Colorado Flower Growers Association

IN COOPERATION WITH COLORADO STATE UNIVERSITY
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Some Effects of Night Temperature on Carnations[1]

by Robert G. Schmidt and W. D. Holley

Red Gayety carnations were grown under controlled conditions with night temperatures of 48, 50, 52 and 54°F.

Flower yield was not significantly affected by these temperatures.

Flower grade improved with each increase in temperature.

Flower color was more intense with each two degree increase in temperature.

Cut flower life was not affected by these temperatures.

There were no differences in percentage of dry matter attributable to temperature.

A distinct trend toward longer internodes with lower temperatures was evident, the differences between the outer limits being highly significant.

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In order to investigate the effects of night temperatures within a narrow range near optimum, a special greenhouse was constructed and partitioned. Light was near equal in all compartments. The four equal compartments are 17½ by 15 feet, arranged in a line from east to west. The compartments are ventilated automatically by exhaust fans and heated by thermostatically controlled steam.

Rooted cuttings of Red Gayety carnation were planted June 25, 1956, using 6 by 8-inch spacing. These plants were grown out of doors under uniform growing conditions until October 3, then moved into the temperature control chambers. The plants were given a pinch and a half to accomplish steady production through the winter and spring. All plants were irrigated when Lark tensiometers registered 30 to 50.

For day temperatures, thermostats in all compartments were set to allow steam heat up to 60°F. and cooling by the exhaust fans at 68 ± 2°F. Night temperatures were different for each compartment with two degree separations beginning at 48°F and progressing to 54°. Progressing from east to west the night temperatures maintained by compartment were 50, 52, 48, and 54°. Night temperature controls operated between 6 p.m. and 8 a.m. daily.

Yield and Grade

Flowers were harvested from November 23, 1956 to May 4, 1957, and graded in the following manner: 1)

1/ This is a part of Robert G. Schmidt's thesis for the Master of Science degree in Horticulture.

fancy--any flower with a large head, no defects, a 24-inch stem, and weighing at least 25 grams; 2) standard--flowers having stem length less than 24 inches but more than 20 inches, no defects, and weighing more than 15 grams; 3) short--flowers having stem less than 20 inches or weight less than 15 grams; and 4) design--all flowers failing to meet the above specifications including defective flowers or those with weak stems. Mean grades were obtained by assigning values to the respective grades as follows: design, 2; short, 3; standard, 4; and fancy, 5. The differences in total yield were not great enough to be significant. There was a significant trend toward higher grades with increasing night temperature, Table 1.

Table 1. The effects of 4 night temperatures on yield and grade of Red Gayety carnation.

Night temperature	Total Yield	Grade				
		Design	Short	Standard	Fancy	Mean
48°F	835	17	14	416	388	4.402
50°F	840	10	15	362	453	4.493
52°F	843	10	17	332	484	4.530
54°F	887	6	15	328	538	4.576

A difference between means of 0.086 is significant with odds of 19 to 1.

Color

Periodically flowers were graded for color by matching them with spinning discs containing a gradation in amounts of white and Chinese Red. All color grading was done with a uniform light source. The color percentages on the spinning discs were as follows:

Color Grade	Red percentage
1	100
2	99
3	98
4	97
5	96
6	95
7	94
8	90

Only a very few flowers were lighter than grade 5. Flowers were graded for color 11 times between January 20 and April 21. There was a distinct improvement in color with each increment of temperature, the results being most striking. Flower color from all treatments improved gradually from January to April, indicating that night temperature has its most critical effects when day temperatures and light are also low. Table 2 gives the mean color per treatment at the different dates of sampling.

Table 2. The effects of four night temperatures on flower color of Red Gayety carnation.

Grading Dates	Night temperature			
	48°F	50°F	52°F	54°F
Jan. 20	3.9*	3.9	2.7	2.1
Feb. 4	4.3	4.0	2.9	2.1
Feb. 8	5.3	4.8	3.9	2.0
Feb. 13	4.7	3.8	2.8	1.3
Feb. 15	5.0	4.8	2.5	2.0
Feb. 18	4.7	3.2	2.5	1.6
March 4	5.0	4.0	3.0	1.9
March 10	4.2	3.6	3.3	2.3
March 27	3.7	3.4	2.5	1.8
April 7	3.7	2.9	2.3	1.2
April 21	2.5	1.9	1.6	1.3
Average per temperature	4.27	3.66	2.73	1.78

*Average color grade per sampling date.
Note--color decreases as number increases.

