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SAVING FUEL WITH MINIATURE CARNATIONS

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The miniatures 'Georgia Ann', 'Tinkerbell', 'Elegance' and 'Corona' may be grown at 50° F during the first half of the night, reducing the temperature to 40° F from midnight to 7:00 A.M. without significant effect on flower quality or yield. Plants grown at 52/47 peaked in late March, while the plants grown at 50/40 had a much greater peak in early May. Production curves for 'Tinkerbell', 'Corona' and 'Elegance' were similar, but 'Georgia Ann' consistently peaked earlier and produced one extra crop the first year. The highest yield was obtained at split temperatures of 50/40. There were significant differences between cultivars as to yield and quality with 'Georgia Ann' producing twice as many stems per sq. ft. as 'Tinkerbell'.

Methods

The miniature carnation cultivars 'Georgia Ann', 'Tinkerbell', 'Elegance' and 'Corona' were planted three per sq. ft. on June 8, 1978, in 5 sq. ft. plots (15 plants per plot) in soil and in gravel raised benches. The plots were replicated in each bench in each of four identical compartments of the CSU Temperature House. All compartments were heated to 62° F during the day with ventilation starting at 75° F. CO_2 was injected to maintain approximately 500 ppm on bright days with no ventilation. The soil benches were watered as required, the gravel benches automatically once to 4 times daily, depending upon the season. Fertilizer, following CSU recommendations, was injected at each watering.

The plants were single pinched on July 3, 1978, with production beginning August 27. Flowers were cut below the second vegetative break. Beginning in the fall, as outside temperature become lower, the night temperatures in each compartment were set to maintain 48, 50, 52 and 54° F respectively, from nightfall to midnight. At midnight, the temperatures were allowed to drop to 43, 40, 47 and 44° F respectively until 7:00 A.M., when the temperatures were increased to the initial night temperature. At 8:00 A.M. the temperatures were raised to the day setting of 62° F. The treatments are summarized: 48/43, 50/40, 52/47 and 54/44.

A sample of ten stems was taken from each plot every four weeks and stem length, number of buds per stem, number of flowers per stem, and stem weight were recorded. The total number of stems cut was recorded on a weekly basis. A grading system was devised in order to obtain a mean value for flower quality: 1) Fancy — 5 to 6 open flowers, strong stem, good flower form. 2) Standard — 4 to 5 open flowers, acceptable stem strength. 3) Short — 3 to 4 open flowers, acceptable stem strength, and 4) Design — flowers having one or more of the faults such as fewer than 3 flowers, less than 15 inches in length, weak stems, bullheads, split calyces and slab sides. Each grade was assigned a number ranging from 5 for fancy to 2 for design, and the number of stems in each grade was multiplied by the grade value, accumulated, and divided by the total stems cut to obtain a mean grade for each plot. Records were terminated on May 27, 1979.

Results

There were differences in yield between the different split night temperatures (Table 1) and root media. Plants grown at 50/40 nights produced 20% more flowers than plants subjected to 52/47. There was a 10% higher production from plants established in gravel. Stems were significantly shorter and had fewer buds and flowers from plants grown at 52/47, with a tendency toward lower stem weights (Table 2). The numbers of open flowers per stem were not different in the various split night temperature treatments.

The night temperatures did not affect mean grade. However, there was marked difference according to the cultivar. 'Corona' had the highest mean grade (4.4), followed by 'Elegance', 'Georgia Ann' and 'Tinkerbell' with the lowest (3.8). Stems produced in soil had the highest mean grade.

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Table 1. Number of stems cut per square foot for four miniature carnation cultivars grown at four split night temperatures. Production from August 27, 1978, to May 27, 1979.

Split Night Temperature[a]	'Georgia Ann'	'Tinkerbell'	'Corona'	'Elegance'	Average
48°/43°F	73	29	36	51	47
50°/40°	79	41	53	49	55
52°/47°	66	37	35	38	44
54°/44°	70	37	36	43	46
Average	72	36	40	45	

[a]Higher temperature from sundown to midnight; lower temperature to 0700.

Table 2. Average stem length, fresh weight, and number of buds and flowers of four miniature carnation cultivars grown at four split night temperatures.

Split Night Temperature[a]	Stem Length (inches)	Fresh Weight (ounces)	Number of Buds and Flowers per Stem
48°/43°F	20.7	1.10	8.5
50°/40°	19.8	1.06	8.2
52°/47°	19.1	1.03	7.5
54°/44°	20.1	1.11	8.2

[a]Higher temperature from sundown to midnight; lower temperature to 0700.

There were no great differences in production cycles until late spring (Fig. 1). Plants grown at 52/47 peaked in late March while plants grown at 50/40 had a much greater peak in early May. Production of plants grown at 54/44 and 48/43 peaked in mid-April and late April, respectively. Production for 'Tinkerbell', 'Corona' and 'Elegance' were similar, but 'Georgia Ann' was considerably different (Fig. 2). 'Georgia Ann' consistently peaked earlier and produced one extra crop the first year compared to the other cultivars.

