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Effects of Time and Level of Pruning on the Growth and Flowering of *Jasminum sambac* (L.) Cv. Gundumalli

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A B S T R A C T

An investigation was carried out during (2014-16.) at the garden of the Department of floriculture and landscaping, College of Agriculture, OUAT, Bhubaneswar to study the Effects Of Different Time And Level Of Pruning On The Growth, Flowering And Yield Of *Jasminum Sambac* (L.) Aiton with sixteen treatment combinations in Factorial Randomised Block Design with three replications. The treatments comprised four timings of pruning viz., 2nd week of September,2nd week of October,2nd week of November,2nd week of December and four levels of pruning viz.,20,40,60,80cm above ground level . Among the four levels of pruning, 40 cm from the ground level showed the best result with respect to productive shoots/plant(57.71) maximum flower yield(14.97t/ha). Pruning during 2nd week of November reached the highest primary shoot length (108.82 cm), number of productive shoots/plant (57.04) and maximum yield (15 t/ha in Jasminum sambac whereas, lowest yield (10.58t/ha) was observed in September pruning. In case of interaction effect of different pruning time and pruning level was found non-significant with respect to all vegetative growth and flowering parameters except number of sprouts, yield of flower buds per hector

Introduction

Flower is the symbol of beauty, love and tranquility, flower conveys the message of love, joy and affection. In beautification, flowers are one of the main ingredients since the beginning of history and its importance has not yet diminished but rather increased as time proceeds. Among the commercial flowers grown in India the most important are roses, carnation, gerbera, orchid, chrysanthemum, jasmine, marigold, aster etc.

Jasmine (Jasmine sambac L.) is a very important group of plants, belongs to family Oleaceae. It is naturally distributed in Andhra Pradesh, Karnataka and TamilNadu and to some extent in West Bengal states of India (Randhawa and Mukhopadhyay, 1986) which is cultivated extensively in tropical and sub-tropical areas of Southeast Asia and other parts of world for garden decoration and commercial purposes. In Fragrance industry, jasmine has unique importance and popularity due to its unique sweet fragrance like that of

rose, vetiver and represents a type that cannot be exactly imitated at present by a mixture of any known synthetic aroma chemicals or natural isolates The extracts of jasmine are used for flavoring or preparation of 'Jasmine scented Tea' in China and 'Jasmine rice' in Bangkok, Thailand. The antioxidant properties has the potential to induce weight loss and to reduce serum and hepatic lipid levels through the increase of leptin level which address the burning problems of fattiness and obesity (Li Zhen *et al.*, 2011). Jasmine will definitely emerge as an important "Industrial flower crop" (Bhattacharjee,1980). The essential oil is being used in cosmetics, perfumery and as a source of aroma chemicals and food flavoring industries. Jasmine flower crop is grown on commercial scale throughout India, but extensively in Tamil Nadu (12590 ha area and 1, 30, 070 MT production, 2015-16), Karnataka (5760 ha area 3, 69,200 MT), Andhra Pradesh (2710 ha area and 1, 51,300 MT).

Being industrial flower crop large quantities of flowers need to be produced continuously for a longer period of the year to meet the break-even production of the essential oil industry. The large quantitative production requirement can be achieved by area expansion and increasing productivity, by adopting improved horticultural practices like training, pruning, irrigation, use of optimum dose of manures and fertilizers, inter cultural operation, staking, plant protection etc. are required to be properly followed

One of the important cultural operations in Jasmine is pruning, which requires regular pruning to encourage more number of shoots and sprouting of dormant buds. It helps in utilization of energy by elimination of unwanted shoots. It is important for rejuvenation of old plants, and maintenance of floriferousness, increases flower size and quality along with vigor of jasmine plant. (Gibson, 1984; Anderson, 1991). The main object of pruning jasmine plant is to remove the unproductive growth, ensure production of large number of strong and healthy shoots, which will bear flowers and improve the quality of blooms. Pruning encourages growth of new healthy shoots which bear more flowers than an old branch. It keeps the plants in shape and form

The best time of pruning is the period when the activity of the jasmine plant is least and the plant is at dormant to near dormant stage... 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 of Jasmine (*jasminum sambac* (l.) aiton

Materials and Methods

The present investigation was undertaken at the garden of the Department of floriculture and landscaping, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar during two consecutive years (2014-15 and 2015-16.) to study the Effects Of Different Time And Level Of Pruning On The Growth, Flowering And Yield Of *Jasminum Sambac* (L.) Aiton with sixteen treatment combinations in Factorial Randomised Block Design with three replications.

