North Carolina Flower Growers' Bulletin

VOL. 14 NO. 1

JANUARY – 1970

OFFICIAL PUBLICATION OF THE N.C. COMMERCIAL FLOWER GROWER ASSOCIATION

SEASONAL CROPPING OF CARNATIONS IN PIEDMONT NORTH CAROLINA

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Seasonal cropped carnations offer definite advantages for the commercial grower. These advantages include 1) ability to bring a crop into flower for a given date or holiday, 2) possibility of varying the ratio of flower colors for each holiday, and 3) rotation of carnations with other crops because of the ability to grow plants at 60°F night temperature instead of the usual 52°F.

Several universities and companies have conducted studies on the "seasonal cropping" system of carnation culture. Typical of the results of these studies is a program published in Yoder Grower Circle News, No. 67 October 1968. This program deviates from the standard system of one to two-year crops in several ways. The spacing is closer (4 in x 6 in) to allow heavier yields from the first crop of flowers. Overcrowding of stems, which normally produce the second crop of flowers, is of no consequence since the plants are ripped out after the first crop is harvested. The period of harvest usually lasts five to six weeks. The night temperature can be as high as 60°F. The middle of the night is interrupted with 15 foot candles of light (regular chrysanthemum system) for a length of time which, when added to the natural daylength, will give a total of 17-18 hours of light per day. The period of lighting begins on the pinch date in July and August and two weeks after the pinch date in September through February. The important point here is that the lateral shoots be 1 to 1 1/2 in. long. Lighting then continues for a period of three to eight weeks, depending upon the planting date (see Table 1). The purpose of lighting is to hasten the first date of harvest as well as to shorten the period of time over which the crop is cut. It is important that lighting be carried out only during this period to prevent a reduction in quality which would ensue from lighting during the entire time the crop is in the bench.

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Table 1. Yoder timetable for lighted single pinch carnations including Christmas through Mother's Day 1970 based on work at latitude (41°). This table taken from Yoder Grower Circle News. No. 67, October 1968.

Plant 1969	Pinch	**Night Temp. Min. °F	Day Temp. Min. °F	Day Temp. Max. °F	*Lighting Period	Growing Weeks	Approximate Flower Date 1969	Approximate Flower Date 1970
7/21	8/11	60 55	65 60	75[1] 65	8/11- 9/22 (6 wks)	18-24	11/24	to 1/05
7/21	8/11	60 55	65 60	75 70	8/11- 9/22 (6 wks)	19-25	12/01	to 1/12
7/28	8/18	60 55	65 60	75 65	8/18- 9/29 (6 wks)	19-25	12/08	to 1/19
8/04	8/25	60 55	65 60	75 65	8/25-10/06 (6 wks)	19-25	12/15	to 1/26
8/04	8/25	60 55	65 60	75 65	8/25-10/06 (6 wks)	20-26	12/22	to 2/02
8/11	9/01	60 55	65 60	70 65	9/01-10/20 (7 wks)	20-26	12/29	to 2/09
8/11	9/01	60 55	65 60	70 65	9/01-10/20 (7 wks)	21-27	1970 1/05	to 2/16
8/18	9/08	55	60	65	9/15-11/03 (7 wks)	21-27	1/12	to 2/23
8/25	9/15	55	60	65	9/22-11/10 (7 wks)	21-27	1/19	to 3/02
8/25	9/15	55	60	65	9/22-11/10 (7 wks)	22-28	1/26	to 3/09
9/01	9/22	55	60	65	9/29-11/24 (8 wks)	22-28	2/02	to 3/16
9/08	9/29	55	60	65	10/13-12/08 (8 wks)	22-28	2/09	to 3/23
9/15	10/06	55	60	65	10/20-12/15 (8 wks)	22-28	2/16	to 3/30
9/15	10/06	55	60	65	10/20-12/15 (8 wks)	23-29	2/23	to 4/06
9/22	10/13	55	60	65	10/27-12/22 (8 wks)	23-29	3/02	to 4/13
9/29	10/20	55	60	65	11/03-12/29 (8 wks)	23-29	3/09	to 4/20
10/06	11/03	55	60	65	1970 11/17- 1/12 (8 wks)	23-29	3/16	to 4/27
10/20	11/17	55	60	70	12/01- 1/26 (8 wks)	22-28	3/23	to 5/04
10/27	11/24	55	60	70	12/08- 2/02 (8 wks)	22-28	3/30	to 5/11
11/03	12/01	55	60	70	12/15- 2/09 (7 wks)	22-28	4/06	to 5/18
11/17	12/15	55	60	70	12/29- 2/16 (7 wks)	21-27	4/13	to 5/25
11/24	12/22	55	60	70	1970 1/05- 2/23 (7 wks)	21-27	4/20	to 6/01
12/01	12/29	55	60	70	1/12- 2/23 (6 wks)	21-27	4/27	to 6/08
12/15	1970 1/12	55 60	60 65	70 75	1/26- 3/09 (6 wks)	20-26	5/04	to 6/15
12/22	1/19	55 60	60 65	70 75	2/02- 3/16 (6 wks)	20-26	5/11	to 6/22
1970 1/05	2/02	55 60	60 65	70 75	2/16- 3/23 (5 wks)	20-25	5/18	to 6/29
1/19	2/16	55 60	60 65	70 75	3/02- 4/06 (5 wks)	20-24	5/25	to 7/06
2/02	2/23	55 60	60 65	70 75	3/09- 4/06 (4 wks)	19-23	6/01	to 7/13
2/09	3/02	55 60	60 65	70 75	3/16- 4/06 (3 wks)	19-23	6/08	to 7/20

