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Effect of time and level of pruning on growth and flowering quality in *Jasminum sambac* var. Baramasi

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Abstract
The present investigation was conducted at Floriculture Research Farm, Navsari Agricultural University, Navsari (Gujarat) during the year 2016-17 under a Randomized Block Design with Factorial concept (FRBD) along with nine treatment combinations consisting three pruning time *i.e.* last week of November, second week of December and last week of December and three different levels of pruning *i.e.* 25 cm, 50 cm and 75 cm from the ground level. The treatments were repeated thrice. Different pruning time and pruning level influenced significantly on vegetative and flowering characters in *Jasminum sambac*. Among the various pruning time, 2nd week of December had most striking influence in enhancing the vegetative attributing characters *viz.* incremental plant height at 60, 120 and 180 days, (87.32, 95.90 and 112.94 cm, respectively), length of primary shoot (52.76 cm), number of leaves on primary shoot (66.72) and plant spread in E-W and N-S (92.45 and 94.88) as compared to the other treatments. Superiority of flowers with respect to flower bud length (3.41 cm) and flower bud diameter (1.00 cm) was recorded in plants pruned in second week of December, whereas, the traits such as minimum days taken for first bud initiation, commencement of flowering (43.93 and 53.38 days, respectively) and the weight of hundred flower buds (33.42 g) were noticed in plants pruned on last week of December. Among the various pruning levels, pruning done at 75 cm from the ground level was most significantly influenced vegetative attributing characters *viz.* incremental plant height at 60,120 and 180 days (106.97, 115.05 and 118.64 cm respectively) and plant spread in E-W and N-S (106.38 and 106.93 cm) directions as compared to the other treatments. However, the length of primary shoot at 60 days (59.02 cm) and maximum number leaves per primary shoot (84.98) were found in bushes pruned at 50 cm from the ground level. Flower bud length (3.46 cm), flower bud diameter (1.04 cm) and weight of hundred flower buds (33.42 g) were highest in the plants pruned at 50 cm above the ground level, whereas early flower bud initiation (42.15 days) and commencement of flowering (51.93 days) were noticed in the plants pruned on last week of December. In case of interaction effect of different pruning time and pruning level was found non-significant with respect to all vegetative growth and flowering traits. Pruning of *Jasminum sambac* var. Baramasi at 50 cm above ground level during second week of December is beneficial for better growth and flowering with good quality of jasmine flowers.

Keywords: Pruning, *Jasminum sambac* var. Baramasi

Introduction
Jasminum sambac commonly known as the "Arabian Jasmine" or "Tuscan Jasmine" belongs to the family Oleaceae. It is naturally distributed in Andhra Pradesh, Karnataka and Tamil Nadu and to some extent in West Bengal states of India (Randhawa and Mukhopadhyay, 1986) [12]. Jasmine is one of the important fragrant flowers used even from very ancient days in India. It is highly esteemed for its attractive, white colored and fragrant flowers. In perfume industry, jasmine has unique importance and popularity due to its unique odour like rose, vettiver and represents a type that cannot be exactly imitated at present by a mixture of any known synthetic aroma chemicals or natural isolates. The essential oil is being used in cosmetic, perfumery, source of aroma chemicals and food flavoring industries. The different plant parts like leaf, stem, bark, root, seed and fruit are also used for medicinal purpose (George and Watt, 1980) [4]. In India, Jasmine flowers are harvested manually with fully developed but still unopened buds for both fresh loose flower market and for concrete (Essential oil) extraction. It has antioxidant properties, potential to induce weight loss and to reduce serum and hepatic lipid levels through increase of leptin level, address the burning problems of fattiness and obesity (Li *et al.*, 2011) [9]. Jasmine will definitely emerge as an important "industrial flower crop".

The flower trade is one of the most rapidly expanding and dynamic global enterprise in today's world. The scope of floriculture (cultivation of flowers) has increased tremendously in India, which is evident by exponential increase in area 2,55,000 hectare and production of 17,54,000 MT loose flowers and 543 lakh numbers of cut flowers per annum. Gujarat is one of the most producing flower state in India comprising 17,300 ha area with 1,63,600 MT loose flowers production (Anon., 2014) [2].

