An Analysis of Alfalfa Harvest Costs: Implications for Custom Harvest Charges

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Study Objectives

- Estimate alfalfa harvest costs with various equipment combinations
- Compare swathing with a cutterbar versus a rotary mower
- Compare large bales with small bales
- Estimate change in costs at differing yields
- Estimate change in costs from increasing the number of cuttings
Data Sources

- **American Society of Agricultural Engineers**
  - Equipment hours of life
  - Equipment speed
  - Equipment repair costs
  - Equipment fuel use
- **Equipment Prices**
  - Equipment dealers, Northern CA and OR
- **Custom Harvest Operators**
  - Hours per acre at varying yields
# Equipment Use by Operation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Equipment</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Swath</td>
<td>Swather – 126 HP</td>
<td>Cutterbar header</td>
</tr>
<tr>
<td>1b. Swath</td>
<td>Swather – 186 HP</td>
<td>Rotary cutter header</td>
</tr>
<tr>
<td>2. Rake</td>
<td>Tractor – 62 HP</td>
<td>Rake – 27’ center delivery</td>
</tr>
<tr>
<td>3a. Bale small bales</td>
<td>Tractor – 62 HP</td>
<td>Small bale baler</td>
</tr>
<tr>
<td>3b. Bale large bales</td>
<td>Tractor – 145 HP</td>
<td>Large bale baler</td>
</tr>
<tr>
<td>4a. Roadside small bales</td>
<td>Balewagon</td>
<td></td>
</tr>
<tr>
<td>4b. Roadside large bales</td>
<td>Balewagon</td>
<td>Large bale pickup attachment</td>
</tr>
</tbody>
</table>
Equipment Costs

- Overhead (Annual Ownership)
  - Capital recovery (principal and interest)
  - Insurance
  - Taxes

- Operating Costs (Hourly)
  - Repairs
  - Fuel and Lube
  - Labor
### Cost per Acre by Operation*

<table>
<thead>
<tr>
<th>Operation</th>
<th>Acres/ Hour</th>
<th>$/ Hour</th>
<th>$/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Swath - cutterbar</td>
<td>6</td>
<td>$62.10</td>
<td>$10.56</td>
</tr>
<tr>
<td>1b. Swath - rotary</td>
<td>13</td>
<td>88.75</td>
<td>7.01</td>
</tr>
<tr>
<td>2. Rake</td>
<td>13</td>
<td>42.77</td>
<td>3.25</td>
</tr>
<tr>
<td>3a. Bale small bales</td>
<td>7</td>
<td>65.73</td>
<td>10.05</td>
</tr>
<tr>
<td>3b. Bale large bales</td>
<td>10</td>
<td>78.79</td>
<td>8.04</td>
</tr>
<tr>
<td>4a. Roadside small bales</td>
<td>5</td>
<td>99.45</td>
<td>19.50</td>
</tr>
<tr>
<td>4b. Roadside large bales</td>
<td>8</td>
<td>107.25</td>
<td>14.02</td>
</tr>
</tbody>
</table>

* Includes labor, equipment overhead, and operating costs
Factors Influencing Speed

- Equipment capabilities
- Condition of the field (e.g. gopher holes)
- Size and shape of the field (number of turns)
- Operator skill
## Harvest Equipment Options

<table>
<thead>
<tr>
<th>Bale Size</th>
<th>Swath Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Small Bale</td>
<td>Swath - Cutterbar</td>
</tr>
<tr>
<td>2. Small Bale</td>
<td>Swath - Rotary Cutter</td>
</tr>
<tr>
<td>3. Large Bale</td>
<td>Swath - Cutterbar</td>
</tr>
<tr>
<td>4. Large Bale</td>
<td>Swath - Rotary Cutter</td>
</tr>
</tbody>
</table>
Cost to Swath
Cutterbar vs. Rotary

Costs:
- Cutterbar:
  - Overhead Costs: $1.34
  - Operating Costs: $6.34
  - Labor: $2.88
- Rotary:
  - Overhead Costs: $0.62
  - Operating Costs: $5.04
  - Labor: $1.35

Comparing Cutterbar and Rotary:
- Cutterbar costs $10.56 per acre per cutting.
- Rotary costs $7.01 per acre per cutting.

UCD Alfalfa Workgroup
Costs to Bale and Roadside
Small Bales vs. Large Bales

<table>
<thead>
<tr>
<th></th>
<th>Small Bales</th>
<th>Large Bales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bale</td>
<td>$10.0</td>
<td>$10.0</td>
</tr>
<tr>
<td>Roadside</td>
<td>$19.50</td>
<td>$14.02</td>
</tr>
<tr>
<td>Overhead Costs</td>
<td>2.7</td>
<td>4.73</td>
</tr>
<tr>
<td>Operating Costs</td>
<td>4.73</td>
<td>4.46</td>
</tr>
<tr>
<td>Labor</td>
<td>10.18</td>
<td>7.18</td>
</tr>
</tbody>
</table>

$ per acre per cutting

UCD Alfalfa Workgroup
Harvest Costs - Small Bales
$43.35/Acre/Cutting
Harvest Costs - Large Bales & Cutterbar