No economic gain has been found from lighting in this way for the remainder of the year.

* **Lighting requirements.** A minimum of 15 foot candles of incandescent light at plant height is recommended.

** **Minimum temperatures** have been established in conjunction with the use of supplemental carbon dioxide from mid-October on. Approximately 1000 ppm are recommended during daylight hours between 9 a.m. and 3 p.m.

[1] The lower recommended temperatures are preferable where they can be controlled by air cooling.

OBJECTIVES

The plant environment in North Carolina is quite different from that of the northern latitudes where many of the studies were conducted which led to current recommendations. With this in mind this study was established to 1) determine if the timetable for seasonal cropping developed in northern latitudes had to be altered for the Raleigh, North Carolina, area, 2) to verify the advantages of supplemental lighting, and 3) to compare several carnation cultivars for usefullness in this program.

EXPERIMENT A

Four carnation cultivars, provided by Yoder Brothers, Inc., Ohio Red Sim, Connecticut Sim #1, Scania and Improved White Sim, were planted at a spacing of 4 in. by 6 in. in two raised 3 1/2 by 10 ft. benches on January 11, 1969 and again on January 25, 1969. On the second planting date Ohio White Sim was substituted for Connecticut Sim #1. On each date one bench was set up for natural daylengths and the other for supplemental long day conditions. The night temperature was 60°F and the day temperature ranged from 70-75°F. The soil mix consisted of 1 soil:1 sphagnum peatmoss:1 coarse sand ammended with 7 lbs. dolomitic limestone and 3 1/2 lbs. 20% superphosphate per cubic yard. Fertilization consisted of 1.5 lbs. 20-5-30/100 gals. weekly.

The first set of plants was pinched back to four or five pairs of leaves on February 3, 1969 and the second set on February 17. Half of each cultivar of plants in the first set were provided supplemental light from February 17 until March 24 and half of the plants in the second planting date from March 3 to April 7. Lighting was carried out from 10 P.M until 2 A.M.

Adjustment of Timetable: According to the Yoder timetable for latitude 41° the first set of plants was scheduled to flower May 24 but the crop actually flowered 12 days earlier on May 12. The gain in time was due to the superior growing conditions at the Raleigh latitude during January and February. The crop reached the proper pinching stage (elongation of the internode above the 4th or 5th pair of leaves up from the ground) 19 days ahead of the Yoder schedule and plants were at the stage for lighting 5 days ahead of schedule. It is therefore apparent that crops established during the winter months of December and January will require later planting dates in order to conform to the flowering dates in Table 1. For trial purposes it is suggested that they be planted two weeks later.

Value of Supplemental Lighting: In order to study the influence of lighting upon flowering, the length of harvest time required to yield 12 blooms per square foot was calculated for each cultivar and treatment (Table 2). The initial date for all calculations was May 12. It can readily be seen that from one to two weeks were gained in flowering time and also that the harvest extended over a shorter period of time when supplemental lighting was used.

Table 2. The number of days from the date of first harvest, May 12, 1969, until an average of 12 blooms per square foot was cut for each carnation cultivar and treatment.

