Colorado Flower Growers Association, Inc.

IN COOPERATION WITH COLORADO STATE UNIVERSITY

Doris Fleischer, Executive Secretary

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Malformation of Carnation Flowers

by

W. D. Holley and Jim Manring

Every fall growers in Colorado raise the question of why we are producing so many malformed carnations. Since memory is short, each fall's production of slab-sided and bullheaded flowers seems greater than that of previous years. Actually these slabs and bullheads are similar in most respects to the flowers with split calyxes which were produced in Colorado some years ago and are still produced in large numbers in many carnation growing areas. With more accurate temperature control and greenhouse cooling to avoid excess temperatures, the trigger for splitting the calyx is lacking in our present methods of growing. Many of the flowers which split in former years are now slab-sided or bullheaded.

Fig. 1.

Malformed flowers are caused by the development of rudimentary flowers among the petals.

To go into the anatomy of malformation briefly, auxiliary whorls of petaloids are produced around the ovary of the flower. The capacity for producing these rudimentary flowers is in all good carnation varieties, including the Sim sports, Some varieties, and even selections within varieties, produce extra rudimentary flowers within the calyx much more freely than others. Varieties produced by the Italian experimental stations for the Nice and Riviera sections are actually selected for this characteristic since they make larger flowers.

In selection work at Colorado State University, we are constantly discarding the lines of all Sim varieties which produce the most slabsided, bullheaded, or split flowers. However, some slabsidedness must be tolerated in order to have full flowers. When selection is completely away from these malformations, the resulting clons are hollow. More information on this selection work will be published in the near future.

After careful study of the carnation yield and grade records from the CSU Research Greenhouses for the past several years, the following assumptions seem evident:

1. Malformation is highest on young plants at their most vigorous stage.
2. More malformed flowers are produced during the fall months.
3. The Sim varieties differ significantly in their production of slabsided and bullheaded flowers.
4. Rapid drops in temperature, especially those involving chilling of the buds, seem to increase malformation. The malformed flowers are cut about 3 to 5 weeks following chilling.

Observations made in commercial greenhouses tend to confirm this temperature assumption. Fan ventilation during cold weather often causes high production of malformed flowers on the plants hit first by cold air currents. Ventilation with conventional top sash can do the same thing, if drafts of cold air move directly into the plants. Specific air flow patterns are easily determined by use of smoke bombs.

Variety

The yield and percentage of malformed flowers for five Sim varieties may be seen in Table 1. These varieties were grown in equal-sized plots and were duplicated in two adjacent benches. Plants were set in mid June of 1958 with yield records included for the first year of growth. Red Gayety and Crowley's Pink Sim produced significantly more bullheads and slabsided flowers than Gayety and Pikes Peak Frosted Sim, even though they occupied more favorable positions with respect to incoming air. All ventilation

Table 1. The production of malformed flowers by five varieties (1958-59).

Variety	Total Yield	Number Malformed[a]	Percent Malformed
White Sim	1669	54	3.2
Gayety	1890	47	2.5
Pikes Peak Frosted	1756	43	2.4
Red Gayety	2107	92	4.4
Crowley's Pink Sim	2052	92	4.5
Total	9474	328	3.5

[a]Includes slabsided, bullheaded, and split flowers.

