

FORCED-AIR, PRE-COOLING METHODS FOR CUT FLOWERS — REPORT FROM THE 1977 WESTERN REGIONAL, ROSES, INC. MEETING, MONTEREY

Joe J. Hanan

Farm Advisor Delbert S. Farnham and Agricultural Engineer, James Thompson, reported on studies of temperatures in cut-flower boxes and pre-cooling. Earlier work by Dr. Maxie had shown that temperatures in boxes can be quite variable despite the use of crushed ice. Present boxes are made to keep flowers cool or hot, depending upon the temperature at which packed for shipment. If flowers are not cooled prior to packing, temperatures inside boxes will

never reach the temperature of ice in the box. Respiratory rates can reach very high levels if temperatures are not controlled. Even if the boxes are left open in a cooler, or stored at 32°F prior to shipping, internal temperatures of 32°F will not be achieved until several (8 to 12) hours after packaging. The longer the flowers remain at high temperatures, the greater the tendency to "heat", and the more likely problems will result.

Packed boxes of cut-flowers can be cooled with forced-air in less than one hour with relatively simple equipment. Work is being carried out to design boxes with holes which can be closed after pre-cooling is completed. Dr. Thompson showed one set-up for two boxes in which a small suction fan pulled air through the boxes while in a refrigerator. Boxes can be filled prior to pre-cooling, but flowers cannot be surrounded with an impermeable plastic layer or paper. Crushed ice can still be utilized to help maintain desired temperatures should the boxes be shipped by bus. Pre-cooling helps reduce ice loss, and paper to absorb moisture may not be necessary if the flowers are properly pre-cooled. Humidity should be maintained between 90 and 95 percent, with air-flows less than 500 feet per minute. Lower relative humidities and higher rates of air movement will tend to increase petal damage from drying.

An empirical formula was presented for calculating refrigeration requirements:

$$\frac{(\text{Box/hr}) (\text{weight/box}) (\text{Initial temperature} - \text{final temperature})}{(\text{Efficiency Factor})}$$

In an example:

$$\frac{(42 \text{ boxes}) (50 \text{ pounds}) (80-32)}{(0.7 \times 12,000 \text{ BTU/hr})} = 14 \text{ to } 15 \text{ tons refrigeration.}$$

Obviously, a tremendous amount of heat is being removed in a short time as contrasted to existing refrigeration methods. Many common refrigerators may have less than 5 tons refrigeration, the heat being removed over a longer period. Attention will have to be given to evaporative coil surfaces to ensure that there is sufficient coil cooling area. Otherwise, if the coils become too cold, condensation on the coils will remove water and decrease relative humidity.

Chrysanthemums are the hardest to cool when packed in boxes, but cooling is still quite rapid. Holes in the flower boxes should comprise 4 to 5 percent of the total, outer surface area of the box in order to permit adequate air flow. If the boxes are shipped by refrigerated truck, no ice is necessary. Studies are continuing on machines for cooling several boxes at one time, and there needs to be additional studies on temperature variations in refrigerators and trucks. Preliminary studies have shown considerable variation, depending upon box arrangement in the cooled space.

The question was raised about using jellied ice, dry ice, or very cold ice for boxes. Dr. Thompson pointed out that it is the melting of ice which removes heat, and there would be very little effect to using very cold ice. Also, precautions would have to be taken to prevent freeze damage. There are instruments available which allow one to probe boxes for temperature measurements, and one company on the West Coast indicated they may be manufacturing a throw-away device which would indicate, at the end of a shipping period, whether the flowers had been subjected to temperature extremes.

It appears that the industry could do much to improve flower handling procedures, and the California work indicates that many problems arise from carelessness and inadequate knowledge of temperature patterns and conditions in cut-flower boxes. With the continuing increase in truck shipments, the opportunity is offered the industry to institute precise handling methods and good quality control procedures that should help them in competition with imports.