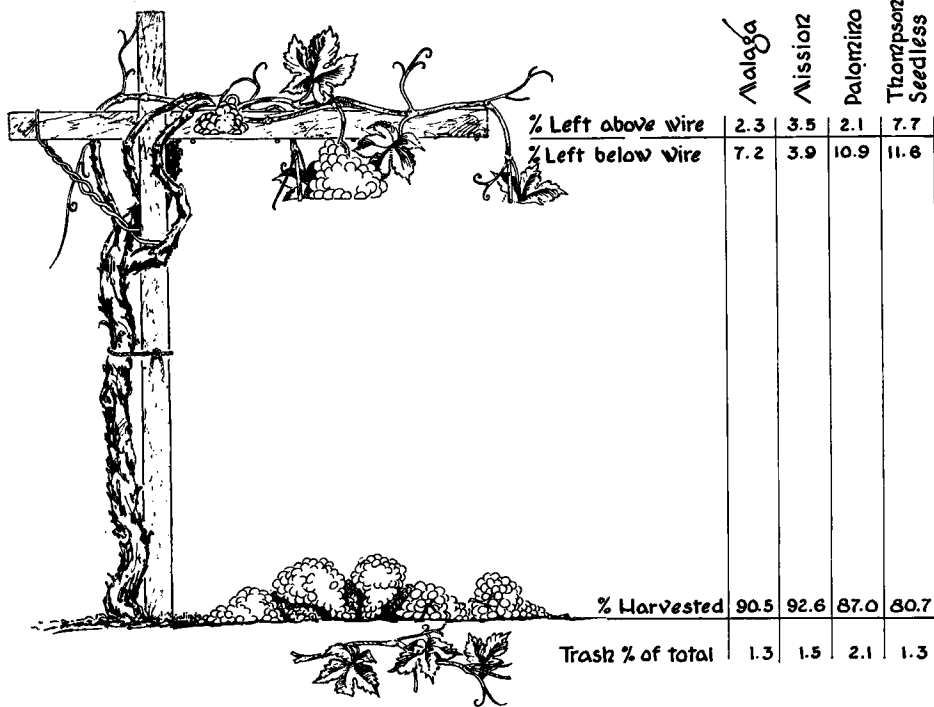


# Machine Harvesting of Grapes

annual labor requirements stabilized by shifting part of the harvest work to growing season when labor needs slacken

A. J. Winkler and Lloyd H. Lamouria

Summary of 1955 harvest.



Efficient labor management on the 437,000 acres of California grapes has been difficult to attain because—according to the State of California Department of Employment—there has been a statewide seasonal labor fluctuation of 6:1 in agricultural crops. The peak harvest labor demand of 360,000 man weeks was not easily obtained.

A research program to alleviate the problems of detrimental peak labor demands, high unit cost of production and to improve product sanitation was initiated in 1953. The research developed a trellising-training system for the vines plus a harvester.

Special training or handling of the fruiting wood was necessary to form a vine in which all of the bearing units could be brought to one side of the row. The bearing units—spurs or canes—were supported by a horizontal trellis at 45" above the ground. The horizontal cross-arm was placed so that it extended 30" on one side of the row and 12" on the other side. Five smooth wires, equally spaced, were attached to the underside of the long arm, while the short end of the crossarm was solely for bracing.

Thompson Seedless fruit canes were tied to the middle trellis wire. In the other varieties the bearing units were attached to the second and third wires of the trellis on the row side. As the new shoots elongated and were bent down by their own weight and that of the fruit, they rested on the upper side of the trellis, the clusters hanging free below the wires.

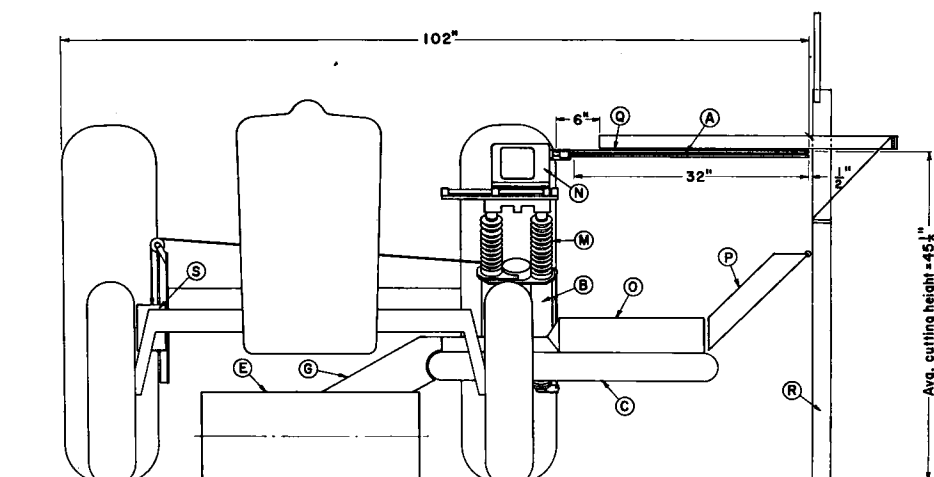
Hand work was required to free the clusters from the shoots and wires so they would hang free. However, this work came in midseason when the demand for vineyard labor was slack.

The harvesting machine was designed to float a cutter bar unit along the underside of the trellis wires to remove all the fruit, leaves and cane which lay in its path. In 1954 the harvester was adapted to the wine harvest.

