Effects of handling procedures and temperature on

POTATO CRACKING

. . .forced-air warming reduces cracking

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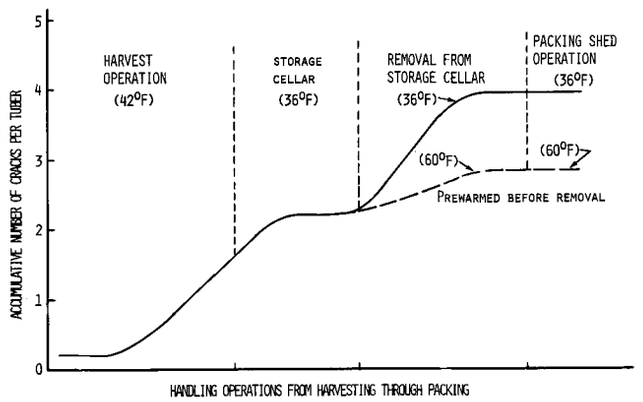
POTATO CRACKING results from poor handling procedures during harvest, while loading into storage cellars, and during removal from storage. The percentage of marketable tubers (and profits) decreases while the potential infection of tubers increases. Levels of tuber damage caused at various stops during handling of Russet Burbank potatoes were determined during 1971-72 at Tulelake. Prewarming, by forced air heating before removal of potatoes from storage and lowering them through a vertical deceleration chute resulted in a marked reduction in the amount of tuber cracking.

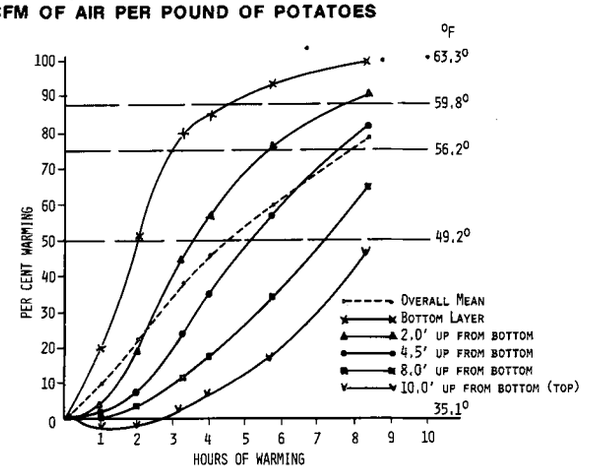
Counts were made of the number of cracks per tuber from harvesting, loading into and during storage, and during removal from storage and packing shed handling operations. Results (graph 1) showed that considerable tuber cracking occurred during harvest, when being placed into storage, and while being removed from storage. Less cracking occurred while in storage, and very little cracking could be attributed to packing shed operations.

At temperatures below 45° F, potato tubers were very turgid and

GRAPH 1. POTATO CRACKING OBSERVED DURING COMMERCIAL HARVESTING AND HANDLING OPERATIONS AT SHIPPING POINT



GRAPH 2. POTATO WARMING RATES WITH FORCED-AIR WARMING AT .09 CFM OF AIR PER POUND OF POTATOES



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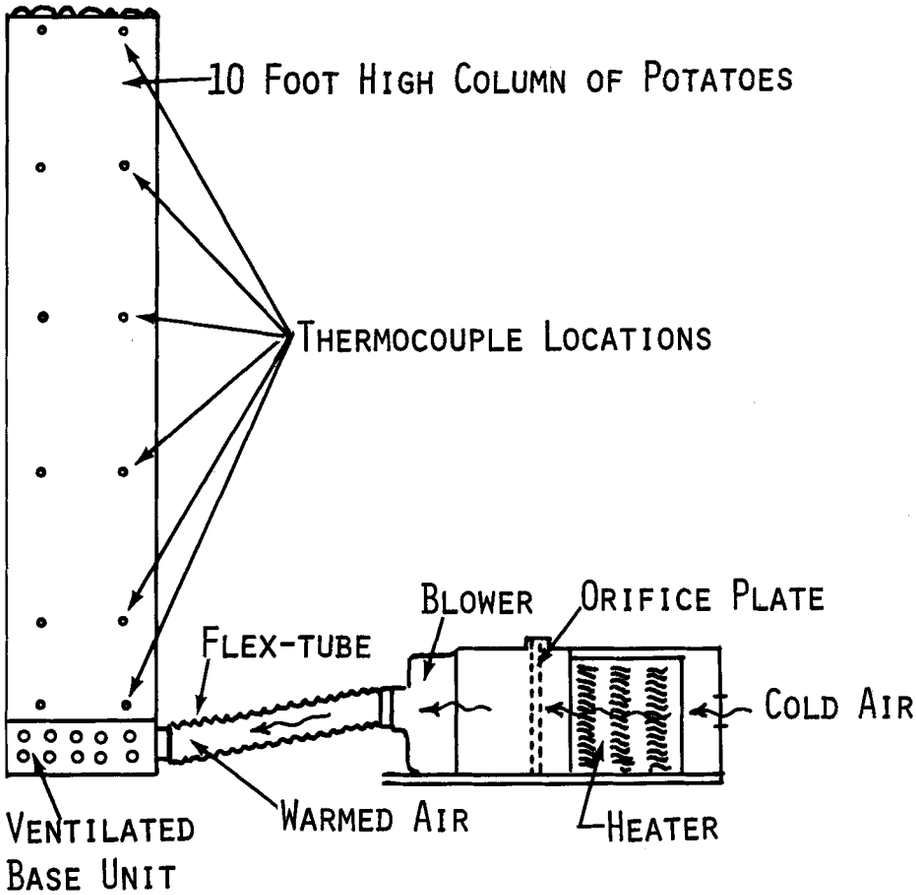

