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Effect of pruning and application of growth regulators on growth and flower characteristics of jasmine (*Jasminum sambac* (L.) Aiton) during off-season flower production under polyhouse condition

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Abstract

The present investigation was carried out during 2021-2023 at the Department of Horticulture, UAS, GKVK, Bengaluru to study the Effect of pruning and application of growth regulators on growth and flower characteristics of jasmine (*Jasminum sambac* (L.) Aiton) during off-season flower production under polyhouse condition. There were 21 treatments with three replications comprising of pruning schedule and growth regulators was laid out in Factorial Completely Randomized Design (FCRD). Three pruning treatments were imposed during the second fortnight of August (P₁), October (P₂) and December (P₃ control). Foliar application of growth regulators viz., GA₃ at 100 (G₁), 150 (G₂), and 200 ppm (G₃); Cycocel at 500 (G₄), 750 (G₅), and 1000 ppm (G₆) and double distilled water (Control, G₇) were sprayed at 15 days after pruning under polyhouse condition. Among different vegetative characteristics, P₃G₃ (December pruning + GA₃ at 200 ppm) had recorded maximum plant height and plant spread in E-W and N-S directions at 60 days after pruning, respectively. Number of primary branches per plant showed no significant difference among the treatments. Higher number of secondary branches per plant was recorded in P₃G₆ (December pruning + Cycocel at 1000 ppm). Flower characteristics viz., days taken for bud initiation (31.33 days), first flowering (43.33 days) and 50 per cent flowering (71.44 days) were minimum in December pruning along with foliar application of Cycocel at 1000 ppm (P₃ G₆) and significantly different from others. Off season duration of flowering (87 days) and on season duration of flowering (197 days) were maximum in plants pruned during October month with application of Cycocel at 1000 ppm (P₂ G₆) with significantly increased in off season flower yield (December to February) per plant (0.366 kg) and on season flower yield per plant (2.345 kg).

Keywords: Jasmine, off season, on season, polyhouse

Introduction

Jasmine is one of the oldest and important commercial fragrant flower crop in India. A flower so appealing to the senses and eyes. Its allure lies in its beautiful white blossoms with a captivating fragrance. Jasmine is a versatile plant of climbing, trailing and growing erect flowering shrub that belongs to the family Oleaceae of the order Oleales.

Jasmine can be grown in a variety of climate and soils as an open field crop. Generally, it prefers mild tropical climate for proper growth and flowering. *Jasminum sambac* requires dry and warm climatic conditions with an optimum temperature of 27-32 °C during day time and 21-27 °C at night with low humidity is ideal for flowering and peak flowering season is from March to July. There is less scientific studies under polyhouse in the regions of Bengaluru and surroundings areas of Karnataka makes congenial for growth and flowering (Navya and Nirmala 2023) [12].

Low winter temperature causes ultra-structural cellular changes in the flowers and reduces the growth and yield of the flower (Su *et al.*, 2001) [16]. Hence, flowering in *Jasminum sambac* is restricted to summer months only. Reduction in the flower production during cooler months, leading to hike in price during September to February is almost ten times higher than the remaining part of the year that can be termed as "off- season" in Jasmine cultivation (Krishnamoorthy, 2014) [7]. In this aspect the possibility of altering the time of pruning and application use of synthetic plant growth regulators as well as effect of

polyhouse condition may enhance the flower production in off- season.

Flowering habit in *Jasminum sambac* is terminal and axillary. So, increasing the number of shoots would increase the yield, for which pruning is essential. Early flower initiation in early pruning may be attributed to the early start of new vegetative growth along with higher number of leaves per shoot and leaf area, which eventually initiate the flowers during off- season (Adhikari and Kandel, 2015) [1]. In addition to this, pruning also maintains the growth and vigour of the plants and balance the vegetative and flowering phase. In recent years scientists have given attention to the idea of regulating plant growth in improving the growth, yield and flower quality with the application of plant growth regulators in various ways under polyhouse condition.

Foliar spray of GA₃ enhances early phase of vegetative growth which favours the cell enlargement and cell division activities in the plant, increasing photosynthesis and CO₂ fixation. Further, it has also favoured floral quantity influencing carbohydrate pathway and photo periodic pathway with GA, pathway (Sobhana *et al.*, 2014) [14]. Spray of Cycocel produces compact growth, increases the number of shoots, early bud initiation due to it improved the nutrients uptake from the soil and increasing the nutrient use efficiency for better synthesis of assimilates in the large photosynthetic area and optimum nourishment to the growing meristematic tissues.

