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Influence of pruning schedule and growth regulators on growth and quality characteristics in jasmine (*Jasminum sambac* (L.) Aiton.) During off season flower production

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Abstract

The present investigation entitled "Influence of pruning schedule and growth regulators on growth and quality characteristics in jasmine (*Jasminum sambac* (L.) Aiton.) During off season flower production" was carried out at the Department of Horticulture, UAS, GKVK, Bengaluru during 2022-2023. 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. 21 treatments comprising of pruning schedule and growth regulators was laid out in Factorial Randomized Complete Block Design (FRCBD) with three replications. Among off season pruning October pruning with GA₃ at 200 ppm was recorded maximum plant height, plant spread in E-W and N-S directions at 120 days after pruning. Higher number of secondary branches per plant were recorded in P₂G₆ (October pruning + Cycocel at 1000 ppm) at 120 days after pruning. Flower quality characteristics viz., corolla tube length, bud length and flower diameter were significantly maximum in plant pruned with October pruning with GA₃ at 200 ppm. While, bud diameter and 100 buds weight higher in P₂G₆ (October pruning + Cycocel at 1000 ppm). Shelf life showed no significant difference among the treatments. Total duration of flowering was maximum in plants pruned during October month with application of Cycocel at 1000 ppm (P₂G₆) with significantly increases in off- season flower yield per plant (0.285 kg).

Keywords: Jasmine, off season, pruning, growth regulators

Introduction

Jasmine (*Jasminum* spp.) holds a significant historical and cultural significance in India. This fragrant flower has been cherished since ancient times and is particularly adored by South Indian women. Its allure lies in its beautiful white blossoms with a captivating fragrance. 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.

Low winter temperature causes ultra-structural cellular changes in the flowers and reduces the growth and yield of the flower (Su *et al.*, 2001) ^[7]. Hence, flowering in *Jasminum sambac* is restricted to summer months only. The flower production is reduced 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) ^[3]. This results in scarcity during lean season and glut during the peak season creating a wide fluctuation in price, demand and supply. Hence, in this aspect the possibility of altering the time of pruning and application use of synthetic plant growth regulators may enhance the flower production in off- season.

Recent finding after the discovery of growth regulators and their application in horticulture have significantly influenced the production in horticultural crops. Growth and flowering responses of flower crops to these chemical substances have been intensively studied with a view to have compact plants with greater flower yield and also to hasten or delay flowering according to the needs of the market (Sridhar *et al.*, 2013) ^[6]. Regulation of flowering in jasmine has immense practical value as there are peak and lean productive seasons in jasmine with consequent gluts and scarcity which influences the price trends greatly.

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Timing of the peak flowering to coincide with the time of greatest demand would confer great advantage to the growers and consumers. Keeping this in view, the present investigation was formulated to study the effect of pruning schedule and growth regulators at different concentration on growth and flowering of jasmine.

Materials and Methods

The present research was carried out in the Department of Horticulture at UAS, GKVK, Bengaluru, from 2022 to 2023. The experimental field was located in Zone-5 of the Eastern dry zone in Karnataka at 13°05" North latitude and 77°34" East longitude, with an elevation of around 924 meters above sea level. The experiment included 21 treatments laid out in Factorial Randomized Complete Block Design (FRCBD) with three replications. These treatments were applied to investigate the most effective combination of pruning and growth regulators for inducing off-season flowering. Pruning was performed at three different times at 45cm above ground level in the second fortnight of August (P₁), October (P₂), and December (P₃: control). Additionally, various concentrations of plant growth regulators were sprayed 15 days after pruning. The growth regulator treatments included the following: 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 a control group (G₇) treated with double distilled water. The data observed on vegetative parameters, such as plant height, plant spread in both the east-west and north-south directions, number of secondary branches and chlorophyll content (SPAD value) were recorded. Flower quality parameters, including duration of flowering, corolla tube length, bud length, bud diameter, flower diameter, 100 bud weight, shelf life, on season and off-season yield were also

recorded. The data were subsequently analyzed using OPSTAT.

