Mechanical Potato Harvesting

studies conducted in Kern County indicated less injury to potatoes when harvested by machine than by hand harvesting

J. R. Tavernetti and Mike B. Zahara

Three varieties of potatoes—White Rose, Pontiac, and Kennebec—were harvested mechanically to study the operational efficiency of the machines and to make a comparison between the amount of damage to the potatoes by mechanical and by hand harvesting. Six two-row, direct harvesting type—digging and loading in one operation—machines of the same make were used. The harvesters were pulled by track type tractors of 40–45 horsepower but had their own engines for operating the harvester mechanisms. The studies were made in three fields near Arvin and in two fields near Edison.

Crew Size Varied

One of the two growers cooperating in the study used a crew of seven men and women on one harvester and crews of eight on each of two other machines. The crews included a tractor driver, harvester operator, and five or six persons to pick out clods, vines, and so forth.

The second grower used a crew of 13 men and women on one harvester and crews of 12 an the second and third harvesters. In addition to the tractor driver and harvester operator, the crews consisted of eight or nine clod and vine pickers, and two scavengers. The two scavengers alternated in following the harvester and picking up potatoes—carried over the rear on the vine and weed eliminator chain—and placing them on undug rows. No determination was made of the amount of potatoes carried over by the chain, but it appeared to be most serious with green vines and in weedy spots.

Potato Injury with Different Methods of Harvesting

Field	Area	Potato variety	Maturity, days	Method of hauling	Place of sampling	Bruised %	Cut %	Skinned %
			Machine harvested					
1	Arvin	Kennebec	108	Bulk	Shed	2.3	1.4	89.4
2	Arvin	Pontiac	122	Bulk	Shed	30.5	.7	97.6
3	Edison	White Rose	...	Bulk	Shed	4.5	1.4	64.8
4	Arvin	White Rose	128	Bulk	Shed	5.0	.6	23.1
5	Edison	White Rose	123	Bulk	Shed	7.1	1.7	20.6
			Hand harvested					
6	Edison	White Rose	117	Stubs	Shed	21.7	2.3	77.8
7	Arvin	White Rose	111	Stubs	Field	10.2	.5	29.3
7	Arvin	White Rose	111	Stubs	Shed	16.9	.4	61.7
8	Arvin	White Rose	114	Stubs	Field	9.6	.9	52.2
8	Arvin	White Rose	114	Stubs	Shed	25.3	.8	67.8
9	Shafter	White Rose	...	Bulk	Field	16.0	0	64.4
9	Shafter	White Rose	...	Bulk	Shed	20.4	.3	79.4
10	Wasco	White Rose	...	Bulk	Field	5.3	1.9	50.8
10	Wasco	White Rose	...	Bulk	Shed	10.4	2.4	74.5
11	Formoso	White Rose	...	Bulk	Field	10.9	0	55.8
11	Formoso	White Rose	...	Bulk	Shed	12.0	1.0	67.0

Field Delays

The average acreage harvested per machine ranged from about two thirds to three fourths acre per hour. The rate of travel of the harvesters was generally between 2.0 and 2.3 miles per hour although in a field of Pontiacs near Arvin there were times when the speeds were as high as three miles per hour. Practically 50% of the time the machines were in the field they were not harvesting but turning, traveling across the ends of the lands, and stopping. The most serious causes of stops were the absence of trucks for loading, and broken chains. Other causes of stops were changing trucks; cleaning weeds and vines from the harvester; trash, such as old cotton stalks and roots, catching on the digger blade; being held up by another machine, when

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Harvester Study 1

A. Field Conditions
- Location: Edison
- Potato variety and age: White Rose, 123 days
- Row spacing and lengths: 30", 1,825'
- Average yield: 308 sacks/acre, field run
- Vines: Dry but not beaten
- Last irrigation: 13 days before harvest
- Soil type: Sandy loam
- Soil moisture: Sprinkled during day and night before harvest, extra wet in spots
- Weeds: Scattered large weeds

B. Harvester Performance
- Number of harvesters: 3
- Total harvester hours (1 day): 30.5
- Acres harvested: 20
- Average acres/hr/harvester: 0.66
- Average sacks/hr/harvester: 202 (field run)
- Average harvester speed: 2.1 mph
- Total time machines were harvesting: 51%
- Total time stopped, turning, etc.: 49%

C. Average Operating Costs

1 tractor driver	$1.25/hr
1 harvester operator	1.25/hr
6 clod, vine pickers @ $1.00	6.00/hr
1 tractor	2.00/hr
1 harvester (fuel and oil)	0.50/hr
Total cost/harvester	$11.00/hr
Cost/acre	$16.70
Cost/sack	$0.055

Rear view of harvester showing weed and vine eliminator chains in center, and conveyors on the sides elevating the potatoes to the front cross conveyor.