The treatments comprised of four different

time of pruning viz i.e 10th September 10th October, 10th November, 10th December and at four levels of severity of pruning viz 20, 40, 60, 80 cm from the ground level by keeping uniform number of branches. The three year old bushes of Gundu malli variety of jasmine were pruned according to the treatment schedule to a level of 20, 40, 60, 80 cm cm above ground level. Immediately after pruning, the FYM and chemical fertilizers were applied at a dose of 14:7:7gm NPK/plant at 15 cm deep and 20 cm away from the main stem in the rings and covered with soil. The urea, single super phosphate and murate of potash were used as the sources of nutrient elements. All the cultural operations viz., weeding, irrigation, pest control etc. were carried out as and when required.

Five randomly selected plants were tagged per replication in each treatment and observations were recorded for vegetative growth and flowering and data were recorded for two consecutive years (2014-15 and 2015-16.) The pooled analysis of two years data was carried out as per the method suggested by Fisher (1954) and Pansy and Sukhatme (1967).

Results and Discussion

The experimental results of the present investigation on various vegetative parameters are recorded for two years and the pooled analysis of two years data are represented in Table1

Growth characteristics

Number of Sprouts per plant

A perusal of data presened1 regarding number of Sprouts per plant at 28 days after pruning as influenced by different pruning time was found significant. It is evident from the data that significantly maximum sprouts (191.73) was found in plants pruned in November(T3) which was statistically at par with the plants pruned in October (T2) and minimum number of sprouts (160.48) was recorded in the plants pruned in December (T4). Significantly maximum number of sprouts (195.99) was noted in the plants pruned at 40 cm from the ground level (L2) Whereas, minimum number of sprouts (144.81) was recorded by the plants pruned at 80 cm above ground level (L4). The data revealed that interaction effect of different pruning time and pruning level showed significant result with respect to number of sprouts.

Primary shoot length

Maximum length of primary shoot (108.82 cm) was recorded in plants pruned in T3 which is significantly superior over all other treatments and minimum (100.52cm) was found in bushes pruned in T4 at 90 days after pruning. Significantly longest primary shoot (127.91cm) was noted in plants pruned at H2, while shortest primary shoot (75.94 cm) was obtained in plants pruned at L1 at 90 days. Various combinations of pruning time and pruning levels had no significant influence on this parameter.

Shoot thickness

Significantly maximum Shoot thickness (1.08cm) was recorded in plants pruned in T3 and minimum (0.97 cm) was noted in the plants pruned in T4. Significantly maximum Shoot thickness (1.13cm) was noted in plants pruned at L3, while minimum (0.89 cm) was obtained in plants pruned at a height of L4.

Number of leaves per primary Shoot

The data resulted that the significantly maximum number of leaves per primary shoot (118.76) was observed in plants pruned in T3

and minimum (106.46) in T4. Significantly highest number leaves per primary shoot (117.75) were noted in plants pruned at L2. While least number of leaves per primary shoot (106.46) was obtained in plants pruned at 80 cm from ground level (L4).

Number of laterals per primary shoot

The data resulted that the significantly more number of laterals per primary shoot (9.79) was observed in plants pruned in T3 a on the other hand minimum (7.91) in T3. Significantly highest numbers of laterals per primary shoot (10.86) were noted in plants pruned at a height of 40cm (L2). While least number of laterals per primary shoot (7.91) was obtained in plants pruned at 80 cm from ground level (L4) interaction of pruning time and pruning levels had no significant influence on this parameter

Productive shoots/plant

Significant difference in number of productive shoots/plant. November pruned plants T3 recorded maximum number of productive shoots (57.04 and minimum (45.02) in T4. The plants pruned at a height of 40cm (L2) recorded maximum (57.71) and minimum (45.02) was observed in L4.

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. The plants pruned during December (T4) were the earliest for flower bud initiation (42.77 days) while late flower bud initiation (61.27 days) was observed in plants pruned in September (T1). The perusal of the data revealed that earlier flower bud initiation was observed significantly in plants pruned at 60 cm from the ground level (L3) with 45.09 days. Whereas, plants pruned from 80 cm above ground level (L4) noted late flower bud initiation with 61.75days.

