Colorado Flower Growers Association, Inc.

IN COOPERATION WITH COLORADO STATE UNIVERSITY

H. A. Lazier, Executive Secretary

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Day Temperature Experiments -- A progress Report

by Joe J. Hanan, Jr.

Carnations have different day temperature requirements depending upon 1) the time of the year and the light available, and 2) the age of the plants.

Raising the day temperature during the winter to hasten flowering of carnations is a debatable procedure. Under low light conditions, an increase in day temperature markedly reduces quality, while hastening flowering only slightly. 60°F day temperatures causes a distinct delay in flowering.

Cooling on Old Plants

On May 1, 1957, individual compartments in the temperature research house at Colorado State University were set for day temperatures of 60, 65, 70, and 75°F. Night temperatures through the summer were allowed to reach equilibrium with those of the outside air. However, if the night temperature remained above the cut-off point of the cooling fans, they continued to operate. The fan in the 60° compartment operated for 24 hours a day several times during the summer. For the winter period, the night temperature in all compartments has been controlled at 52°F.

One-year-old Red Gayety plants from a previous experiment were carried over for the purpose of investigating the effects of summer cooling on old carnations. Some effects of the previous treatments probably influenced the results of this experiment, however the results for the first two months after start of this experiment are not included in this paper.

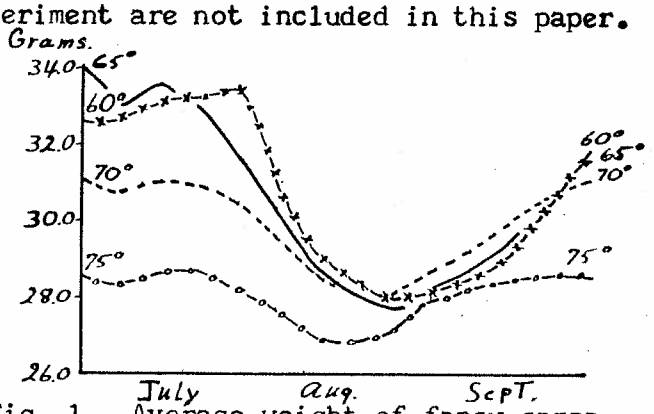

Fig. 1. Average weight of fancy carnations from one-year-old Red Gayety plants cooled to four temperatures.

Table 1. The percentage of various grades of flowers cut from one-year-old Red Gayety Carnations in the period May 1 to October 4, 1957.

Grade	Day temperature 60°F	65°	70°	75°
Fancy	74.9	74.2	71.4	58.7
Standard	12.6	10.6	14.1	25.7
Short	6.1	10.6	7.4	8.2
Design	6.4	4.5	7.2	7.5
Average grade	4.53	4.52	4.48	4.32

Fig. 1 and Table 1 give a brief resume of some effects of differential cooling on old plants. To summarize the major results:

1. Day temperatures of 70°F or more caused a market reduction in cut flower weight.
2. The average grade of flowers produced at 60, 65, and 70° was not significantly different. Flowers produced at 75° were of significantly poorer quality.
3. There were no measurable differences in color, nor were there significant differences in yield.

From August 1 to September 1, outside humidity and air temperatures overloaded the capacity of the evaporative pad cooling system, cancelling most of the differences between the three lower temperatures. All treatments showed a sharp decrease in fresh weight of fancy flowers (Fig. 1) during this period.

Young Plants

Red Gayety cuttings were benched on May 21, 1957, and pinched on June 15. Day temperatures were regulated by heating and cooling at 60, 65, 70, and 75°F. The accuracy of the control, measured at the thermostats, has been ±1½ degrees during the day and ±1 degree during the night. The night temperature in all compartments has been controlled at 52o.

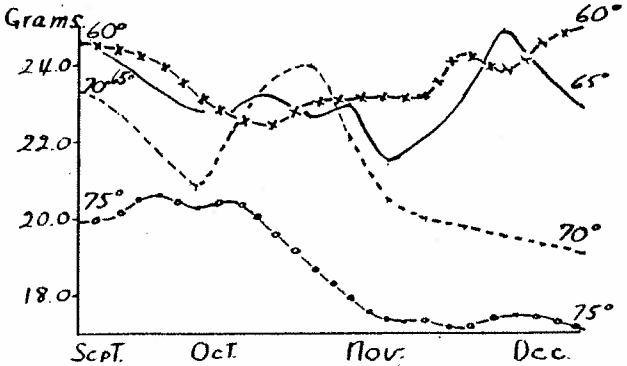

Fig. 2. Averege weight of standard grade carnations from young Red Gayety plants grown at four day temperatures.