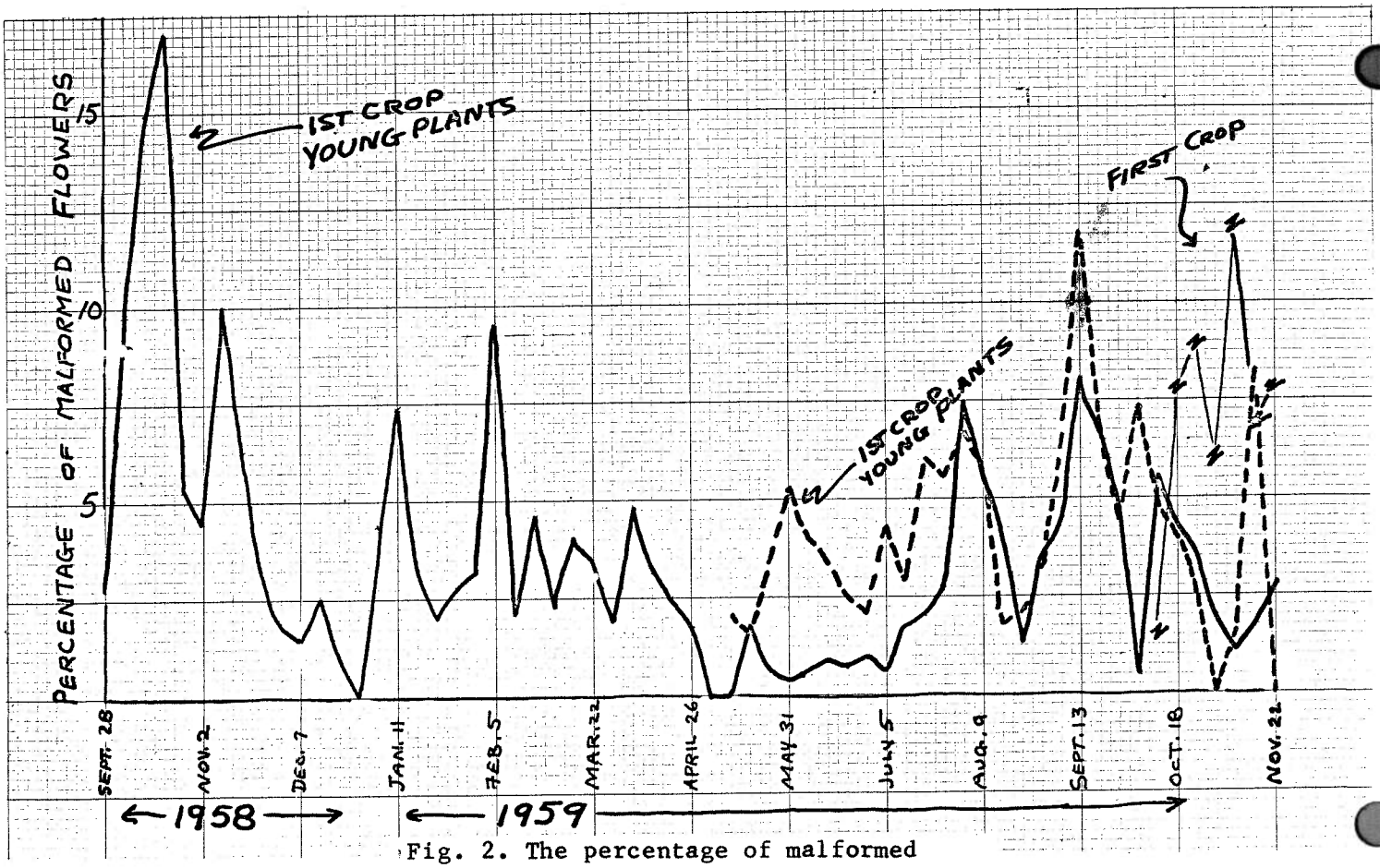

Fig. 2. The percentage of malformed flowers produced by five Sim varieties of carnation compared to two later plantings of White Sim.

was by fans with the incoming air warmed slightly as it came through an adjacent corridor. The air stream hit White Sim first, followed by Gayety, Pikes Peak Frosted, Red Gayety, and Pink Sim in that order.

Age and Vigor of Plants

The production of malformed flowers by the same plants in the same periods of 1958 and 1959 are compared in Table 2. The highest percentage of malformation is common to this fall period (see also Fig. 2). Malformation in this case on young plants was more than double that on the same plants in their second year. The same system of ventilation was used both years, although the day temperature was lowered three to five degrees the second year.

Table 2. The production of malformed flowers by the same plants for the same period in two different years.

Period	Yield	Number Malformed	Percent Malformed
Sept. 28, - Nov. 29, 1958	1840	140	7.6
Sept. 28 - Nov. 29, 1959	1554	45	2.9

Time of year

A graph of the percentage of malformed flowers produced by these two benches of plants (solid line) during 1958 and 1959 is shown in Fig. 2. Malformation was highest in September (first crop), decreasing in late November and December, making week to week fluctuations in January and early February, then levelling off the rest of February and March. During April, May and June the fewest malformed flowers were produced. Distinct periods of malformed flowers occurred in July, September, and October of the second year. Comparisons are made in the graph with two other plantings of White Sim. The first of these (dash line) began flowering in May and June in a period inducive to low malformation (solid line). Malformation on this new crop, however, was up to ten times as high as that for older plants. A new crop of White Sim in October and November of 1959 produced significantly more malformed flowers than either of the two previous plantings for this period.

