

INFLUENCE OF CONTINUOUS ILLUMINATION DURING VEGETATIVE GROWTH ON FLOWERING RESPONSE OF CARNATION (*DIANTHUS CARYOPHYLLUS* L.)

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SUMMARY

Standard carnation cultivars Red Corso and Cabaret were exposed to continuous artificial illumination at 4-5th, 6-7th and 8-9th leaf pair stages for 10, 15 and 20 days to determine the growth stage which is more responsive and the duration of illumination required for advancing the flowering. Carnations exposed at 6-7th leaf pair stage, for a duration of 15 days produced higher number of quality flowers per plant and gave an earlier crop.

Key words: Carnation, flowering, illumination, photoperiod, polyhouse.

INTRODUCTION

Carnation (*Dianthus caryophyllus* Linn.) is one of the most important commercial flower of the world, valued for its excellent keeping quality, wide array of colours and forms, ability to withstand long distance transportation and remarkable ability to rehydrate after continuous shipping. These unique qualities of carnation fetches it a very high price in both national and international market.

Carnation genetically is a quantitative long day plant (Blake, 1955) and several workers (Heins *et al.*, 1979, Healy and Wilkins, 1983) have demonstrated that flowering is influenced by photoperiod. Harris and Ashford (1966) reported that increase in photoperiod up to 24 hours hastened flower initiation in carnation cv. White Sim. Illumination throughout the night was more effective in promoting flowering particularly when day light intensities are low. The shoots with four to seven pairs of leaves are more sensitive to light intensity and photoperiods than other stages (Mastalerz, 1978). However, continuous light during the full growing period reduces the quality of flower in the first flush and delayed flowering in subsequent flushes (Mastalerz, 1978) and it also increased the cost of production considerably. It is, therefore, very

important to know the correct growth stage when artificial illumination is needed and its duration. The present study was, therefore, undertaken to determine the flowering response of carnation in relation to growth stages under different durations of continuous light treatments.

MATERIALS AND METHODS

Rooted carnation cuttings of cultivars Red Corso and Cabaret of third or fourth leaf pair stage were procured from "Durga Floratech", Solan, Himachal Pradesh, and planted in pots (15 cm x 25 cm) on 3rd Nov., 1997. The pots were rinsed with dilute solution of potassium permanganate and filled with sterilized potting media consisting of two parts sand, and one part each of vermiculite and farm yard manure.

All the potted carnation plants in the green house were pinched at fourth leaf pair stage. Ten potted plants for each treatment were transferred to the culture room and exposed to light intensity of $48.2 \mu\text{E m}^{-2} \text{S}^{-1}$. Continuous illumination was provided at 4-5th, 6-7th and 8-9th leaf pair stages and for a duration of 10, 15 and 20 days by hanging incandescent bulbs of 100 W at one metre height

above beds. Temperature regimes of $18 \pm 2^\circ\text{C}$ and $15 \pm 2^\circ\text{C}$ during day and night respectively and a RH of $70 \pm 5\%$ were maintained in the culture room during the experimental period.

After the treatment, potted plants were transplanted in polyhouse with 15 cm x 15 cm spacing. Disbudding was done down to the sixth node after the flower buds had initiated.

RESULTS AND DISCUSSION

Carnations exposed at 6-7th leaf pair stage for 15 days (T_5) showed earliest flowering (120 and 158 days in Red Corso and Cabaret respectively) (Table I) and 50 per cent flowering at 137 and 166 days in Red Corso and Cabaret respectively than other treatments. However, there was no significant difference for number of leaf pairs at flowering (Table I). Earlier flowering may be due to the fact that a carnation shoot changes from vegetative to reproductive condition when it has about six pairs of leaves (Besemer, 1980). The two carnation cultivars Red Corso and Cabaret were not identical in their flowering response under similar treatment conditions. Sparnaaij *et*

al. (1990) have reported that flowering response to long days varies with genotypes. Maximum number of flowers (8.0 and 6.7 in Red Corso and Cabaret, respectively) were obtained in treatment T_5 (Table II). The beneficial effect of longer photoperiods on the number of flowers per plant have been reported by various workers (Hanan, 1987; Lolapori and Arora, 1995).

Maximum number of lateral shoots (8.66 and 7.33 in Red Corso and Cabaret respectively) per plant were recorded in the treatment T_5 (6-7 leaf pair 15 days) but it was not significantly different from remaining treatments (Table II) except T_3 and T_9 in Red Corso and T_9 in Cabaret. Long photoperiods inhibit lateral shoot development and the same was promoted by short days (Heins *et al.* 1979, Healy and Wilkins, 1983). Lolapori and Arora (1995) also reported that with the increase in hours of light, there was a decrease in number of lateral shoots. However, under present investigation, illumination was provided for short duration and this short exposure of 10-20 days probably was not sufficient to change the degree of apical dominance. Powell and Bunt (1983) also did not observe significant effect of day length on the number of shoots in the first generation carnations of cv. White Sim. The percentage of flowering shoots to total number of shoots

TABLE I: Effect of continuous illumination on days to flowering, days for 50% flowering, number of leaf pairs at flowering and flower stem length.

