

IN COOPERATION WITH COLORADO STATE UNIVERSITY
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LIGHTING CARNATIONS FOR CROP CONTROL

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Dusk-to-dawn lighting is an excellent means of producing timed crops on older carnation plants. It has less value on younger plants due to the timing influence of the initial pinching and the effect of cutting the first crop of flowers. Varying the length of the period between lighting (3 to 5 weeks) directly influenced the length of the "off crop" period. Continuous lighting from August 20th to February 25th reduced yield probably by retarding the development of lateral breaks on the flower stems.

To obtain additional information on when to use lighting and when not to depend upon lighting in controlling carnation flowering, a complex experiment was designed and started in the summer of 1970. Four lighting schedules (see box) and an unlighted control were imposed on three adjacent benches in the CSU Bay Farm Greenhouses. One bench contained plants 1½ years old at the start of the experiment. One bench was planted as rooted cuttings in May of 1970 and grown with a complete second pinch. The third bench was planted as rooted cuttings July 7th and grown with a single pinch. The two benches of young plants were timed to produce Christmas crops. All benches were grown in gravel and were irrigated automatically with nutrient solution at frequencies that gave minimum water stress. Each plot occupied 38 square feet.

¹Paul Schwartz assisted with this project as a special assignment during his senior year. John Parker was responsible for the lighting schedules.

TWO-YEAR PLANTS

By far the best results were obtained with the older plants. At the time lighting treatments were started on August 20th, these plants were in relatively low production, but carried branches in all stages of development. Graphs of production from the unlighted control, continuous d-d lighting from August 20th to February 25th, and the 3 weeks on and 3 weeks off treatment are shown in Fig. 1. Continuous lighting from August 20th produced a heavy crop of flowers starting November 17th and continuing to January 10th. There was no appreciable increase of flowers over the unlighted plants after this time; in fact, there was a distinct decrease from continuous lighting in April and May.

Lighting Treatments

Continuous from Aug. 20 to Feb. 25

3 weeks on, 3 weeks off from Aug. 20

3 weeks on, 4 weeks off from Aug. 20

3 weeks on, 5 weeks off from Aug. 20

Unlighted control

Alternating lights for 3 weeks on and 3 weeks off produced a series of crops indicated in Fig. 1. All peaks from this treatment were distinct and were

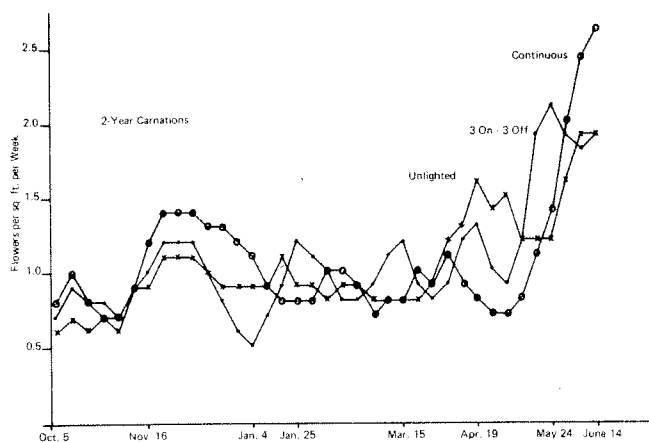


Figure 1. Distribution of crops from unlighted 2-year carnations and from two lighting treatments.

followed by valleys resulting from the periods when lights were off. These low production periods could be just as important to the flower market as are the production peaks. Holiday markets are often, but not always, followed by lower market activity.

Lighting periods were all three weeks except for the continuous lighting treatment. However, these lighting periods were alternated with "lights off" periods of 3, 4, and 5 weeks. The length of the "lights off" periods merely extended the time between crops. Four or 5 weeks between lighting periods were not better than 3 weeks.

Twelve to 16 weeks after the date light was used to start a crop, that crop was in peak production. August 20th lighting required 12 weeks and February lighting required 14 weeks to produce a crop, and lighting started October to early January required 15 to 16 weeks from start of lights to peak production.