System used for measuring forced-air warming rate of bulk potatoes.

susceptible to cracking, or bruising, when handled. Tubers were moderately susceptible to cracking at temperatures of about 55 to 60° F. Tuber temperatures at all sampling points - from the field to the cellar to the packing shed - were below 45° F. To minimize this serious cracking problem, growers and packers have two alternatives, (1) to reduce the effect of handling by padding and by decreasing the number and distance of drops in all operations, and/or (2) to harvest only when the temperature exceeds 45° F, and to warm the potatoes in storage before removing them.

TABLE 1. EFFECT OF PREHEATING POTATOES BEFORE STORAGE EMOVAL ON TUBER CRACKING - TULELAKE - JANUARY 3-4, 1972

Treatment	New Cracks Per Tuber		
	Large	Small	Total
January 3, 1972			
1. Tubers carefully removed by hand from face of cellar pile.	0	.06	.06
2. Tubers commercially scooped from cellar pile and loaded onto bulk truck.	.34	1.38	1.72
3. Tubers carefully removed by hand from face of pile, heated to 55° F, then handled as in treatment 2.	.18	.78	.96
January 4, 1972			
1. Tubers carefully removed by hand from face of pile.	.02	.24	.26
2. Tubers commercially scooped from cellar pile, bulk truck loaded, and packed in shed.	.80	.62	1.42
3. Tubers preheated to 60° F., then handled as in treatment 2.	.32	.92	1.24

Small cracks

Many of the cracks observed in this study were too small to see with the naked eye. A 3X magnifying glass was used in evaluating the tubers for cracks. Upon warming and drying, these very small cracks, as well as the large cracks, enlarged. For this reason, the problem frequently goes unnoticed until the potatoes have left the packing shed and reached destination markets.

Preheating potatoes to 55 to 60° F before removal from cellars reduced total cracks by 25 to 30%, and large cracks by 50 to 55%. Comparisons of damage between non-heated and pre-heated tubers are shown in the table.

Potato warming was obtained by forcing warmed air (55 to 63° F) up through a 10 ft. high column of potatoes, 2 ft square. Heat was supplied by an electric room heater placed across the source of incoming air to the blower (see sketch). Potato temperatures were measured by thermocouples inserted 1 inch deep into two tubers at each of 1, 2, 4, 5, 8, and 10-ft levels from the bottom of the column.

Tuber warming

Tuber warming rates with air flows of 0.09 cfm/lb of tubers are shown in graph 2. Use of warmer air (70 to 75° F), greater air flow rates, and use of steam as a heat source, would reduce the time required to warm the potatoes to 55 to 60° F. The air flow rates used may be attained with fans that are used for forced air cooling systems in commercial operations. Potatoes for packing the following day could be warmed overnight before each day's operation. The slower warming of the top-layer potatoes resulted from their exposure to the large volume of cold ambient air above the potatoes. It is likely that this air could be easily warmed by a space heater in commercial forced-air warming systems.

Potato tuber cracking was further reduced by having the tubers drop through a vertical deceleration chute comparable with the bin fillers utilized for mechanical tomato harvesting. Tubers falling free for 2 ft had an average of 0.88 cracks per tuber, while those falling 2 ft through a model decelerator chute had an average of 0.26 cracks per tuber, a 70% decrease.

The information gained from this study suggests that tuber warming in commercial storage piles and reducing the distance of free fall of tubers in all operations of harvesting and loading will significantly improve potato quality and salability with a minimum increase in cost of operation.

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