Results and Discussion

Influence of pruning and growth regulators application on growth characteristics of *Jasminum sambac* (L.)

Significantly maximum plant height of 89.67 cm, plant spread (E-W) of 82 cm and (N-S) of 78.00 cm directions were observed in P₃G₃ (December pruning with GA₃ at 200 ppm) was on par with off season pruned plant *i.e.*, October pruning with GA₃ at 200 ppm recorded in Table 1 and 2. Increased growth parameters might be due to foliar application of GA₃ will promotes the cell division, cell elongation and canopy expansion. Additionally, under the impact of GA₃, which retains swelling force with the softening of cell wall and increased growth might have been accelerated by osmotic uptake of water and nutrients (Angitha *et al.*, 2022) [1]. Among the off-season pruning October pruning with foliar application of Cycocel at 1000 ppm (P₂G₆) recoded more number of secondary branches per plant (18.67) and chlorophyll content during vegetative phase (52 SPAD value) and flowering phase (53.17 SPAD value). This result attributed by pruning, which act as external mechanical stimulus, helps to enhance the sprouting of dormant bud, new growth and flowering (Borrelli, 1978) [2]. Including application of growth inhibitor act as anti-auxin agent which causes the inhibition of auxin activity in the apical bud thereby it prevents the polar transport of auxins towards the basal nodes leading to the increase in branching habit (Vaghasia and Polara, 2016) [11] and increase in chlorophyll content in leaf might be due to production of higher number of leaves and laterals per plant by breaking the dormancy of cells as reported by Sumangala *et al.* (2003) [9].

Table 1: Effect of pruning month, plant growth regulators and their interaction on growth parameters in *Jasminum sambac*

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 100ppm	79.67	81.67	83.33	81.56	76	77.00	79.67	77.56	58.00	59.67	69.33	62.33
GA ₃ at 150ppm	81.67	84.00	85.33	83.67	77.67	80.00	81.00	79.56	61.33	60.67	72.33	64.78
GA ₃ at 200ppm	86.00	86.00	89.67	87.22	80.33	81.00	82.00	81.11	63.00	63.00	78.00	68.00
Cycocel at 500ppm	78.00	80.33	79.67	79.33	74.33	77.67	78.67	76.89	54.67	56.33	67.00	59.33
Cycocel at 750ppm	77.00	79.67	77.67	78.11	72.33	75.33	76.00	74.56	53.33	55.67	65.00	58.00
Cycocel at 1000ppm	76.00	77.33	76.67	76.67	67.33	74.33	75.33	72.33	50.33	52.67	60.00	54.33
Double distilled water (Control)	78.67	80.00	81.00	79.89	75.33	77.67	78.67	77.22	54.00	59.00	67.67	60.22
Mean	79.57	81.29	81.91		74.76	77.57	78.76		56.38	58.14	68.48	
(P×G) SE(d)	0.883				1.039				1.207			
(P×G) CD	2.561				3.065				2.449			

Table 2: Influence of pruning month, plant growth regulators and their interaction on growth characteristics in *Jasminum sambac*

Treatments	Number of secondary branches				Chlorophyll pigment (vegetative phase)				Chlorophyll pigment (Flowering phase)			
	August	October	December	Mean	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100ppm	15.00	15.33	15.67	15.33	42.10	48.67	50.33	47.03	43.27	49.83	51.5	48.2
GA ₃ at 150ppm	11.33	12.33	14.00	12.56	39.40	48.00	48.00	45.13	40.57	49.17	49.17	46.3
GA ₃ at 200ppm	8.67	11.33	11.00	10.33	38.83	44.33	43.33	42.17	39.67	45.50	44.5	43.22
Cycocel at 500ppm	15.33	16.00	17.33	16.22	42.47	47.33	48.00	45.93	42.97	48.50	49.17	46.88
Cycocel at 750ppm	16.00	17.00	19.67	17.56	46.27	49.00	51.00	48.76	47.43	50.17	52.17	49.92
Cycocel at 1000ppm	16.33	18.67	20.33	18.44	49.73	52.00	52.67	51.47	50.90	53.17	53.83	52.63
Double distilled water (Control)	12.67	15.67	16.67	15.00	41.00	42.67	44.00	42.56	42.17	43.83	45.17	43.72
Mean	13.62	15.19	16.38		42.83	47.43	48.19		43.85	48.6	49.36	
(P×G) SE(d)	0.669				1.450				1.443			
(P×G) CD	1.356				2.939				2.928			

Influence of pruning and growth regulators application on flower characteristics of *Jasminum sambac* (L.)

