DAP & 120 DAP (31.00cm & 45.33cm), which were on par with untreated control (60 DAP-30.42cm & 120 DAP-45.17cm). IAA at 150 ppm (T_3) also recorded increased primary shoot length at different intervals (60 DAP- 33.92cm & 120 DAP- 54.17cm) when compared to the control (T_7) (Table 4).

Table 4. Effect of plant growth regulators on length of the shoots of *Jasminum sambac*

Treatment	60 DAP	120 DAP
T1 - GA_3 @ 150ppm	31.00^{ab}	45.33^b
T2 - GA_3 @ 200ppm	35.25^a	56.33^a
T3 - IAA @ 150ppm	33.92^{ab}	54.17^a
T4 - IAA @ 200ppm	35.33^a	57.50^a
T5 - PBZ @ 150ppm	28.08^b	40.83^b
T6 - PBZ @ 200ppm	27.42^b	39.67^b
T7 - Control	30.42^{ab}	45.17^b

Means with the same letter/s are not significantly different at p=0.05

Different treatments of growth regulators appreciably affected the length of primary shoots. The spraying of IAA 200ppm (T_4) promotes the length of primary shoot of the plant and the minimum was recorded with Paclobutrazol 200 ppm (T_6). In general, it is clear that the spraying of IAA at 200ppm was found most beneficial in increasing the length of primary shoots of *Jasminum sambac* at all stages of growth, while spraying with PBZ at 200ppm was the most effective treatment in reducing the length of primary shoots. It was observed that the length of primary shoots increased with the increase in the height of plants. Similar results were found by Tammam et al. [31] in *Glebionis coronaria,* when spraying 50 & 200mg/kg IAA increased the shoot length.

3.1.4 Number of leaves

A significant difference was observed among the different plant growth regulators used at different levels at 60 & 120 DAP. Plants treated with IAA – 200ppm (T_4) produced more number of leaves per primary shoot at different intervals (23.91 & 44.13), followed by IAA- 150 ppm (60 DAP- 22.33 & 120 DAP- 42.19). Untreated plants (T_7- control) registered the significantly lowest number of leaves at different intervals (60 DAP-15.41 & 120 DAP-30.61). Both concentrations of Paclobutrazol, PBZ 150ppm (18.24 & 34.58) and PBZ 200ppm (21.27 & 35.97) were statistically on par with GA3 200ppm (19.19 & 34.52) at 60 and 120 DAP. GA_3 150ppm (T_1) produced more number of leaves than PBZ 150ppm (T_5), PBZ 200ppm (T_6) & GA_3 200ppm (T_2). GA_3 at 150ppm recorded 21.57 & 38.66 leaves per primary shoot at 60 & 120 DAP (Table 5).

Table 5. Effect of plant growth regulators on number of leaves *Jasminum sambac*

Treatment	60 DAP	120 DAP
T1 - GA_3 @ 150ppm	21.57[a]	38.66[abc]
T2 - GA_3 @ 200ppm	19.19[a]	34.52[bc]
T3 - IAA @ 150ppm	22.33[a]	42.19[ab]
T4 - IAA @ 200ppm	23.91[a]	44.13[a]
T5 - PBZ @ 150ppm	18.24[a]	34.58[bc]
T6 - PBZ @ 200ppm	21.27[a]	35.97[abc]
T7 - Control	15.41[a]	30.61[c]

Means with the same letter/s are not significantly different at p=0.05

It is evident from the data recorded in Table 4 that significantly more leaves were recorded at IAA 200ppm (T_4), followed by IAA 150ppm (T_3). The lowest number of leaves were observed in control (T_7). The increase in the number of leaves may be due to the increase in the length of primary shoots. And IAA increased the height of plants and the number of primary shoots. Similar results were obtained by Kumar et al. [30] and reported in Carnation. The number of leaves per plant were highest with 200ppm IAA. Rajkumari [34] found that foliar spray of IAA at 50, 75, 100ppm increased the number of leaves per plant in *Gladiolus grandiflorus*.

3.1.5 Number of secondary shoots of *Jasminum sambac*

The number of secondary shoots was greater in plants treated with IAA at 200ppm Indole acetic acid (IAA) at 200ppm (T_4) gave the maximum number of secondary shoots per primary shoot at different intervals (60 DAP- 3.51 & 120 DAP- 8.08) followed by PBZ 150ppm (T_5) (3.29 & 7.69 respectively) followed by IAA 150 ppm (T_3) (3.61 & 7.61). PBZ at 150ppm (T_5) was at statistically par with IAA at 150ppm (T_3). The least number of secondary shoots per primary shoot was recorded in water spray (T_7- control) as 2.18 at 60 DAP and 4.33 at 120 DAP. Both concentrations of Gibberallic acid gave a greater number of secondary shoots than control (T_7), as shown in the graph. GA_3 150ppm recorded 3.53 & 6.64 at 60 & 120 DAP and GA_3 200ppm recorded 3.04 and 6.19 at 60 & 120 DAP. However, there is no significant difference between the growth regulators (Table 6).

Table 6. Effect of plant growth regulators on number of secondary shoots per primary shoot at different intervals

Treatment	60 DAP	120 DAP
T1 - GA_3 @ 150ppm	3.53[a]	6.64[a]
T2 - GA_3 @ 200ppm	3.04[a]	6.19[ab]
T3 - IAA @ 150ppm	3.61[a]	7.61[a]
T4 - IAA @ 200ppm	3.51[a]	8.08[a]
T5 - PBZ @ 150ppm	3.29[a]	7.69[a]
T6 - PBZ @ 200ppm	2.61[a]	6.91[a]
T7 - Control	2.18[a]	4.33[b]

Means with the same letter/s are not significantly different at p=0.05

Different treatments of growth regulators affected the number of secondary shoots of the plant. The results of the present study showed that the highest number of secondary shoots per primary shoot was recorded in T_4 (IAA 200ppm) followed by T_5 (PBZ 150ppm). The lowest number of secondary shoots was recorded in T_7 (control). But PBZ 200ppm was expected to show the maximum number of secondary shoots because the maximum number of primary shoots per plant was recorded in T_6 (PBZ 200ppm) followed by T_4 (IAA 200ppm). However, a significant difference between the treatments cannot be observed here.