Figs. 2 and 3 and Table 2 give some of the results to December 27. These plants produced a first crop in September and returned a second crop beginning in December. The cropping stage of the plants complicates to some extent the smoothness of the curves, especially in Fig. 2.

Listing the most obvious results:

1. As light intensity decreased, high temperatures (70-75°) reduced cut flower weight (Fig. 2).
2. Under limiting light the later part of the record period, high temperatures (70-75°) decreased flower color, increased stem elongation, and caused weaker stems and smaller flowers (Fig. 5).
3. Low temperatures (60-65°) increased cut flower weight (Fig. 2), stem strength, and under high light (early in the period) markedly decreased stem length (Table 2).

Table 2. The percentage of various grades of flowers cut from young Red Gayety carnations benched May 21 and harvested from August 16 to December 27.

Grade	Day temperature 60°F	65°	70°	75°
Fancy	15.2	23.1	45.2	47.2
Standard	71.0	65.8	50.5	47.1
Short	10.4	9.1	2.9	3.5
Design	3.4	2.0	1.4	2.2
Average grade	4.13	4.30	4.45	4.39

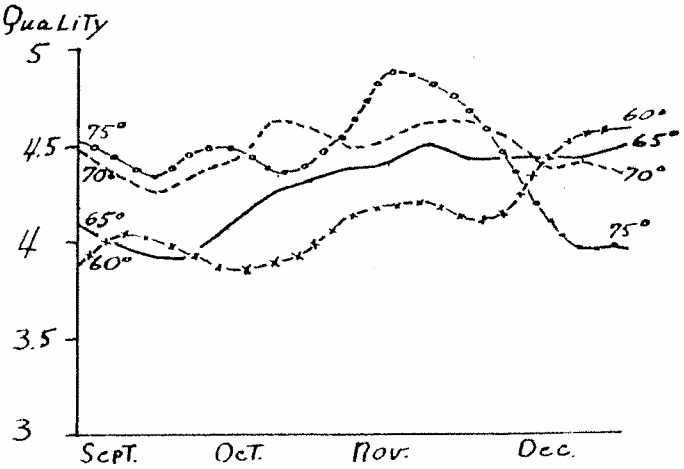

Fig. 3. Average quality of all flowers cut from young Red Gayety plants grown at four temperatures. Average computed by assigning the following numbers: fancy 5, standard 4, short 3, and design 2.

If the last five weeks (Nov. 22-Dec. 27) were disregarded in the present results, the highest average quality of flowers would have been produced with the 75° day temperature (Table 2). During this period, approximately 70 per cent of the flowers from the 75° temperature were downgraded because of insufficient weight and 10 per cent were downgraded due to small flowers or hollow centers. This latter effect is similar to that experienced with carnations prior to the use of cooling systems during the summer. In this same five-week period, 35 and 8 per cent of the flowers from the 70 and 65° temperatures respectively were downgraded due to weight. This has occurred in spite of continual bright weather at Fort Collins during the same period.

Raising the temperatures during the winter to hasten flowering of carnations is a debatable practice. Under low light conditions, an increase in day temperature markedly reduces quality. Raising the temperature hastens flowering only slightly, while lowering the day temperature to 60° causes a sharp delay in flowering.

While production records are not complete, both 75 and 60° day temperatures appear to reduce yield.

Under the light conditions that have prevailed (May 21-Dec. 27, 1957), the optimum day temperature for carnations in their first 7 months of growth seems to lie between 65 and 70°F with a 52° night temperature.

Total Growth at Different Temperatures

To get evidence on the effects of different day temperatures on growth of the entire plant, 10 rooted cuttings per treatment are being planted 2 to the container each 3 weeks. After 12 weeks of growth, the plants are pulled, the roots washed and the plants dried to constant weight. The resulting oven-dried weight is a reliable measurement of the total growth a plant has made in each environment. The mean dry matter produced per plant for the first three plantings is given in Table 3. Typical plants produced at the four temperatures are shown in Fig. 4.

Summarizing this experiment to date:

1. The greatest increase in dry matter for plants in this stage has occurred at 70°F day temperature.
2. High temperature (75°) hastened flowering slightly and low temperature (60°) caused a sharp delay in plant growth.
3. There was a general decrease in dry weight accumulation as the amount of light decreased with each successive planting.

Table 3: The average yield in grams of dry weight of carnation plants grown at different day temperatures.