Protected cultivation is an innovative way of raising seasonal and off-seasonal crops under a partially controlled environment. Flower crops have tremendous potential to augment productivity, generate employment, utilize land efficiently and enhance export. Growers in India with marginal and small land holdings can benefit from protected cultivation, which enables them to produce more crops from their land each year, especially during the off-season when prices are higher. Jasmine's suitability for cultivation under protection has less scientific investigated so far.

Materials and Methods

The present study was conducted in the Department of Horticulture, UAS, GKVK, Bengaluru during 2022-23. The experimental field was located in Eastern dry zone (Zone-5) of Karnataka state at 13°05" at North latitude and 77°34" East longitude with an elevation of about 924 meters above mean sea level. The experiment included 21 treatments laid out in Factorial Completely Randomized Design (FCRD) with three replications. Treatments were imposed to find out the suitable interaction effect of pruning and growth regulators for the induction of off season flowering. Pruning was done at 45cm above ground level during the second fortnight of August (P1), October (P2) and December (Regular pruning) and different concentration of plant growth regulators were sprayed on 15th day after the pruning. The growth regulator treatments included application of GA₃ at 100 ppm (G1), GA₃ at 150 ppm (G2), GA₃ at 200 ppm (G3), Cycocel at 500 ppm (G4), Cycocel at 750 ppm (G5), Cycocel at 1000 ppm (G6) and double distilled water (G7-Control). Vegetative parameters recorded were plant height, plant spread in E-W direction, N-S direction, number of primary branches and number of secondary branches at 60 days after pruning. The flowering parameters like days to bud initiation, days taken for first flowering, 50 per cent flowering and duration flowering and flower yield were also recorded. The data were analyzed using OPSTAT.

Result and Discussion

Influence of Pruning and Growth Regulators on Vegetative Growth of *J. sambac*

The data on plant height and plant spread (E-W and N-S) as influenced by different month of pruning, foliar application of plant growth regulators and their interaction effects are presented in Table 1.

The impact of pruning and foliar application of growth regulators on plant height under polyhouse condition was evident in this study. The combined impact of pruning time and growth regulators revealed notable variations. In the case of different treatment combination P₃G₃, which involved pruning in December with foliar application of GA₃ at 200 ppm, maximum plant heights (88.33 cm) and plant spread (E-W and N-S) were observed in measuring 78.67 cm and 63.67 cm at 60 days after pruning, respectively. Among the off-season treatments, there was a significant difference noted in the P₂G₃ interaction. Specifically, when plants were pruned in October and treated with GA₃ at 200 ppm, they exhibited the highest plant heights (85.33 cm), plant spread in East-West directions (78.67 cm) and North-south directions (63.67 cm) followed by those pruned in August and treated with GA₃ at 200 ppm (P₁G₃). Conversely, the minimum plant heights (61.67 cm), plant spread in East-West direction (59.33 cm) and North-south directions (49.00 cm) were observed in plants pruned during August and treated with Cycocel at 1000 ppm (P₁G₆) at 60 days after pruning. Parallel results were reported by Navya *et al.* (2023) [10]; Naik *et al.* (2019) [9]; Pawar *et al.* (2019) [13] and Danashekar (2018) in *Jasminum sambac* and Kumar *et al.* (2021) [5] in *Jasminum multiflorum* under open condition.

Vegetative characteristics were maximum observed during October pruning (P₂) within a polyhouse environment. This can be attributed to the more favourable conditions inside the protected structures, where plants received an extended photoperiod and experienced higher maximum temperatures (29 °C) and optimum humidity. These conditions contribute to increase in leaf area and higher chlorophyll content, which are conducive to plant growth (Navya 2023) [10]. Additionally, GA₃ applied through foliar spray was effectively absorbed by the leaves and swiftly transported through both the xylem and phloem tissues, facilitating it is even distribution throughout the plant. This, in turn, stimulated a higher rate of cell division, elongation of internodes and stems, ultimately resulting in an increase in the plant height (Danashekar, 2018) [3].

