Improving Prune Dehydration

work simplification study and methods analysis of current dehydrater practices suggest improvements

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This is the second of two articles reporting the results of a work simplification study and methods analysis undertaken for California prune growers and dehydrater operators.

At about $4.00 a fresh ton the labor cost of the estimated 170,000 tons of dried prunes produced in California in 1951 was in excess of $2,000,000.

Some dehydrater operators could install labor saving improvements immediately and obtain savings this year.

The most efficient method of carrier unloading and dipper dumping for most sizes of dehydrater plants is the fork lift-gravity conveyor combination. If a tractor fork lift attachment can be used, the cost of the attachment and the conveyor is small compared with the labor savings.

Lugs should be supported as they are being emptied. This can be done by providing support bars over the hopper.

Where carriers are unloaded by placing lugs on a conveyor at the carrier, a parallel conveyor should return empties directly to the truck.

If bulk handling bins are developed for use with the mechanized harvesters, the dumping operation will be simplified.

Tunnel Productivity Factors

Green graded fruit when dried will be of more uniform quality than nongraded. If fruit is not graded, some prunes are overmoist after drying and therefore susceptible to spoilage. Others undergo severe browning because of too high a fruit temperature during final drying.

An investigation into the feasibility of green grading was made at Santa Clara. A variable-size grader, producing a balanced amount of two grade sizes made it possible for four tunnels to be kept continuously supplied with two grades of fruit. The test of the effects of green grading on drying time indicated that tunnel capacity was increased by approximately 5.6%. In addition, quality of dried fruit was greatly improved. Although green grading increases tunnel capacity and improves fruit quality, it is not being recommended until the economic effects can be ascertained.

Air Stream Velocity

The same tunnels were also used to investigate the effect of high and normal air velocities on drying time of different grades of fruit. Both high and low air stream velocity tunnels were automatically controlled at 173° F and 168° F respectively, although there was no automatic wet-end humidity control.

The results of these preliminary tests—as to the effects of air velocity on tunnel drying time—are inconclusive. Further field tests need to be run.

However, the results did indicate that if fruit is graded and tunnels with different air stream velocities are available, the larger prunes should be dried in the higher air stream velocity tunnels for most efficient tunnel utilization.

Also it was found that the axial fan delivered greater air velocities using approximately the same power as the centrifugal fan. Fans are unnecessarily loaded unless there is a large space at the tunnel entrance to the fire tunnels.

Estimating Moisture

Observations indicate there is a lack of uniform control in drying time which

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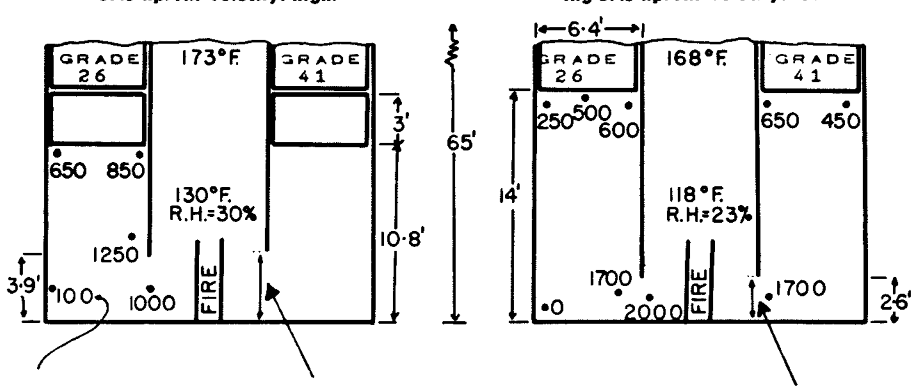
Layout of counterflow tunnels used to test effects of air velocity and size grading on drying time.

Tunnel H
Fan: axial flow type. Motor: 40 hp drawing 37.5 hp. Air velocity: high.