Harvest Study 2

A. Field Conditions
- Location: Arvin
- Potato variety and age: Pontiac, 122 days
- Row spacing and length: 30", ½ mile
- Average yield: 290 sacks/acre, field run
- Vines: Half dry, not rolled or beaten
- Last irrigation: Sprinkled 9 days before harvest
- Soil type: Sandy, few clods
- Soil moisture: Medium, not sprinkled
- Weeds: Scattered weeds of various sizes

B. Harvester Performance
- Number of harvesters: 3
- Total harvester hours (2 days): 44
- Acres harvested: 31
- Average acres/hr/harvester: 0.70
- Average sacks/hr/harvester: 203
- Average harvester speed: 2.3 mph
- Total time machines harvested: 50%
- Total time stopped, turning, etc.: 50%

C. Average Operating Costs

1 tractor driver	$1.25/hr
1 harvester operator	1.25/hr
6 clod, vine pickers @ 1.00	6.00/hr
1 tractor	2.00/hr
1 harvester (fuel and oil)	0.50/hr
Total cost/harvester	$11.00/hr
Cost/acre	$15.70
Cost/sack	$0.054

Area-wide Drainage

herringbone pattern and interception type systems solve drainage problems

Jewell L. Meyer and Clyde E. Houston

Installing concrete tile drainage system.

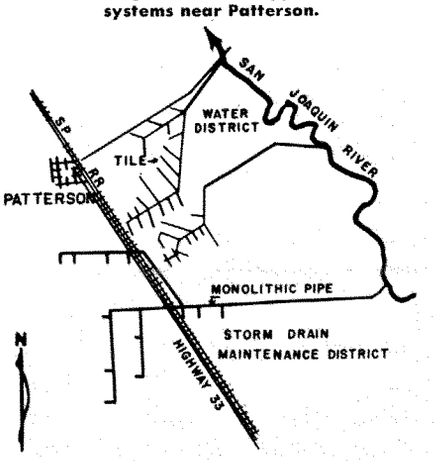
Nearly 50 acres of apricot trees in the Patterson area of Stanislaus County were killed when the water table rose to within 3′ of the surface in 1955. Several hundred additional acres were threatened by a rising water table.

Interpretations of water table fluctuations and determinations of hydraulic conductivity of the soil indicated that an area-wide drainage system installed in a herringbone pattern of 40,000′ of 4″ laterals and 10,000′ of 8″ main line should lower the water table to sufficient depth to eliminate water damage to trees. The system was installed with concrete tile laid about 8′ deep and with a gravity discharge into the San Joaquin River.

During the exceptionally wet winter of 1957–1958, the water table in the tiled area rose to within 5′ of the surface. Rainfall was recorded at 24″; annual average rainfall in this area is 11″. However, no trees were lost and farmers and irrigationists have estimated as many as 400 acres of trees were saved by the tile drain.

Investigation for a second project to help drain surface water from an adjacent rich vegetable land was begun in 1956. All water from irrigated crop land drained to the low end of fields and was ponded on individual farms to eventually evaporate or to percolate into the sub-

Installation diagram of two types of drainage systems near Patterson.



soil and contribute to the water table in the adjacent and lower orchard areas.

Investigation indicated that an interception type drainage system would be necessary to handle the problem. Consequently, 20,000′ of main line 30″ and 36″ diameter monolithic concrete pipe was laid in November, 1958, to discharge into the San Joaquin River and serve as the master drain. Thirty thousand feet of farm laterals 8″–20″ in diameter were tied into the master drain line. The entire system was designed to handle irrigation waste water for about 4,000 acres and storms of about 25 years frequency.

Observations the spring of 1959 indicate the interceptor line will handle all surface runoff. During pre-irrigation for tomatoes and beans in April and May over 3,000 acres of the 4,000 acres in the district were being irrigated at the same time. The system carried all excess water with no ponding on individual fields. Rainfall during the winter of 1958–1959 was below normal, therefore, a good test of storm drainage was not possible.

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The Patterson Water District was responsible for the tile installation. Stanislaus County Storm Drain Maintenance District No. 1 was responsible for the installation of the monolithic concrete pipe.

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both were operating on the same land; running out of fuel in the tractor, or harvester; trucks getting stuck in wet spots; foreign objects being dug up; adjustments of harvester parts; and rest periods for the crews. The lands were laid out by the harvesters. This required removing the outer rear dual wheel from the trucks.

Potato Injury

Samples of potatoes from several different fields and growers using machine and hand harvesting were examined for injuries. The injuries were classed into three groups as bruised, cut, skinned. Bruised, included any damage to the flesh regardless of the amount; cut, anything sliced or shaved; and skinned, any skinning regardless of amount.

Machine harvested potatoes were hauled in side or rear dump type trucks and samples were taken as the trucks unloaded into pits at the shed.

Hand harvested potatoes were hauled in stub sacks and in bulk. Samples were taken from the stub sacks in the field before loading onto the trucks and again from the conveyor at the shed when the potatoes were unloaded from the trucks.

A comparison of the same variety of potatoes—White Rose—showed less injury with machine harvesting than with hand harvesting. There was a considerable increase of injury to the hand harvested potatoes between field and shed. Maturity of the potatoes could have been a factor in the difference.

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fields; 2, complete burning of straw and chaff in the field after harvest; 3, tillage after harvest to cover seeds left in the field; 4, prevention of seed set on regrowth after harvest; and 5, covering of trucks loaded with seed to prevent the scattering of infested seeds or the occurrence of volunteer plants along highways. To be most effective, these measures should be generally practiced throughout seed producing areas.

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