Days taken for full development of flower: Early development of flower (14.63days) was noted in plants pruned during December (T4) while late development of flower (16.06days) was observed in plants pruned in pruned in September (T1). In case of level of pruning, early development of flowering was observed significantly in plants pruned L3 with 15.07days, while in L1 pruning level noted late flower bud initiation with 15.74 days.

Duration of flowering (days): The data indicated that significantly longer duration(134.77days) of flowering was recorded in T1 while the shortest duration(115.21days) was recorded in T4. In case of level of pruning, significant difference was noticed with respect to this parameter. Longest duration of flowering (146.92 days) was recorded in H2 whereas shortest duration of flowering (104.46) was observed in H4

Flower bud length: The data indicated that flower bud length was influenced significantly by pruning time. Longest flower bud length (3.44cm) was noted in plants pruned in November (T3) However, shortest flower bud length (3.11cm) was reported in plants pruned in December (T4). At the pruning level, the result stated that flower bud length was observed significantly maximum in plants pruned at 40 cm from the ground level (L2) with (3.37cm), while plants pruned from 80cm ground level (L4) noted minimum flower bud length (3.23 cm).

Diameter of flower bud: The maximum diameter of flower bud (0.97cm) was noted in plants pruned in T3, while minimum diameter of flower bud (0.85 cm) was observed in plants pruned in T4. The data revealed that flower bud diameter was observed

significantly maximum (0.95cm) in plants pruned at L2, whereas minimum flower bud diameter (0.85 cm) noted in plants pruned at L3.

Weight of fifty flowers buds: Significantly maximum weight of fifty flowers (16.05 g) was noted in plants pruned in T3, while minimum weight of fifty flowers (15.50 g) was observed in plants pruned in T1. In case of pruning level, It is evident from the data that weight of fifty flowers was observed significantly maximum in plants pruned L2 with (16.08 g), while plants pruned at L4 noted minimum weight of fifty flowers (15.15 g).

Flower yield/hector: Significantly highest flower yield (15.00tonn) was noted in plants pruned in T3, while lowest yield (10.59 ton) was observed in T1. In case of pruning level L2 maximum flower yield (14.97t) and minimum yield of (10.35t) was recorded in L13.261

Interaction effect

The data indicated that the interaction effect between both the factors (time of pruning and level of pruning) was found non- significant for all the studied parameters except yield of flower buds per hector.

Table.1 Effect of time and level of pruning on vegetative growth of Jasminum sambac (L.) (Pooled means)

TREATMENTS	Number of Sprouts per plant	Length of primary shoot(cm)	Shoot thickness	Leaves /plant	Number of laterals per primary shoot	productive shoots/plant
FACTOR A-TIME OF PRUNING						
T1: 2nd week of September	170.61	103.42	0.99	112.21	8.65	48.28
T2: 2nd week of October	185.66	103.41	1.04	112.13	9.11	53.73
T3: 2nd week of November	191.73	108.82	1.08	118.76	9.79	57.04
T4: 2nd week of December	160.48	100.52	0.97	106.46	7.91	45.02
SE (m) ±	1.93	1.57	0.01	1.45	0.13	0.64
CD 5%	5.58	4.53	0.03	4.19	0.37	1.85
FACTOR B-LEVEL OF PRUNING						
L1-20cm above GL	174.54	75.94	1.01	112.98	9.57	52.65
L2-40cm above GL	195.99	97.57	1.13	117.74	10.86	57.71
L3-60cm above GL	193.14	114.76	1.04	112.76	8.45	47.37
L4-80cm above GL	144.81	127.91	0.89	106.07	6.57	46.34
SE (m) ±	1.93	1.57	0.01	1.45	0.13	0.64
CD 5%	5.58	4.53	0.03	4.19	0.37	1.85
INTERACTION EFFECT (TXL)						
SE (m) ±	3.86	3.140	0.02	2.90	0.26	1.28
cod 5%	11.16	-	-	-	-	-
F TEST	S	NS	NS	NS	NS	NS

N.B: S: Significant, NS: Non Significant, GL: Ground level

Table.2 Effect of time and level of pruning on flowering, yield, quality of Jasminum sambac (L.)(Pooled means)

