

USING ICE IN CONTAINERS TO MAINTAIN ROSE BUD TEMPERATURES

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California-grown 'Forever Yours' rose buds occasionally arrive in eastern markets partially open and/or with an unattractive blue color. These are symptoms of senescence and the most probable cause is poor temperature management in transit.

Most rose shippers place 8 to 12 pounds of crushed ice near the center of rose containers. Buds may be packed at ambient temperature or with varying degrees of cooling.

To test the effectiveness of ice in maintaining bud temperatures, three standard containers lined with ½-inch Styrofoam® sheets were subjected to the following treatments¹: 1) buds cooled to 41° F. (5° C.), packed with 12 pounds of ice; 2) buds packed at 68° F. (20° C.) with 12 pounds of ice; and 3) buds cooled to 41° F. (5° C.), packed without ice. Thermocouples were placed as follows: 1) in the air adjacent to the

container; 2) in air near the bottom center inside the container; 3) in air above the ice near the top center inside the container; 4) in buds near the bottom of the container; and 5) in buds at the top of the container. All were then held at room temperature—70° to 75° F. (21° to 24° C.). Temperatures were recorded for 24 hours and the experiment was conducted twice.

When buds were held overnight at 41° F. then packed with ice, their temperatures rose continuously from the time the container was closed (figure 1). After 8 hours, the bottom bud was slightly cooler than the bud in the top of the box, indicating that cold air settled at the bottom of the container. The air temperature underneath the ice at the center rose only slightly during the first 8 hours, then rose rapidly thereafter, indicating that most of the ice had melted after 8 to 10 hours. Bud condition in this container was considered acceptable at the end of the experiment, although there was slight blueing and opening.

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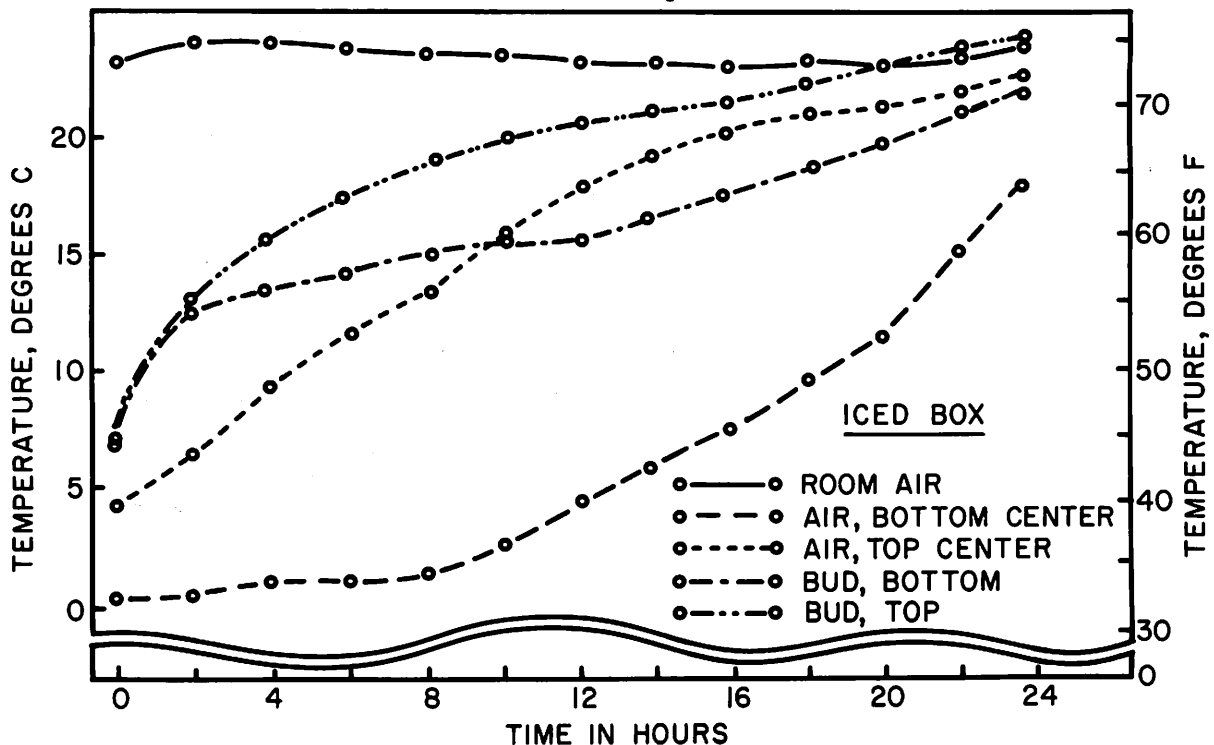