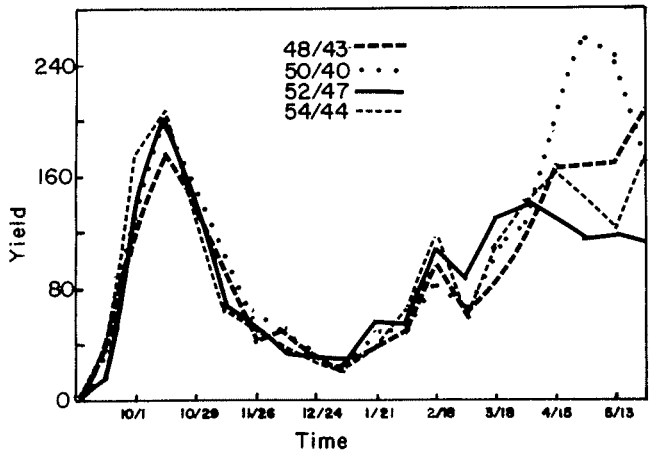

Figure 1: Biweekly production of 'Georgia Ann', 'Tinkerbell', 'Corona' and 'Elegance' miniature carnations grown at four split night temperatures. Curves represent production from 240 plants. Planting date was June 8, 1978. Pinching date was July 3, 1978. Split night temperatures caused few differences in timing until spring.

Discussion

The results confirm earlier data as to the considerable variability between cultivars of miniature carnations. Compared to standard carnations, miniatures are likely to react more on the basis of the particular variety. Secondly, temperature control for miniatures is not as critical as for

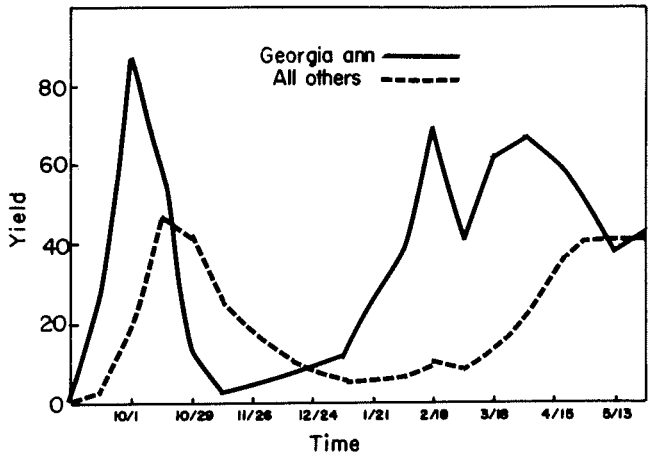

Figure 2: Average biweekly production of 'Georgia Ann' compared to the combined average biweekly production of 'Tinkerbell', 'Corona' and 'Elegance.' Curves represent an average production of 60 plants. Planting date was June 8, 1978. Pinching date was July 3, 1978. 'Georgia Ann' produced one more crop in the first year compared to the other cultivars.

standard varieties. Miniatures will tolerate higher, and lower, temperatures, whereas less than one or two degrees variation at night may cause serious difficulties of splitting and off-color on standards, particularly if the temperature is allowed to deviate for more than a few nights.

In this study, a 10°F drop at midnight increased yield as compared to a 5°F drop. Generally, the cooler split night temperature treatments (48/43 and 50/40) increased the numbers of flowers and buds, fresh weight and stem length compared to the warmer treatments (52/47 and 54/44). The optimal split night temperature was 50/40. However, the warmer temperatures were located in the two inner compartments of the temperature house, whereas the two cooler treatments were located at the west and east ends respectively. This undoubtedly had an effect due to differences in light availability. But previous

experiments have shown the differences due to compartment position range around 10% higher for the ends.

Steam condensate meters were installed in each compartment, and the amount of condensate utilized by each compartment during the night was determined. Unfortunately, the location of the compartments prevented any direct comparisons as to actual heat savings using split temperatures. We hope in the following winter, to compare compartments when maintained at identical temperatures, thereby obtaining a correction factor which can be used to compare energy consumption.

It is important to note that we deliberately raised the split temperatures to the initial night temperature prior to sunrise. Intuitively one might say that more energy will be utilized, but actual differences between energy required to raise temperatures 5° and 10° versus maintaining a given temperature and raising to 62° day have never been measured. We do not feel that the sun should be allowed to raise the temperature to 62° F. During the winter this will result in very low temperatures being maintained to late morning, or even through the entire day if cloudy. Based upon observations with standard carnations, such practice will usually result in poor quality and severe delay. Although miniatures may be tolerant, they might not be tolerant to that degree. Furthermore, we operated on the premise that maintaining good day temperatures may have offset the effect of low night temperatures, particularly by allowing maximum food production.