KEEPING LIFE OF CARNATIONS GROWN UNDER INFRARED AND FORCED-AIR HEAT

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Between June 1983 and May 1985 a study was conducted on the effects of forced-air and infrared heating systems on carnation production. Plant responses under the two heating systems were equivalent (1). We also evaluated keeping life of carnations grown under the two heating systems. We concluded there were no differences in keeping life of fresh or dry stored cut carnations.

Materials and Methods

Six cultivars of *Dianthus caryophyllus* L. were planted in raised benches of gravel or idealite in a fiberglass-covered greenhouse on 21 June 1983. The two-year experiment has been outlined in previous CGGA bulletins (407-409). Three miniature carnation cultivars, 'Cappello,' 'Etna,' and 'Georgia Ann,' and three standard cultivars, 'CSU Red,' 'Nora,' and 'White #1,' were utilized. There were three plots of 30 plants of each cultivar under each heating system. Flowers were cut and graded three times weekly according to industry standards.

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Two keeping life trials were conducted, utilizing fresh and dry-stored carnations. In the first trial, flowers were cut on 11 January 1985, graded, and placed in clean vases containing 200 ppm solution HQC (hydroxyquinoline citrate). The vases, each containing three stems of each cultivar, were placed in a post-harvest room with temperature at 16°C. Fluorescent lights, on between 0800 and 2200 hr, provided a level of 1.21 w/sq.m. Days of vase life were counted until browning was visible on petal edges. The flowers to be dry-stored were harvested 14 January 1985. After grading, they were wrapped in newspaper, then again in polyethylene plastic. The bundle was placed in a cooler at 36°F for one week. On 21 January 1985 these flowers were removed from the cooler and were treated in the same manner as those cut fresh.

The second trial was conducted in a similar manner to the first except the temperature in the post-harvest room was

kept at 21°C. Fresh-cut flowers were harvested 18 February 1985 and flowers to be dry-stored were cut and placed in the cooler 11 February 1985 and were taken to the post-harvest room 18 February 1985.

Data were analyzed using a one-way analysis of variance available in the MINITAB statistical package.

Results and Discussion

Results from the first trial indicated significantly better keeping life of fresh cut 'Georgia Ann' and 'Nora' grown in the IR system **(Table 1).** The reason that all three stems of 'Georgia Ann,' cut from the forced-air heated greenhouse, lasted only three days is unknown. In the case of 'Nora,' flowers cut from the IR treatment lasted five more days. The IR treated flowers kept an average of four more days compared to those grown in a forced, hot-air system.

Table 1. Means and standard deviations of the vase life, in days, of six fresh-cut cultivars of *Dianthus caryophyllus* L. grown in forced-air or infrared heat. Flowers were cut 11 January 1985, graded, and placed in 200 ppm HQC at 16°C. Values are averages of three flowers.

Cultivar	Forced-air Heat		Infrared Heat	
	x	s	x	s
'Cappello'	6.7	2.9	8.7	1.5
'Etna'	10.7	3.5	7.3	2.5
'Georgia Ann'*	3.0	0.0	13.0	1.0
'CSU Red'	7.3	4.0	11.7	2.3
'Nora'*	10.0	0.0	15.3	3.1
'White #1'	6.3	4.2	12.0	3.5
MEAN	7.3		11.3	

**Vase life averages of flowers grown under the two heating systems were statistically different at the 5 percent probability level.*

When the flowers were dry-stored for a week in the first trial, no significant differences in keeping life were found between the two heating systems **(Table 2).** In this case, the flowers harvested from the forced-air heated greenhouse kept an average of 3.1 days longer than those cut from the infrared heated house. Less variation among the three flowers in each vase was also noted **(Table 2).**

In the second trial, the flowers did not last as long as those in the first trial due to the higher keeping room temperature. Results from the fresh-cut flowers **(Table 3)** showed a significantly longer keeping life of 'White #1' produced in the forced heat-air system. However, the average keeping life of fresh-cut carnations grown in forced, hot-air heat was slightly less than those cut from plants grown in infrared heat.

With dry-stored flowers in the second run, 'Cappello' grown in an IR system had longer keeping life **(Table 4).** The keeping life of the flowers from the two heating systems were similar after storage for one week.

Conclusions

It is doubtful that the differences in this trial were, in fact, real. We suggest the differences result from factors other than the type of heating system.