Figure 1. Warming rates at various positions in a packed container of 'Forever Yours' rose buds where the buds were cooled to 41° F. (5° C.), then packed with 12 pounds crushed ice in the center of the container.

When buds were packed warm—about 68° F.—with ice (figure 2), there was a sharp drop in air temperature for 2 hours in the bottom center of the container. Thereafter, the temperature rose progressively, indicating that the ice was gone. The air temperature in the top of the container showed little cooling effect due to melting of the ice. There was a slight initial drop in bud temperature in the bottom of the container followed by a rapid rise after 12 hours. This indicates that the refrigeration effect from the melting ice was barely adequate to maintain bud temperatures and was of no value in cooling the buds. This is shown also by the temperature of the bud in the top of the container, where there was a sharp rise in temperature when the ice was melting most rapidly. Approximately one-third of the buds in this container were discarded at the end of the experiment. The other two-thirds were considered salable but of reduced quality.

When cooled buds were packed without ice, temperatures in all positions rose immediately and

rapidly (figure 3). There was a slight air temperature lag in the bottom center of the container because the cool buds were acting as a refrigerant. This effect can be explained on the basis of time required for heat to transfer from the surrounding air through the container and product mass. The buds in this container were excessively blue and had no value at the end of the experiment.

The data presented here emphasize three points: 1) rose buds should be cooled before packing; 2) ice, in the amounts currently used, can retard warming of the buds if the container is not placed in a warm environment; and 3) ice has no measurable value for cooling buds that are packed warm.

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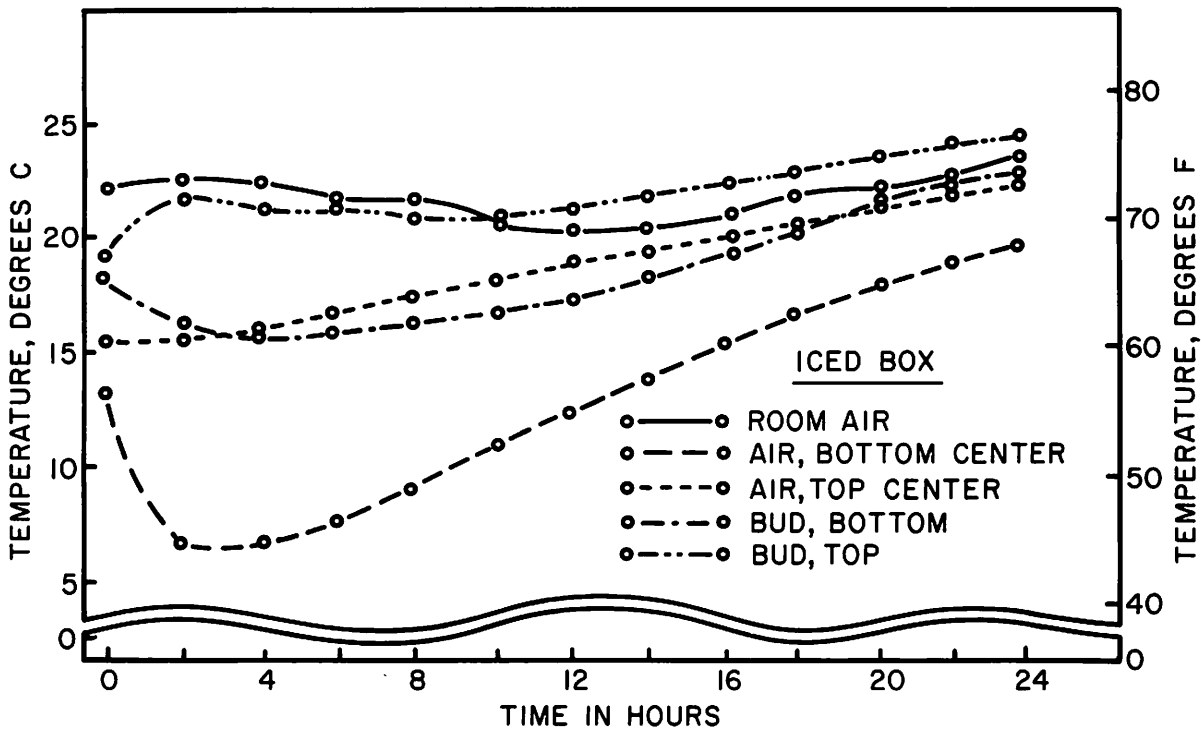


