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Optimization of planting stage and pinching level in carnation

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ABSTRACT : The experiment on the optimization of planting stage and pinching level in carnation was carried out with the different stages of day's old rooted cuttings and pinching level. The experimental combinations of the study with different days of rooted cuttings and single pinching at three different nodal point resulted in the optimizing the days and pinching level in carnation. This will directly have an impact on the ultimate productivity of the crop. The treatment T_8 with 30 day old rooted cuttings + single pinch at the 5th node proved to be the best in terms of number of flowers per plant (6.00, 8.30 and 5.40) and flower yield per sq.m. area (216.00, 298.80 and 194.40). The vegetative characters plant height, number of leaves per plant and laterals per plant, internodal length, quality characters *viz.*, length and girth of flower stalk, flower yield parameters and physiological characters all of which tends to increase in the overall production and quality of flower.

KEY WORDS : Carnation, Planting stage, Single pinching, Nodal level

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Carnation is one of the most important cut flower grown under protected environmental conditions. It is gaining popularity among the flower growers, traders and flower lovers and one among the top ten cut flowers grown in India. It requires pinching for the regulation of flowering process (Imamura and Suto, 2001). It causes sudden reversion from flowering to vegetative phase and in turn prolongs the duration of flowering. Pinching level decides the lateral shoot development and will aide in the proper establishment of young rooted cuttings. The propagation of carnation is through terminal cuttings. It takes 25 - 30 days for rooting of cuttings. The correct stage of rooted cuttings is very important in deciding the initial establishment of plants from mortality. The number of days old rooted cuttings and the pinching stage will have an important fact in the production and productivity of flowers in a square metre area inside the polyhouse.

The research study on identifying the right age of the cuttings and the pinching level is an important prerequisite in carnation cultivation. Hence, the present study was carried out with the objective to optimize the correct stage of planting and pinching level.

RESEARCH METHODS

The present investigation was carried out at M/s. Elkhill Agrotech, Ooty, a leading carnation unit and one of the consortium partners in the National Agricultural Innovation Project with the Department of Floriculture and Landscaping, Tamil Nadu Agricultural University, Coimbatore during December, 2009 to December, 2011. The experiment was carried out in a Randomized Block Design with nine treatments and three replications.

Treatment details

Treatments	Particulars
T_1	25 day old rooted cuttings + single pinch at the 4th node
T_2	25 day old rooted cuttings + single pinch at the 5th node
T_3	25 day old rooted cuttings + single pinch at the 6th node
T_4	35 day old rooted cuttings + single pinch at the 4th node
T_5	35 day old rooted cuttings + single pinch at the 5th node
T_6	35 day old rooted cuttings + single pinch at the 6th node
T_7	30 day old rooted cuttings + single pinch at the 4th node
T_8	30 day old rooted cuttings + single pinch at the 5th node
T_9	30 day old rooted cuttings + single pinch at the 6th node (Check)*

Single pinching is the generally adopted method by carnation growers. In this experiment, cuttings of various ages namely 25, 30, 35 days were compared along with the various levels of pinching *viz.*, 4 th, 5 th and 6 th nodes from the base. The observations on growth parameters *viz.*, plant height (cm), number of leaves per plant, number of laterals per plant and internodal length (cm) were recorded at monthly intervals for three flushes of the crop. Yield parameters *viz.*, days taken for flower bud appearance and flower bud opening, duration of flowering (days), number of flowers per plant, flower yield per sq.m. and quality parameters namely length of flower stalk (cm), bud length (cm), bud circumference (cm), number of quality grade flowers/m^2, calyx splitting (%), vase life (days) and physiological parameters *viz.*, leaf area (cm^2), chlorophyll content (mg/g) were observed for the three flushes of flowering.

RESEARCH FINDINGS AND DISCUSSION

The stage of planting *i.e.*, age of rooted cuttings decides the field establishment, growth and development in carnation. The main plight of carnation cultivation rests with the quality of planting material which decides the ultimate yield and quality of flowers. The rooted cuttings should be maintained in nurseries for optimum number of days to attain age of planting (*i.e*., to develop three pairs of leaves and adequate root volume).

Carnation exhibits apical dominance which influences the development of axillary shoots and flower production (Cline, 1997). Pinching is a physiological intervention and a special horticultural practice to regulate the flowering and break apical dominance which allows axillary shoots to emerge and produce more number of flowering stems. It is practiced in carnation to have more yields. Single pinching is the most successful and viable method, which gives steady yield and earliness in flowering. Normally pinching is done at 30 days after planting.

Pinching at the appropriate nodal point is quite imperative factor that aids to achieve sustainable boosting in flower yield and quality. The present research experiment was taken up to optimize the ideal planting stage and pinching level of carnation rooted cuttings.