Treatment No.	Treatment	Days for flowering		Days for 50% flowering		No. of leaf pairs at flowering		Flower stem length (cm)	
		Red	Cabaret	Red	Cabaret	Red	Cabaret	Red	Cabaret
T_1	4-5th leaf pair 10 days	149	171	158	181	32.33	23.33	48.00	28.33
T_2	4-5th leaf pair 15 days	149	175	159	187	27.00	27.33	50.33	34.66
T_3	4-5th leaf pair 20 days	128	168	143	173	28.00	25.33	48.33	36.33
T_4	6-7th leaf pair 10 days	154	167	162	174	32.00	22.66	54.66	31.00
T_5	6-7th leaf pair 15 days	120	158	137	166	24.66	21.33	58.00	44.33
T_6	6-7th leaf pair 20 days	165	170	173	181	29.66	25.66	51.66	36.66
T_7	8-9th leaf pair 10 days	170	179	174	188	31.33	27.00	53.66	34.00
T_8	8-9th leaf pair 15 days	173	185	181	192	33.00	27.66	49.33	33.00
T_9	8-9th leaf pair 20 days	178	193	190	198	32.33	28.00	52.66	33.66
	C.D. at 5%	13.97	5.86	7.36	10.13	6.89	4.98	6.96	8.77

FLOWER RESPONSE IN CARNATION

TABLE II: Effect of continuous illumination on total number of lateral shoots, number of flowers per plant, diameter of flower and number of petals.

Treatment No.	Treatment	Total No. of lateral shoots		No. of flowers		Diameter of flower (cm)		No. of petals	
		Red Corso	Cabaret	Red Corso	Cabaret	Red Corso	Cabaret	Red Corso	Cabaret
T ₁	4-5th leaf pair 10 days	6.00	5.66	4.7	3.7	5.66	6.06	47	68
T ₂	4-5th leaf pair 15 days	6.00	5.33	4.0	3.7	5.66	5.93	47	71
T ₃	4-5th leaf pair 20 days	5.00	6.00	3.0	4.0	6.26	5.83	51	68
T ₄	6-7th leaf pair 10 days	7.66	6.66	6.3	4.7	6.13	6.60	50	78
T ₅	6-7th leaf pair 15 days	8.66	7.33	8.0	6.7	6.83	7.10	62	87
T ₆	6-7th leaf pair 20 days	6.33	6.33	5.0	5.0	6.60	6.80	55	82
T ₇	8-9th leaf pair 10 days	5.66	5.66	3.3	4.7	5.40	5.80	42	67
T ₈	8-9th leaf pair 15 days	6.00	5.33	4.7	4.3	6.20	5.73	49	64
T ₉	8-9th leaf pair 20 days	5.00	5.00	4.0	4.0	5.86	5.80	51	66
C.D. at 5%		3.17	2.16	3.29	2.07	0.51	0.71	11.54	10.07

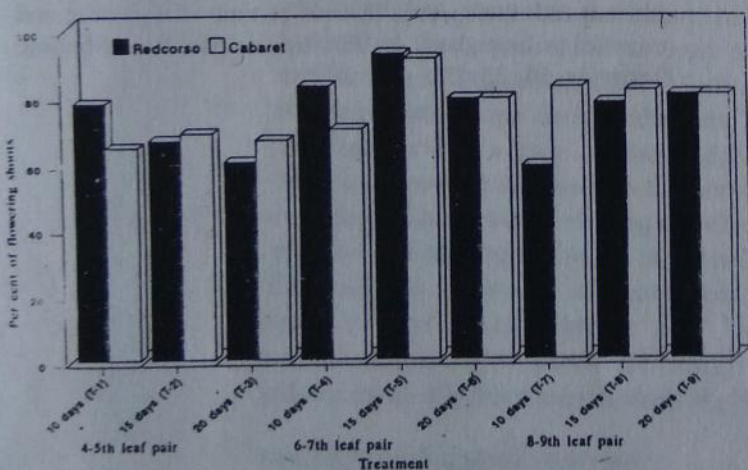


Fig. 1. Effect of continuous illumination on the percentage of flowering shoots in cvs. redcorso and cabaret

were highest (92.3 and 90.8 in Red Corso and Cabaret respectively) when carnations were exposed at 6-7th leaf pair stage for 15 days (Fig. 1).

Flower quality in terms of flower stem length, diameter of flower and number of petals per flower was also best

in the carnations exposed at 6-7th leaf pair stage for 15 days. In both the cultivars viz., Red Corso and Cabaret, maximum and minimum flower stem lengths (58.99 cm, 44.00 cm and 48.00 cm, 28.00 cm) (Table I) were recorded in treatments T₅ and T₁, respectively. Diameter of flower and number of petals per flower were highest in treatment T₅ (Table II), but flower diameter was on par with the treatment T₆. Cleland and Zeevart (1970) suggested that increased gibberellin synthesis under long days was responsible for the induction of shoot elongation. Mastalerz (1983) also reported that flower quality was higher when the photoperiods was extended with incandescent dusk to dawn lighting. Improved flower size was due to increased number of petals per flower. As the carnations were grown in polyhouse after the light treatment, it could be the effect of growing environment, which enhanced flower quality. But, Lolapori and Arora (1995) reported that only light treatments were responsible for the improved flower size in carnations.

The results of present study suggest that continuous illumination of the carnations at 6-7th leaf pair stage for 15 days produced higher number of quality flowers and

an earlier crop, instead of illumination throughout the growing period.

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