Timing "One Crop" Carnations

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Introduction

Until a short time ago the carnation was considered as not responsive to photoperiod. Since researchers have shown carnations to flower sooner and yield more flowers per unit area when grown under longer than normal photoperiods, we should expect to see more carnations grown commercially in this manner. Grower interest in this method of production is increasing. Based on the interest to this response it was our objective to determine how carnations planted at monthly intervals respond to 18-hour photoperiods.

Review of Literature

Many workers have grown carnations with long photoperiods (4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 26, 27, 28, 29,) and reported plants grown under these extended photoperiods flowered sooner than those grown under natural days or short days. Even though this was known for some time it was not until Freeman in 1965 (8) and Freeman and Langhans in 1965 (9) reported the reason flowering was hastened. Their results showed the hastening was due to a photo-receptive period during which carnation shoots were highly responsive or receptive to daylength. If carnations were subjected to 18-hour photoperiods during this three week period they would flower as much as a month sooner than plants exposed to 9-hour photoperiods. This is well illustrated and described in New York State Flower Growers Bulletin 231, elsewhere (8), and in this manuscript.

Keeping in mind the photo-receptive period and the role it can play in commercial carnation production it was considered time to determine the number of days required from planting to flowering for plants planted at monthly intervals for a period of one year and grown under 18-hour photoperiods. Similar programs have been reported for plants grown under normal daylengths and (17, 18, 19, 21, 22, 23, 24, 25) pinched once and a half (1, 20,

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25), and also for return crops following harvest (1, 2, 3). Even though the response of varieties is not identical it is similar enough to be used as a guide in their commercial carnation production programs. Likewise, a similar guide for carnations grown under 18-hour photoperiods may prove helpful for growers planning to time crops for specific times of the year.

Materials and Methods

One hundred-eight rooted cutting of the cultivar CSU White Pikes Peak were planted 4 inches by 8 inches (four plants per square foot) in 8 feet-4 inches by 3 feet raised beds in steam pasteurized soil on the first week of each month between July 1966 through July 1967. The cuttings originated from Meristem culture-indexed plants and the mother block was grown under short days. All plants were pinched once and were subjected to 18-hour or 9-hour photoperiods. The 18-hour photoperiod was achieved by using 60 watt incandescent lamps with built-in reflectors spaced 3½ feet apart and 4 feet above the soil surface. The lights turned on ½ hour before sunset and remained on long enough until the daylight hours plus the period from sunset to end of lighting totaled 18 hours. The light intensity ranged from 10 to 20 ft-c at the soil surface. The 9-hour photoperiod was achieved by covering the plants with black sateen cloth at 5 PM and uncovering at 8 AM.

In the greenhouse night temperatures were 52° and day temperatures 60-65°F when controllable. All plants were fertilized once per week with ¼ pound 20-5-30 soluble fertilizer per 100 square feet of bench area. A regular preventative insect and disease control program was used following planting. Data recorded were date of flowering, flower number, and grade. Flowers were graded by using the proposed Society of American Florists grading system.

Results

Peak flowering period. The peak flowering dates for each of the monthly plantings are recorded in Table 1. Starting with the July 1966 planting each successive planting flowered later than the previous one. The number of days required from planting to the peak flowering period are shown in Table 1. The number of days from planting to flowering increased between the June and October planting dates. Plantings made between November and the following June showed a corresponding decrease with each successive month up to June. The November and December plants took the same number of days to flower.

Table 1. Peak flowering time and duration of flowering of CSU White Pikes Peak carnations planted at monthly intervals and grown under 18-hour photoperiods.

Planting	Peak		Duration of Crop	
Date	Date	No Days	Date	No Days
Jul	Oct 20	111	Oct 10–Nov 15	36
Aug	Dec 10	131	Dec 1–Jan 1	31
Sep	Feb 1	152	Jan 20–Feb 20	31
Oct	Mar 20	170	Mar 10–Apr 10	31
Nov	Apr 10	160	Apr 1–May 5	34
Dec	May 10	160	May 5–Jun 8	34
Jan	May 20	140	May 20–Jun 15	26
Feb	Jun 10	130	Jun 10–Jul 5	25
Mar	Jun 20	111	Jun 15–Jul 5	20
Apr	Jul 20	110	Jul 10–Aug 1	22
May	Jul 25	85	Jul 20–Aug 5	16
Jun	Aug 20	80	Aug 20–Sep 10	21
Jul	Oct 20	111	Oct 10–Nov 10	31

Duration of flowering period. The duration of the flowering period was longest in the July 1966 planting and shortest in the May planting. In general, the duration of the flowering period decreased from July through May. The duration of the crops was longer in the 18-hour than 9-hour treatments. Fewer days were required however, in the January planting than the November planting (18-hour photoperiods.

Effect of 9-hour days. The peak flowering dates, number of days to flower and duration of the crops grown under 9-hour photoperiods are presented in Table 2. More days were required for flowering in the November than the January planting. When the data in Table 2 is compared to the data in Table 1 one can note 18-hour photoperiods speed production by 45 and 25 days for the November and January plantings, respectively.

Table 2. Peak flowering time and duration of flowering of CSU White Pikes Peak carnations grown under 9-hour photoperiods and planted in November and January.

Planting	Peak		Duration of Crop	
Date	Date	No Date	Date	No Days
Nov	May 25	205	May 15–Jun 10	20
Jan	Jun 15	165	Jun 5–Jun 25	20

Mean grade. The July through December plantings yielded extremely high grades of flowers whereas the lowest grades were produced from the April, May, and June plantings.

