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Photoperiod, Temperature and Light Intensity Effect "One Crop" Carnations*

R. W. Langhans
Department of Floriculture
Cornell University

Introduction

Monthly plantings of carnations were made on Long Island during the 1966-'67 season. We wanted to run a parallel study in Ithaca to observe the differences, if any, between the 2 climatic areas. Since these comparative plantings were made at the cooler time of the year, temperature control at both locations was good, the differences observed in these studies were probably due to differences in light intensity. Ithaca also had facilities available to study the effects of 5 temperatures (50°, 55°, 60°, 65°, 70°) and 2 photoperiods (18 hr and natural). The objectives were to study the effects of temperature, photoperiod and light intensity on the growth and flowering of the carnation.

Procedures

CSU White Pikes Peak carnation cuttings from stock plants which had been heat treated and meristemmed were used in these studies. The cuttings and plants were visibly free of any virus or disease symptoms. The stock plants were grown under short day conditions as described earlier (N.Y.S.F.G. Bulletin 272) and the cuttings were uniform throughout this study. The cuttings were mist propagated and rooted in about three weeks. A steam sterilized 2:1:1 soil mixture was used. A constant liquid fertilization program was followed and the nutrients in the soil were checked every 2 months by soil tests. Insect and disease control was by a preventative program consisting of a weekly spray program (Malathion plus alternating Captan or Zerlate).

Five sections (25 x 35 feet) each with its own heating and cooling controls were maintained at 50°, 55°, 60°, 65° and 70°F constant temperatures, i.e. day and night. Temperature control during the period of these studies was excellent and rarely did the temperatures vary.

The 18-hour photoperiod was achieved by adding lights to the end and the beginning of each day. The light (60 watt lamps, 3 feet above the soil and 3 feet apart) was on at 4 pm and off at 10 pm and on again at 4 am and off at 8:30 am. (In the Long Island program the lights were just extended from the end of the day). This insured an exact 18 hours of daylength. A shade petition was pulled between the 18-hour treatments and the natural day treatments, so both groups received the same amount of sunlight.

The cuttings were planted and usually were ready for pinching in 2 weeks or less. The spacing was 4 cuttings per square foot and the plants were pruned to 3 shoots per plant for a total of 12 shoots per square foot. (The Long Island program had 4.5 plants per square foot or 14 shoots per square foot).

Plantings were made 8/31/66, 11/1/66, 12/6/66, and 1/3/67. The flowers were cut on the average of 3 times a week and graded according to the proposed SAF grades. A mean grade figure was determined by giving a value of 4 to the blue grade, 3 to the red grade, 2 to the green grade, and 1 to the yellow grade. The number of flowers in each grade was multiplied by the grade number and the totals for all grades divided by the total number of flowers. A mean grade figure of 3 or better would be considered commercially acceptable.

Results

The results for the 4 plantings are shown in Table 1. The results will be discussed: (1) temperature, (2) photoperiod, (3) comparison of Long Island and Ithaca (light intensity) are shown in table 2.

Temperature

Number of flowers—Temperature apparently did not have any great effect on the number of flowers produced. The highest and lowest temperatures usually produced the fewest flowers. If all the plants produced the three selected shoots per plant, the total would have been 144. The losses were due to breakage and in a few cases improper pinching, i.e. pinching too low for 3 breaks per plant to develop. We did not consider flower number as an important factor. More experience with this cultural method would improve this figure.

Grade—Temperature played a very important role in controlling the grade of flowers. It was interesting to note the coolest temperature (50°) did not always produce the best mean grade. The 55 and 60° temperature in three of the four plantings (the 8/31/66 planting was the exception) had the highest mean grade. These temperatures, it should be noted, were constant temperatures, i.e. day and

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Table 1. The number of flowers, mean grade, peak production (date and days from planting) and duration of cropping for 4 crops of carnations grown under 5 temperatures and 2 photoperiods.

	18-hour day					Natural Day				
		Mean	Peak				Mean	Peak		
	No. fls	Grade	Date	(Days)	Duration	No. fls	Grade	Date	(Days)	Duration
					Planting 8/31/66					
70°	118	2.2	2/25	175	88	126	2.3	4/20	230	119
65°	130	2.3	2/20	170	64	122	2.5	4/20	230	120
60°	136	2.7	2/15	165	74	103	3.4	5/10	250	78
55°	133	3.0	2/25	175	49	128	3.4	4/15	225	73
50°	132	4.0	4/20	230	55	82	3.9	5/17	257	30
					Planting 11/1/66					
70°	60	2.2	4/19	169	43	99	2.4	5/22	202	50
65°	93	2.4	4/19	169	50	123	2.5	5/17	197	66
60°	80	3.5	5/15	195	40	124	3.3	6/10	220	46
55°	69	3.4	5/12	192	42	126	3.3	6/6	214	50
50°	107	3.0	6/28	238	25	120	3.0	6/28	238	25
					Planting 12/6/66					
70°	93	2.2	5/10	154	90	118	2.4	5/29	173	66
65°	130	2.4	5/8	152	77	149	2.6	6/5	179	51
60°	124	3.3	5/24	168	52	143	3.2	6/16	190	58
55°	129	3.5	6/6	180	49	136	3.1	6/16	190	45
50°	126	3.0	6/22	196	25	117	2.9	6/22	202	25
					Planting 1/3/67					
70°	93	2.6	6/10	157	67	102	2.5	6/15	162	42
65°	97	2.9	6/16	163	40	130	2.8	6/6	153	37
60°	105	3.0	6/16	163	26	124	3.0	6/22	169	26
55°	134	2.9	6/22	169	35	131	3.0	6/22	169	38
50°	92	2.6	7/3	180	25	106	2.6	7/5	182	25