Growth parameters:

The planting stage and pinching level in treatment T_8 with 30 day old rooted cuttings and single pinching at the fifth node significantly influenced the growth parameters namely, plant height, number of leaves, laterals per plant and internodal length. The plants showed linear increase in height after pinching which extended upto the third flush of flowering period in this treatment with 77.78, 75.80 and 66.30 cm against 66.53, 64.13, 59.45 cm in treatment T_4 with 35 day old rooted cuttings + single pinch at the 4th node (Table 1). The number of leaves showed 180.47, 170.60, and

Table 1: Effect of planting stage and pinching level on plant height (cm)

Treatments	Days after planting																					
	Flush I						Flush II						Flush III									
	30	60	90	120	150	180	At harvest (181 – 240)	270	300	330	360	390	420	At harvest (421 – 480)	510	540	570	600	630	660	At harvest (661 – 720)
T_1	7.65	13.76	17.54	26.73	44.37	66.00	71.00	21.03	31.28	40.67	49.47	53.87	65.13	66.07	20.20	26.60	37.00	42.60	52.00	56.70	61.35
T_2	8.70	15.65	20.74	31.67	50.80	66.50	72.45	25.07	35.30	45.60	57.53	62.67	69.00	70.20	21.47	30.93	40.15	45.23	55.78	59.80	64.50
T_3	8.18	15.45	20.25	31.47	49.93	66.10	73.17	24.33	34.00	43.13	54.67	58.87	67.27	69.93	21.33	29.73	39.15	44.85	55.00	58.10	63.50
T_4	7.00	13.10	16.71	22.60	40.15	62.27	66.53	18.51	28.67	36.13	42.07	50.27	57.60	64.13	19.87	23.00	34.45	39.80	50.55	54.65	59.45
T_5	8.13	15.37	20.00	30.13	48.00	67.60	72.47	23.37	33.50	42.30	53.07	57.87	67.00	69.10	21.51	28.67	39.00	44.10	54.65	58.00	62.05
T_6	8.02	15.10	19.45	29.65	47.40	66.73	71.20	22.07	33.00	42.93	52.00	54.40	66.93	68.67	21.00	27.87	38.60	43.20	53.45	57.60	61.75
T_7	7.35	13.61	17.73	25.60	42.77	65.40	69.67	20.23	30.87	38.40	47.20	52.27	64.53	66.00	20.00	25.47	36.10	41.50	51.20	55.20	60.25
T_8	9.94	16.69	22.31	33.93	54.60	69.75	77.78	28.40	40.00	53.49	64.70	69.07	72.73	75.80	25.13	34.00	43.25	48.40	57.45	62.15	66.30
T_9(Check)	9.83	16.60	21.59	32.80	52.00	68.67	77.00	26.20	38.20	46.80	58.47	64.83	70.25	72.93	22.27	32.93	42.20	47.62	56.80	60.35	65.70
Mean	8.31	15.04	19.59	29.40	47.78	66.56	72.70	23.25	33.87	43.27	53.24	58.24	66.72	69.20	21.42	28.80	38.88	44.14	54.10	58.06	62.76
SE(d)	0.007	0.009	0.013	0.025	0.031	0.014	0.023	0.021	0.023	0.032	0.044	0.041	0.027	0.024	0.011	0.024	0.019	0.019	0.017	0.016	0.015
C.D. (P=0.05)	0.015	0.019	0.027	0.054	0.066	0.031	0.049	0.045	0.050	0.069	0.095	0.087	0.059	0.052	0.025	0.051	0.041	0.040	0.036	0.034	0.032

160.65 in treatment T_8 with 30 day old rooted cuttings and single pinching at the fifth node against treatment T_4 with 156.73, 147.13 and 134.45 during the first, second and third flushes of flowering, respectively. The highest number of laterals with 6.00, 8.30 and 5.40 was exhibited in treatment T_8 and lowest with 3.90, 6.75 and 4.05 in treatment T_4. This might be due to the removal of apical portion of plant at optimal level which neutralizes the effect of apical dominance. Similar results with respect to single pinch retaining five pairs of leaves were reported by Patel and Arora (1983), Khanna *et al.* (1986) in carnation. Moreover, pinching at lower position, *i.e.*, fourth nodal level tends to decrease the plant height, number of leaves, laterals and internodal length. This pinching intensity apparently tends to release apical dominance associated with reduced quantitative characters of plant. This finding is in accordance with the results of Pathania *et al.* (2000) in carnation. The stage of planting at 30 day old rooted cuttings might have also been favourable and complementary in boosting the plant growth characters. Delay in planting coupled with pinching at a lower level resulted in an unfavourable response as evident from the higher mortality rate observed with 35 day old rooted cuttings and pinching at the fourth node.

Flower yield and quality parameters:

The planting stage and pinching level had significantly influenced the flowering behaviour of carnation. The treatment T_9 with 30 day old rooted cuttings and single pinching at the sixth node registered better performance by shortening the time needed for appearance of visible flower bud with 145.00, 149.50 and 156.00 days during the first, second and third flushes of flowering, respectively. It may be due to the early physiological maturity of shoots after pinching which in turn results in early emergence of flower. The results are in conformity with findings of Arora and Khanna (1986) in marigold cv. African Giant Double Orange and Ubukata (1999) in carnation.

