Photo 4. From left to right: berries were sprayed with GA_3 at 20 ppm five days before bloom; beginning of bloom; 25% capfall, 50% capfall, 75% capfall; 100% capfall; and two days after bloom and just prior to shatter. Note that later sprays produced larger berries.

calyptras had fallen. In a second test, vines were sprayed with gibberellin at 40 ppm on May 24, after the shatter of berries following bloom. In a third test plot, vines received both of these treatments. The results at harvest on August 12 showed that berries sprayed at shatter were larger than those sprayed at bloom, but that the largest berries resulted when both sprays were applied (table 2; photo 3). Clusters sprayed at bloom were less compact than those sprayed at shatter, and the fewest berries per centimeter of primary rachis were produced by the multiple spray.

Timing

A third series of experiments concerned the timing of bloom sprays to produce looser clusters. Vines were sprayed about five days before bloom, at the initiation of capfall, at 25% capfall, 50% capfall, 75% capfall, 100% capfall, and two days later, just before shatter commenced. The results at harvest on August 16 showed that the optimum time for spraying was between 25 and 75% capfall. With earlier sprays there was less increase in berry size (photo 4) but adequate thinning occurred. Later sprays produced larger berries, but the degree of thinning was reduced, causing more compact clusters to be produced. These results show that there is considerable latitude during bloom, in which good loosening effects may be obtained along with good increases in berry size.

A fourth experiment was conducted to determine the optimum GA_3 concentration for berry size increase as well as cluster loosening when applied at full bloom (50% of calyptras fallen). Vines were sprayed on May 15 with GA_3 at 0, 2.5, 5, 10, 15, 20, or 40 ppm. At harvest time, August 10, berry weight and looseness were adequate when GA_3 applications ranged from 10 to 20 ppm. GA_3 at 2.5 ppm resulted in some increase in berry size and some loosening. There was sufficient loosening with GA_3 at 5 ppm but increase in berry size was small. There was considerable variation in berry size in clusters treated with GA_3 at 40 ppm and looseness in some cases was excessive. There was also considerable variation in amount of berry elongation among berries, and in many clusters there were an excessive number of shot berries.

Since this is the first year of testing prebloom thinning by hand followed with bloom spraying, further research is required before such techniques can be recommended for commercial use.

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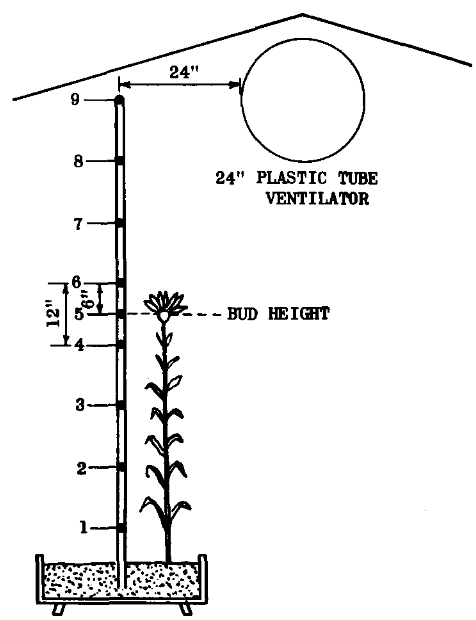
NEW SYSTEMS for greenhouse management have been introduced in recent years that necessitate changes in some of the traditional methods of growing greenhouse crops. Evaporative cooling. infra-red heating, elevated levels of CO_2, and positive ventilation may each, if improperly used, result in changes in plant response that are not necessarily to the grower's advantage. When one aspect of a plant's environment is altered, it is necessary to reevaluate the total production system to bring all factors back into balance.

In the spring of 1965, a greenhouse operator in the San Francisco Bay area reported carnation plants were reacting as they do when subjected to high night temperatures, followed by days of low light conditions (weak growth, widely spaced internodes, and loss of leaf curl). The thermostat was set at 55° F, the usual temperature setting for this time of year, and a seven-day hydrothermograph showed the daytime air temperature holding at a satisfactory level.

Positive ventilation

A major change in this greenhouse was the recent installation of a positive ventilating system. A plastic tube, 24 inches in diameter had been suspended from the

Locations of thermocouples on vertical rods in poly-tube-ventilated greenhouse (note 12-inch spacing, except for position 5, at bud height halfway between 4 and 6).



TEMPERATURE PATTERNS

in a poly-tube-ventilated greenhouse

Poly-tube ventilator in greenhouse.

ridge of the greenhouse. The tube was attached at one end to a box housing a 1/4 hp, 24-inch fan rated at 5,800 cfm. An arrangement of louvers in the box permitted either the recirculation of air inside the greenhouse, or the introduction of outside air. Two rows of holes, 2½ inches in diameter, spaced 24 inches apart, were aligned opposite each other down the length of the tube to introduce the moving air into the greenhouse. Each house was 20 ft wide, and the bottom of the ventilating tube was 6½ ft above the center walk. This system of ventilation obviously produced an air flow pattern different from the conventional side- and ridge-vent system. Although the thermostat settings were unchanged, plant growth responses suggested higher night temperatures.

