



EFFECT OF TEMPERATURE ON CARNATION CUTTING PRODUCTION

Dale Kiyota and Joe J. Hanan¹

The highest cutting production from four standard carnation varieties grown as mother block plants was obtained at 52F nights, heating to 60F days, with cooling starting at 70F (22.4 cuttings per sq.ft. per month, 2.6 plants per sq.ft.). The next best was 48F nights, 65 days (21.1 cuttings per sq.ft. per month, 5 months data) followed by 52 nights and 55 days (20.4) and last by 52F night and day (20.2 cuttings per sq.ft. per month). All treatments were cooled at 70F. Mother plants in gravel produced 2.6 more cuttings per sq.ft. per month than those in soil (19.8 per sq.ft. per month). There was no difference between variety, but there was a marked difference between temperature treatment and time of year, with lowest production in January. There were significant effects on fresh and dry weights of cuttings, but there was no statistically significant effects on rooting of cuttings produced under the temperature treatments.

Methods

The standard carnation varieties 'Scania', 'Elliott White', 'Crowley Sim' and 'White #1' were planted July 25, 1981, in randomized plots of 24 plants each, 2.6 plants per sq.ft., in soil and gravel, 2 plots per compartment, in the CSU Temperature House. Each bench had a buffer row at the ends. The temperature regimes established in the four compartments were, starting at the west end of the house:

| | Heat to at night: | Heat to during day: | Cooling started at: |
|----|----------------------|------------------------|------------------------|
| 1. | 48 F | 65 F | 70 F |
| 2. | 52 | 60 | 70 |
| 3. | 52 | 55 | 70 |
| 4. | 52 | 52 | 70 |

Mother plants in soil were watered as required while those in gravel were watered automatically by timer, both media using the CSU recommended fertilization injection rates. CO₂ was injected. The house was covered with one year old, Tedlar coated FRP. The plants were allowed to flower, and the first cutting flush discarded. Cuttings were

¹Undergraduate student and professor respectively.

harvested weekly December through April, 1982. Samples were taken for fresh and dry weights, and three times during the five month period, rooting trials were carried out.

Results and Discussion

There were differences in yield as the result of time and temperature treatment (Tables 1 and 2). The 52-60 temperature regime produced the highest number of cuttings (112 cuttings average per sq.ft.). This was followed by the 48-65 treatment. However, over the 25 years we have been using the Temperature House, the position of the two inner compartments (52-60 and 52-55) usually means a lower yield of about 10% due to shading. In that case, the 52-55 treatment would have out-produced the 48-65 treatment. The mother plants in the 52-52 treatment produced markedly fewer cuttings, despite the advantage of an end compartment.

Table 1: Total average monthly cutting production per plot of 24 plants of four standard carnation varieties planted July 25, 1981, and subjected to four temperature regimes. Mother plants allowed to flower and the first cutting flush discarded.

| Temperature regime (°F night-day) ¹ | Month | | | | | Average total (5 mon.) | |
|--|-------|-----|-----|-----|-----|------------------------------|------|
| | D. | J. | F. | M. | A. | | |
| 48 - 65 | 217 | 111 | 134 | 226 | 279 | 194 | 967 |
| 52 - 60 | 231 | 86 | 179 | 239 | 295 | 206 | 1030 |
| 52 - 55 | 203 | 60 | 160 | 265 | 254 | 188 | 942 |
| 52 - 52 | 193 | 77 | 145 | 284 | 233 | 186 | 932 |
| Mean ³ | 211 | 83 | 154 | 254 | 265 | | |

¹Day temperatures raised to those given, cooling in all treatments at 70F.

²Honestly significant difference at 95% probability = 18 on treatment means.

³Honestly significant difference at 95% probability = 21 on monthly means.

Honestly significant difference on interaction between monthly and treatment means at 95% level = 51.

Table 2: Average monthly cutting production per plant and per square foot of four standard carnation varieties planted July 25, 1981, and subjected to four temperature regimes. Mother plants allowed to flower and the first cutting flush discarded.

| Month | Temperature regime (°F night-day) ¹ | | | | | | | | Average per month | |
|----------------------------------|--|------------|-----------|------------|-----------|------------|-----------|------------|-------------------|------------|
| | 48-65 | | 52-60 | | 52-55 | | 52-55 | | | |
| | Per plant | Per sq.ft. | Per plant | Per sq.ft. | Per plant | Per sq.ft. | Per plant | Per sq.ft. | Per plant | Per sq.ft. |
| Dec. | 9.0 | 23.6 | 9.6 | 25.1 | 8.5 | 22.1 | 8.0 | 21.0 | 8.8 | 22.9 |
| Jan. | 4.6 | 12.1 | 3.6 | 9.3 | 2.5 | 6.5 | 3.2 | 8.4 | 3.5 | 9.0 |
| Feb. | 5.6 | 14.6 | 7.5 | 19.4 | 6.7 | 17.4 | 6.0 | 15.8 | 6.4 | 16.7 |
| Mar. | 9.4 | 24.6 | 10.0 | 26.0 | 11.0 | 28.8 | 11.8 | 30.9 | 10.6 | 27.6 |
| Apr. | 11.6 | 30.3 | 12.3 | 32.1 | 10.6 | 27.6 | 9.7 | 25.3 | 11.0 | 28.8 |
| Average per treatment per month | 8.1 | 21.1 | 8.6 | 22.4 | 7.8 | 20.4 | 7.8 | 20.2 | | |
| Average total cutting production | 40.3 | 105.1 | 42.9 | 112.0 | 39.3 | 102.4 | 38.8 | 101.3 | | |

¹All treatments cooled at 70F.

