ing the period of highest temperature. The greatest increases achieved, throughout the season, while the air temperature was above 90°F, were two rises to more than 60 per cent. These occurred during the late afternoon just prior to termination of sprinkling and were exceptions to the general situation.

A summary of results for the 1969 season is shown in the table. The temperatures indicated are air temperatures. These data suggest that air temperature due to sprinkling is usually depressed by 6 to 10 degrees and humidity increased by 10 to 20 per cent. This has been the experience over the past three seasons.

Plant temperature changes

Plant temperatures (leaf tissue and grape berry temperatures) are generally depressed by 15 to 25 degrees and 10 to 13 degrees respectively. Since the grape berry is the end product of vineyard operations, study has been concentrated on measuring the temperature of the berries (graph 3). Measurements of berry tissue in 1969 revealed that whenever sprinklers were in operation throughout the season, berry temperatures seldom exceeded 90°F; and in those three or four instances where 90°F was exceeded, the deviation was less than 0.5°F.

As previously stated, experienced growers believe that 90°F is the optimum temperature for the growth and development of both Tokay and wine variety grapes. Using this as base data, radio control equipment set at 90°F was used during the 1968 and 1969 seasons to start the sprinklers. Recording instruments were started at 88°F.

During the 1968 tests the sprinklers remained in operation until the air temperature outside the test areas dropped below 90°F. While the sprinklers started, as a general rule, between 10:00 and 11:00 a.m., they often continued until 8:00 p.m. or after. By the end of the season, two varieties of the wine variety block and the Tokay plot had developed serious *Botrytis cinerea* rot problems. During 1969, the tests started at the 90°F threshold but terminated at 6:00 p.m. Sprinkler shut-down was accomplished by an electric time clock. The two wine grape varieties, susceptible to rot during 1968, continued to show heavy *Botrytis* rot damage. The Tokay plot contained far less bunch rot than in 1968. It is now believed an earlier shut-off would be desirable, and that variety response to this technique may be a genetic factor not yet evaluated.

Before vineyard cooling will be widely accepted, it must meet two specific criteria: *first,* the cost must be minimal; *second,* an increase in yield or an increase in the quality of product should result.

Using 1 to 1.5 cents per horsepower-hour as the cost of sprinkling, and keeping in mind that sprinklers operate only 10 minutes in an hour, the cost of this technique would seldom, if ever, exceed $10.00 per acre per year.

In the 1967 and 1968 tests, the Tokay vineyard tended toward higher yields. However, these were not critically evaluated, hence remain a trend. Wine grapes, on the other hand, have not indicated a yield advantage. However, fruit quality, measured by pH, sugar/acid ratio, and total acidity, tends to be slightly better with some varieties when crop cooling is practiced. The true test for the wine varieties lies in the quality of wine produced.

Still another consideration lies in the application of this technique. In some areas of California it may be possible to change the environment into one more suitable to the production of specific crops—or to eliminate a predictable warm period limiting the quantity or quality of crops presently grown. For example, modifications possible in some areas of the San Joaquin Valley appear capable of producing growing conditions approximating those of the coastal valleys of California. In the desert areas, early crop production is limited by the rapid increase in daytime temperatures during the springtime. Adaptation of evaporation cooling may suppress the rate of rise sufficiently to permit satisfactory crop production.

Both of these examples point out alternatives which could be used when specific crop demands exceed availibility because of limited growing sites, or maximum production in ideally suited areas.

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ROSE PLANTS may be infected with virus even when symptoms are not visible. Various growth abnormalities and color patterns have been associated with virus infection. Despite their demonstrated presence, factual data have not been available to demonstrate the effects of virus on plant growth, survival or flowering.

Heat treatments were used to obtain rose plants free of Prunus ring spot virus. Sufficient quantities of heat treated Rosa "Dr. Huey" understock, and budwood of Chrysler Imperial were available in 1966-67 to begin studies on the influence of virus on performance of the plants in the nursery, and in the landscape.

Nursery performance

The plants were propagated by a nursery in their commercial rose fields during the 1967–68 growing seasons. Three combinations of scion and stock were made but only two were compared—(1) non-heat-treated scion and stock, vs. (2) heat-treated stock and virus free scions. Indexing for virus on "shiro-fugen" flowering cherry showed none of the plants in the latter combination to have virus while those of the first combination were 100 per cent infected.