To evaluate the effects of poly-tube ventilation upon night temperature patterns, an experiment was devised to record air temperature at various levels in the house. Two rods, carrying thermocouples spaced at 12-inch intervals, were inserted into raised beds; one in a house ventilated by the poly-tube method and one in a house with conventional ridge ventilation. The rods were located approximately 6 ft from the east side and 40 ft in from the north end of each house. The sketch indicates the spacing of the nine thermocouples relative to the crop (note thermocouple 5 located at bud height halfway between 4 and 6).

For temperature measurements, wires leading to the appropriate thermocouples were connected to a galvanometer and readings were taken. Temperatures were recorded over a period of several days, but primarily at night, when steam was circulating through the heating pipes.

Temperature data

The inside temperature, recorded at the top of the table, refers to a dry-bulb reading taken approximately 3½ ft above the ground near the thermostat in the poly-tube-ventilated greenhouse.

Some general observations from this table comparing the two ventilation systems, include a notation that the air temperature at soil level (position 1) was from 1.5° to 5.5° F warmer in the poly-tube-ventilated house than the air in the other house. Of greater interest, however, is the pattern of temperature differentials at flower bud height (position 5): the temperature of the house with positive ventilation varied from 0° to 4.5° F warmer, averaging 2.6° F higher than the other house with the same thermostat setting.

As a result of this study, the grower reduced the thermostat setting to 52° F in the poly-tube-vented greenhouses to compensate for the increased "air mix" and the higher temperature obtained under this system.

TEMPERATURE RECORDINGS UNDER TWO GREENHOUSE VENTILATING SYSTEMS
(Thermostat set at 55° F in both greenhouses)

Date	4/9/65	4/9	4/9	4/9	4/10	4/10	4/11	4/15	4/29	4/30
Hour	1500	1530	1605	1635	1930	2230	0001	2350	2320	0045
Light condition	Rain	Rain	Rain	Rain, high wind	Clear, slight wind	Clear, light wind	Clear, vy lt wind	Rain	Clear	Clear
Outside temp (°F)	50.5	51.0	50.0	52.0	47.0	44.5	44.5	56.0	52.5	49.0
Inside temp (°F) (dry bulb)	55.0	53.0	57.0	56.0	53.0	58.0	60.0	57.5	55.0	53.0
Recording position	WITH POLY-TUBE VENTILATION IN OPERATION									
1	58.0	54.8	56.0	56.5	55.5	56.5	57.5	58.0	56.3	
2	59.0	54.0	57.2	56.5	55.5	57.0	58.0	58.0	56.0	
3	60.0	54.0	58.5	57.0	55.5	57.0	58.2	58.0	55.8	
4	62.0	54.0	59.0	57.2	55.2	58.0	58.8	58.0	55.5	
5*	59.0	53.5	58.5	55.0	55.5	58.0	59.0	57.5	55.2	
6	59.0	53.5	58.5	56.5	55.2	58.0	58.5	58.0	55.5	
7	58.0	53.0	58.0	56.0	55.5	58.0	58.8	58.0	55.2	
8	57.0	53.5	57.5	55.5	55.5	57.5	58.0	58.0	55.0	
9	50.5	53.8	57.0	55.0	54.2	56.2	56.5	58.0	55.0	
Recording position	WITHOUT POSITIVE VENTILATION									
1	52.5	51.5	54.5	55.0	52.5	52.5	54.0	56.8	55.3	54.0
2	53.5	51.5	56.0	55.8	53.0	53.2	54.8	56.5	54.2	52.2
3	56.0	51.0	57.8	56.5	53.2	54.0	55.8	56.2	53.5	52.0
4	55.5	50.8	58.0	56.5	53.5	55.0	56.2	56.1	53.0	51.5
5*	54.5	50.0	58.0	55.0	53.8	55.0	56.5	56.0	53.2	51.5
6	55.0	50.2	57.5	56.0	53.5	55.0	56.2	56.0	53.2	51.5
7	55.5	51.0	58.5	56.8	53.5	55.0	56.0	56.0	53.5	52.0
8	56.5	52.5	59.0	58.0	53.8	55.0	56.8	56.0	54.0	52.1
9	57.0	53.0	60.0	58.5	54.0	55.0	56.9	56.0	54.0	52.0

**Position 5 is at bud height, six inches from 4 and 6.*

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Woodside Nurseries Co., Redwood City, designed and installed the system involved in these studies.