Pruning is an important step because it increases the growth and its aesthetic value, e.g. increase flower size and quality (Gibson, 1984; Anderson, 1991) [6, 1]. The pruning date and pruning intensity also influences quality and quantity of flower production. Regulation of flowering in jasmine has great commercial and practical value due to seasonal nature of flowering and peak productivity confined to certain months of the year that is a major problem in jasmine flower production. Pruning done at right time and in specific amount provide fuel for the initiation of flowering by sufficient ventilation leading to least susceptibility of plant to diseases. Hence, present investigation was carried out to study the effect of time and level of pruning on growth and flowering quality in Jasmine.

Materials and Methods

The present investigation was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari to study the Canopy Management in *jasminum sambac var*. Barmasi with nine treatment combinations in a Factorial Randomised Block Design (FRBD) with three replications. The treatments comprised of three different time of pruning *viz*., last week of November (T_1), 2nd week of December (T_2) and last week of December (T_3) and three levels of pruning *viz*., heavy pruning at 25 cm above ground level (L_1), medium pruning at 50 cm above ground level (L_2) and light pruning at 75 cm above ground level (T_3) (Figure-1). The seven years old bushes of Barmasi variety of jasmine were pruned according to the treatment schedule to a level of 25 cm, 50 cm and 75 cm above ground level. Immediately after pruning, the FYM and chemical fertilizers were applied 15 cm deep in rings and 20 cm away from the main stem. The urea, single super phosphate and muriate of potash were used as the sources of nutrient elements. All the cultural operations *viz*., weeding, irrigation, pest control etc. were carried out as characters *viz*., length of primary shoot, plant spread N-S, E-W, number of leaves per primary shoot and flowering characters *viz*., days taken to first bud initiation and days for emergence of first flower after pruning and quality parameters *viz*., length and diameter of flower bud and 100 flower bud weight were recorded and the data were analysed statistically as per the method suggested by Panse and Sukhatme (1967) [11].

Fig 1: Three levels of pruning (L) in Jasmine

Results

Growth characteristics

Plant height: A perusal of data regarding plant height at 60 and 120 days as influenced by different pruning time was found significant, while plant height at 180 days was found non-significant. It is evident from the data that significantly superior plant height (87.32 cm and 95.90 cm) was found in plants pruned in second week of December (T_2) at 60 and 120 days which was statistically at par with the plants pruned in last week of November (T_1) and minimum plant height was recorded in the plants pruned in last week of December (T_3) at 60, 120 and 180 days, respectively. Significantly maximum plant height (106.97 cm and 115.05 cm) was noted in the plants pruned at 75 cm from the ground level (L_3) at 60 and 120 days, respectively, while plant height at 180 days was not affected significantly. Whereas, minimum plant height (55.31 cm, 68.04 cm and 102.05 cm) was obtained by the plants pruned at 25 cm above ground level (L_1) at 60, 120 and 180 days, respectively. The data revealed that interaction effect of different pruning time and pruning level were showed non-significant result with respect to plant height at 60, 120 and 180 days (Table-1).

Table 1: Effect of time and level of pruning on growth and flowering quality of *Jasminum sambac* var. Baramasi

Treatments	Incremental plant height (cm)			Plant spread (cm)		Primary shoot length at 60 days (cm)	Number of leaves per primary shoots at 60 days	Flower bud initiation (days)	Commencement of flowering (days)	Flower bud length (cm)	Flower bud diameter (cm)	Weight of 100 flower buds (g)
	60 Days	120 Days	180 Days	N-S	E-W							
Factor A- Time of pruning (T)												
T_1 – Last week of November	82.89	94.44	112.15	82.62	81.26	49.33	61.99	51.13	60.8	3.04	0.94	28.83
T_2– Second week of November	87.32	95.9	112.94	92.45	94.88	52.76	66.72	50.96	60.73	3.41	1.00	32.16
T_3– Last week of December	77.03	86.03	107.98	88.87	84.35	47.37	60.56	43.93	53.38	3.23	0.93	31.02
SE (m) ±	2.48	2.67	5.12	6.56	9.78	1.2	1.69	1.51	1.44	0.06	0.02	0.89
CD at 5%	7.43	8.01	NS	19.66	29.33	3.6	5.07	4.53	4.32	0.19	0.06	2.66
Factor B - Level of pruning (L)												
L_1– 25 cm from ground	55.3	68.04	102.05	67.3	65.81	52.55	56.26	54.77	64.1	3.39	0.96	33.42