Number of secondary branches in plant is a pivotal trait that exhibits a direct and positive correlation with the overall yield in Jasmine plants. The impact of pruning months and growth regulators were evident as a higher count of secondary branches per plant presented in Table 2. Interaction effect revealed that in P₃G₆ (December pruning + Cycocel at 1000 ppm) produced maximum number of secondary shoots per plant (13.67) followed by P₃G₅ (December pruning + Cycocel at 750 ppm) treatment combination. In off- season treatments P₂G₆ plants (October pruning + Cycocel at 1000 ppm) recorded maximum number of secondary branches (12.00) 60 days after pruning, respectively, while, P₁G₃ (August pruning + GA₃ at 200 ppm) had least number of secondary branches (9.00). There was no significant difference was observed in number of primary branches.

Table 1: Effect of pruning, plant growth regulators and their interaction on Plant height and plant spread (East-West and North-South) in *Jasminum sambac* under polyhouse condition

Treatments	Plant height (cm)				Plant spread (E-W)				Plant spread (N-S)			
	August	October	December	Mean	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100 ppm	76.00 ^{hi}	78.33 ^{gh}	83.33 ^{cd}	79.22 ^{bc}	68.33 ^{fg}	71.33 ^d	73.33 ^c	71.00 ^c	55.33 ^{fg}	58.33 ^{cd}	59.00 ^c	57.56 ^c
GA ₃ at 150 ppm	78.67 ^{gh}	80.00 ^{efg}	86.67 ^{ab}	81.78 ^b	71.00 ^d	73.67 ^c	75.33 ^b	73.33 ^b	57.67 ^d	59.33 ^c	62.33 ^b	59.78 ^b
GA ₃ at 200 ppm	84.33 ^{bcd}	85.33 ^{abc}	88.33 ^a	86.00 ^a	76.33 ^b	77.67 ^a	78.67 ^a	77.56 ^a	59.33 ^c	61.67 ^b	63.67 ^a	61.56 ^a
Cycocel at 500 ppm	66.00 ⁱ	76.00 ^{hi}	81.67 ^{def}	74.56 ^{de}	66.33 ⁱ	67.67 ^{fg}	69.67 ^e	67.89 ^d	53.33 ⁱ	56.33 ^{ef}	57.33 ^{de}	55.67 ^d
Cycocel at 750 ppm	64.33 ^{lm}	73.67 ^{ijk}	78.33 ^{gh}	72.11 ^{ef}	64.33 ^j	66.67 ^{hi}	67.67 ^{gh}	66.22 ^c	51.00 ^j	53.33 ⁱ	54.33 ^{ghi}	52.89 ^e
Cycocel at 1000 ppm	61.67 ^m	70.67 ^k	75.33 ^{hij}	69.22 ^f	59.33 ^j	60.67 ^{kl}	61.33 ^k	60.44 ⁱ	49.00 ^k	51.33 ^j	51.33 ^j	50.56 ^f
Double distilled water (Control)	72.67 ^{jk}	77.33 ^{gh}	82.33 ^{cde}	77.44 ^{cd}	67.33 ^{ghi}	68.67 ^{ef}	69.67 ^e	68.56 ^d	53.67 ^{hi}	54.67 ^{gh}	57.33 ^{de}	55.22 ^d
Mean	71.95 ^c	77.33 ^b	82.29 ^a		67.57 ^c	69.48 ^b	70.81 ^a		54.19 ^c	56.43 ^b	57.91 ^a	
(P×G) SE(d)	1.455				0.582				1.197			
(P×G) CD	2.946				1.178				0.591			

Interaction effect of pruning month and growth regulator application resulted in October pruning with Cycocel application producing the greater number of secondary shoots per plant under polyhouse condition. Pruning and photoperiod under polyhouse condition has favored the growth of secondary shoots and activated dormant buds from the mature shoots. This process needs external mechanical stimulus like pruning to enhance the sprouting of buds, new growth and flowering. Similar results were observed in rose by Borrelli (1978) [2] and Jadhav *et al.* (2015) [8]. Along with pruning, application of Cycocel, has inhibitory role in the cell division and elongation of apical meristematic cells active as anti-gibberellin compound. by limiting vertical growth, cycocel can redirect the plant's energy toward lateral branching. This can lead to a bushier and more dense branches in plant (Soliman *et al.*, 2022) [15].