night were the same. A more complete analysis of day and night temperatures was studied and will be reviewed in a later article in this series.

Peak production—The effects of temperature again showed some interesting differences in production time. The expected results were for the highest temperature to peak first, followed consecutively by the cooler temperatures until the coolest which should have peaked last. The results indicated the coolest temperature (50°) did indeed flower last. The warmest temperature (70°), however, did not consistently flower first and lower temperatures often flowered at the same time or faster. A closer look at this will be made in other studies on temperature to be reported in this series.

Duration of Crop—There was no apparent effect of photoperiod on the duration of the crop. There appeared to be an effect of temperature and the warmer temperatures had the longest duration of cropping. This will be discussed again in a later series.

Photoperiod

Number of flowers—there is no indication of any particular effect of photoperiod on the number of flowers produced. From our previous work we did not expect a conspicuous difference.

Grade—a comparison of the mean grades does not show any indication of large differences between the 2 photoperiods (18 hour and natural days.) Previous work indicated there may be no differences.

Peak production—We expected a large difference between the peak production of the 2 photoperiodic treatments and the results have borne out these expectations. It was interesting to note the results with the different plantings.

A. 8/31/66 Planting—There was a large difference between the peak production in the long day and natural day treatments, 27 to 85 days. The September planting

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Table 2. Mean grade, peak production (date and days from planting) and duration of 4 selected plantings at 2 locations (Long Island and Farmingdale). Plants at both locations grown with 18-hour photoperiods. Long Island temperature 52° night, 60 to 65° day and Ithaca 55° constant.

Planting		Long Island				Ithaca		
	Mean	Peak			Mean	Peak		
date	grade	Date	(Day)	Duration	grade	Date	(Day)	Duration
8/31/66	3.8	2/1	152	31	3.0	2/25	175	49
11/1/66	3.9	4/10	160	34	3.4	5/12	192	42
12/6/66	3.9	5/10	160	34	3.5	6/6	180	49
1/3/67	3.6	5/20	140	26	2.9	6/22	169	35

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was grown during the dark short day period of the year. Flower initiation of the natural day treatment was probably during November and December.

B. 11/1/66 Planting—A difference between long and normal day treatments at the 55° and above temperatures was recorded. There was, however, no difference at 50°.

Growth and development of the crop at 50° was extremely slow, 46 days slower than the 55° long day treatment. The reason was probably the cool, dark period of the year. The same results were seen in the Long Island work (see NYSFG Bul. 272). The flowering of these plants was actually slower than the next months plantings and very similar to the planting 2 months later.

C. 12/6/66 Planting—The difference between the long day and normal day treatments were less than the previous planting dates. The long day grown plants were 1 to 4 weeks quicker than the normal day treatments. It was interesting to note a few treatments. The 50° normal day treatment (ND 50°) flowered faster than the same treatment of the previous month. In fact, a close pursual of the data would indicate this planting generally flowered just a few days after the October planting.

D. 1/3/67 Planting—There was just a slight difference between the long and normal day treatment for this planting. The reason for this we can relate to light intensity, part of which will be discussed in the next section. The natural longer days of spring, at the time of flower bud initiation also had its effect.

Light Intensity

Table 2 shows a comparison between the plantings at Long Island and Ithaca. The plants on Long Island flowered 3 to 4 weeks earlier and the flowers were of higher grade than the Ithaca plantings. The cuttings were the same for both areas, i.e. they were grown and rooted in Ithaca. Cultural conditions, planting date, temperature, fertilizer levels, watering, etc, were similar. The major difference between the 2 areas was the greater amount of light in the Long Island area. Light intensities studies in the growth chambers, will be discussed in a later article and will help to substantiate the differences observed here.

Summary

This study indicates some of the problems facing the carnation grower. To obtain accurate timing, he must control photoperiod, temperature, and light intensity. Light intensity, at least for the present, is difficult to control, whereas, temperature and photoperiod are controllable under greenhouse conditions. It also shows clearly an area like Long Island is more desirable to grow carnations than Ithaca.