DOES CURING CALIFORNIA SWEET POTATOES PAY?

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Properly cured sweet potatoes loose less weight, have a higher sugar content, and are less susceptible to disease organisms (with the exception of black rot) than are uncured sweet potatoes. This has been shown by many people over the years but how much weight savings can a grower expect and does the savings pay for the cost and nuisance of curing?

Uncured sweet potatoes have weight loss rates of 1.5% to 4% per month. The variation in rate is caused by difference in the level of harvest injury and differences between cultivars. Weight loss is caused primarily by water escaping through the surface of the root. If scuffing at harvest removes some skin, the sweet potatoe's natural moisture barrier, the sweet potato will be more susceptible to moisture loss during storage. The Jewel variety has only moderate potential for weight loss compared with varieties like Travis and Centennial.

The curing process allows the sweet potato to heal harvest wounds and retard the rate of moisture loss during storage. Well cured sweet potatoes loose only 1% to 2% of their weight per month.

California climatic conditions and harvest practices tend to favor low levels of weight loss in storage. Several years ago we conducted a test of cured versus uncured storage of Garnet variety sweet potatoes. The cured roots lost 1% of their initial weight per month for six months of storage. Uncured sweet potatoes lost 1.5% of their weight per month.

Curing can also be a cause of weight loss. Improper curing conditions, particularly low humidity in the curing room, can result in up to 10% weight loss. This of course, would make curing infeasible. Proper curing temperatures and humidities can result in less than 1% weight loss. In our tests, the roots lost a little more than 2% of their weight in a 3 day cure. However, uncured sweet potatoes loose weight rapidly when they are first put into storage. We found that after 5 days of storage uncured sweet potatoes lost slightly more than 2% of their weight, virtually the same as during an equivalent curing cycle.

• Cost of Curing

Table 1 lists the costs for curing sweet potatoes in California. The total cost per bin is $1.45. The cost per 40 lb. carton, assuming an 80% pack out is only $0.06/carton. If we assume that uncured sweet potatoes will loose 1/2% more weight per month than cured roots and a carton is worth $10, then the weight savings for curing is worth $0.05/month. This means that the cost of curing is paid back in a little over one month of reduced weight loss. Sweet potatoes that are going to be stored for more than one month should be cured.

The value of curing adds up for each month of storage after the cost of curing is paid back in the first month. For example, after six months of storage a 40 lb. carton of cured roots has a 25 cent greater value than an uncured carton based on weight savings. In addition to this, the cured sweet potatoes have less likelihood of disease problems and will have better quality.

TABLE 1.
Cost of Curing Sweet Potatoes in California*

Cost of curing a batch of 300-1,000 lb. bins of sweet potatoes:

	Cost
labor - 8 hr. at $7/hr.	56
lift truck - 8 hr. at $12/hr.	96
natural gas - 143 therms at $0.50/th	72
heaters - annualized cost of $1,000/yr, 6 cures/yr	170
humidifier - annualized cost of &240/yr, 6 cures/yr	40
Total cost per person	$434

* The analysis assumes no cost for the curing room and fans. All curing is done in rooms that are designed for storage and the room cost is best assigned to the cost of storage. Often the heaters are also used for pre-sprouting prior to planting but in the analysis the full cost of the heaters is assigned to curing.

RESPONSE OF CARROTS TO REDUCED OXYGEN AND ENRICHED CARBON DIOXIDE ATMOSPHERES

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Recent reports from receivers at distant markets (transit times greater than 5 weeks) have indicated that carrots have arrived with a brown discoloration to the peel, with some sprouting and mold present. High carbon dioxide (5-10%) and low oxygen (2.5-6%) is known to enhance mold development, while sprouting is usually associated with high temperature (41-50°F). In addition, there have been reports of a "surface discoloration" due to modified atmosphere packaging.

To address this problem, carrots were held in simulated transit under several combinations of temperature, oxygen, and carbon dioxide concentrations in an attempt to duplicate the