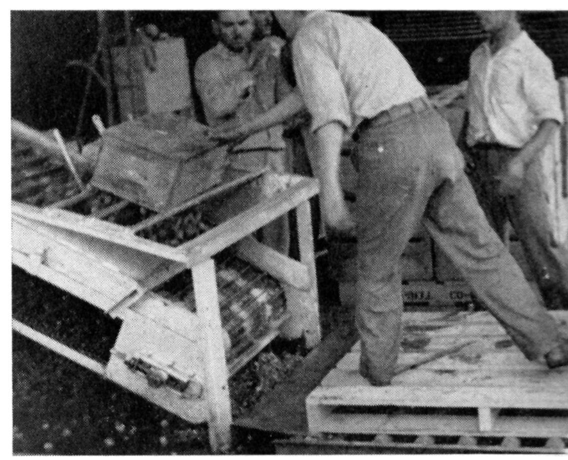
Tunnel L
Fan: centrifugal flow type. Motor: 30 hp drawing 37.5 hp. Air velocity: low.



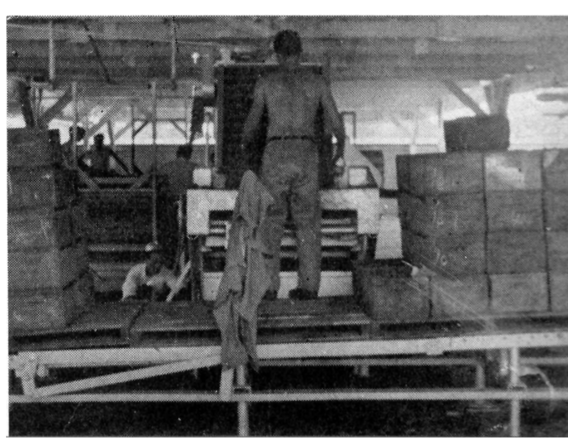
(100 fpm) Note: Large fire tunnel entrance and therefore low air velocity.

Note: Small fire tunnel entrance and therefore high air velocity.

Grade 26, at the left of each tunnel, means a wet count of 26 per pound. Grade 41, at the right of each tunnel, means a wet count of 41 per pound.



Above: Dumping from a horizontal conveyor. Note dumping bars, crew of four, and inefficient layout of the conveyor. Below: Lug dumping from pallets stored on a gravity conveyor.



DEHYDRATION

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results in either over- or under-drying.

There is a potential increase in tunnel capacity available merely by withdrawing the cars at the correct time to eliminate improper drying. This can be achieved by direct checking with moisture testers, such as an electric resistance tester.

A more economical method is to use a moisture tester to spot check the tunnel man's estimates of prune moisture. In addition to increasing capacity, moisture testing will also improve quality.

Tray Design

Reversible trays have been installed in some of the newest plants.

One of the advantages given for the use of reversible trays is that one lot of bleeding prunes will not cause a disruption in schedule during peak production. Auxiliary equipment such as scrapers can be much simpler in construction as tray reversing devices are not essential in tray design.

Post-Dipper Handling

The one-man dehydrater, incorporating mechanical tray handling, scraping and tray loading, provides the most efficient use of labor at the dehydrater. The numbers of dollies and trays needed are reduced by approximately 50%. Processed fruit undergoes a minimum of delay before drying and before scraping.

Moisture in Storage

Some operators believe that when wet prunes are stored with dry prunes there is an exchange of moisture between fruit which tends to equalize the moisture content. Experimental work, when using fruit within the range of possible moisture contents, has failed to show any significant transfer of moisture from one fruit to another.