Planted	Light	Cultivar				
		Ohio Red Sim	Ohio White Sim	Conn. Sim #1	Scania	Imp. White Sim
1-11-69	Yes	17	-	25	34	32
1-11-69	No	23	-	31	35+	31
1-25-69	Yes	21	27	-	35+	26
1-25-69	No	35	35+	-	35+	35+

It has been well established that the use of supplemental light during the entire life of the crop will reduce flower and stem quality. When applied only during the flower bud initiation period as in this work there should be no reduction in quality. This conclusion was substantiated by the data in Table 3. In Table 3 the average numerical grade of flowers cut in each variety and treatment is listed. Flowers were graded according to the North Central Grading system in which the blue grade flower (assigned a value of 3) has a diameter of at least 2 3/4 in. and a stem length of 22 in., the red grade flower (assigned a value of 2) has a diameter of 2 1/4 to 2 3/4 in. and a stem length of 17-22 in. and, the green grade flower (assigned a value of 1) is less than 2 1/4 in. in diameter and less than 17 in. long. Since a second crop of flowers was not harvested in this system there was no problem obtaining at least 22 in. of stem with each flower. Flower diameter and stem strength were the main variables accounting for grade.

Table 3. The average grade of all carnation flowers harvested within each treatment and cultivar.

Planted	Light	Cultivar				
		Ohio Red Sim	Ohio White Sim	Conn. Sim #1	Scania	Imp. White Sim
1-11-69	Yes	2.2	-	2.1	2.2	2.1
1-11-69	No	2.3	-	1.9	2.1	1.9
1-25-69	Yes	2.2	2.1	-	2.3	2.2
1-25-69	No	2.3	2.0	-	2.2	2.1

Cultivar Selection: Based on Table 2, Ohio Red Sim and Conn. Sim #1 are the fastest cropping cultivars. Also important is the total number of flowers harvested. According to Yoder Bros., Inc., a minimum of 16 flowers per sq. ft. must be harvested within a six weeks period for this system to be profitable. The number of flowers cut per sq. ft. for each cultivar in the supplemental light treatments only is listed in Table 4. It should be noted that these values represent a five-week harvest for the first planting date and a four-week harvest for the second ate. On this basis all cultivars except Scania would easily yield 16 flowers per sq. ft. over six weeks time.

Table 4. The average yield per sq. ft. of carnation flowers of five cultivars grown under a supplemental light program.

	Cultivar				
Planted	Ohio Red Sim	Ohio White Sim	Conn. Sim #1	Scania	Imp. White Sim
1-11-69	14.6	-	17.4	12.5	14.3
1-25-69	14.4	15.1	-	9.9	14.8

Looking at the cultivars from the standpoint of time of harvest and total yield it is apparent that Conn. Sim #1 and Ohio Red Sim are the best suited to a program of seasonal cropping followed closely by Ohio White Sim and Improved White Sim. Scania is not a desirable cultivar in this system for late spring flowering.

EXPERIMENT B

Based on the results of Experiment A a second study of seasonal cropping was conducted. The two cultivars, Ohio Red Sim and Ohio White Sim, were planted on July 21, 1969, pinched on August 11 and subjected to supplemental lighting daily between 10 P.M and 2 A.M. from August 11 until September 22. All other cultural procedures were the same as for Experiment A.

According to the Yoder timetable (Table 1) the flowering period for 41° latitude should have extended from November 24 to January 5; however, the harvest occurred better than three weeks earlier and lasted for only 4 1/2 weeks (November 1-30). An average of 7.4 flowers per sq. ft. was harvested from each cultivar from the entire crop (Table 5). Flower size was adequate but stems were excessively weak and resulted in most blooms being lowered a grade. The production volume and grade were too low for this crop to be profitable.

Table 5. Production and average grade of carnations planted on July 21, 1969 and grown according to the seasonal cropping procedure.

	Ohio Red Sim	Ohio White Sim
Blooms/sq. ft.	7.4	7.4
Ave. grade	1.5	1.7

The greenhouse was equipped with fan and pad cooling; however, temperatures were still sufficiently high during August and September to adversely affect the newly forming floral shoots. Secondary lateral shoots which began developing during the cooler period of late September and October were of very high quality. Two weeks after the conclusion of the first crop (about mid-December) a second crop of flowers began to mature. The quality of these flowers was satisfactory.

From this experiment it appears that the earliest flowering date for seasonal cropped carnations grown inside the greenhouse in the Raleigh area is for a Christmas crop.

CONCLUSIONS

1. Seasonal cropping of carnations for the month of May is profitable. It appears that a successful crop could be harvested for Christmas but earlier dates would not be successful.

2. The Yoder schedule has to be altered for the Raleigh area to take into account three weeks earlier flowering in the late fall and two weeks in May.

3. The use of supplemental lighting is highly advantageous and should be used as recommended.

4. The cultivars Conn. Sim #1 and Ohio Red Sim are best suited for May flowering while Ohio White Sim and Improved White Sim run a close second.