Dry Matter

Sizeable samples of the stems from freshly harvested flowers were weighed, oven dried, then weighed again on January 23 and again on April 5. The percentage of dry matter in the carnation stems was slightly over 20 in January and varied from 19.7 to 21.3 in April. The differences were not statistically significant nor was there any trend toward dry matter varying with the temperatures used in this investigation.

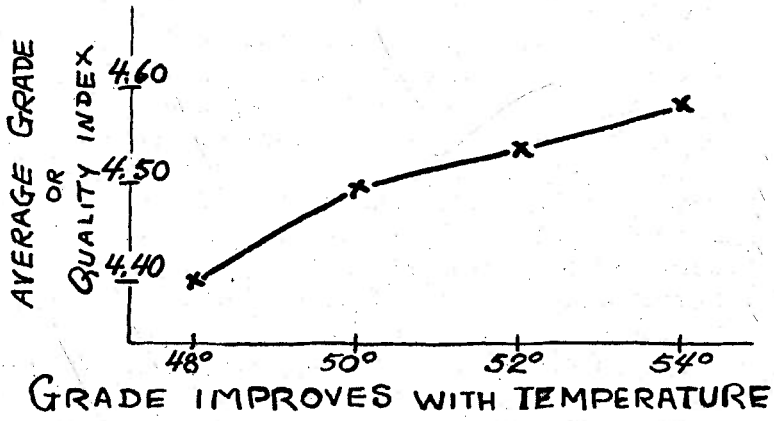
Cut Flower Keeping Life

The useful life of the freshly harvested flowers was measured nine times from January 20 to May 1. Flowers were placed in neutral water in a room at 68°F ± 2 with low humidity. The keeping life varied with sampling date as would be expected. There was a trend toward better keeping life with the higher temperatures, but the differences were not large enough to be significant. (Table 3.)

Table 3. The effects of 4 night temperatures on cut flower keeping life of Red Gayety carnations.

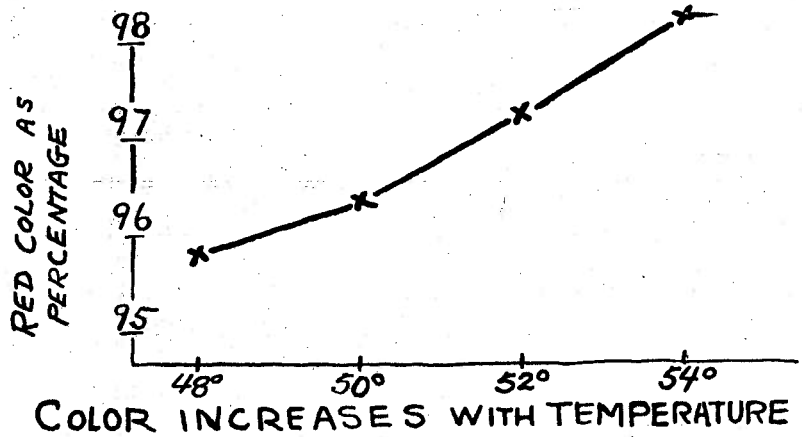
Keeping trial dates	Night Temperature 48°F	50°F	52°F	54°F	No. fls. per sample
Jan. 3	8.00*	8.25	8.50	8.75	4
Feb. 1	10.00	9.60	9.60	9.60	5
March 4	7.30	7.60	8.70	8.10	10
March 13	8.10	8.00	7.30	7.30	10
March 27	9.14	9.00	8.28	9.57	7
April 5	8.00	9.40	10.80	11.00	5
April 22	7.20	8.20	8.10	7.30	9
April 24	7.80	7.80	8.20	8.60	8
May 1	8.00	8.90	8.50	8.60	10
Average per temperature	8.17	8.49	8.66	8.76	

