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Photoperiod Affects Carnations

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Several research workers have reported (1, 6 & 8) carnations were hastened into flowering by long days. If long days hasten flowering and short days retard flowering, there would appear to be a possible commercial application of photoperiod for carnation timing. The objectives of this study were to determine the effect of photoperiod on growth and flowering and to determine if there was a photo-sensitive stage.

Review of Literature

The flowering and vegetative growth of many plants is controlled by the length of the day, for example the chrysanthemum. This response of plants to the length of the day was first termed 'photoperiodism' by Garner and Allard in 1920 (4). Since this first major contribution in 1920, a great amount of photoperiodism research has been done.

Post (7) considered the carnation to be indifferent to the length of day for flower bud formation. Several researchers have studied the effects of photoperiod on various varieties of carnations and reported photoperiod to affect the number of shoots, internodes and flower bud initiation.

In a photoperiodic study, Pokorny and Kamp (6) used the carnation variety Sidney Littlefield and found photoperiod had a definite effect on the number of breaks which developed on flowering stems. They noted flowering stems produced under long photoperiods (16 hours) formed very few shoots.

Blake (1, 2) and Harris (5) reported carnation plants grown under short days produced more nodes than plants grown under long day conditions. They also reported an elongation of internodes on plants which grew under long days in contrast to plants grown under short days.

Blake (1) considered daylength as a main influencing factor for flower bud initiation. She reported the longer the daylength to which carnations were exposed the earlier flower bud initiation occurred. She later reported flower bud initiation was strongly hastened by long day treatments while short day treatments greatly delayed the process (2).

Researchers have shown carnation plants grown under long days resulted in an increase in production (6, 8). Pokorny and Kamp (6) showed this quite effectively. In their photoperiodic study, stock plants were grown under two daylengths—long days (16 hours) and short days (8 hours). Cuttings from the long day stock plants were divided so half were grown under long days and the other half grown under short days. In the same manner, cuttings from short day stock plants were divided into two halves, one-half were grown under long days and the other half were grown under short days. The results showed under short day growing conditions, plants from long day stock plants produced 5.4 flowers per square foot as compared with 11.1 flowers per square foot by plants from short day stock plants. Under long day conditions, plants from long day stock plants yielded 23.2 flowers per square foot whereas plants from short day stock plants produced 34.2 flowers per square foot. Plants from stock plants grown under short days always yielded more flowers per square foot than similar plants from stock plants grown under long days.

Methods and Materials

The carnation 'CSU White Pikes Peak' was used in this work. The cuttings were obtained from disease free mother stock. The original cuttings were supplied through the courtesy of Professor W. D. Holley of Colorado State University.

Four photoperiods were used, natural, 9-, 18- and 24-hour. The extended photoperiods were achieved by 60 watt incandescent lamps spaced 3.5 feet apart and 4 feet above the soil surface. The light intensity ranged from 10 to 20 ft-c. The 9-hour photoperiod was achieved by covering the plants with black sateen cloth, at 5 pm and uncovering at 8 am.

The rooted cuttings were planted in 5 inch clay pots in a 2-1-1 (Eel silt loam, peat moss and perlite) steam pasteurized soil. The plants were grown single stem at a night temperature of 50° and a day temperature of 60°F.

In the first study, plants were propagated and grown under controlled photoperiods (natural day, 9- hour and 18-hr). Seventy-five rooted cuttings from each photoperiod were potted on December 19, 1962.

Results

The various stages to flowering were carefully recorded, and the number of days required for the develop-

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ment to the bud, cracking and open flower stage is given in Table 1. Photoperiod had an important influence on the speed of flower development. Note the similarity between the 9-hr and natural day treatment. This study was done during the short day period of the year. The 18-hr treatment flowered faster (approx. 1 month). It may be seen the hastening occurred before the first recorded bud stage. This is emphasized in Table 2, which shows the number of days for the development of each stage. Although the 18-hr treatment flowered 1 month earlier, it took longer to develop from the bud to open flower stage than the other photoperiod treatments.