Work by Goldsberry (CFGA Bul. 164) showed that plants treated with elevated CO₂ produced 123 cuttings per sq.ft. total over a 12 month period, from planting, as contrasted to 118 with no CO₂ injected. The last temperature study on mother stock by Allstadt (CFGA Bul. 176) showed a temperature regime of 55 night and 75 days produced the greatest number of cuttings. But, the difference was not significantly different from 55-70 or 55-65. A regime of 55-80 definitely caused a reduction in yield. There was a higher cutting fresh weight when 55-65 was employed, with the greatest number of first crop flowers from cuttings produced in this temperature treatment.

There was a definite effect of temperature on cutting fresh and dry weight (Tables 3 and 4). Maximum fresh weight of cuttings was for those produced at 52-55 or 52-52 (7.1 and 7.5 grams respectively) with maximum dry weight from the 52-55 treatment (1.4 grams per cutting). Allstadt (CFGA Bul. 178) recommended a fresh weight of 10 to 15 grams per cutting with 6 to 8 leaf pairs. However, discussion with propagators indicated that 10 to 15 grams is too big, and that a range of 6 to 8 grams per cutting is probably more within reason. Cuttings produced in the 48-65 treatment had the lowest fresh weight (6.3 grams).

Table 3: Fresh weight (grams) of carnation cuttings from four standard varieties and subjected to four temperature regimes planted July 25, 1981. No significant difference between cuttings from plants grown in soil or in gravel, or between varieties.

| Temperature regime (°F night-day) ¹ | Variety | | | | Average for treatment ² |
|--|--------------|---------------|-------------|----------|------------------------------------|
| | Scania White | Elliott White | Crowley Sim | White #1 | |
| 48 - 65 | 6.3 | 6.4 | 6.3 | 6.3 | 6.3 |
| 52 - 60 | 6.6 | 6.7 | 7.1 | 6.3 | 6.7 |
| 52 - 55 | 7.0 | 7.1 | 7.5 | 6.9 | 7.1 |
| 52 - 52 | 7.5 | 7.1 | 7.9 | 7.4 | 7.5 |
| Average per variety | 6.8 | 6.8 | 7.2 | 6.7 | |

¹All treatments cooled at 70F.

²Honestly significant difference for 95% probability = 0.9 grams for treatment means.

Table 4: Dry weight (grams) of carnation cuttings from four standard varieties subjected to four temperature regimes. No significant difference between gravel or soil or between varieties.

| Temperature regime (°F night-day) ¹ | Month | | | | Average per treatment ² |
|--|-------|-----|-----|-----|------------------------------------|
| | J. | F. | M. | A. | |
| 48 - 65 | 1.8 | 0.9 | 0.8 | 0.8 | 1.1 |
| 52 - 60 | 1.7 | 0.9 | 0.8 | 0.9 | 1.1 |
| 52 - 55 | 2.8 | 1.1 | 0.8 | 1.0 | 1.4 |
| 52 - 52 | 1.8 | 1.1 | 0.9 | 1.0 | 1.2 |
| Average per month ³ | 2.0 | 1.0 | 0.8 | 0.9 | |

¹All treatments cooled at 70F. Honestly significant difference at 95% probability for interaction between temperature and time = 0.4 grams.

²Honestly significant difference, 95% level, for treatments = 0.2 grams.

³Honestly significant difference, 95% level, for time = 0.2 grams.

The three rooting trials showed no statistically significant effect of temperature regime on subsequent rooting. There was considerable difference between trials. The first trial, in January, had very poor rooting due to the fact that cuttings were removed too early, and there was a positional effect in the propagating bed. This was corrected in the next two trials, with Trial II showing an average rooting index of 4.14 (scale of 1 to 5 with 1 poorest), while Trial III, rooted in April-May, had an index of 3.69. In our estimation, as long as the cuttings have sufficient "health", and are handled properly, factors within the propagation bed, such as temperature, medium, misting, and light intensity, are likely to have a much greater effect than any reasonable temperature regime to which the mother plants might be subjected. There was no significant effect of mother plant growing medium on rooting, nor was there a significant difference between varieties in these tests.

Summary

Failure to raise the temperature during the day above the night temperature will have an adverse effect on cutting

production. Similarly, lowering the night temperature (48F), and attempting to compensate by raising the day temperature (65), is not completely successful. For flower production, Munoz and Holley (CFG A Bul. 267) found that

a lower night temperature can be partially off-set by a higher day temperature, but there is a major loss of color. Also, splitting the night temperature on standards in flower production does not appear to be viable (CFG A Bul. 361).