TREATMENTS	Initiation of flower bud (Days)	Full development of flower (Days)	Duration of flowering (Days)	Flower bud length (cm)	Diameter of flower bud (cm)	Weight of fifty flowers buds (gm)	Flower yield of /ha (ton)
FACTOR A-TIME OF PRUNING							
T1: 2nd week of September	61.27	16.06	134.77	3.33	0.90	15.50	10.58
T2: 2nd week of October	57.32	15.43	130.36	3.39	0.93	15.77	12.30
T3: 2nd week of November	51.70	14.89	124.62	3.44	0.97	16.05	15.00
T4: 2nd week of December	42.77	14.63	115.21	3.11	0.85	16.02	13.26
SE (m) ±	0.94	0.20	1.89	0.02	0.01	0.64	0.16
CD 5%	2.71	0.59	5.48	0.07	0.03	1.85	0.48
FACTOR B-LEVEL OF PRUNING							
L1-20cm above GL	55.71	15.74	131.07	3.31	0.94	16.05	13.38
L2-40cm above GL	50.51	15.08	146.91	3.36	0.95	16.08	14.97
L3-60cm above GL	45.09	15.07	122.53	3.37	0.92	16.06	12.45
L4-80cm above GL	61.75	15.13	104.46	3.23	0.85	15.15	10.35
SE (m) ±	0.94	0.20	1.89	0.02	0.01	0.18	0.16
CD 5%	2.71	0.59	5.48	0.07	0.37	0.53	0.48
INTERACTION EFFECT (TXL)							
SE (m) ±	1.38	3.79	3.79	0.05	0.02	0.36	0.33
CD5%	-	-	-	-	-	-	0.96
F TEST	NS	NS	NS	NS	NS	NS	S

Figure.1 Percentage increase in number of productive shoots by the influence of time and levels of pruning

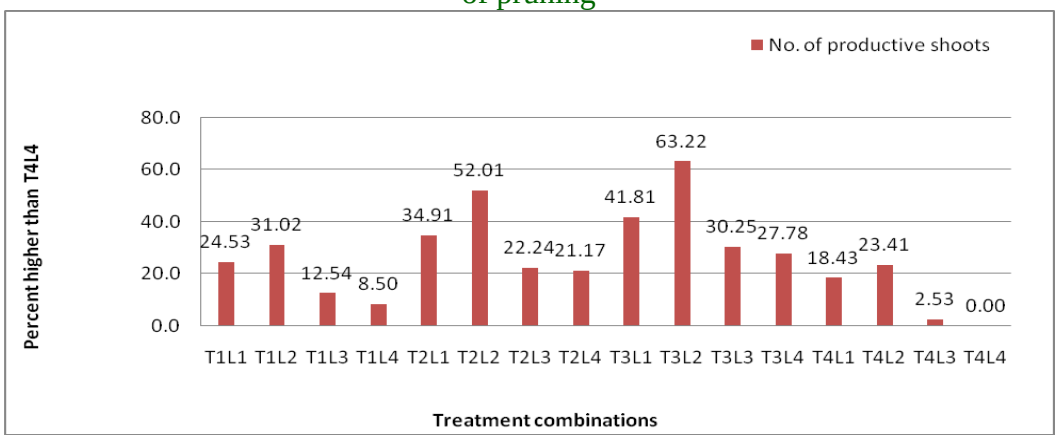
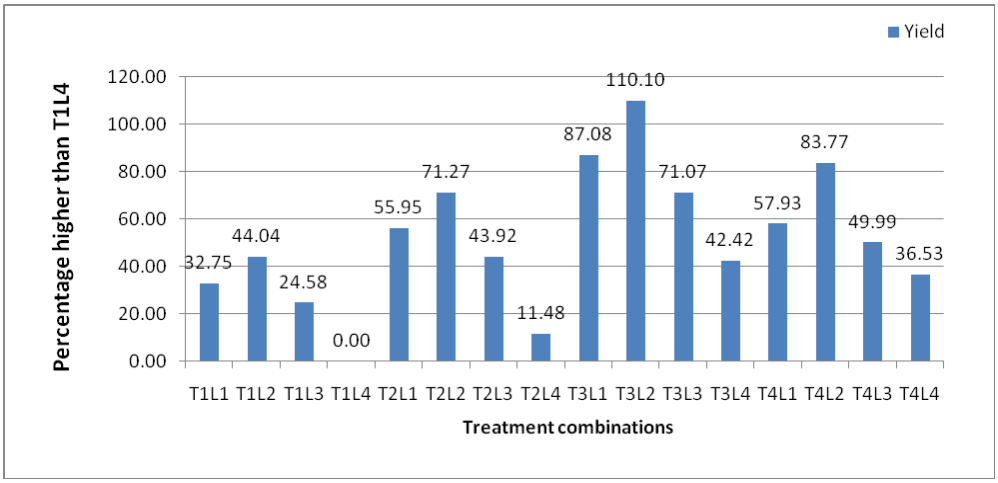


