Getting the Most From Your Irrigation System

Larry Schwankl
UC Cooperative Extension
(559) 646-6569  ljschwankl@ucanr.edu

Powerpoint at:  http://ucanr.edu/schwankl
Irrigation Systems

- Types of irrigation systems:
  - Surface irrigation – furrow and border strip
How Do We Become Efficient Irrigators?

- Know how much water to apply.
How Do We Become Efficient Irrigators?

- Know how much water to apply.
- Irrigation Scheduling.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
Irrigation Scheduling

• Approaches:
  • Monitor the soil
    • There are numerous techniques, soil moisture monitoring devices, and soil moisture monitoring services available.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
    - There are numerous techniques, soil moisture monitoring devices, and soil moisture monitoring services available.
      - Most tell when to irrigate, but not all provide how much to irrigate.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
    - There are numerous techniques, soil moisture monitoring devices, and soil moisture monitoring services available.
    - Most tell when to irrigate, but not all provide how much to irrigate.
  - Effectiveness is subject to representative placement of sensors and good understanding of the crop root zone.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
    - Relatively new approach (infrared thermometers, pressure chambers, etc.).
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
    - Relatively new approach (infrared thermometers, pressure bombs, etc.).
  - Information available for some crops & not for others.
  - Methods tend to be labor intensive – working towards automation.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
    - Relatively new approach (infrared thermometers, pressure bombs, etc.).
    - Information available for some crops & not for others.
    - Methods tend to be labor intensive – difficult to automate.
  - Readings tell you When to irrigate (plant is stressed) but not How Much.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
    - Relatively new approach (infrared thermometers, pressure bombs, etc.).
    - Information available for some crops & not for others.
    - Methods tend to be labor intensive – difficult to automate.
    - Readings tell you when to irrigate (plant is approaching critical stress level) but not How Much.

  - How much water is needed can be learned with experience or by coupling plant monitoring with other approaches (i.e. ET).
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
  - Monitor the weather

  - Climatic conditions drive the water use of plants.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
  - Monitor the weather
  - Monitor the weather and use it to estimate crop ET.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
  - Monitor the weather

  - California has the CIMIS network to provide the weather info. and estimates of Reference Crop ET (ET of pasture grass).
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
  - Monitor the weather
    - Monitor the weather and use it to estimate crop ET.
    - Tells us both When and How Much to irrigate.
Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
  - Monitor the weather
    - California has the CIMIS network to provide the weather info. and estimates of Reference Crop ET (ET of pasture grass).
    - Sometimes a challenge with annual crops due to canopy development.
How Do We Become Efficient Irrigators?

- Know how much water to apply.
- Apply the correct amount of water with a good irrigation system.
Applying the Correct Amount of Water

- Need to know how much water is being applied – critical.
Need to Measure the Applied Water
Measuring Applied Irrigation Water

- How much water is being applied?
  - Measure with a flow meter.
    - They need to be installed correctly and they have their challenges, but every irrigation system should have a flow meter.
Surface Irrigation Systems:

- What is a “good irrigation system”?
Surface Irrigation Systems:

- What is a “good irrigation system”?
  - Allows you to put on just the right amount of water to refill the crop’s root zone – Irrigation Efficiency.
Irrigation Efficiency

\[
\text{Irrigation Efficiency (\%) = } \frac{\text{Beneficially - Used Water}}{\text{Total Water Applied}} \times 100
\]
Irrigation Efficiency

Different people arrive at different estimates for Irrigation Efficiency. Why?

- Field scale – vs – Watershed or basin scale
- Single irrigation – vs – Sum of several irrigations in a season
Surface Irrigation Systems:

- **What is a “good irrigation system”?**
  - Allows you to put on just the right amount of water to refill the crop’s root zone - Efficiency.
  - Apply the same amount of water to all portions of the field – Irrigation Uniformity.
Irrigation Uniformity

- Measure of how evenly water is applied to the field.
Irrigation Uniformity

- What’s happening when we irrigate?
ADVANCE PHASE
TIME (MIN) = 125.25
ADV. DIST. (M) = 220.0
STORAGE PHASE
TIME (MIN) = 398.19
Surface Irrigation

- Water losses can be from deep percolation and tailwater runoff.
Surface Irrigation

- How do you improve surface irrigation?
Surface Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly – reduces the non-uniformity.
Surface Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
    - Shorten the field length.
Improving Furrow Irrigation Performance

▪ Reduce field length.
  ▪ Often the most effective option
  ▪ Also often the least popular option
  ▪ For more info:
    http://cetulare.ucanr.edu/newsletters/Field_Crop_Notes48141.pdf

<table>
<thead>
<tr>
<th></th>
<th>1250’ Field</th>
<th>2-600’ Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Amount</td>
<td>9.1”</td>
<td>5.4”</td>
</tr>
</tbody>
</table>
Surface Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
    - Shorten the field length.
  - Increase the field slope.
Improving surface irrigation performance

- Increase the field slope.

<table>
<thead>
<tr>
<th>Irrigation Applied</th>
<th>0.001 slope</th>
<th>0.002 slope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.1”</td>
<td>4.8”</td>
</tr>
</tbody>
</table>
Improving border check irrigation performance

- Reduce field length.
- Increase the field slope.
- Increase the flow per foot of border check.

Case study: Usually run 2 valves per check. Make checks half as wide and run 1 valve at a time. More flow per foot of check width.

<table>
<thead>
<tr>
<th>Irrigation Applied</th>
<th>Wide check (200’)</th>
<th>Narrow check (100’)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.1”</td>
<td>4.3”</td>
</tr>
</tbody>
</table>
Improving border check irrigation performance

- Reduce field length.
- Increase the field slope.
- Increase the flow per foot of border check.
  - Doesn’t work for furrow irrigation.
Furrow Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
    - Shorten the field length.
    - Increase the field slope.
  - Torpedoes
Furrow Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
    - Shorten the field length.
    - Increase the field slope.
  - Torpedoes.

Field Trial of Torpedoes – Early Season Irrigation

<table>
<thead>
<tr>
<th>Irrigation Applied</th>
<th>Not Torpedoed</th>
<th>Torpedoed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12.9”</td>
<td>9.4”</td>
</tr>
</tbody>
</table>

About a 25% decrease in applied water.
Surface Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
    - Shorten the field length.
    - Increase the field slope.
    - Torpedoes.
  - Irrigate alternate furrows.

Studies have shown about a 25% reduction in applied water.

May need to irrigate more often since applying less per irrigation.
Surface Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
  - Shorten the field length.
  - Increase the field slope.
  - Torpedoes.
  - Irrigate alternate furrows.

- Switch from borders to furrows.
  - Remember, you are applying less water per irrigation so may need to irrigate more often.
Furrow Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
  - Shorten the field length.
  - Increase the field slope.
  - Torpedoes.
  - Alternate furrows.
- Surge Irrigation.
Surface Irrigation

- How do you improve surface irrigation?
  - Reuse tailwater runoff.
  - Tailwater return systems.
Surface Irrigation

- How do you improve surface irrigation?
  - Reuse tailwater runoff.
  - Tailwater return systems.

For more info.: Reducing Runoff from Irrigated Lands: Tailwater Return Systems
Improving Surface Irrigation

- What happens if none of the previous alternatives work, or you don’t want to try them?
Improving Surface Irrigation

- What happens if none of the previous alternatives work, or you don’t want to try them?
  - Switch to a pressurized irrigation system – sprinklers or drip (usually subsurface drip).
Questions???

Larry Schwankl
559-646-6569   ljschwankl@ucanr.edu

Presentations available at:  http://ucanr.edu/schwankl