Significant difference was noticed among interaction effect between treatments with respect to leaf area. The higher leaf area was observed in December pruning without the application of growth regulators (33.96 cm²) which was on par with December pruning with GA₃ at 100 ppm (P₃G₁) at 60 days. Among the off- season treatments P₂G₇ combination *i.e.*, October pruning without application of growth regulators (30.77 cm²) recorded significantly higher leaf area. However minimum leaf area was observed in August pruning with Cycocel at 1000 ppm (21.89 cm²). Under polyhouse condition, October pruning led to a notable increase in leaf area among off- season pruning. Protected environment provides favourable conditions for plant growth with elevated levels of temperature, CO₂ level and humidity, which can promote optimal conditions for photosynthesis and potentially result in larger leaf area. The impact of GA₃ and cycocel are showed in Table 2.

Table 2: Influence of pruning month, plant growth regulators and their interaction on number of primary branches, number of secondary branches and Leaf area in *Jasminum sambac* under polyhouse condition

Treatments	Number of Primary branches (No.)				Number of secondary branches (No.)				Leaf area (cm ²)			
	August	October	December	Mean	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100 ppm	2.00	2.33	2.33	2.22	9.00 ^{ghi}	9.33 ^{fghi}	10.33 ^{cdef}	9.56 ^{cd}	22.75 ^{efg}	23.71 ^{efg}	23.91 ^{efg}	23.17 ^d
GA ₃ at 150 ppm	2.33	2.67	2.33	2.44	8.67 ^{hi}	9.00 ^{ghi}	9.33 ^{fghi}	9.00 ^d	21.93 ^e	22.78 ^{efg}	23.06 ^{efg}	22.82 ^d
GA ₃ at 200 ppm	2.33	2.67	2.33	2.44	5.00 ^k	7.00 ^j	8.33 ⁱ	6.78 ^e	21.89 ^e	22.63 ^{efg}	22.47 ^{fg}	22.38 ^d
Cycocel at 500 ppm	2.33	2.33	2.33	2.33	10.00 ^{defg}	10.33 ^{cdef}	11.00 ^{bcd}	10.44 ^{bc}	23.97 ^{efg}	28.66 ^{cd}	32.48 ^{ab}	28.37 ^{ab}
Cycocel at 750 ppm	2.33	2.33	2.33	2.33	10.33 ^{cdef}	10.67 ^{cde}	12.00 ^b	11.00 ^b	24.49 ^{efg}	28.66 ^{cd}	25.99 ^{de}	26.38 ^{bc}
Cycocel at 1000 ppm	2.33	2.33	2.33	2.33	11.33 ^{bc}	12.00 ^b	13.67 ^a	12.33 ^a	23.61 ^{efg}	25.46 ^{ef}	25.32 ^{efg}	24.8 ^{cd}
Double distilled water (Control)	2.33	2.33	2.33	2.33	9.33 ^{fghi}	9.67 ^{efgh}	10.00 ^{defg}	9.67 ^{cd}	24.43 ^{efg}	30.77 ^{bc}	33.96 ^a	29.72 ^a
Mean	2.29	2.43	2.33		9.10 ^b	9.71 ^b	10.67 ^a		23.30 ^b	26.10 ^{ab}	26.74 ^a	
(P×G) SE(d)	0.455				0.471				1.418			
(P×G) CD	NS				0.955				2.871			

Influence of Pruning and Growth Regulators on Jasmine Flower Characteristics

The major objective of applied research is to optimize income through early flowering and maximum duration of flowering presented in Table 3. Plants treated with combination of pruning and growth regulators application resulted that, P₃G₆ combination (plants pruned during December along with foliar spray of Cycocel at 1000 ppm) recorded significantly minimum days taken for appearance of flower buds (31.33 days), days to first flowering (43.33 days) and days to 50% flowering (68.33 days) followed by off-season treatment interaction *i.e.*, plants pruned during October along with spray of Cycocel at 1000 ppm (P₂G₆). Minimum days taken to bud initiation (34.67 days), days to first flowering (47.00 days) and days to 50% flowering

(70.00 days). In polyhouse conditions resulted in early appearance of flower buds which might be attributed to both the influence of microclimate in polyhouse and application of Cycocel, which plays a crucial role in facilitating flowering process. October pruned plants flowered during November to December months, during which period the plants were exposed to 24.17 k lux intensity, lowest minimum temperature (17.89 °C), with 11 °C diurnal variation in temperature. This might have influenced the metabolic and physiological processes required for flowering (Navya 2023) [10]. Along with this, application of Cycocel helped the plant in restraining from stem elongation and encouraging a more compact growth pattern. This, in turn, affect metabolic processes and reduces the carbon to nitrogen (CN) ratio by

leading to significant carbohydrates accumulation. As a result, the plant's energy is redirected towards the formation of flower buds, rather than excessive stem growth (Kohombange *et al.*, 2017) [4].

