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## Carnation Calyx Splitting

by

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Colorado carnation growers experienced a serious wave of calyx splitting the last week of March and the first week of April, 1960. Since this splitting period began and ended abruptly for most growers, it promised an excellent source of information about calyx splitting.

Through the cooperation of the wholesale houses in Denver the per cent splits of each grower's daily cut was calculated. Thirty growers were selected for interview as follows: 10 who had produced very few splits, 10 who produced from 10 to 20% splits, and 10 who produced from 20 to 35% splits at the peak of the period.

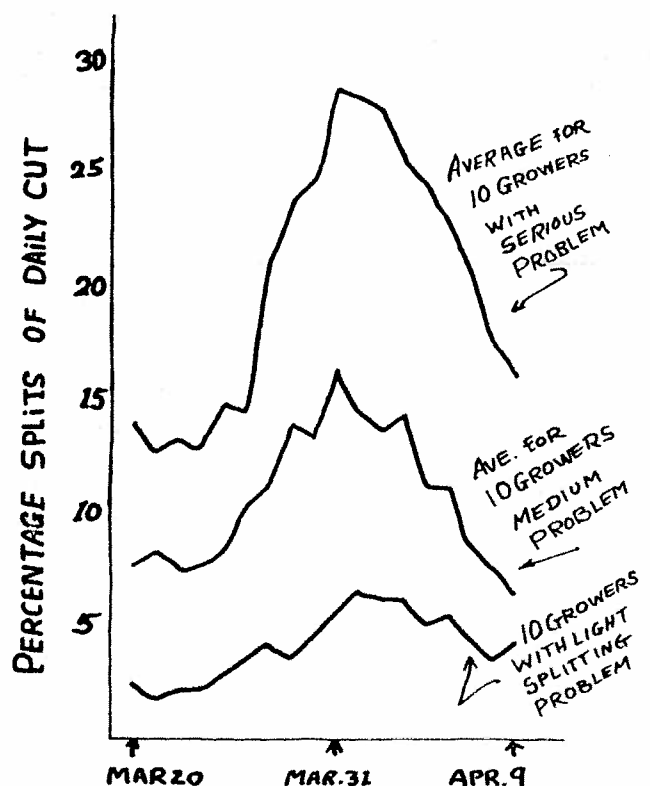
After personal interviews with these growers and careful study of the information obtained from them it was possible to classify growers into the following five categories according to the percentages of splits they produced:

1. Those who grow so warm that they do not have full flowers, hence few, if any splits. These growers may have reasonably good quality flowers, but usually they cut a high percentage of design grade flowers during late winter.

2. Those who heat to 58-60 degrees on cold days (all day long) and cool around 60 to 65 on sunny days. These growers had

very little splitting problem and high average quality.

3. Those in category 2 who during the first warm days (March 20 to 21) could not keep greenhouse temperatures down. These growers had high average quality but split a lot of Fancy Grade flowers during the 2-week period.



4. Those who do not heat on cold days in winter, or who heat to some point below 60 degrees, and who ventilate or cool to 60-65 degrees on sunny days (possibly only when the sun is out). These growers have had a continuous problem with calyx splitting, with those who run colder on dark days having the most problem.

5. Those in category 4 who also were caught with excessive greenhouse temperatures on March 20 and 21, possibly again March 26 and 27, when outside maximum reached 74 degrees. Growers in this group were cutting over 25% splits on March 31.

The information obtained by interview was not sufficient to place two of the growers in their respective categories. Both of these growers were cutting 25% splits or more on March 31.

## Weather 1960

Temperatures for February and March were highly unusual for Colorado. Extremely cold weather prevailed through most of February and the early half of March, with no warm days. The average Denver temperature for this period was 8 degrees below normal. The maximum outdoor temperature exceeded 50 degrees only three times in February and 5 times during the first 19 days of March. For one 12-day period the maximum did not exceed the freezing point. On Sunday, March 20, the outdoor maximum was 63° and on the following two days it rose to 68°. This set of weather conditions has not occurred in the previous eleven years, however warm days following shorter cold periods occur every year.

## From Wagner's Work 1953

The actual splitting of the calyx occurred from 1 to 12 days after calyx opening stage, with the average being 4.5 days. A stage of bud 2 to 6 days after calyx opening was the most susceptible to high temperatures. On the average for April and May, the calyx split 13 days before the flower was cut, with some calyxes splitting 18 days before and a few splitting as late as 9 days before the flowers were cut.

Wagner found also that the calyx must be full before it will split. Environmental conditions conducive to a full calyx have not been firmly established,

but the following are indicated: 1) a long period of cool temperatures (55-65°) with good light, and 2) day to day fluctuations of temperatures within the range of 50 to 65°. The indications are strong that fluctuating temperatures will fill the calyx faster than evenly controlled temperatures. Hanan (1957) found that there was a tendency toward hollow flowers when carnations were grown at controlled temperatures either too high or too low for the amount of light. Especially were the centers of the flowers hollow at 60° when light intensity was high. Neither Hanan (1958) nor Manring (1960) produced split calyxes under accurately controlled day temperatures. In one experiment Manring used a 60° temperature for cloudy days while the temperature was allowed to rise to 70° on sunny days. This temperature range, which was predominantly 65° and above, produced hollow flowers freely during winter and spring.

## Discussion

The seriousness of the splitting problem of late March and early April for the individual grower depended upon two factors: 1) the day temperature he maintained during February and March, and 2) the peak temperature in his greenhouses on March 20 and 21. This winter has been unusually cold and dark. Some growers could not maintain desirable greenhouse temperatures, day or night, during the long cold spell of late February. On occasional sunny days during this time, some growers let their houses get too warm (above 65°). The majority of growers experiencing a serious splitting problem either knowingly or unknowingly subjected their plants to variable day to day temperatures during February and March.

The second factor was the peak day temperatures allowed in greenhouses on March 20 and 21, the first warm days of the year. Calyxes that were full and in the tightest stage had a good chance to split, especially on the first day. If they were subjected to 12 or 15 degrees warmer than they were accustomed, a high percentage of them split. This means that a grower who had been controlling his day temperature at 60°F, could tolerate 70° with little splitting, but 75° split a large percentage of buds. Outside maximum temperatures in Denver were 63° on March 20 and 68° on March 21. Without

cooling pads, greenhouse temperatures were probably at least 10 degrees warmer. Some houses were 85° or higher on this Sunday. If evaporative pads were used during these two days and thereafter as needed, the problem was minimized.

Cooling pads and fan ventilation did not prevent calyx splitting unless they were used properly. In many cases they kept the splitting problem low. In others they may have accentuated the problem by helping to fill the calyx prior to the two warm days. The equipment used for cooling or ventilating had no relation to splitting problem of the individual grower. Whether he had a light, medium, or heavy production of splits depended upon how he used his heating, ventilating and cooling equipment and the degree of temperature control he accomplished.

## Conclusion

To minimize calyx splitting:

1. Carnation houses should be heated to a predetermined day temperature preferably by turning the thermostats to day temperature in early morning and back to night temperature at dark. The best way

to do this is by a central switch and dual thermostats. To allow houses to run at night temperature on cold days causes too great a spread in temperature between cold and warm days.

2. The optimum winter day temperature for Colorado is 58-60°F.

3. Houses that were heated to 60° on cold days and cooled to 65° on sunny days produced few splits during the March-April period, however quality of the flowers in these houses was good.

4. Carnations can be grown too cold as well as too warm.

## Literature cited

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