LIGHTING YOUNG PLANTS

Scheduled lighting produced small and relatively insignificant production peaks on single-pinched carnations that were planted to produce the first crop for the Christmas market (Fig. 2). The first crop flowered 2 to 3 weeks earlier when lighted, and 11% more blue grade flowers were produced up to Christmas. There were also nearly 25% more flowers prior to Christmas on lighted plants. Following Christmas (Dec. 22 - Feb. 28), the unlighted plants produced a 30% higher yield with 78% more red and blue grade flowers. While lighting brought the crop on earlier, the individual grower must decide the feasibility of lighting the

first crop from young plants. Lower grade flowers were cut on the young plants that were lighted when compared to the unlighted controls.

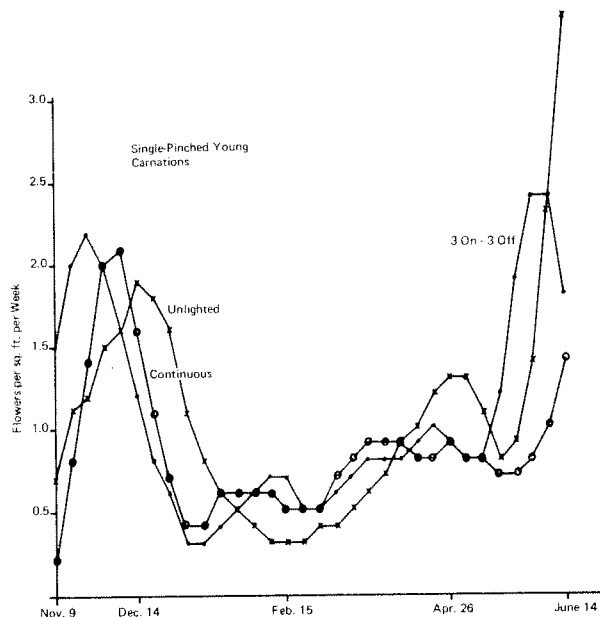


Figure 2. Distribution of crops from unlighted, single-pinched carnations and from two lighting treatments.

Figure 2 shows the yield distribution from single-pinched plants. The unlighted control peaked December 15, too late for the Christmas market. This could be corrected by planting a week or two earlier. All plants lighted from August 20th produced crops from November 17th to December 15th, the same as for two-year plants (Fig. 1). Winter yield on all treatments and the unlighted controls was low until March. The second crop from the unlighted plants came in April and early May, and a second peak in June. The 3 weeks lights on and 3 weeks lights off treatment was as good as any lighting treatment. Small but insignificant production peaks were caused by this treatment on February 8th, March 22nd, and April 19th (Fig. 2). The extremely high production peak of May 17th to May 30th was caused by growths being in the susceptible stage for lighting on February 4th, the last scheduled lighting period. Prior to February 4th there were too few shoots in the susceptible stage (4 to 6 leaf pairs) at any given lighting period.

DOUBLE-PINCHED YOUNG PLANTS

Figure 3 gives the yield from plants that were started in May and given a complete second pinch in July. The unlighted plants produced a heavy

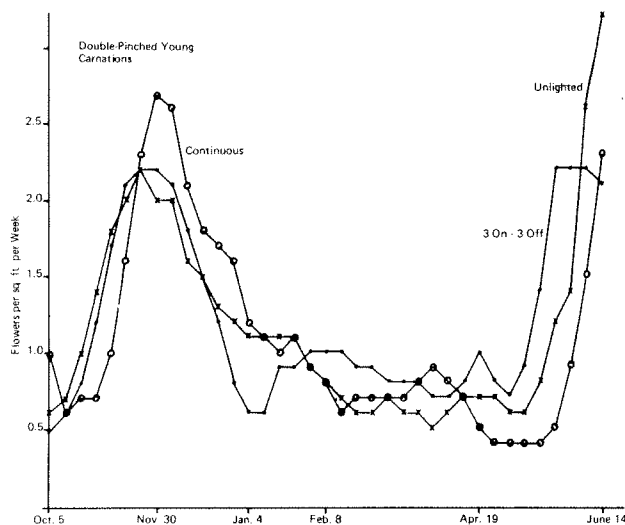


Figure 3. Distribution of crops from unlighted, double-pinched carnations and from two lighting treatments.

first crop from October 20th to February 14th. The second crop did not start until May 18th, and continued on into the summer. There was a low and fairly steady yield from February 15th to May 15th. Continuous lighting d-d from August 20th to February 25th merely accentuated the first crop with some slight delay. The second crop was also delayed, probably because of the inhibitory effect of lighting on the development of laterals on first crop flower stems. Three weeks of light alternating with 3 weeks of lights off did not alter the first crop but caused a distinct valley in production during the first half of January, followed by some increase above the control from February to April. In general, lighting was of no particular benefit to these heavily loaded plants. Both continuous lighting and on-off lighting reduced the grade of flowers as shown in Table 1.