Significantly longest flower duration was observed in P₂G₆ combination (plants pruned in October along with the application of Cycocel at 1000 ppm) exhibited the longest off- season flower duration (87.00 days), followed by P₂G₅ (October pruning + Cycocel at 750 ppm) and P₁G₆ (August pruning + 1000 ppm) interactions. While, the shortest off-season flowering duration (60.33 days) was observed in plants pruned in August without the use of growth regulators (P₁G₇). The interaction between pruning and growth regulators played a significant role in influencing the off-season duration of flowering presented in Table 4.

The results showed that the P₃G₆ interaction, which involved pruning plants in December along with a foliar application of Cycocel at 1000 ppm, exhibited the longest duration of flowering during the on-season (197.67 days). Among the off-season treatment interactions, the longest duration of on-season flowering duration (181.33 days) was observed in

plants pruned in October and treated with a foliar spray of Cycocel at 1000 ppm (P₂G₆). Whereas, the shortest on-season flowering duration (152.67 days) was recorded in the P₁G₇ interaction, which involved august pruning without growth regulator application.

The maximum duration of flowering under polyhouse condition was observed in October pruning. This is attributed to, October pruned plants produces the flowers during November, during that period plant expose to longer photoperiod and maximum temperature along with 11-12 °C diurnal difference in temperature are favourable for production of maximum number of flowers due to Jasmine flowers are born on current season shoots. Off- season pruning *i.e.*, October pruned plants produced flowers during both on- season and off- season from November to July without affecting the regular flowering period, results are presented in Table 4. Along with application of cycocel helps to higher photosynthesis might have helped the accumulation of more carbohydrates which helps for enhancing the duration of flowers (Kumaresan, 2017 in *J. sambac*) [6].

Table 4: Effect of pruning, plant growth regulators and their interaction on off- season duration of flowering and on-season duration of flowering in *Jasminum sambac* under polyhouse condition

Treatments	Off- season duration of flowering (Days)				On season duration of flowering (Days)			
	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100 ppm	65.33 ^f	68.33 ^f	0.00 ^h	44.56 ^d	160.33 ^g	163.33 ^g	173.33 ^e	165.67 ^d
GA ₃ at 150 ppm	71.67 ^e	71.67 ^e	0.00 ^h	47.78 ^c	163.33 ^g	166.33 ^f	179.33 ^{cd}	169.67 ^{cd}
GA ₃ at 200 ppm	74.33 ^{de}	77.00 ^d	0.00 ^h	50.44 ^c	173.33 ^e	166.33 ^f	182.33 ^c	174.00 ^c
Cycocel at 500 ppm	80.33 ^c	82.00 ^{bc}	0.00 ^h	54.11 ^b	174.67 ^{de}	175.00 ^{de}	188.00 ^b	179.22 ^b
Cycocel at 750 ppm	82.33 ^{bc}	85.00 ^{ab}	0.00 ^h	55.78 ^{ab}	179.00 ^{cde}	176.67 ^{cde}	195.00 ^a	183.56 ^{ab}
Cycocel at 1000 ppm	85.00 ^{ab}	87.00 ^a	0.00 ^h	57.33 ^a	177.67 ^{cde}	181.33 ^c	197.67 ^a	185.56 ^a
Double distilled water (Control)	60.33 ^g	65.67 ^f	0.00 ^h	42.00 ^d	152.67 ^h	158.00 ^{gh}	166.67 ^f	159.11 ^e
Mean	74.19 ^a	76.67 ^a	0.00 ^b		168.71 ^b	169.57 ^b	183.19 ^a	
(P×G) SE(d)	1.48				2.528			
(P×G) CD	2.997				5.12			

Influence of Pruning and Growth Regulators on Jasmine Flower Yield

The highest off-season flower (September to January) yield per plant (0.366 kg) was observed when plants were pruned in October and subsequently sprayed with Cycocel at 1000 ppm, followed by October pruning with Cycocel at 750 ppm (P₂G₅). Lowest yield per plant and per hectare (0.193 kg) was recorded in the treatment where pruning was carried out in August without the application of any growth regulators (P₁G₇). These conditions are beneficial for achieving higher yields during the month of October the data represented in Table 5. Similar results were recorded by Krishnamoorthy (2014) [7]; Kumaresan (2017) [6]; Sujatha *et al.* (2009) [17]; Navya and Nirmala (2023) [12].