Table 1. The number of days required for shoots to develop on plants grown at 3 photoperiods.

Stage of Development	Photoperiod		
	18-hr	Natural Day	9-hr
Shoot to Bud	87	121	124
Shoot to Cracking	113	146	146
Shoot to Open	132	164	164

Table 2. The number of days required for 3 stages of bud development on plants grown at 3 photoperiods.

Stage of Development	Photoperiod		
	18-hr	Natural Day	9-hr
Bud to Cracking	26.9	24.1	22.6
Cracking to Open Flower	18.2	19.3	17.7
Bud to Open Flower	45.0	43.0	40.3

The number of nodes produced by the plants under these 3 photoperiods is shown in Table 3. The longer the photoperiod the fewer the number of nodes or leaves. The height of these same plants is shown in Table 4. Notice the reverse situation.

Table 3. The number of nodes produced on plants at 3 different photoperiods and grown at a 50° night and 60° day temperature.

Photoperiod		
18-hr	Natural Day	9-hr
12.8	13.8	14.3

Table 4. Height (in centimeters) recorded at monthly intervals from plants grown under 3 different photoperiods at a 50° night and 60° day temperature.

Date	Photoperiod		
	18-hr	Natural Day	9-hr
January 19	33.5	21.9	21.6
February 19	60.6	41.0	34.8
March 19	81.6	72.0	60.1
April 19	91.1	86.0	78.6

This study indicated plants grown under the long photoperiod flowered faster with fewer nodes and greater internodes than short photoperiods. The effect of the photoperiod appeared to occur before the visible bud stage.

In the second study, rooted cuttings were planted on October 16, 1963 and subjected to long and short photoperiods as well as a number of shifting periods of photoperiod (Table 5 also illustrated in Figure 1). There were 40 plants per treatment.

Table 5. The photoperiodic treatments used in Study 2.

- 9-hr
- Natural day
- 18-hr
- 24-hr
- 9-hr for 4, 6, 8, 10 and 11 weeks after planting then 18-hr.
- 18-hr for 3, 4, 6, 8, 10, 12, and 14 weeks after planting then 9-hr.

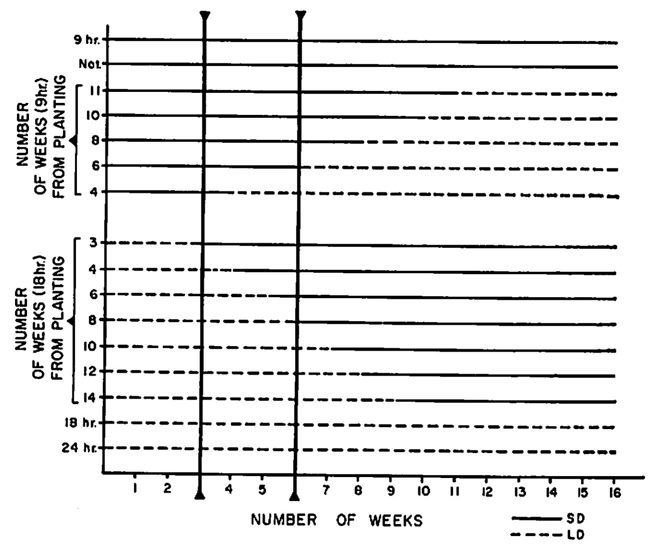

Figure 1. The photoperiodic treatments used in Study 2. The solid line indicates the short day (SD) treatments and the broken line the long day (LD) treatments.

The number of days to flower and the number of nodes produced are graphically shown in Figures 2 and 3. Some rather interesting trends appear when these 2 graphs are studied. The 9-hr and natural day and the 18-hr and 24-hr treatments are similar. We could classify these as typical long day and short day results.