In 1955 the raisin-lay version was developed with which a continuous paper tray was laid on the ground along the tractor centerline. The unrolling of the paper was accomplished by hydraulically lowering the roll into contact with the ground.

Front elevation—1955 grape harvester.

- (A) 32" Double acting cutter bar
- (B) Cutter head support
- (C) Cross conveyor
- (E) Paper roll
- (G) Chute for raisin lay
- (M) Dust boot
- (N) Cutter head
- (O) Cross conveyor chute
- (P) Cross conveyor chute extension
- (Q) Trellis wires
- (R) Grape stake
- (S) Counter weight for cutter head balance



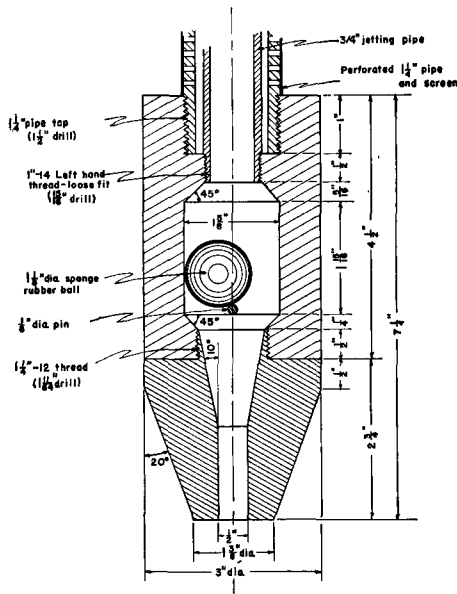
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## DRAINAGE

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soil surface. About 600' from the river the permeability of the soil is such that little resistance is offered to the upward movement of the water and it rises into the peaty surface layers to create the drainage problem. This conclusion is based on the small vertical pressure gradient at this point. The small gradient indicates a high permeability of the soil. In addition, the lateral movement of the water seems to be impeded by a lens of clay located 1,000' from the river. The extent of the clay is not clearly defined and the effect of the clay lens is a matter of conjecture.

To extend the existing information well points were put in. A well point is a piece of perforated pipe about 1½" to 2" in diameter. The perforated section is 2' to 3' long and is wrapped with two layers of screen to keep the sand from entering the pipe. Some well points are equipped with a valve arrangement to allow them to be jetted into the soil. Two well points were jetted into the soil to a



Section view of jet-type well point.

depth of 55' to 60'. At this depth the well points were in gravel and could not be jetted any farther because the soil was

The purpose of putting in the well points is to determine if the water table can be lowered effectively by pumping from the gravel layer. They can also be used to estimate the permeability of the soil. After the well points were in place, pumping tests were run to determine the amount of water pumped per foot of drawdown in the well. In addition, piezometers were jetted into the gravel layer. These piezometers were spaced 10', 20' and 100' from the well points. The well points were pumped at the rate of 45 gallons per minute. After 13 minutes the water level in the piezometer 10' away had dropped 11"; the water level in the piezometer 20' away had dropped 8" and the piezometer 100' away changed very little. These readings indicated the possible success of drainage by pumping from a well.

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## HARVESTER

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A trailing vine elevator—spring loaded sheet metal vine chute—lifted the trailing vines over the top of the cutter bar. An unguarded double sickle, driven by a hydraulic motor, Scotch yoke assembly cut the fruit from the vines.

A floating cutter bar was necessary to compensate for wire-to-ground elevation differences. A net upward force of about 20 pounds—accomplished with a counterbalance—was exerted against the underside of the trellis.

The cutter bar was supported by a low friction telescope accomplished by the use of a multi-ball bushing linear guide for round tubes.

A 6" retraction of the cutter bar permitted the bar to cut in line with the stakes and to automatically by-pass each obstacle.

The retraction unit was composed of a hydraulic sensing unit, holding relay circuit, time delay circuit, four way solenoid valve and an oil cylinder.

Cutter bar protection was provided by an oil cylinder connected to a closed accumulator that held the cutter bar perpendicular to the tractor yet permitted the bar to swivel when obstructions were met.

A sheet metal cane depressor—dragged along the top side of the trellis—assisted in holding the clusters at a minimum elevation while being cut.

A cross conveyor received the falling

fruit and moved it to the continuous paper tray along tractor centerline.

To permit easy access into a row, vertical separation of the cane depressor and cutter bar was required and accomplished by a hydraulic cylinder plus cable linkage.

In 1955 selected varieties of grapes were prepared for machine harvesting by the trellising-training system of growing. As a result, the peak labor requirement was reduced by shifting part of the conventional labor from the harvest pe-

riod to the more slack growing season. A labor shift was desirable because it would result in a more stabilized labor force. Further development of both the vines and the harvester are required before a finite analysis can be made.

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Side elevation—1955 grape harvester.

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|-------------------------|--------------------------|------------------------------------|---------------|
| (A) 32" Cutter bar      | (E) Paper roll           | (I) Retraction head cylinder       | (M) Dust boot |
| (B) Cutter head support | (F) Cane depressor       | (J) Cutter bar hydraulic motor     |               |
| (C) Cross conveyor      | (G) Chute for raisin lay | (K) Cross conveyor hydraulic motor |               |
| (D) Vine lifter         | (H) Swivel head cylinder | (L) Cutter head balance cable      |               |