Table 1. Yield and percent by grade from 3 plantings of unlighted carnations and four dusk-to-dawn lighting treatments. Each plot occupied 38 sq. ft. of bench area.

Lighting treatment	Total yield	Design	Percent by Grade		
			Green	Red	Blue
<u>2-year plants</u>					
Continuous	1556	3	8	28	60
3 on - 5 off (weeks)	1259	3	10	33	55
3 on - 4 off	1484	2	10	35	53
3 on - 3 off	1544	2	9	36	53
Unlighted	1498	2	10	38	50
<u>Double-pinched young plants</u>					
Continuous	1560	7	22	36	35
3 on - 5 off (weeks)	1483	6	14	34	46
3 on - 4 off	1478	8	19	35	38
3 on - 3 off	1710	7	21	34	38
Unlighted	1648	5	14	37	44
<u>Single-pinched young plants</u>					
Continuous	1034	11	18	34	37
3 on - 5 off (weeks)	1230	7	15	36	42
3 on - 4 off	1223	5	12	33	50
3 on - 3 off	1323	8	18	32	41
Unlighted	1278	6	10	36	49

EFFECTS OF LIGHTING ON GRADE

All lighting treatments improved the grade of flowers produced by two-year-old plants. This improvement was accomplished almost entirely by reducing the red grade flowers and increasing those in the blue grade. Design and green grade flowers were about the same in all treatments as for unlighted plants.

The double-pinched young plants produced by far the poorest average grade of flowers, probably due to the heavy load of developing flowers for early winter. Lighting generally increased the green (short) grade and reduced the percent of flowers in the blue grade. There were a few more designs produced by lighted plants and about the same percent of red grade produced by all treatments.

The lighting of single-pinched young plants may be a questionable practice for some growers. While

Table 2. The effects of dusk-to-dawn lighting on yield of single-pinched young carnations before and after Christmas with percent in blue and red grades.

Lighting treatment	Before Christmas			Dec. 22-Feb. 28			Total yield all grades - both periods
	Red	Blue	Total	Red	Blue	Total	
Unlighted	62	27	306	45	33	294	600
3 on - 3 off (weeks)	43	35	412	39	15	209	621
3 on - 4 off	48	42	411	46	22	193	604
3 on - 5 off	54	33	423	44	15	187	610
Continuous	46	41	305	39	13	223	528

Suggested timing for dusk-to-dawn lighting from this experiment, provided there are sufficient shoots on the plants with 4 to 6 expanded leaf pairs:

Lighting period	Should produce a crop	Should be off crop
August 20 - Sept. 10	Nov. 16 - Dec. 16	Dec. 21 - Jan. 17
Oct. 1 - Oct. 22	Jan. 18 - Feb. 14	Feb. 15 - March 1
Nov. 12 - Dec. 3	March 8 - March 28	March 29 - April 11
Dec. 24 - Jan. 14	April 12 - April 25	April 26 - May 9
Feb. 4 - Feb. 25	May 17 - May 30	Not off crop

Your editor,

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FIRST CLASS

Table 1 shows variable percentages of flowers by grade and treatment, the percent in the green grade was increased by all lighting treatments. This was due primarily to more weak-stemmed flowers in January and February from lighted plants. To see this better, Table 2 has been prepared. While it is often said that lighting increases the production of blue grade flowers on the first crop, it will be noted in Table 2 that this increase is at the expense of winter production. In other words, the blue grade flowers are produced earlier by lighting. Actually, unlighted plants produced as many or more blue grade flowers when both the Christmas and winter production were examined. Unlighted plants produced 89% in the top two grades before Christmas and 78% in these grades between Christmas and the end of February. Several lighting treatments match or improve the performance before Christmas. All lighting treatments on young plants seriously reduced the grade of flowers after Christmas.