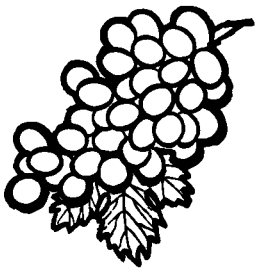
Refinements in the U. C. grape harvester resulted in significant operating improvement during the 1961 mechanical harvesting tests with raisin grapes. Positioning of the harvester operator behind and below the cutter bar successfully solved the problem of steering inaccuracies that has existed since the original design was introduced in 1957. Use of a crawler tractor to pull the harvester and operator allowed adequate steering stability in freshly-disced soil. Synchronization problems were minimized by installing an intercom system for communication between harvester operator and tractor driver. Adequate trash removal was provided (except for pieces of cane accidently cut off) by twin air ducts mounted below the automatic-positioning cutter bar. A summary of harvesting efficiency for the 1961 tests indicated that 62 to 87 per cent of the grape clusters on the vines were removed by machine and dropped onto the paper as it unrolled from the side of the machine.

A PROGRESS REPORT



GRAPE MECHANICAL HARVESTING

comes closer to reality

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IN THE 1961 TESTS, grapes were harvested by machine from plots at Davis and at Di Giorgio Farms, Kern County. The two-acre mechanical harvester plot at Di Giorgio Farms included 26 rows of 38 vines per row (37 spans) on an 8 × 12 foot spacing. Trellising followed the basic pattern devised originally for the machine. Three wires are attached to the underside of the 3-foot horizontal crossarm with the outside wire used as the guide line for the automatic-positioning cutter bar on the harvester. In this plot, rows 8 and 10 were put on short crossarms because of the need to shift the direction of crossarms on the adjoining rows. Rows 1 through 7 had crossarms with overhang to the South; rows 9 through 18, to the North and rows 20 through 26 had arms overhanging to the South. Rows 8 and 10 were not harvested by machine.

Vine handling costs for the Black Monukka variety vines in the test plot at Di Giorgio Farms added up to $8.14 per acre for a total of 73.8 man hours per acre at $1.10 per hour. Pruning the 24 rows of 912 vines was calculated to require 26.3 man hours per acre; tying, 12.2 man hours per acre; opening vines the first of May, 10.9 man hours per acre; and opening vines and freeing bunches at the end of May, 24.4 man hours per acre.

Pre-harvest procedures

Other pre-harvest procedures included the necessity to tighten crossarm wires to return some arms to within 10 degrees of horizontal. Hand removal of canes from the entry end of vine rows, required to allow visibility and easier positioning of the cutter bar by the harvester operator, was handled at about 115 openings per man hour. Hand harvesting of all fruit in line with the stakes was also necessary, along with the control spans. All spans were tagged for statistical sampling. Grape maturity identification was also an important consideration for the one-shot mechanical harvesting procedure.

A crawler tractor (D-4) replaced the

Operator of the U.C. mechanical grape harvester sits low to control the cutter bar as it removes clusters of grapes hanging below trellis. Intercom system allows operator communication with driver of tractor pulling the harvester.

previously used wheel tractor to pull the grape harvester, adding needed steering stability on the freshly-disced soil. An intercom system allowed contact between the harvester operator and the tractor driver. The harvester operator steered the harvester and controlled the on-off operation of the cutter bar. He could also over-ride the cutter's normal automatic positioning mechanism that keeps it against the trellis guide wire. This automatic positioning of the cutter bar is accomplished by overbalancing counter weights that hold the top support plate (protecting the cutting blades) against the wires.

Cutter bar operation

In normal operation, the harvester operator manually lowers the cutter bar to its minimum elevation at entry to the row and then allows it to rise and automatically follow the underside of the trellis. The cutter bar can be manually retracted when an obstruction such as old wood is observed. The harvester operator can stop the equipment to free obstructions if either the cutter bar or the conveyor system becomes clogged.

The harvesting machine was operated at a ground speed range of from 0.6 to 1.3 mph. Cutter bar frequency range was from 650 to 950 cycles per minute; conveyor velocity, 125 feet per minute; hydraulic pump velocity, 500 rpm; and blower discharge, approximately 1,150 cubic feet per minute.

The reciprocating cutter bar was trouble free in these operating tests, although it could be stalled on old wood. With a second year of vine training, or improved training the first year, old wood would not be a problem, however. The cutter effectiveness *may* be improved by decreasing the thickness of the top support plate. However, when this change was simulated by increasing the angle of attack (upward) the fruit removal effectiveness increased, but sensitivity of the cutter to wire sag was also increased. Wire cutting which was negligible prior to changing the angle of attack, became a problem with the slack trellis.

Trash removal with the twin air ducts was adequate, provided that pieces of cane were not being removed. Major improvements in vine training to eliminate the drooping canes would be possible the following year, according to the viticulturists. In the 1961 tests, one man followed the machine to remove the pieces of cane that caused periodic clogging of the conveyor.

Operator protection in the form of a face shield should be provided in order to protect the man from protruding canes. Quicker response on the steering would also have been desirable.

A second harvester worker changed the 1,320-foot rolls of 70-pound extensible kraft paper as it was used. This same worker also inspected the fruit being discharged from the conveyor and removed occasional pieces of cane. The raisin lay required extra hand labor to complete the spread in the test at Di Giorgio Farms but this was not necessary when the machine was used at Davis. The difference was attributed to the method of vine manipulation.

MECHANICAL GRAPE HARVEST EFFICIENCY SUMMARY[1]

Date	No. vines harvested	% machine harvested	% left above wire	% left below wire	% off tray	% on ground under wire
Sept. 20–21, 1961	608	62	15	15	1	7
Oct. 10, 1961[2]	114	73	27		Not measured	Not measured
Oct. 10, 1961[3]	38	87	7	6	Not measured	Not measured

[1] Range in machine speed was 0.6 to 1.34 mph.

[2] All fruit within 2" of the outboard wire which supports the trailing canes was removed by hand prior to harvest. This was 1 lb of fruit per vine on Rows 23, 24, 25 and 2 lbs per vine on Row 26.

[3] Same as note (1) except that angle of attack of cutter bar was increased to provide closer cutting to the wire surface. (Wire cutting resulted at this new angle).

Fruit losses

Fruit losses resulting from the overmature shattered berries rolling off the tray proved to be a real problem on the first day in the field. The standard paper curler was not functional. This problem was solved on the second day by providing a sled-type tray-former. Installation of the tray-former made it impossible to use the automatic paper cut-off, however.

John Stanley's Raisin Maker machine with Stanley as operator, handled both the turning and boxing operations. The fruit was turned on October 16 and boxed on October 20. Because a suitable tractor was not available for proper mounting of the Raisin Maker (boxing), most of the rows were boxed by hand.

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