There also appears to be a pattern or separation of the other treatments. If we arbitrarily draw a line across the graph at 172 days in figure 2 and at 14 nodes on figure 3, we note a separation of results. Those less than the lines responding like the long (18-hr) photoperiod plants and those greater than the line responding like the short (9-hr) photoperiod plants. Those treatments which responded like those under the long photoperiod—were exposed to long photoperiods during the 3rd to 6th week (see figure 1). If the photoperiod was 9-hr during the 3rd to 6th week, the plants responded as though they were grown under short photoperiods.

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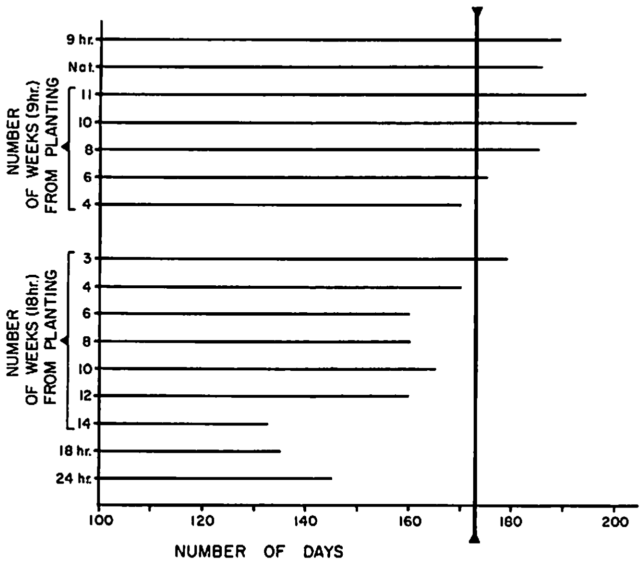

Figure 2. The number of days required for flowering when grown under various photoperiodic treatments. The heavy vertical line is an arbitrary line used to separate the treatments.

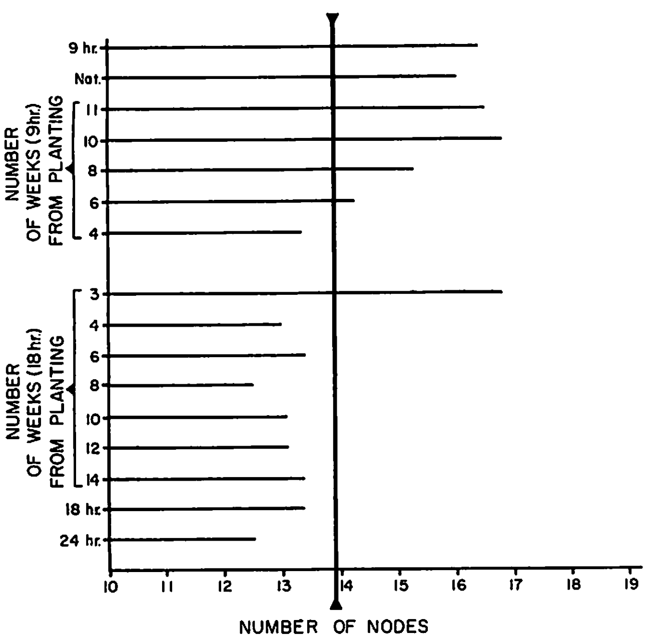

Figure 3. The number of nodes produced under various photoperiodic treatments. The heavy vertical line is an arbitrary line used to separate the treatments.

Discussion

As had other workers before, we were able to show the carnation responds to the length of day. When the plants were growing under long days (18-hr) they flowered faster, produced fewer nodes and were longer than plants grown under short days (9-hr).

In the first study the stage of bud, cracking and open flower was carefully recorded. It was shown the differences had already occurred by the time the first stage (bud) was recorded, and the photoperiod did not appear to effect the flower development stage. Since this study indicated the long day grown plants had approximately 1.3 nodes less than the short day plants, it may be assumed the long day plants initiated flowers sooner. It also indicated photoperiod was affecting a stage early in the development.