Flower quality parameters such as corolla tube length (1.310 cm), bud length (1.477 cm) and flower diameter (3.83 cm) were higher in December pruning with foliar application of GA₃ at 200 ppm on par with October pruning with foliar application of GA₃ at 200 ppm. The plants pruned during October with foliar application of cycocel at 1000 ppm (P₃G₆) resulted in highest off-season duration of flowering (84 days). While, on season duration of flowering was higher in December pruning with cycocel at 1000 ppm data presented Table 3-5. The October pruned plants flowers during November to December months, October pruned plants are exposed to higher bright sunshine

hours, lowest minimum temperature (20.05 °C). In addition to this exogenous application of GA₃ must have favoured the increased photosynthesis and CO₂ fixation (Sendhinhathan *et al.*, 2017) [4].

Among the off-season pruning bud diameter (1.267 cm) and 100 bud weight (51.27 g) were maximum in October pruning with cycocel at 1000 ppm. While, shelf life was recorded non-significant among the different treatments. This might be due to the combination effect of October pruning and foliar application of Cycocel may encourage the plant to allocate more of its energy towards flower production and development (Soliman *et al.*, 2022) [5].

Table 3: Effect of pruning, plant growth regulators and their interaction on duration of flowering in *Jasminum sambac*

Treatments	Off season duration of flowering				On season duration of flowering			
	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100ppm	62.00	65.00	0.00	42.33	146.00	148.00	157.00	150.33
GA ₃ at 150ppm	68.00	68.33	0.00	45.44	149.00	151.00	161.33	153.78
GA ₃ at 200ppm	71.00	74.00	0.00	48.33	153.33	152.33	167.33	157.67
Cycocel at 500ppm	76.66	79.00	0.00	51.88	158.67	159.00	171.00	162.89
Cycocel at 750ppm	79.00	82.00	0.00	53.66	161.33	161.00	177.00	166.44
Cycocel at 1000ppm	81.33	84.00	0.00	55.11	164.00	166.00	182.00	170.67
Double distilled water (Control)	56.66	62.66	0.00	39.77	140.67	143.00	151.67	145.11
Mean	70.667	73.571	0.000		153.29	154.33	166.76	
(P×G) SE(d)	0.712				0.867			
(P×G) CD	1.445				1.759			

Table 4: Influence of pruning month, plant growth regulators and their interaction on off- season flower quality parameters in *Jasminum sambac*

Treatments	Corolla tube length				Bud length				Bud diameter			
	August	October	December	Mean	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100ppm	1.027	1.027	1.093	1.049	1.127	1.163	1.227	1.172	0.967	1.033	1.033	1.011
GA ₃ at 150ppm	1.060	1.110	1.127	1.099	1.143	1.368	1.243	1.252	0.950	1.000	1.067	1.006
GA ₃ at 200ppm	1.110	1.193	1.310	1.204	1.175	1.227	1.477	1.293	0.850	1.100	1.017	0.989
Cycocel at 500ppm	1.010	1.077	1.127	1.071	1.11	1.152	1.21	1.157	1.000	1.133	0.983	1.039
Cycocel at 750ppm	0.993	1.027	1.077	1.032	1.117	1.118	1.193	1.143	1.017	1.200	1.033	1.083
Cycocel at 1000ppm	0.943	1.010	1.027	0.993	1.093	1.102	1.15	1.115	1.100	1.267	1.067	1.144
Double distilled water (Control)	0.877	1.060	1.010	0.982	0.96	1.043	1.05	1.018	1.033	1.033	1.000	1.022
Mean	1.003	1.072	1.110		1.104	1.168	1.221		0.988	1.110	1.029	
SE(d)	0.035				0.061				0.062			
C.D	0.071				0.124				0.126			