The plants were harvested in December, 1968 and graded. Composite results were as follows:

Treatment	Per cent survival to harvest	Grade distribution per cent of original planting		
		#1	#1½	#2
Heat treated "virus free"	97	57.6	21.4	11.0
Non-heat-treated	89	50.2	22.4	11.0

The source of the budwood influenced the results. The non-heat-treated budwood came from six sources that were identified throughout the study, five of them from Davis. All these showed visual symptoms of virus. The variation in results is shown by these data:

Non-heat-treated budwood source	Per cent survival to harvest	Grade distribution per cent of original planting		
		#1	#1½	#2
Source 1 (Davis)	94.0	52.0	22.0	10.6
Source 3 (Davis)	81.4	39.4	23.4	14.0
Source 6 (Wasco)	92.6	64.6	15.4	10.6

A preliminary report on

VIRUS-FREE ROSE
cv. CHRYSLER IMPERIAL

The availability of "clean" buds permitted limited observations on the effect of placing clean buds on infected understock. This was not part of the comparison above, however enough plants were budded to this combination to indicate the following effects of placing clean buds on infected stock:

Survival to harvest—96.0 per cent
Grade #1—61.6 per cent of original planting
Grade #1½—25.0 per cent of original planting
Grade #2—7.0 per cent of original planting

Plants from both combinations were planted in the landscape at six locations throughout California. Plants budded from the Davis sources were used. Paired plants of grade 1 and 2 were planted at each location during the winter of 1969. Throughout the summer, data were collected on the number of flowers, the time of flowering and the weight of the flowering shoot. (Data from two of the six locations were not usable in this preliminary analysis because delayed planting resulted in plant mortality and upset of normal flowering).

Length of harvest

The length of the harvest, and the method of removing the flowers varied. At Davis and Bakersfield, the stem was cut to the lowest 5-leaflet leaf, and the entire stem weighed; and at Ontario and Wasco, only the flower was removed (thus the latter locations reported many more flowers). Number of flowers were as follows:

NUMBERS OF FLOWERS AT FOUR LOCATIONS

Planting location	Grade 1 plants		Grade 2 plants	
	Heat treated	Non-heat treated	Heat treated	Non-heat treated
Ontario	77	65	44	45
Wasco	170	148	186	204
Bakersfield	44	45	34	32
Davis	55	51	45	32
Average	87	77	78	78

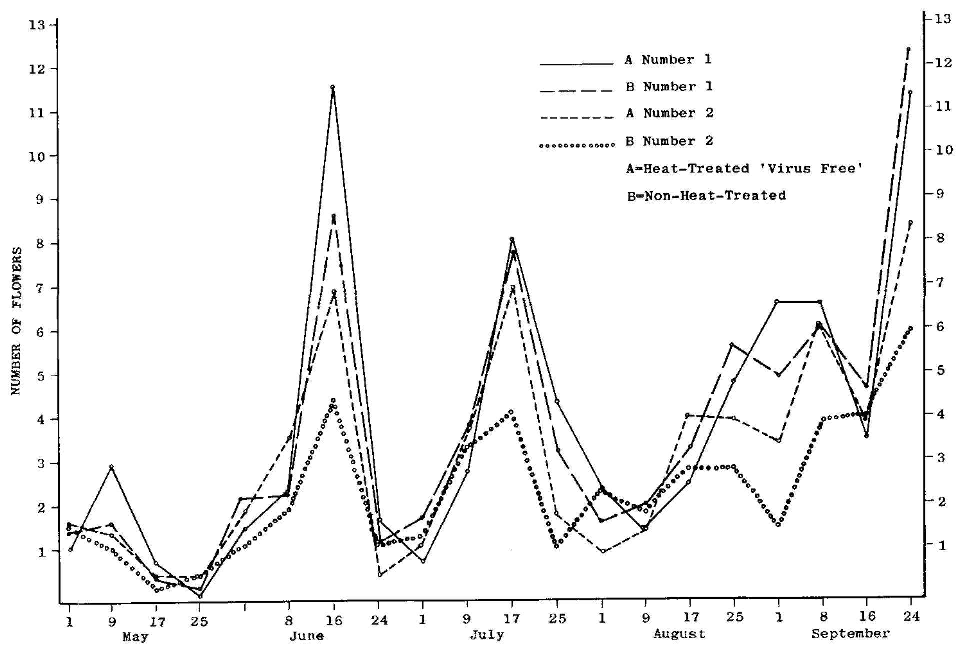
The weight of the stem at flowering at Davis and Bakersfield were as follows:

Location	Grade 1		Grade 2	
	Heat treated	Non-heat treated	Heat treated	Non-heat treated
	gr	gr	gr	gr
Davis	14.8	14.8	15.2	13.0
Bakersfield	13.0	13.2	13.9	13.4

Flowering dates at Davis are shown in the graph. The variability between plants in producing flowers are indicated by these data on coefficient of variability:

Planting location	Grade 1 plants		Grade 2 plants	
	Heat treated	Non-heat treated	Heat treated	Non-heat treated
Wasco, Calif.	23.5	23.1	16.0	14.0
showing virus symptoms	—	22.3	—	—
not showing virus symptoms	—	25.9	—	—
Bakersfield	27.6	38.9	14.8	23.2
Davis	19.6	17.1	13.5	11.6

AVERAGE NUMBER OF FLOWERS PER ROSE PLANT (CHRYSLER IMPERIAL) PER WEEK 1969, DAVIS



Conclusions would be premature, however, there are indications of slightly superior performance of heat treated "virus free" plants. Instances where the reverse was true appeared frequently, however, not only between test sites, but between the matched pairs of plants at each test location.

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