

Blueing of Better Times Roses

by
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Better Times roses hardened in water for 3 to 24 hours became blue after 12-15 days at 31°F. Roses packaged directly from the plants and placed at 31°F retained their red color and retained the same quality and life as fresh cut roses after 12 to 15 days at 31°F. This blueing is accompanied by reduced respiration and is associated with some undetermined relationship of the water absorbed before packing.

Selection of Flowers for Treatment

Better Times roses were cut each morning at the Cornell University greenhouses. They were carefully graded to eliminate all flowers having traces of blue color. This eliminated half of the daily cut. The large percentage of flowers having traces of blue color when cut may account for some of the discrepancies in the temperature conditioning results of commercial growers.

The roses were packaged in Cellophane or in the "Leverpak" drums and placed at 31°F within an hour after cutting. Roses were hardened in water at 40°F for the required interval and then packaged. The response to hardening was similar for roses obtained from Elmira Floral Products, Incorporated, Elmira, New York.

Length of Hardening Period

Blue color developed in Better Times roses during low temperature treatment as a result of hardening for periods as short as three hours. In a number of trials conducted from August, 1951 to March, 1952, all roses hardened in water for three or more hours before packaging developed a blue color in the petals after 12 to 15 days at 31°F. Data presented in Table 1 show that flowers in water three hours or longer blue; those hardened 2 hours or less remained the same color as fresh cut flowers. Roses packaged directly from the plants retained their red color and could not be distinguished from fresh cut flowers after 12 to 15 days at 31°F. The longer the period of hardening, the more severe is the development of blue color.

To determine the length of time necessary for the development of blue at the low temperature Better Times roses were removed from 31°F after 7, 11, 13 and 16 days. Traces of blue showed in hardened flowers in 11 days, and after 13 and 16 days of low temperature conditioning, the blue color was pronounced as compared to fresh cut flowers or flowers packaged directly from the plant. These data show that hardened roses should not be held more than 7 to 8 days or blue color will develop. Roses placed in nearly air tight packs immediately after cutting and held at 31°, 36° and 40°F for 15 days retained their color. At 40°F both hardened and unhardened roses were extremely blue. The room temperature life after 15 days conditioning was 4 days for 31°F., 3 days for 36°F and 1 day for 40°F.

Drying Following Hardening

After hardening, several groups of Better Times roses were exposed to air from a circulating fan in the refrigerator at 31°F and at 40°F.

Table 1. The effect of hardening before packaging on the development of blue color in Better Times roses at 31°F

Date cut	Days held	Hardening treatment	Results
9/17/51	16	none	red
		3 hours	slightly blue
		24 hours	severely blue
2/7/52	15	none	red
		2 hours	red
		4 hours	traces of blue
		6 hours	blue
		12 hours	more severely blue
		24 hours	severely blue
2/26/52	20	none	red
		3 hours	traces of blue
		12 hours	blue
3/8/52	15	none	red
		2 hours	red - traces of blue
		4 hours	slightly blue
		6 hours	blue
Average of 6 to 24 flowers per treatment.			

Table 2. Holding period necessary for development of blue color of Better Times roses at 31°F.

Date cut	Days held	Hardening treatment	Results
10/3/51	7	none	red
		8 hours	red
		24 hours	red
	11	none	red
		8 hours	trace of blue
		24 hours	trace of blue
	13	none	red
		8 hours	slightly blue
		24 hours	blue
	16	none	red
		8 hours	blue
		24 hours	severely blue
Fifteen flowers per treatment.			

After the flowers had lost approximately 50% of the water absorbed during hardening, they were packaged and held at 31°F for 15 days. Flowers held at low temperature after hardening and reducing the water content, blueed as much as those not dried after hardening.

Hardening Reduces Respiration

The following experiments show that hardened roses respire less than those not hardened before packing.

To measure respiration hardened and unhardened roses were placed in sealed mason jars and kept at 31°F. After 13 to 17 days, samples of gas were removed from the containers and the percentage of oxygen and carbon dioxide was determined. As indicated in Table 3, unhardened roses produced more carbon dioxide than hardened flowers showing they respired more than hardened flowers.

In another test, carbon dioxide-free air was then passed over the roses and the carbon dioxide given off by the roses was absorbed in alkali. Respiration of the unhardened flowers was also greater than for roses hardened in water for 24 hours before storage.

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The water absorbed before packaging is responsible, in some undetermined manner, for the development of blue color during temperature conditioning.

Table 3. Concentration of oxygen and carbon dioxide from Better Times roses packaged directly or hardened before holding at 31°F.

Date cut	Days held	Hardening treatment	Gas concentration at end of holding period	
			% CO ₂	% O ₂
6/4/52	17	none	19.4	1.4
		24 hours	15.8	2.8
6/24/52	13	none	16.2	1.8
		24 hours	12.7	5.0
7/19/52	14	none	17.6	1.4
		24 hours	15.9	2.3
Average of 5 containers of 5 flowers each.				

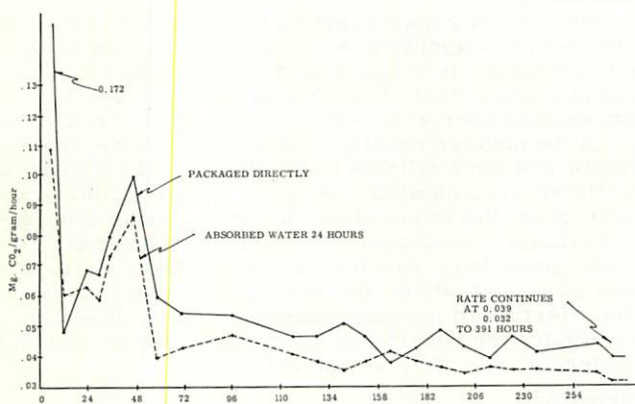


FIG. 1 - RATE OF RESPIRATION OF ROSES (BETTER TIMES) PACKAGED DIRECTLY OR THAT ABSORBED WATER FOR 24 HOURS BEFORE HOLDING AT 32°F. CONDITIONED 6/3/52 - 6/20/52

Oxygen Deficiency

In the experiments with flowers held in gas-tight containers, oxygen may have become deficient as suggested by the presence of an aldehydic odor characteristic of fermentation or anaerobic respiration. A group of unhardened roses were packaged in sealed mason jars and gas mixtures of oxygen and nitrogen were passed into the containers to establish oxygen levels of 0, 5, 10, 15 and normal 20%. In all of the containers where oxygen was 15% or less at the beginning of the storage period, anaerobic respiration had taken place as indicated by the aldehydic odor. This experiment suggests that oxygen may easily become limiting in containers that are absolutely gas-tight. However, the grower should remember that the container must be sealed relatively tight to prevent excessive moisture loss. Additional work is necessary to determine the optimum concentrations of oxygen and carbon dioxide in the storage container.

Recommended Procedure

To insure successful holding of Better Times roses, the flowers should be packaged directly from the plants, never placed in water. The grower may object to this requirement because of the danger of excessive wilting of the roses from the time of cutting until packaging. Speed in handling is essential and this may require a reorganization of the handling procedures. To prevent excessive moisture loss in the greenhouse, the flowers may be placed in trays of cracked ice and covered. The ice will cool the flowers and raise the humidity thus reducing the rate of evaporation from the flower.

If the roses must be placed in water before pack-

aging (not recommended) the hardening period should not exceed one hour, and if the flowers are hardened for more than two hours, they should not be held longer than 7 days at 31°F or less time at higher temperatures.