level	1											
L_2 – 50 cm from ground level	84.97	93.28	112.39	89.73	88.31	59.02	84.98	49.11	58.89	3.46	1.04	30.34
L_3– 75 cm from ground level	106.97	115.05	118.64	106.93	106.38	37.91	48.05	42.15	51.93	2.84	0.88	28.27
SE (m) ±	2.48	2.67	5.12	6.56	9.78	1.2	1.69	1.51	1.44	0.06	0.02	0.89
CD at 5%	7.43	8.01	NS	19.66	29.33	3.6	5.07	4.53	4.32	0.19	0.06	2.66
Interaction (TxL)												
SE (m) ±	4.29	4.63	8.86	3.79	5.65	2.08	2.93	2.62	2.49	0.11	0.03	1.54
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	9.02	8.71	13.82	7.45	11.27	7.22	8.03	9.31	7.41	5.92	6.19	8.68

Plant spread (N-S): The perusal of the data revealed that significantly maximum plant spread (92.45 cm) in North-South direction was observed in plants pruned in T_2 which was statistically at par with the plants pruned in T_3 being 88.87 cm. Further, minimum plant spread (82.62 cm) was found in bushes pruned in T_1. Significantly maximum plant spread in North-South direction (106.93 cm) was noted in plants pruned at L_3, while minimum plant spread (67.30 cm) was obtained in plants pruned at L_1.

Plant spread (E-W): Significantly maximum plant spread (94.88 cm) in E-W direction was recorded in plants pruned in T_2 and minimum plant spread (81.26 cm) was noted in the plants pruned T_1. Significantly maximum plant spread in East-West direction (106.38 cm) was noted in plants pruned at L_3, while minimum plant spread (65.81 cm) was obtained in plants pruned L_1.

Primary shoot length: Maximum length of primary shoot (52.76 cm) was significantly observed in plants pruned in T_2 and minimum (47.37 cm) was found in bushes pruned in T_3 at 60 days. Significantly longest primary shoot (59.02 cm) was noted in plants pruned at L_2, while shortest plant primary shoot (37.91 cm) was obtained in plants pruned at L_3 at 60 days.

Number of leaves per primary shoot: The data resulted that the significantly maximum number of leaves per primary shoot (66.72) was observed in plants pruned in T_2 and minimum T_3. Significantly highest leaves per primary shoot (84.98) were noted in plants pruned at L_2. While least number of leaves per primary shoot (48.05) was obtained in plants pruned at 75 cm from ground level (L_3).

Flowering characteristics

Days taken to first flower bud initiation: The data related to number of days taken for first flower bud initiation was influenced significantly by pruning time. Early flower bud initiation (43.93 days) was noted in plants pruned in last week of December (T_3), while late flower bud initiation (51.13 days) was observed in plants pruned in last week of November (T_1). The perusal of the data revealed that earlier flower bud initiation was observed significantly in plants pruned at 75 cm from the ground level (L_3) with 42.15 days. Whereas, plants pruned from 25 cm above ground level (L_1) noted late flower bud initiation with 54.77 days.

Commencement of flowering: Early commencement of flowering (53.38 days) was noted in plants pruned in last week of December (T_3) while late commencement of flowering (60.80 days) was observed in plants pruned in last week of November (T_1). In case of level of pruning, early commencement of flowering was observed significantly in plants pruned L_3 with 51.93 days, while in L_1 pruning level noted late flower bud initiation with 64.10 days.

Flower quality characteristics

Flower bud length: The data indicated that flower bud length was influenced significantly by pruning time. Longest flower bud length (3.41 cm) was noted in plants pruned in second week of December (T_2) which was statistically at par with pruning done in last week of December (T_3) being 3.23 cm. However, shortest flower bud (3.04 cm) was reported in plants pruned in last week of November (T_1). At the pruning level, the result stated that flower bud length was observed significantly maximum in plants pruned at 50 cm from the ground level (L_2) with (3.46 cm), while plants pruned from 75 cm ground level (L_3) noted minimum flower bud length (2.84 cm).

Diameter of flower bud: The maximum diameter of flower bud (1.00 cm) was noted in plants pruned in T_2, while minimum diameter of flower bud (0.93 cm) was observed in plants pruned in T_3. The data revealed that flower bud diameter was observed significantly maximum in plants pruned at L_2, whereas minimum flower bud diameter (0.88 cm) noted in plants pruned at L_3.