Longer duration of flowering was observed in treatment T_8 with 30 day old rooted cuttings and single pinching at the fifth node with 79.00, 85.00 and 86.50 days which is due to steady and more number of laterals per plant which might have encouraged the flower bud to flower long period. Delayed flowering was registered in treatment T_4 with 35 day old rooted cuttings and pinching at fourth node which might be a consequence of removal of the physiologically mature portion of shoot during pinching, making the axillary to take more time to become physiologically inductive to produce flowers. These results are in conformity with the findings of Ferrato *et al.* (1996) in chrysanthemum cv. ALBA.

To get maximum number of flowers per plant, the nodal point where pinching is to be done is very important since it regulates the number of flowers per plant in each flush of flowering. The flower yield per plant (6.00, 8.30 and 5.40) (Fig.1) and flower yield per m^2 (216.00, 298.80 and 194.40) (Table 2) increased significantly in treatment T_8 with 30 day old rooted cuttings and single pinching at the fifth node against treatment T_4 with flower yield per plant (3.90, 6.75 and 4.05) and flower yield per m^2 (140.40, 243.00 and

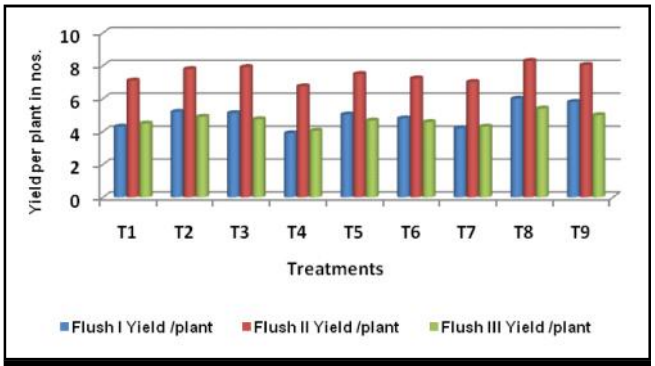

Fig. 1 : Effect of planting stage and pinching level on flower yield per plant

Table 2 : Effect of planting stage and pinching level on flower yield (number of flowers) per plant and per m^2

Treatments	Flush I		Flush II		Flush III	
	Yield /plant	Yield/ m^2	Yield /plant	Yield/ m^2	Yield /plant	Yield/ m^2
T_1	4.30	154.80	7.10	255.60	4.49	161.64
T_2	5.20	187.20	7.80	280.80	4.90	176.40
T_3	5.12	184.32	7.92	285.12	4.75	171.00
T_4	3.90	140.40	6.75	243.00	4.05	145.80
T_5	5.04	181.44	7.50	270.00	4.67	168.12
T_6	4.80	172.80	7.23	260.28	4.58	164.88
T_7	4.20	151.20	7.02	252.72	4.30	154.80
T_8	6.00	216.00	8.30	298.80	5.40	194.40
T_9 (Check)	5.80	208.80	8.05	289.80	5.00	180.00
Mean	4.93	177.44	7.52	270.68	4.68	168.56
SE(d)	0.004	0.170	0.004	0.127	0.003	0.096
C.D. (P=0.05)	0.009	0.362	0.009	0.270	0.006	0.204

145.80) during the first, second and third flushes of flowering, respectively. This could be due to activation of more number of axillary buds which in turn become flower stems at later stages of crop growth. These results are in conformity with the reports of Yassin and Pappiah (1990) in chrysanthemum.

A higher proportion of good quality flowers with maximum length of flower stalk (75.78, 73.60 and 63.50 cm), stalk girth (1.72, 1.35 and 1.19 cm), bud length (6.15, 6.10 and 5.90 cm), bud circumference (7.20, 7.12 and 6.75 cm) and improved grades of flowers along with less calyx splitting percentage (5.80 per cent) were noticed in treatment T_8 with 30 day old rooted cuttings and single pinching at the fifth node. This might be due to the maximum utilization of photosynthates as compared to other treatments. Similar observations were made by Singh and Baboo (2003) in chrysanthemum.

Physiological parameters:

Physiological parameters *viz.*, leaf area 18.50, 18.20 and 17.80 cm^2 was found maximum in the treatment with 30 day old rooted cuttings and single pinching at 5th node and lowest with 15.60, 14.22 and 13.20 cm^2 in T_4 which might be due to more favourable development and arrangement of laterals, which would have utilized light and other resources effectively.

Inference :

The results of the study led to the inference that planting of 30 day old rooted cuttings with single pinching at fifth nodal point proved to be better in terms of vegetative and physiological parameters, number of flowers per plant, yield per m2 and quality during first, second and third flushes of flowering.

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