Figure.2 Percentage increase in flower yield by the influence of time and levels of pruning



Effect of time and levels of pruning

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. The plants pruned during Second week of November produce maximum primary shoot length and thickness. This may be 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) in Jasminum sambac under Karnataka condition and lokhande *et al.*, (2015) in Jasmine. Earlier studies have also found that plants pruned in November month contents more total polysaccharide, which resulted high number of leaves in Jasminum sambac (Sumangala *et al.*, 2003). Pruning in second week of December (T4) in J. sambac bushes triggered early flower bud initiation (42.77days and Days taken for full development of flower (14.63days) (Table2). It might be due to the juvenile phase in late pruning was less compared to other treatments. The jasmine bushes pruned in December month produced late flowering due to low temperature and shorter sun shine hours. Similar trend was also observed by Gowda *et al.*, (1986) in Jasminum auriculatum and Sujatha et.al (2009) and lokhande *et al.*, (2015) in J. sambac. Significantly larger flower bud with respect to diameter of bud (0.97cm) and bud length (3.44cm) were obtained by plants pruned in November (T3). 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 other months of pruning. The results obtained are in close agreement with the findings of Khattak *et al.*, (2011) due to pruning time in Rose. Similarly, finding of weight of fifty flower buds were also agreement of the findings of Sumangala *et al.*, (2003) in Jasminum sambac.

It is evident from the table1 and 2; significantly longest primary shoot (127.91cm) was noted in plants pruned at level of 80 cm (L4) while shortest primary shoot (75.94 cm) was obtained in plants pruned at 20 cm (L1) at 90 days after pruning

it might be due to higher initial height and high polysaccharide content in plants. Similar trend was found by Zekavati (2013) in rose. Pruning encourages the shoot length but serve as well as minimum pruning discourage the shoot length (Sharma and Singh, 1991) and pruning reduces apical dominance and enhances lateral growth of plant. This might have been the reason for increasing length of primary shoot, leaf area and number of secondary laterals per primary shoot in jasmine. Similar results were obtained by Santhoshini (2014) in rose under Nagpur (M.S.) conditions. 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) in rose and Chopde *et al.,* (2017) in jasmine. Early emergence of first flower bud (45.09days) and early development of flowering (15.07 days) was observed significantly in plants pruned at a level of 60 cm (L3) from ground level. This 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)in rose and lokhande *et al.,* (2015) in jasmine. Highest length and diameter of flower bud and 50 flower bud weights, flower yield was observed in the plants pruned at a level of 60 cm (L3) could be due to increased availability of photosynthetic due to enhanced vegetative growth of plant which might have been diverted to the sink and utilized for the production of better quality flowers as well as more flower yield. The results are in line with the findings of Porwal *et al.,* (2002) in 8 year-old-damask rose (Rosa damascena) Ghulam *et al.,* (2004) in rose, Adnan *et al.,* (2013) in Rosa centifolia and lokhande *et al.,* (2015) in jasmine. Percentage higher yield as effected by interaction of time and level of pruning

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.. By the influence of time and levels of pruning the number of productive shoots increase by 63.2 percentage and flower yield by 110.10 pecentage over (T4L4) and (T3L2)respectively when the plants pruned during November at a height of 40cm from ground level i.e.T3L2 (Fig1 andFig2). The results are in agreement with the earlier findings of Lokhande *et al.,* (2015) and Chopde *et al.,* (2017)

It was concluded that pruning of Jasminum sambac var. Gundumalli during second week of November at 40 cm above ground level is beneficial for better growth and flower traits with good quality of jasmine flowers. This is due to change in weather conditions like change in temperature and day length prevailed during November month. Hence, according to changes in weather the pruning month should be changed to get an ample production and yield in Jasminum sambac

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