Weight of hundred flowers buds: Significantly highest weight of hundred flowers (32.16 g) was noted in plants pruned in T_2, while lowest weight of hundred flowers (28.83 g) was observed in plants pruned in T_1. In case of pruning level, It is evident from the data that weight of hundred flowers was observed significantly maximum in plants pruned L_1 with (33.42 g), while plants pruned at L_3 noted minimum weight of hundred flowers (28.27 g).

Interaction effect

The data indicated that the interaction effect of both factors (time of pruning and level of pruning) was found non-significant for all the studied parameters.

Discussion

Effect of pruning time: The factors responsible for growth and flower quality in a plant are depending upon climate, soil cultural manipulations and their interactions. Pruning time and pruning level play a prime role in deciding the growth and quality of plant flowers in the jasmine. Knowledge on this aspect is of paramount importance to manipulate the plants physiology, which may eventually lead to the maximum production. Vegetative growth characteristics were resulted due to an availability of suitable climatic condition. Plant spread in N-S and E-W direction was increased due to increase in light intensity as well as aeration, diversion of sap flow towards lateral buds after pruning. The results are also substantiated the findings of Ratikanth (2005) [13] in *Jasminum sambac* under Karnataka condition and lokhande *et al.* (2015) [10] in Jasmine. Earlier studies have also found that plants pruned in December month contents more total polysaccharide, which resulted high number of leaves in

Jasminum sambac (Sumangala *et al.*, 2003) [15]. Pruning in last week of December (T_3) in *J. sambac* bushes triggered early flower bud initiation (43.93 days) and commencement of flowering (53.38 days). It might be due to the juvenile phase in late pruning was less compared to other treatments. The jasmine bushes pruned in November month produced late flowering due to low temperature and shorter sun shine hours. Similar trend was also observed by Gowda *et al.* (1986) [7] in *Jasminum auriculatum* and Sumangala *et al.* (2003) [15] and lokhande *et al.* (2015) [10] in *J. sambac*. Significantly larger flower bud with respect to diameter of bud (1.00 cm) and bud length (3.41 cm) were obtained by plants pruned in second week of December (T_2). The better flower size was obtained due to better vegetative growth, congenial climatic condition and production of large quantity of reserve food as compared to November month pruning. The results obtained are in close agreement with the findings of Khattak *et al.* (2011) [8] due to pruning time in Rose. Similarly, finding of weight of hundred flower buds were also agreement of the findings of Sumangala *et al.* (2003) [15] in *Jasminum sambac*.

Effect of pruning level: It is evident from the data plant height (106.97 cm and 115.05 cm) at 60 days and 120 days, respectively was significantly maximum in plants pruned at 75 cm from the ground level (L_3). It is might be due to higher initial height and high polysaccharide content in plants. Similar trend was found by Zekavati (2013) [16] in rose. Pruning encourages the shoot length but serve as well as minimum pruning discourage the shoot length (Sharma and Singh, 1991) [14] and pruning reduces apical dominance and enhances lateral growth of plant. More number of leaves might be produced due to increased light intensity and good aeration caused by pruning. The results are in close conformity with the findings of Zekavati (2013) [16] in rose and Chopde *et al.* (2017) [3] in jasmine. Early emergence of first flower bud (42.15 days) and commencement of flower (51.93 days) could be due to the fact that pruning helps to broaden the C/N ratio, thus stimulating flowering and increasing vigor of plant as a result of adequate pruning level. The results are in close agreement with the findings of Ghulam *et al.* (2004) [5] in rose and lokhande *et al.* (2015) [10] in jasmine. Highest length and diameter of flower bud and 100 flower bud weights could be due to increased availability of photosynthates due to enhanced vegetative growth of plant which might have been utilized for the production of better quality flowers. The results are in line with the findings of Ghulam *et al.* (2004) [5] in rose and lokhande *et al.* (2015) [10] in jasmine.

Interaction effect (T x L): The interaction effect of different pruning time and pruning level was found non-significant for the growth and flowering characteristics due to the climatic conditions and number of leaves with photosynthesis activity. The results are in agreement with the earlier findings of Lokhande *et al.* (2015) [10] and Chopde *et al.* (2017) [3] in jasmine.

Conclusion

It was concluded that pruning of *Jasminum sambac* var. Baramasi at 50 cm above ground level during second week of December is beneficial for better growth and flower traits with good quality of jasmine flowers based on the results of the present investigation.

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