3.2 Effects of Plant Growth Regulators on days to Flower Bud Initiation of *Jasminum sambac*

In general, GA_3 treated plants started flowering earlier and it gave flowering at 22.92 days after pruning in plants treated with GA_3 200ppm (T_2), followed by 23.67 days after pruning at GA_3 150 ppm (T_1), against

29.92 days after pruning in control (T_7), as shown in Table 7. However, all the treatments showed significantly early flowering when compared with the control (T_7). Both concentrations of Paclobutrazol (T_5- 24.33 days & T_6- 23.75 days) recorded early flowering than both the concentrations of IAA (T_3- 25.50 days & T_4- 26.50 days) and showed slightly late but almost equal to the duration to flower bud initiation of GA_3. Duration to flower bud initiation of GA_3 150ppm (T_1) (23.67 days) and Paclobutrazol 200ppm (T_6) (23.75 days) are statistically at par with each other. IAA 200ppm (T_4) showed a longer duration to flower bud initiation with 26.50 days followed by 25.50 days at IAA 150ppm (T_3) compared to other growth regulators.

Table 7. Effect of plant growth regulators on days to flower bud initiation

Treatment	Flower bud initiation (Days)
T1 - GA_3 @ 150ppm	23.67^{bc}
T2 - GA_3 @ 200ppm	22.92^{c}
T3 - IAA @ 150ppm	25.50^{bc}
T4 - IAA @ 200ppm	26.50^{b}
T5 - PBZ @ 150ppm	24.33^{bc}
T6 - PBZ @ 200ppm	23.75^{bc}
T7 - Control	29.92^{a}

Means with the same letter/s are not significantly different at p=0.05

The data regarding the number of days to flower bud initiation are in Table 8. It is clear from the table that treatment T_2 (GA_3 200ppm) required a lower number of days for flower bud initiation followed by treatment T_1 (GA_3 150ppm). Comparatively delayed flowering was recorded in plants of treatment T_7 (Control). When considering the plant growth regulators, IAA delayed the flowering more than the other growth regulators. Similar results were obtained by earlier workers. Dhanasekaran (2018) found that GA_3 application resulted in earliness of flowering in *Jasminum sambac*. Muhammad (2010) observed that GA_3 resulted in early flowering of *Chrysanthemum morifolium*.

3.3 Number of Flower Bud per Plant of *Jasminum sambac*

Paclobutrazol 200ppm treated plants produced significantly more number of flower buds per plant followed by 200ppm of IAA treatment PBZ 200ppm (T_6) treated plants produced the highest (241.00) number of flower buds per plant, followed by IAA 200ppm (T_4) with 233.00 flower buds. The least number of flower buds were recorded with GA_3 at 200ppm (T_2) (190.92) and GA_3 at 150ppm (T_1) (197.67). PBZ 150ppm (T_5) and IAA 150ppm (T_3) also recorded appreciably more (T_5- 229.58 & T_3- 223.08) number of flowers compared to untreated plants (T_7) (Table 8).

The number of flower buds per plant is the main yield contributing character and all the treatments of growth regulators at different concentrations affected significantly in the number of flower buds produced per plant. According to the present study, T_6 (PBZ 200ppm) produced significantly more number of flowers, followed by T_4 (IAA 200ppm). Similar results were obtained in the findings of Swaminathan (2006), which observed that the yield of flowers per plant increased with the application of Paclobutrazol in *Jasminum sambac*. Suradinata (2015) observed that PBZ increased the crown display, number of flowers, and quality of roses.

Table 8. Effect of plant growth regulators on number of flower buds per plant

Treat-ment	Nov	Dec	Jan	Feb	Total
T_1	23.50^{bc}	34.33^{d}	59.25^{c}	80.58^{ab}	197.67^{cd}
T_2	21.25^{c}	32.42^{d}	58.33^{c}	78.92^{b}	190.92^{d}
T_3	28.08^{ab}	41.00^{bc}	65.33^{abc}	88.67^{ab}	223.08^{ab}
T_4	29.83^{a}	45.92^{a}	67.33^{ab}	90.67^{ab}	233.75^{a}
T_5	29.33^{ab}	43.33^{ab}	66.83^{ab}	90.08^{ab}	229.58^{ab}
T_6	31.33^{a}	47.17^{a}	70.00^{a}	92.50^{a}	241.00^{a}
T_7	26.75^{abc}	38.33^{c}	61.17^{bc}	86.92^{ab}	213.17^{bc}

Means with the same letter/s are not significantly different at p=0.05

4. CONCLUSION

Based on the study findings, it can be concluded that, with respect to the cultivation of *Jasminum sambac,* the yield can be increased by spraying PBZ at 200ppm. IAA at 200ppm was next to PBZ in increasing the flower yield. IAA 200ppm was found effective for increasing the growth of the *Jasminum sambac* plant. It can be used to increase plant height, length of primary shoots, number of leaves, number of secondary shoots, and length of flower buds. GA_3 200ppm was found effective in inducing early flowering, closely followed by PBZ 200ppm. Judicious application of PBZ and IAA will be useful in increasing the growth and yield of *Jasminum sambac*.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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