Figure 2. Warming rates at various positions in a packed container of 'Forever Yours' rose buds where the buds were packed warm—68° F. (20° C.)—but with 12 pounds of crushed ice in the center of the container.

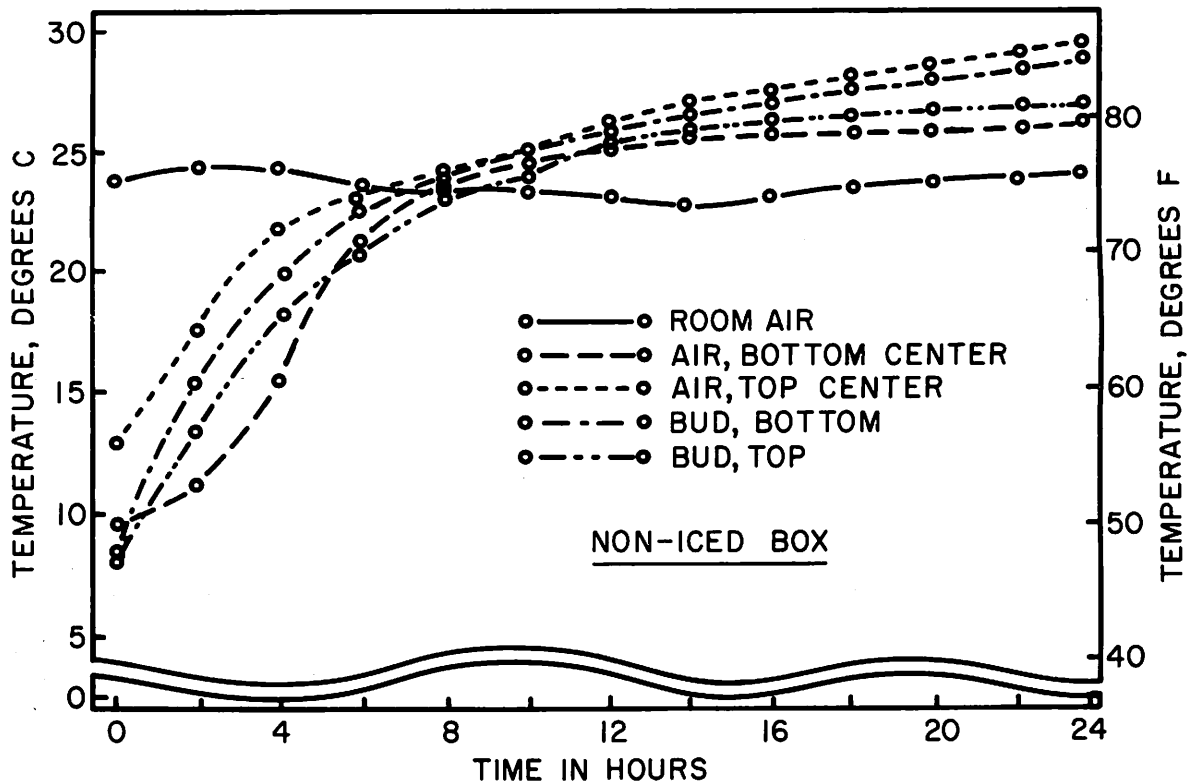


Figure 3. Warming rates at various positions in a packed container of 'Forever Yours' rose buds where the buds were cooled to 41° F. (5° C.), then packed without ice in the container.