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—were compared. Rose, Pontiac, and Kennebec were harvested 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 or nine on each of two other machines. The crew included a tractor driver, harvester operator, and five or six persons to pick up clod, vines, and so forth.

The second grower used a crew of 13 men and women on one harvester and crews of 12 men on the second and third harvesters. In addition to the tractor driver and harvester operator, the crews consisted of eight or nine clod and vine tickers, 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 undisguised 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.

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 fields, 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

Harvester Study 1

Field Conditions
Location: Edison
Potato variety and age: White Rose, 123 days
Row spacing and length: 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

Harvester Performance
Number of harvesters: 3
Total harvester hours (1 day): 30.5
Acres harvested: 20
Average acres/hr: 6.66
Average sacks/hr: 202 (field run)
Average harvester speed: 8.0 mph
Total time machines were harvesting: 51%
Total time stopped, turning, etc.: 49%

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

Harvester Study 2

A. Field Conditions
Location: Arvin
Potato variety and age: Pontiac, 122 days
Row spacing and length: 30", 1,825'
Average yield: 290 sacks/acre, field run
Vines: Dry but not beaten
Last irrigation: Sprinkled 9 days before harvest
Soil type: sandy, few clods
Soil moisture: medium, not sprinkled
Weeds: scattered small weeds

B. Harvester Performance
Number of harvesters: 3
Total harvester hours (2 days): 44
Acres harvested: 31
Average acres/hr: 1.11
Average sacks/hr: 183
Average harvester speed: 8.0 mph
Total time machines were harvesting: 50%
Total time stopped, turning, etc.: 50%

C. 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

C. AGRICULTURE, JULY, 1959

Potato Injury with Different Methods of Harvesting

<table>
<thead>
<tr>
<th>Field</th>
<th>Area</th>
<th>Potato variety</th>
<th>Maturity, days</th>
<th>Method of placing</th>
<th>Machine harvested %</th>
<th>Cut %</th>
<th>Skinned %</th>
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<tbody>
<tr>
<td>1 Arvin</td>
<td>Kennebec</td>
<td>108 Bulk</td>
<td>Shed</td>
<td>2.2</td>
<td>1.4</td>
<td>89.4</td>
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<tr>
<td>2 Arvin</td>
<td>Pontiac</td>
<td>122 Bulk</td>
<td>Shed</td>
<td>30.5</td>
<td>7</td>
<td>97.6</td>
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<tr>
<td>3 Edison</td>
<td>White Rose</td>
<td>117 Bulk</td>
<td>Shed</td>
<td>4.5</td>
<td>1.4</td>
<td>64.8</td>
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<tr>
<td>4 Arvin</td>
<td>White Rose</td>
<td>128 Bulk</td>
<td>Shed</td>
<td>5.0</td>
<td>1.6</td>
<td>23.1</td>
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<tr>
<td>5 Edison</td>
<td>White Rose</td>
<td>123 Bulk</td>
<td>Shed</td>
<td>7.1</td>
<td>1.7</td>
<td>20.6</td>
<td></td>
</tr>
</tbody>
</table>

Machine harvested
6 Edison | White Rose | 117 Stubs | Shed | 21.7 | 2.3 | 77.8 |
7 Arvin | White Rose | 111 Stubs | Field | 10.3 | .5 | 29.3 |
8 Arvin | White Rose | 111 Stubs | Shed | 14.5 | .4 | 61.5 |
9 Arvin | White Rose | 114 Stubs | Field | 9.6 | .9 | 52.3 |
10 Arvin | White Rose | 114 Stubs | Shed | 25.3 | .8 | 67.9 |
9 Shafter | White Rose | 116 Bulk | Shed | 16.0 | .0 | 64.4 |
10 Shafter | White Rose | 114 Bulk | Shed | 20.4 | .3 | 79.6 |
11 Wasco | White Rose | 114 Bulk | Shed | 5.3 | 1.9 | 50.8 |
12 Wasco | White Rose | 114 Bulk | Shed | 10.4 | 2.4 | 74.5 |
11 Formoso | White Rose | 114 Bulk | Field | 10.9 | 0 | 55.8 |
12 Formoso | White Rose | 115 Bulk | Shed | 12.0 | 1.0 | 67.0 |

Average sacks/hr/harvester
6 Edison | White Rose | 117 Stubs | Shed | 21.7 | 2.3 | 77.8 |
7 Arvin | White Rose | 111 Stubs | Field | 10.3 | .5 | 29.3 |
8 Arvin | White Rose | 111 Stubs | Shed | 14.5 | .4 | 61.5 |
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11 Formoso | White Rose | 114 Bulk | Field | 10.9 | 0 | 55.8 |
12 Formoso | White Rose | 115 Bulk | Shed | 12.0 | 1.0 | 67.0 |

Average cost/sack
6 Edison | White Rose | 117 Stubs | Shed | $21.7 | $2.3 | $77.8 |
7 Arvin | White Rose | 111 Stubs | Field | $10.3 | $.5 | $29.3 |
8 Arvin | White Rose | 111 Stubs | Shed | $14.5 | $.4 | $61.5 |
9 Arvin | White Rose | 114 Stubs | Field | $9.6 | $.9 | $52.3 |
10 Arvin | White Rose | 114 Stubs | Shed | $25.3 | $.8 | $67.9 |
9 Shafter | White Rose | 116 Bulk | Shed | $16.0 | .0 | $64.4 |
10 Shafter | White Rose | 114 Bulk | Shed | $20.4 | .3 | $79.6 |
11 Wasco | White Rose | 114 Bulk | Shed | $5.3 | 1.9 | $50.8 |
12 Wasco | White Rose | 114 Bulk | Shed | $10.4 | 2.4 | $74.5 |
11 Formoso | White Rose | 114 Bulk | Field | $10.9 | 0 | $55.8 |
12 Formoso | White Rose | 115 Bulk | Shed | $12.0 | 1.0 | $67.0 |

Average cost/acre
6 Edison | White Rose | 117 Stubs | Shed | $21.7 | $2.3 | $77.8 |
7 Arvin | White Rose | 111 Stubs | Field | $10.3 | $.5 | $29.3 |
8 Arvin | White Rose | 111 Stubs | Shed | $14.5 | $.4 | $61.5 |
9 Arvin | White Rose | 114 Stubs | Field | $9.6 | $.9 | $52.3 |
10 Arvin | White Rose | 114 Stubs | Shed | $25.3 | $.8 | $67.9 |
9 Shafter | White Rose | 116 Bulk | Shed | $16.0 | .0 | $64.4 |
10 Shafter | White Rose | 114 Bulk | Shed | $20.4 | .3 | $79.6 |
11 Wasco | White Rose | 114 Bulk | Shed | $5.3 | 1.9 | $50.8 |
12 Wasco | White Rose | 114 Bulk | Shed | $10.4 | 2.4 | $74.5 |
11 Formoso | White Rose | 114 Bulk | Field | $10.9 | 0 | $55.8 |
12 Formoso | White Rose | 115 Bulk | Shed | $12.0 | 1.0 | $67.0 |
Area-wide Drainage

herringbone pattern and interception type systems solve drainage problems

Jewell L. Meyer and Clyde E. Houston

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 subjacent rich vegetable land was begun in 1955. Several 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.

POTATO

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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, or 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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