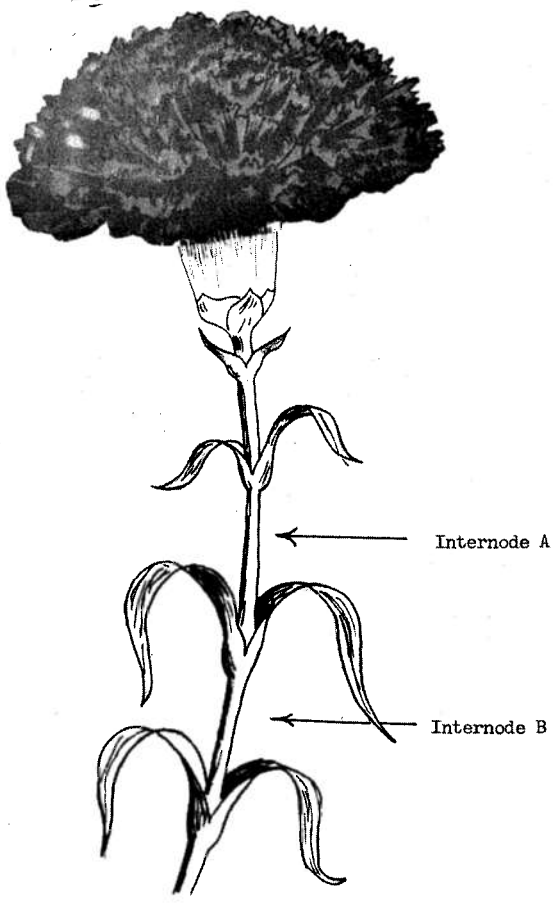
*Average per sample



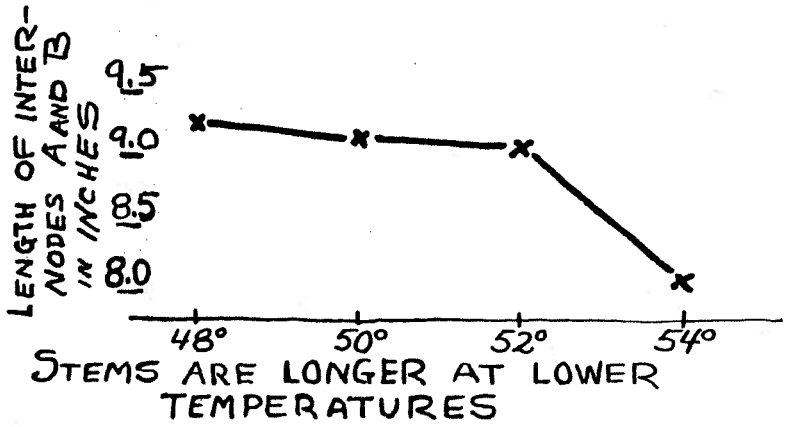
Stem Elongation

During the month of April it was observed that the carnation plants varied in height according to treatment. Ten stems per sample were measured at six intervals. The second and third internodes below the calyx were arbitrarily selected for measurement. The internode length decreased with each two degree rise in night temperature, the differences between the extreme temperatures being highly significant.





Internodes Measured



Discussion

This investigation has indicated one fallacy in our reasoning heretofore. If any change was in order as we approached the winter season, we have lowered the night temperature, often to 48 and sometimes to 46°F. This has been done to help offset the ill effects of dark weather. This investigation has indicated serious detrimental effects to carnation quality by colder night temperatures. These include loss of color, longer internodes enhancing weak stems, and reduced grade of flowers. Although no evidence is presented in this paper, the flowers produced at the colder night temperatures had form and opening characteristics somewhat inferior to those produced at higher temperatures.

The winter of 1956-57 was pretty much the same as most winters in Colorado, with some dark weather and the usual short days and reduced light. It is apparent to the authors that night temperature effects are most critical under these conditions and less critical as light and day temperatures rise in the spring. Incidentally, it costs about 2½ cents per square foot of bench area to heat to 54° instead of 50° F. (adapted from production costs by Andy Washburn).

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your editor,

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