$35.87/Acre/Cutting
Harvest Costs - Large Bales, Rotary $32.34/Acre/Cutting

[Bar chart showing costs per cutting for Rotary, Rake, Bale, and Roadside]
Variation in Harvest Operation Time at Varying Yields - Acres per Hour

Survey Results from Custom Operators

- Intermountain Region N = 5
- San Joaquin Valley N = 10

- Highest, average, and lowest values reported
Variation in Time per Acre for Swathing at Varying Yield

Intermountain Region

San Joaquin Valley

Acres per hour

Tons per Acre per Cutting

UCD Alfalfa Workgroup
Variation in Time per Acre for Rake at Varying Yield

Intermountain Region

San Joaquin Valley

UCD Alfalfa Workgroup
Variation in Time per Acre for Baling (Small) at Varying Yield

Intermountain Region

San Joaquin Valley
Variation in Time per Acre for Baling (Large) at Varying Yield

Intermountain Region

San Joaquin Valley

Acres per hour

Tons per Acre per Cutting

UCD Alfalfa Workgroup
Variation in Time per Acre for Roadside (Small) at Varying Yield

Intermountain Region

San Joaquin Valley

Acres per hour

1 2 3

Tons per Acre per Cutting

0.75 1.25 2

Tons per Acre per Cutting
Variation in Time per Acre for Roadside (Large) at Varying Yield

Intermountain Region

San Joaquin Valley

Acres per hour

Tons per Acre per Cutting

Tons per Acre per Cutting
## Harvest Operation Time by Yield
### Survey Results

<table>
<thead>
<tr>
<th>Operation</th>
<th>San Joaquin Valley</th>
<th>Intermountain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swath</td>
<td>None</td>
<td>20%</td>
</tr>
<tr>
<td>Rake</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Bale - Small bales</td>
<td>25%</td>
<td>30%</td>
</tr>
<tr>
<td>Bale - Large bales</td>
<td>None</td>
<td>27%</td>
</tr>
<tr>
<td>Roadside - Small bales</td>
<td>50%</td>
<td>33%</td>
</tr>
<tr>
<td>Roadside - Large bales</td>
<td>None</td>
<td>25%</td>
</tr>
</tbody>
</table>
Comparison of Harvest Costs per Acre Varying Number of Cuttings

- Intermountain Region – 6 tons/acre/year
  - 3 cuttings – 2 tons per cutting
  - 4 cuttings – 1.5 tons per cutting

- San Joaquin Valley – 9 tons/acre/year
  - 7 cuttings – 1.25 tons per cutting
  - 8 cuttings – 1.1 tons per cutting
Intermountain Region
Cost Per Acre  3 vs. 4 Cuttings
6 Tons per Acre per Year Held Constant

- 3 cuttings @ 2 tons each
- 4 cuttings @ 1.5 tons each

<table>
<thead>
<tr>
<th></th>
<th>Small bale Cutterbar</th>
<th>Small bale Rotary</th>
<th>Large bale Cutterbar</th>
<th>Large bale Rotary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per Acre</td>
<td>$130</td>
<td>$120</td>
<td>$107</td>
<td>$97</td>
</tr>
</tbody>
</table>
San Joaquin Valley
Cost Per Acre 7 vs. 8 Cuttings
9 Tons per Acre per Year Held Constant

- 7 cuttings @ 1.3 tons each
- 8 cuttings @ 1.1 tons each

<table>
<thead>
<tr>
<th></th>
<th>Small bale Cutterbar</th>
<th>Small bale Rotary</th>
<th>Large bale Cutterbar</th>
<th>Large bale Rotary</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Cuttings</td>
<td>$304</td>
<td>$279</td>
<td>$251</td>
<td>$226</td>
</tr>
<tr>
<td>8 Cuttings</td>
<td>$318</td>
<td>$290</td>
<td>$286</td>
<td>$258</td>
</tr>
</tbody>
</table>
Take Home Ideas

- The rotary mower costs less per cutting than the cutterbar type
  - despite increased purchase cost and horsepower requirements
  - due to greater speed.

- Large bales cost less to bale and roadside per cutting than small bales
  - despite increased purchase cost and horsepower requirements
  - due to greater speed.
Impact of Yield on Hours per Acre

- All growers said that there was no impact on raking time.

- Some growers noted a large effect for the remaining harvest operations (swath, bale, and roadside) and other growers did not.

- IM growers indicated larger yield effects than SJV growers.

- The impact was greater for small bales than large bales.
Impact of Number of Cuttings on Total Harvest Cost per Acre

- Increasing the number of cuttings by one and holding the total yield constant, the cost per cutting decreases but the cost per acre increases.

- The increase in cost is greater for large bales than small bales because there is less savings from a lower yield per cutting.

- The difference in cost per acre is greater in the IM region than the SJV because one cutting is a 33% increase for the IM and only a 14% increase in the number of SJV cuttings.
Impact of Number of Cuttings on Total Harvest Cost per Acre

- Increase in the number of cuttings needs to be justified by an increase in the quality and/or the price of the hay cut on a shorter schedule to be profitable.