Table 2. Means and standard deviations of the vase life, in days, of six dry-stored cultivars of *Dianthus caryophyllus* L. grown under either forced-air or infrared heat. Flowers were cut 14 January 1985, graded, and placed in dry storage at 2°C until 21 January 1985. Flowers were then removed from storage and placed in 200 ppm HQC at 16°C. Means are averages of three flowers.

Cultivar	Forced-air Heat		Infrared Heat	
	x	s	x	s
'Cappello'	12.0	4.0	9.0	1.0
'Etna'	11.7	3.8	9.0	2.0
'Georgia Ann'	13.0	1.7	10.7	4.0
'CSU Red'	16.0	0.0	13.3	2.5
'Nora'	18.0	1.7	12.3	9.9
'White #1'	12.0	3.6	10.0	7.8
MEAN	13.8		10.7	

Table 3. Means and standard deviations of the vase life, in days, of six fresh-cut cultivars of *Dianthus caryophyllus* L. grown in forced-air or infrared heat. Flowers were cut 18 February 1985, graded, and placed in 200 ppm HQC at 21°C. Means are averages of three flowers.

Cultivar	Forced-air Heat		Infrared Heat	
	x	s	x	s
'Cappello'	9.0	1.0	9.0	1.0
'Etna'	6.7	1.2	8.0	0.0
'Georgia Ann'	8.3	0.6	8.3	2.5
'CSU Red'	8.3	0.6	7.7	1.2
'Nora'	10.0	1.0	8.0	1.0
'White #1'*	9.3	1.2	7.0	0.0
MEAN	7.3		8.0	

**Vase life averages of flowers grown under the two heating systems were statistically different at the 5 percent probability level.*

Table 4. Means and standard deviations of the vase life, in days, of six cultivars of *Dianthus caryophyllus* L. grown under either forced-air or infrared heat. Flowers were cut 11 February 1985, graded, and placed in 200 ppm HQC at 21°C. Means are averages of three flowers.

Cultivar	Forced-air Heat		Infrared Heat	
	x	s	x	s
'Cappello'*	6.0	0.0	9.3	1.5
'Etna'	6.0	0.0	6.0	0.0
'Georgia Ann'	8.0	2.0	6.0	0.0
'CSU Red'	7.7	0.6	8.0	1.0
'Nora'	8.7	0.6	6.7	4.9
'White #1'	7.3	0.6	7.0	1.0
MEAN	7.3		7.2	

**Vase life averages of flowers grown under the two heating systems were statistically different at the 5 percent probability level.*

Literature Cited

1. *Panter, K.L. 1985. Responses of carnation and calceolaria to infrared and forced-air heat. Ph.D. dissertation. Colorado State University, Ft. Collins, CO.*

FORT COLLINS GREENHOUSE CLIMATOLOGICAL SUMMARY, BEGINNING DECEMBER 29, 1985, AND ENDING JANUARY 25, 1986. (See Bulletin 426 for details.)

	Week beginning							
	Dec. 29		Jan. 5		Jan. 12		Jan. 19	
	Day	Night	Day	Night	Day	Night	Day	Night
Average outside temperature (°F)	35.8	27.0	37.9	26.2	42.6	32.7	41.2	34.0
Maximum outside temperature (°F)	52.9	44.8	64.0	39.0	57.0	52.3	64.2	52.7
Minimum outside temperature (°F)	21.6	14.2	18.9	8.1	31.8	18.9	24.6	18.5
Degree-days of heating	102.2	133.0	94.9	135.8	78.4	113.1	83.3	108.5
Average hours in the period	8.3	15.7	8.5	17.7	8.7	15.3	7.5	15.4
Accumulated total solar radiation (MJ/sq.m.)	52.6	.7	54.7	.7	55.3	.4	56.1	.9
Average relative humidity (%)	49.7	62.6	55.3	77.0	45.7	63.0	38.2	54.2
Maximum relative humidity (%)	84.1	92.6	85.1	100.0	67.6	91.1	74.2	84.9
Minimum relative humidity (%)	10.4	22.4	11.3	33.3	23.6	32.0	15.1	22.8
Average absolute vapor pressure (mb)	3.6	3.1	4.3	3.7	4.2	3.7	3.4	3.6
Average wind speed (mph)	3.1	2.7	.9	.7	1.1	1.1	4.3	4.9
Maximum wind speed (mph)	43.6	36.9	15.4	19.5	30.4	23.7	31.1	45.9
Average CO_2 concentration (Pascal)	21.9	—	27.6	—	31.0	—	29.1	—
Accumulated gas consumption (cu.ft./sq.ft.)	2.8	9.0	2.1	8.7	1.6	7.6	2.4	8.4