Crop	Day temperatures 60°	65°	70°	75°
A Planted Aug. 21, 1957 Pinched Sept. 11 Harvested Nov. 12	6.55	7.70	9.05	7.44
B Planted Sept. 11, 1957 Pinched Oct. 2 Harvested Dec. 4	4.74	4.80	6.04	5.65
C Planted Oct. 2, 1957 Pinched Oct. 23 Harvested Dec. 21	3.70	4.37	5.15	5.04

Fig. 4. The general characteristics of Red Gayety carnations as influenced by four day temperatures. Planted Sept. 11, pinched Oct. 2, and harvested for dry weight records Dec. 4, 1957.

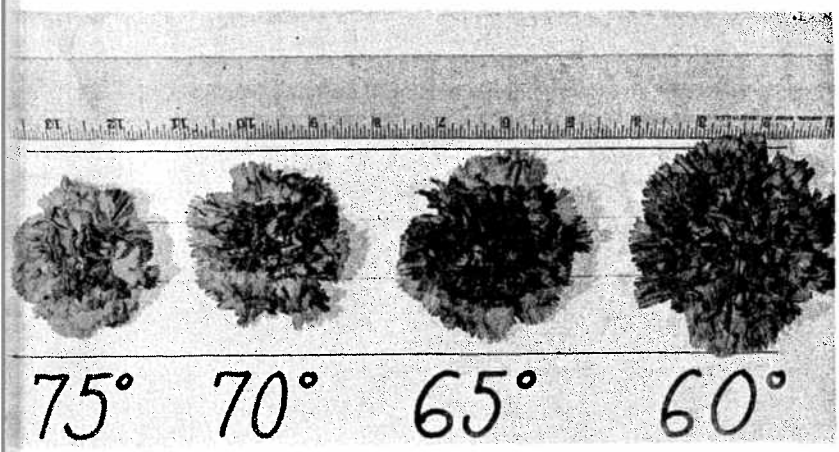

Fig. 5. Typical flowers produced from the four day temperature treatments in late December.

Discussion and Conclusions

This investigation is by no means completed and the results given so far may be subject to revision at a later date. However, tentative conclusions other than the ones given can be stated as 1) equal differences in day temperature do not cause equal effects on carnation plants, nor are the differences the same at different stages of growth; 2)as the plant matures the optimum day temperature decreases; 3) as light decreases, a carnation plant grows less at all temperatures and the optimum temperature decreases; and 4) the response of a carnation to changes in day temperature is not as great as the response to a corresponding change in night temperature.

The above conclusions lead us to the viewpoint that, under continually improving methods, it is no longer practical, or desirable to recommend one temperature for the entire year or to cover all stages of growth. If night temperatures different from the 52° used in this investigation had been used, the results of the day temperature experiments might be different. Conversely, a change in day temperature might call for a change in the night setting.

Other factors also influence the temperature requirement of plants. If plants are suffering from a nutrient deficiency, a so-called "optimum" temperature may aggravate the condition. The plant response a grower desires depends upon several factors. A change in one factor changes the requirement for all the others. For young carnations, in their first, and possibly their second crops, 75°F may not be too high under high light conditions. However, the results at this time indicate that 70° becomes too high when light reaches the level commonly available in Colorado during January and February.

Theoretically, if all factors are rigidly controlled, it would be possible to compute and predict, on the basis of a "normal" year, how much a grower should raise or lower the temperature to get the best results--provided the grower has maintained all other environmental factors at a specified optimum. Such accurate temperature recommendations await the results of further research.

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U.S.D.A. Survey of 1957 Cut Flower Production Planned in Colorado

Now in your hands should be forms for the second annual report on cut flower production in Colorado from the Crop Reporting Board of the United States Department of Agriculture. The survey continues to cover four major cut flowers--carnations, chrysanthemums,roses and gladiolus. Sales of these products by Colorado growers were placed at $5,500,000 in 1956.

Approximately 125 Colorado producers are asked to report information on the number of plants or acres of the four major cut flowers in production during 1957, quantities sold, and value of sales. Growers are also asked to estimate the number of plants or acres of these flowers to be grown in 1958. The estimates will relate to commercial producers. A comercial producer is defined as one who produced and sold $1,000 or more of cut flowers in 1956. An extensive survey has previously been conducted in Colorado to determine the size and number of commercial producers. Growers who are not raising any carnations, chrysanthemums, roses or gladiolus will not receive the January questionnaire.

The continued success of the new program of "crop reports" for the Colorado floral industry will be dependent upon the cooperation the Department receives from commercial producers regardless of the size of operation. Individual reports are confidential and will be used only in developing State totals. Prompt response from growers will facilitate the completion of the survey at an earlier date than was possible for the first report.

Additional mailings of questionnaires to non-respondent growers will delay the completion of the survey and the publication of the results. Please take a few moments to complete your reports and send it to the U. S. D. A., if you have not already done so.

Your editor, W D Holley

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