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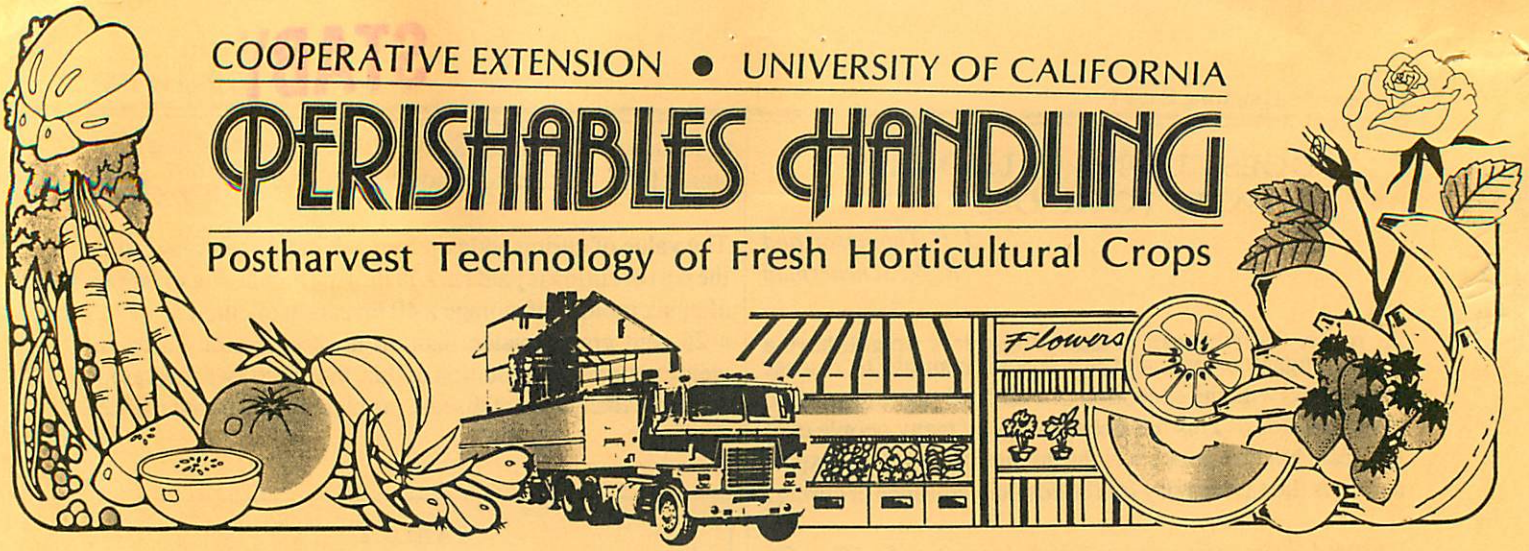
Postharvest Technology of Fresh Horticultural Crops



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symptoms. No abnormalities were observed in any of the treatments until after 4 weeks and were not readily apparent until 5 weeks. The results are shown below in the following tables.

32°F

		% Oxygen		
		0	5	10
% Carbon Dioxide	0	--	--	Slight mold
	5	--	Slight mold	Slight peel browning
	10	Slight peel browning Slight mold	--	--

41°F

		% Oxygen		
		0	5	10
% Carbon Dioxide	0	--	Slight mold & sprouting	Mold & sprouting
	5	Pitting	--	Slight mold
	10	Pitting & severe peel browning	Pitting & moderate browning	Mold

As the tables show, there was no sprouting at the colder recommended temperature of 32°F. At the warmer temperature, sprouting was inhibited by higher levels of carbon dioxide. Mold growth appeared to be inhibited by high carbon dioxide and low oxygen at the warmer temperature, which is in conflict with earlier reports. However, the control (air) group had no mold at either temperature. At 41°F, pitting and browning of the surface occurred at 10% CO_2 + 0 or 5% O_2. Pitting alone occurred at 5% CO_2 + 0% O_2. At the colder recommended temperature of 32°F, no pitting occurred and peel browning was observed at 5% CO_2 + 10% O_2 and 10% CO_2 + 0% O_2.

Surface browning of carrots appears to be associated with low levels of oxygen in combination with high levels of carbon dioxide. Its appearance is time dependent, taking 5 weeks to develop. In addition, it is enhanced by higher temperatures. Sprouting is inhibited by cold (32°F) temperature and high levels of CO_2. For optimum results, keep carrots at 32°F. Pack carrots in packages with adequate ventilation holes and maintain a slow but steady airflow through the load to prevent excessive buildup of CO_2 and depletion of O_2.

LATE HARVESTED KIWIFRUIT STORE BETTER

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Pomology

In a 1988 study of kiwifruit maturity we had an opportunity to evaluate the storage performance of fruit from six locations over a six month period. Each location was harvested five times at approximately ten day intervals, extending from before commercial harvest commenced until after commercial harvest was completed.

• Soluble Solids

There was no surprise in the continual increase in soluble solids content of the ripened fruit as harvest was delayed. After harvest, both soluble solids content and total solids declined slowly throughout the six month storage period. Late harvest fruit maintained the highest level of soluble solids content throughout the six month storage period. The soluble solids content of fifth harvest fruit after six months storage was higher than the soluble solids content of second harvest fruit that were ripened immediately after harvest.

• Flesh Firmness

Most surprising was the pattern of flesh firmness retention of fruit after four to six months storage (in ethylene free air at 0°C [32°F]). Flesh firmness at harvest averaged about 18lbs-force at the first harvest and declined slowly to about 15lbs-force by the fifth harvest. However, after six month storage, flesh firmness of first harvest fruit averaged only 1.3lbs-force, while fifth harvest fruit averaged 3.9lbs-force, a three fold difference. Because the fifth harvest fruit was picked later, it was also measured forty days later than the first harvest fruit. The pattern of firmness changes was consistent across the five harvests and six sampling locations as shown in the following table.

Kiwifruit Flesh Firmness - 1988
After 6 months at 0°C (32°F)[1]

Grower Number	Approximate Harvest Date 9/23	10/3	10/13	10/24	11/4
	Firmness - lbf[2]				
1	1.4	2.7	2.7	3.6	3.9
2	1.2	2.9	2.8	4.8	3.9
3	1.3	1.9	2.0	3.2	3.7
4	1.3	2.8	2.3	3.8	3.9
5	2.0	3.1	3.6	4.0	5.3
6	0.6	2.0	1.8	1.8	2.7
Average	1.3	2.6	2.5	3.5	3.9

1 Fruit held in ethylene free air and each sample removed after 6 months in storage.

2 Flesh firmness in pounds-force (lbf) measured with a penetrometer using an 8 mm (5/16-inch) tip.