In an attempt to define this (photo sensitive) stage a second study was made. Plants were moved from long days to short days and vice-versa at various times. Observations of the plants indicated a clear cut division, and all the plants responded like those grown under either long or short days. The data recorded (figures 2 and 3) unfortunately were not as dramatic as the actual plants. The photoperiod the plants received during the 3rd to 6th week determined whether they responded as long or short day grown.

Probably the most obvious question "Is there a commercial application?" We have not done enough research to make recommendations. However, it obviously could be very important for accurate timing. It could mean a quicker and more uniform return from a fall crop. Bing (1) reported it took 8 months from a September cut, 7 months from an October cut and 6 months from a November cut until another flower was cut from that shoot. It would appear artificial long days applied at the right time could shorten the return of the crop approximately one month. The problem is exactly when to apply the lights. This work was done under rather ideal conditions, uniformly rooted cuttings grown single stem. More research must be done to find the practical time for application.

This work also explains why timing of carnations varies from year to year and area to area. The natural photoperiod varies from year to year and area to area.

Another probably application of this work, to insure uniform cutting from stock plants, it would appear they should be grown under controlled photoperiod. In this case to insure a vegetative cutting, short days or black cloth should be used during the natural long day period from March through September.

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Crop Manuals

The response to the crop manuals has been extremely encouraging. In almost every mail delivery there is at least 1 request for the various crop manuals. We have sold more than 1500 carnation manuals, 1500 snapdragon manuals (presently out of print) and over 1600 chrysanthemum manuals. Both the carnation and chrysanthemum manuals are still available and can be obtained by writing to: R. W. Langhans, Department of Floriculture, Plant Science Building, Cornell University, Ithaca, New York. The carnation manual costs $1.50 and the check should be made payable to CORNELL UNIVERSITY. The chrysanthemum manual costs $2.00 and the check should be made payable to NEW YORK STATE FLOWER GROWERS ASSOCIATION.

There are 3 other manuals available and we can suggest these very highly. The Geranium manual can be obtained by writing to Dr. John W. Mastalerz, 207 Tyson Building, The Pennsylvania State University, University Park. The cost of this manual is $2.00 and the check should be made out to THE PENNSYLVANIA FLOWER GROWERS. The Poinsettia manual can be obtained by writing to the Office of Extension Information, Ohio State University, 2120 Fyffe Road, Columbus 10, Ohio. The cost of this manual is $2.00 and the check should be made payable to THE OHIO STATE UNIVERSITY. The third manual is "Living Flowers that Last" and this can be obtained by writing to Dr. Marlin N. Rogers, 1-43 Agriculture Building, University of Missouri, Columbia, Missouri. The cost of this manual is $1.50 and the check should be made payable to the UNIVERSITY OF MISSOURI.

If you grow any of these crops you should have and read these manuals.

Membership

Harold Gardner, chairman of the Membership Committee reported at the last Board of Directors meeting a membership of more than 1400. Members are the 'spice of life' for an organization such as ours. Give this application to your competition if he isn't already a member—even if it's only to give you better competition.

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Short Takes

Bob Langhans

While Jim Boodley is on sabbatic leave learning about European Floriculture, I'll try my hand at Short Takes. To insure material, I am going to offer a cup of coffee to the person that offers the best suggestion for a Short Take of the month. The coffee will be payable soon after the suggestion is printed. Just a postcard will do, everyone and anyone is eligible.

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Poinsettia stock plants will soon be arriving. We have shown Poinsettia stock should be 1) planted in a large container (5 gallon cans or bushel baskets), 2) grown warm 70 degrees, or more and 3) be frequently watered and fertilized. This not only will produce more cuttings per stock plant, but I'm sure will produce better quality cuttings.

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Before the 1965 Easter has faded into the past, you should record the facts about your crops. Did you have to push or cool the Lilies? Did the Hydrangeas have a good true color? Could you have sold more white tulips? The notes you make now will help you plan your next Easter, so at least you won't make these same mistakes.

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YOUR EDITOR,

Bob Langhans