Temperature relations

From the evidence at hand, certain temperature relations seem to trigger the development of extra whorls of petaloids within the calyx, thereby causing malformed flowers. These relations are not clearly understood, but certain evidence can be presented here. Several observations have been made in commercial greenhouses where the first plants hit by incoming cold air currents produced abnormally high percentages of bullheaded flowers. The opening angle of side or end ventilators through which this air moves determines the air flow pattern. Often the first plants hit by cold air are not the plants nearest the ventilator, but a strip of plants some distance out in the house. When a ventilator is wide open (warmer days), the air flow will tend to be more horizontal. Each ventilation installation has different air flow characteristics and should be modified if malformed flowers are a problem.

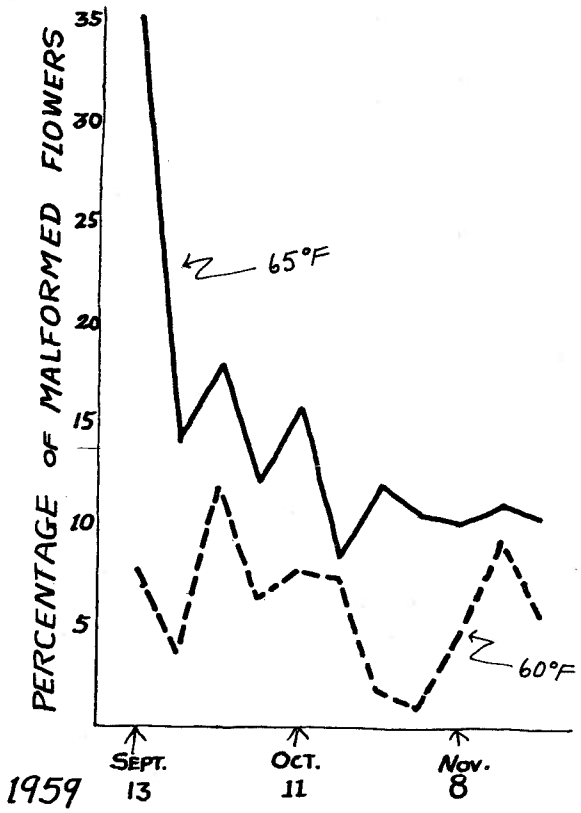

Fig. 3. Malformation is less on plants grown at 60° day temperature.

The number of malformed flowers and the degree of malformation seem to be affected by the amount of temperature drop. Buds which are at 60°F when the fan pulls in cold air are affected less than buds at 65°F before air is brought in. This is brought out in Fig. 3 for White Sim in its first crop in the CSU Temperature House.

One other observation seems pertinent at this point. On January 29, 1959, the door of a temperature compartment blew open early in the evening and remained open all night. The night temperature recorded in this compartment was as low as 40°F. Figure 4 shows the weekly percentage of malformed flowers produced by Red Gayety in this compartment for the 8 weeks following this one night of cold

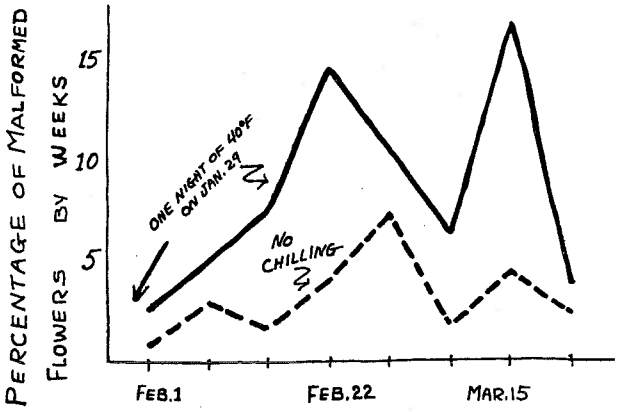

Fig. 4. The percentage of malformed flowers produced by plants chilled with one night of 40°F night temperature compared to flowers from plants not chilled.

temperature compared to the percentage of malformed flowers produced in adjoining compartments not chilled. No calyxes were split in the compartment which was chilled.

Summation

The production of slabsided and bullheaded flowers on carnations in Colorado is highest on young plants during September, October, and November. These malformed flowers are caused by the development of auxiliary whorls of petaloids around the ovary of the flower. The development of these extra whorls seems to be favored by chilling of the bud 3 to 5 weeks before the flower is cut. The percentage of malformed flowers is probably in direct relation to the degree of chilling. Weather most favorable for the causing of malformed flowers should be cold sunny days -- conditions which heat the greenhouse and require cold air to be brought in for cooling the plants. When these days occur, probably the warmer the buds get before cooling, the more buds that will be malformed.

--------your editor,
W D Holley

COLORADO FLOWER GROWERS ASSOCIATION, INC.
OFFICE OF EDITOR
W. D HOLLEY
Colorado State University
Fort Collins, Colorado

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