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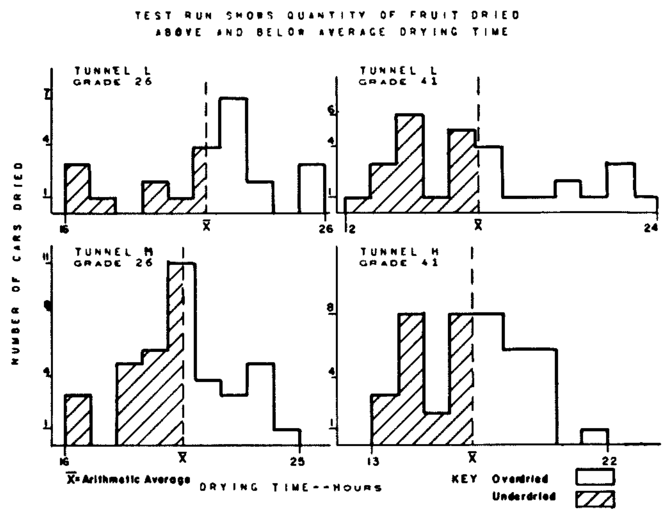
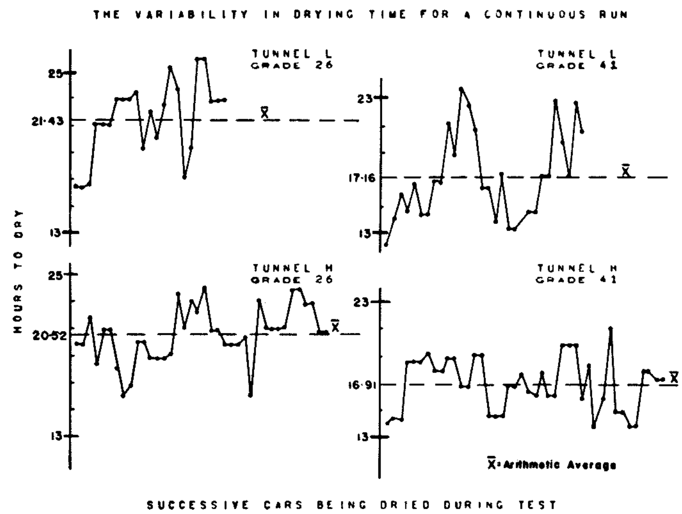
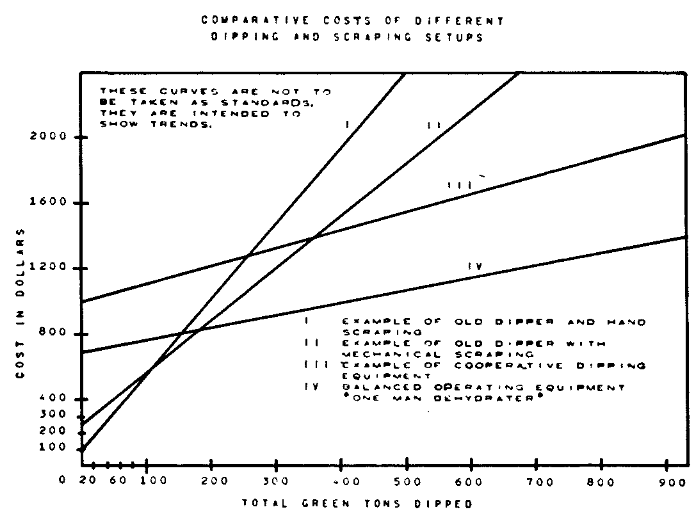
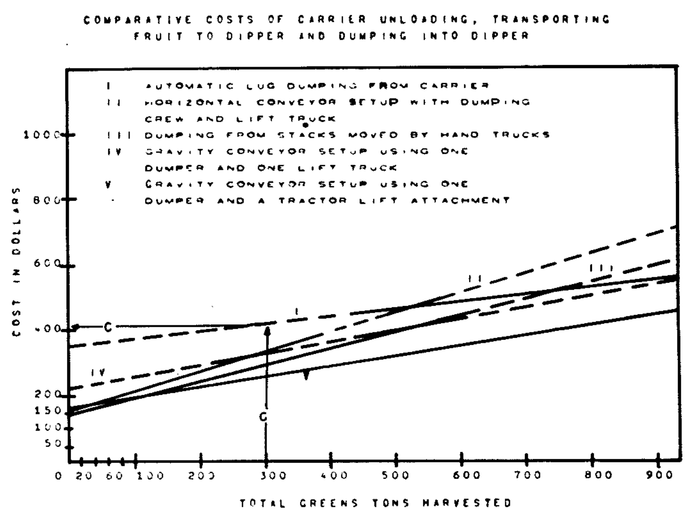
The investigation reported above was carried out cooperatively in 1951 by the Division of Food Technology, University of California College of Agriculture, Davis, and the Division of Mechanical Engineering, University of California, Berkeley.









Trends and not calculated costs should be considered when examining the two cost graphs. The illustration on the left indicates that mechanized equipment is more desirable for seasonal plant capacities over 400 tons. The graph on the right indicates that for plants processing over 150 tons per season, the most efficient equipment includes a gravity conveyor and a tractor fork lift attachment. Large plants of seasonal capacities over 1,000 tons would find an automatic lug dumper preferable to a gravity conveyor and a fork lift combination. Arrow "C" shows the approximate cost of carrier unloading, predipper transporting, and dumping, for a seasonal plant capacity of 300 tons.