Table 5: Effect of pruning month, plant growth regulators and their interaction on off- season flower quality parameters in *Jasminum sambac*

Treatments	Flower diameter				100 flower bud weight				Shelf life			
	August	October	December	Mean	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100ppm	3.23	3.37	3.23	3.28	35.93	41.83	43.33	40.37	38.33	38.50	38.50	38.44
GA ₃ at 150ppm	3.33	3.47	3.33	3.38	34.30	42.20	37.10	37.87	38.17	38.50	38.50	38.39
GA ₃ at 200ppm	3.53	3.83	3.57	3.64	34.00	44.33	35.70	38.01	38.17	38.50	38.50	38.39
Cycocel at 500ppm	3.17	3.27	3.10	3.18	34.33	47.93	44.40	42.22	38.67	39.00	39.00	38.89
Cycocel at 750ppm	3.00	3.17	3.07	3.08	35.93	49.67	50.20	45.27	39.17	39.17	39.00	39.11
Cycocel at 1000ppm	2.97	3.07	2.95	2.99	41.10	50.00	51.27	47.46	39.17	39.00	39.00	39.06
Double distilled water (Control)	2.730	2.970	3.03	2.91	33.230	43.00	38.13	38.12	38.67	38.50	38.17	38.44
Mean	3.140	3.310	3.180		35.550	45.570	42.880		38.62	38.74	38.67	
SE(d)	0.115				0.649				0.563			
C.D	0.234				1.316				NS			

Influence of pruning and growth regulators application on flower yield characteristics of *Jasminum sambac* (L.)

Significantly maximum flower yield per plant of 0.285 kg recorded in October pruning with spraying of Cycocel at 1000 ppm (Table 6). These observation in the present study in *J. sambac* be due to the accelerated mobility of photosynthates from the source to the sink as influenced by growth hormone released or synthesized due to higher number of leaves and the

chlorophyll content. Cycocel will help to redirecting the plants energy away from excessive vegetative growth and towards flowering (Soliman *et al.*, 2022) [5] as observed in *Gardenia jasminoides*.

The highest on- season flower yield per plant of 1.05 kg was observed in December pruning with Cycocel spray at 1000 ppm, followed by December pruning with Cycocel at 750 ppm spraying (P₂G₅) and October pruning with Cycocel at 1000

ppm (P₂G₆). This might be due to pruning during cooler month, that helps to overcome the dormancy of plants. 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 ultimately helps to increase in the yield as observed in chrysanthemum by Tannirwar *et al.* (2011) ^[10].

Table 6: Influence of pruning month, plant growth regulators and their interaction on flower per plant in *Jasminum sambac*

Treatments	Off season yield per plant				On season yield per plant			
	August	October	December	Mean	August	October	December	Mean
GA ₃ at 100ppm	0.276	0.330	0.000	0.202	1.284	1.734	1.972	1.663
GA ₃ at 150ppm	0.250	0.303	0.000	0.184	1.365	1.545	1.576	1.495
GA ₃ at 200ppm	0.223	0.294	0.000	0.173	1.331	1.52	1.466	1.439
Cycocel at 500ppm	0.302	0.321	0.000	0.208	1.478	1.739	2.079	1.766
Cycocel at 750ppm	0.319	0.343	0.000	0.221	1.602	1.956	2.244	1.934
Cycocel at 1000ppm	0.337	0.366	0.000	0.234	1.882	2.263	2.325	2.157
Double distilled water (Control)	0.193	0.300	0.000	0.164	0.996	1.093	1.364	1.151
Mean	0.271	0.323	0.000		1.42	1.693	1.861	
S.E(d)	0.005				0.030			
C.D	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, flower quality with higher off-season flower production and yield in *J. sambac*.

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