Discussion

Carnations grown with 18-hour photoperiods were found to produce timing schedules similar to carnations grown under natural day conditions. However, the number of days from planting to flowering was considerably less when grown with 18-hour photoperiods.

Response to 18-hour photoperiods. Carnations grown under 18-hour photoperiods responded similarly as they have in previous studies (8, 9, 11). The number of days to flowering was less. It was also observed there were longer internodes and few nodes on each stem of 18-hour grown plants when contrasted to 9-hour grown plants. Also, fewer side breaks developed on 18-hour grown stems.

Nine-hour days delay flowering. As previously shown (8, 9, 11) 9-hour or short daylengths will delay the flowering of carnations from one to four weeks depending on time of year plants were planted. The reason for the variation in this study was due to the quantity and intensity of sunlight during the period of growth and development. This is well shown in Table 1. The November planting which flowered in May developed for approximately two months in decreasing light intensity and length of the natural day whereas the January planting was accelerated into flowering during the period of increasing light. In other words, the November planting was vegetative longer than the January planting and the 9-hour plants as a

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whole were vegetative longer than the 18-hour grown plants. This was made evident by the observations made on node number. The 9-hour grown plants had more nodes and this is confirmed by earlier work (8, 9, 11).

Duration of the crops. One of the objectives when timing a crop of carnations for a specific period of time, e.g., a holiday period, would be to have the crop flower and be harvested within a very short time. The shorter the time the better. This would give a grower and also the market a known quantity of flowers at a definite time which would allow growers and wholesalers to plan ahead and plan together. Table 1 shows the number of days it took for 80 percent of each of the 13 crops to be harvested. In general, the longest period of time required for a crop to be harvested was during the July through December planting. The duration of the crop during this period of time was in excess of 30 days.

Part of the reason for this is due to the decreasing daylengths and light intensity which occurs at this time of year thus reducing the rate of plant growth and development. Cox in 1967 (6) reported similar findings. His work at Sparkes in Sussex, England showed the time from commencement of lighting to flowering was shorter in summer and longer in winter.

Practical use of data. The data in Table 1 can be used as a guide when trying to time a crop of carnations for any time of the year. One must realize however, this study was done with CSU White Pikes Peak. Results from studies with many different varieties (to be reported later) indicate there are differences in timing and response of plants to photoperiod due to variety. Also differences in a growers' greenhouse environment may cause slight differences in timing. Even though these variables do exist from variety to variety and from grower to grower the data presented here can be a guide to a grower who is interested in developing a timing program using lights.

Use of lights. Freeman (8) and Freeman and Langhans (9) determined the critical period when carnations are most responsive to photoperiod. Their work showed the photoperiod carnations received during the 4th, 5th, and 6th week following planting determined how carnations would respond—either as 18-hour grown plants (flower quickly, less nodes, and long internodes) or 9-hour plants. The original work was accomplished by using single-stem plants and the work reported here was accomplished with pinched plants. Based on past experience plants were exposed to 18-hour photoperiods from the time shoots were 2 to 2½ inches long to visible flower buds. Lights were left on so long because Freeman (8) showed the number of days to open bloom required for the development of the uppermost shoot below a pinch was less than the secondary shoot to develop. Likewise, the number of days would be greater for the tertiary shoots for development when contrasted to secondary or primary, etc. The plants grown in this study were pinched once and each plant produced at least four shoots per plant. Therefore, if lights were left on until buds were visible all shoots, no doubt, would have been exposed to 18-hour photoperiods for at least the 3-week critical period during which they are receptive to photoperiod. Cox in 1967 (6) suggested the same approach.

Mean grade. As confirmed by earlier work (8, 10, 11) top grade flowers can be produced by plants grown under 18-hour photoperiods. The only time when mean grade was affected seriously was when the blooms developed in the summer heat. This was shown quite effectively (8, 10, 11) when carnations were grown at various temperatures (40° to 80°F). Flowers developing at 70° and 80°F were small in diameter in contrast to those grown at lower temperatures. It should be stressed however, all flowers produced could have been sold commercially.

Stem strength. The grading system did not take into account stem strength as a major factor when grading the flowers. It ought to be noted all stems produced by the plants were of sufficient strength to hold each flower erect (between 11 and 1 o'clock). The authors feel stem strength was not sacrificed due to the 18-hour photoperiods. In fact, stem strength was equivalent to that of natural day-grown plants. It appears when lights are turned off when buds are visible the stems have a sufficient amount of time to continue to develop and increase in strength. One observation made which was confirmed by earlier work (8, 9, 11) indicated 18-hour photoperiod stems had fewer nodes than stems produced in the 9-hour photoperiod.

Summary

CSU White Pikes Peak carnations were planted once per month for 13 months single pinched and grown under 18-hour photoperiods. The following data were recorded: date of flowering, flower number and mean grade. A summary of results is listed below.

1. The number of days from planting to flowering for each of the 13 crops was determined. The number of days increased from the June to the October planting and then decreased from October to the following June.
2. Eighteen-hour grown plants flowered sooner than 9-hour grown plants.
3. The duration of the flowering time varied depending upon the time of year the crops cropped.
4. Mean grade was only affected when crops bloomed in the summer months.

The information presented in this manuscript can serve as a guide for those planning to time and grow carnations with long photoperiods.

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