Water Conservation and Irrigation

Cache County Crop School, Logan, UT, February 14, 2023
Burdette Barker, Extension Irrigation Specialist
Losses in a Gravity System

- **Reservoir**
- **Unlined Canal**
- **Vegetation Evapotranspiration (0.2%)**
- **Irrigation Water Evaporation (0.5%)**
- **Crop Evapotranspiration (38%)**
- **Surface-Irrigated Field**
- **Run Off or Tailwater (12%)**
- **Seepage (30%)**
- **Deep Percolation (18%)**
- **Precipitation**
Sprinkler Inefficiencies

- Irrigation Water Evaporation (12%)
- Crop Evapotranspiration (77%)
- Deep Percolation (12%)

Center-Pivot-Irrigated Field
Irrigation is Money, Why Not Measure It?

- Optimize beneficial water use
- Optimize profitability of irrigation
- Defend water use
Measuring Uniformity
Uniformity
Uniformity

Distance from Pivot Center (ft)

Catch Depth (in)

Actual Catch
Average Catch
Towers

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Extension Utah State University.
Uniformity

Sorted Catch Depth (in)

Cumulative Percent of Field Area

- Sorted Catch
- Average Catch
So, What?

Application Efficiency is related to uniformity

- Suppressed Production
- No Water Stress
- Overirrigated
- Nutrient Leaching

Underirrigated

Applied Irrigation

N
Flow Measurement
Evaporation Losses

Applied Irrigation – Irrigation Reaching the Soil
Leaks?
Is Improving Uniformity Worth It?

• Alfalfa @ $300/ton
• 7.4-acre field
• Wheel line
• 200 feet of pumping lift from well
• Energy @ $0.053/kWh (Rocky Mountain)
• Target production 5 ton/acre yield
• Alfalfa at 27 in/year net requirement
• DU = 37%, Evaporation/Wind = 19%, Efficiency = 38%
• Target DU = 60%, Evaporation/Wind = 19%, Efficiency = 56%
## Is Improving Uniformity Worth It?

### ESTIMATED PUMPING ENERGY COST AND GROSS YIELD IMPROVEMENT

<table>
<thead>
<tr>
<th>Description</th>
<th>Actual</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Total Dynamic Head (ft):</td>
<td>327</td>
<td>327</td>
</tr>
<tr>
<td>Gross Water Requirement (in/yr):</td>
<td>70</td>
<td>47</td>
</tr>
<tr>
<td>Annual Energy Use (kWh/acre/yr):</td>
<td>2,952</td>
<td>2,003</td>
</tr>
<tr>
<td>Annual Energy Cost ($/acre/yr):</td>
<td>$155</td>
<td>$105</td>
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<tr>
<td>Estimated Annual Production (ton/acre):</td>
<td>4.6</td>
<td>4.8</td>
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<tr>
<td>Estimated Annual Crop Revenue ($/acre):</td>
<td>$1,380</td>
<td>$1,425</td>
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<tr>
<td>Net Revenue ($/acre):</td>
<td>$1,225</td>
<td>$1,320</td>
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<tr>
<td>Possible Benefit, Excluding Harvest Costs($/acre):</td>
<td></td>
<td>$95</td>
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</tbody>
</table>
Alternating Sets

60 ft

60 ft

60 ft

20 ft
Alternating Sets

Alternating sets is worth $30 alone!
Is Improving Uniformity Worth It?

- Alfalfa @ $200/ton
- 1,320-ft Pivot (126 Acres)
- ½ mile, 8-in, pipeline
- 20 ft of elevation gain
- Energy @ $0.053/kWh (Rocky Mountain)
- Target 5 ton/acre yield
- Alfalfa at 32 in/year net requirement
- DU = 69%, Evaporation/Wind = 10%, Efficiency = 68%
- Target DU = 80%, Evaporation/Wind = 10%, Efficiency = 77%
### Is Improving Uniformity Worth It?

**ESTIMATED PUMPING ENERGY COST AND GROSS YIELD IMPROVEMENT**

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<tr>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pump Total Dynamic Head (ft):</td>
<td>136</td>
<td>136</td>
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<tr>
<td>Gross Water Requirement (in/yr):</td>
<td>47</td>
<td>41</td>
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<tr>
<td>Annual Energy Use (kWh):</td>
<td>102,897</td>
<td>90,870</td>
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<td>Annual Energy Cost ($)</td>
<td>$5,410</td>
<td>$4,777</td>
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<tr>
<td>Annual Energy Cost ($/acre):</td>
<td>$43</td>
<td>$38</td>
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<tr>
<td>Estimated Annual Production (ton/acre):</td>
<td>4.8</td>
<td>4.9</td>
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<tr>
<td>Estimated Annual Crop Revenue ($/acre):</td>
<td>$1,200</td>
<td>$1,225</td>
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<tr>
<td>Net Revenue ($/acre):</td>
<td>$1,157</td>
<td>$1,187</td>
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<tr>
<td>Possible Benefit, Excluding Harvest Costs($/acre):</td>
<td>$30.0</td>
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Resources

Irrigation
Information about agricultural, small farm, landscape irrigation, and irrigation water use.

USU Extension Irrigation News
Check out the Irrigation Technology Cost/Benefit Analysis Calculator on the USU Extension Crops site.

Irrigation Resources

EXTENSION.USU.EDU
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