The results obtained between the present experiment is attributed to the enhanced movement of photosynthetic products from their origin to where they are needed (the "source to the sink"). A greater abundance of leaves, increased chlorophyll levels and the controlled environment of a polyhouse create favourable climatic conditions that shield plants from external disruptions. These conditions are beneficial for achieving higher yields during the month of October along with application of Cycocel, it will be redirecting the plant's energy away from excessive vegetative growth and towards flowering. This approach has the potential to increase the quantity of flowers produced and extend the duration of flowering, as observed in chrysanthemum by Tannirwar *et al.* (2011) [18].

The interaction effect between pruning and growth regulators application resulted that highest on- season flower yield per plant (2.325 kg) was observed in December pruning with Cycocel at 1000 ppm spraying, followed by December pruning with Cycocel at 750 ppm (P₂G₅). Among off- season pruning, highest yield per plant and per ha (2.263 kg) was observed in October pruning with Cycocel at 1000 ppm (P₂G₆). Plant treated with December pruning without growth regulator application (P₃G₇) resulted in the lowest yield per plant and per ha (0.996 kg).

The present study indicated that December pruned plants produce more yield compared to off- season pruned plant, which might be due to pruning during cooler month, that helps to overcome the dormancy of plants, which produces a greater number of shoots along with resulting in maximum plant height and spread. In addition to that on- season flower production starts in the month of February. During pruning period low temperature and low light intensity was recorded. While flowering, temperature and light intensity starts rising under Bengaluru condition (Table 5). Along with this, application of Cycocel has potential to increase the number of flowers produced by redirecting the plant's energy away from excessive vegetative growth and towards flower yield, resulting in a more abundant and prolonged flowering period, which helps to ultimately increase in the yield as observed in chrysanthemum by Tannirwar *et al.* (2011) [18].

Table 5: Flower yield per plant as influenced by pruning month, plant growth regulators and their interaction in *Jasminum sambac* under polyhouse condition

Treatments	Off season yield per plant (Kg)				On season yield per plant (Kg)			
	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100 ppm	0.276 ^j	0.330 ^d	0.000 ⁿ	0.202 ^d	1.284 ^l	1.734 ^f	1.972 ^d	1.663 ^d
GA ₃ at 150 ppm	0.250 ^k	0.303 ^f	0.000 ⁿ	0.184 ^e	1.365 ^k	1.545 ^{hi}	1.576 ^{gh}	1.495 ^e
GA ₃ at 200 ppm	0.223 ^l	0.294 ⁱ	0.000 ⁿ	0.173 ^f	1.331 ^{kl}	1.52 ^{ij}	1.466 ^j	1.439 ^f
Cycocel at 500 ppm	0.302 ^g	0.321 ^d	0.000 ⁿ	0.208 ^c	1.478 ^j	1.739 ^f	2.079 ^c	1.766 ^c
Cycocel at 750 ppm	0.319 ^e	0.343 ^b	0.000 ⁿ	0.221 ^b	1.602 ^g	1.956 ^d	2.244 ^b	1.934 ^b
Cycocel at 1000 ppm	0.337 ^c	0.366 ^a	0.000 ⁿ	0.234 ^a	1.882 ^e	2.263 ^b	2.325 ^a	2.157 ^a
Double distilled water (Control)	0.193 ^m	0.300 ^h	0.000 ⁿ	0.164 ^g	0.996 ⁿ	1.093 ^m	1.364 ^k	1.151 ^g
Mean	0.271 ^b	0.323 ^a	0.000 ^c		1.42 ^c	1.693 ^b	1.861 ^a	
(P×G) SE(d)	0.005				0.030			
(P×G) CD	0.01				0.061			

Conclusion

The present study showed that among different pruning months and growth regulator treatments, off season pruning *i.e.*, October pruning with foliar application of Cycocel at 1000 ppm at 15 days after pruning enhanced the growth, early flowering, flower quality with higher off-season flower production and yield in *J. sambac* under polyhouse conditions.

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