Introduction

• Irrigation length, frequency, and timing vary based on a number of factors (temperature, wind, crop (growth stage, cultivar), container size, etc.)
• Every grower has developed a way of irrigating that seems to work well for them
• Can your irrigation practices be improved?
• What impact would irrigation changes have on your:
  • Crop growth?
  • Crop health?
  • Bottom line?

What does it take to change practice?

• Trust
• Benefits/costs ($, labor, quality)
• What do I need to do to measure X?
• Scaling
• User friendly
• Integration into existing practices
• Consistency

Introduction

• How do you know when to water your plants?
• How efficient do you think you are?
• Could you be saving water?
• Does it matter?
• What are the implications of over irrigation?
• What are the implications of under irrigation?
Fertilizer rate comparison

- How do my rates compare with other growers?
- Fertilizer = $$$$  
- Could I reduce my rates without impact growth?

Mums

<table>
<thead>
<tr>
<th>Container size</th>
<th>Number of MU's</th>
<th>Statistical value</th>
<th>Kg N/ ha/yr</th>
<th>Kg P/ha/yr</th>
<th>Kg K/ha/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse Mums 4-8 L</td>
<td>7</td>
<td>Lower quartile</td>
<td>110</td>
<td>202</td>
<td>510</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average</td>
<td>250</td>
<td>369</td>
<td>298</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Quartile</td>
<td>304</td>
<td>339</td>
<td>404</td>
</tr>
</tbody>
</table>

- Greenhouse mums: soluble fertilizer (6 of 7)
- Container mums: CRF fertilizer

Sensor Networks

Continuous cut flower production

- Closed system (control)
- Historic and current production records
- Analysis of:
  - Yield/production time
  - Quality
  - Costs
  - Profits
### Annual profitability before/after sensors

<table>
<thead>
<tr>
<th></th>
<th>2007-2009</th>
<th>2010-2012</th>
<th>Difference</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crops / year</td>
<td>37</td>
<td>38</td>
<td>1</td>
<td>1 %</td>
</tr>
<tr>
<td>Stems / year</td>
<td>106,308</td>
<td>139,382</td>
<td>33,074</td>
<td>31 %</td>
</tr>
<tr>
<td>Price / stem</td>
<td>$0.59</td>
<td>$0.62</td>
<td>$0.03</td>
<td>5 %</td>
</tr>
<tr>
<td>Labor costs</td>
<td>$15,905</td>
<td>$17,893</td>
<td>$1,988</td>
<td>12 %</td>
</tr>
<tr>
<td>Electricity</td>
<td>$4,109</td>
<td>$2,923</td>
<td>$1,186</td>
<td>29 %</td>
</tr>
<tr>
<td>Sensor system</td>
<td>$0</td>
<td>$7,147</td>
<td>$7,147</td>
<td>—</td>
</tr>
<tr>
<td>Revenue</td>
<td>$63,094</td>
<td>$85,679</td>
<td>$22,585</td>
<td>36 %</td>
</tr>
<tr>
<td>Profit</td>
<td>$43,080</td>
<td>$57,716</td>
<td>$14,636</td>
<td>34 %</td>
</tr>
</tbody>
</table>

Payback period on upfront costs: 16 months

### Reducing Disease Pressure

- Factors impacting disease presence and movement
  - Plant source
  - Irrigation (timing, type)
  - Water movement (or a lack of it)
  - Soils
  - Species grown
- Where should I focus (time, money, labor) to reduce disease problems?

### Disease management

- Site selection and maintenance
- Water management
- Plant purchases
- Plant propagation
- Media
- Diseased plants
- Scouting
Chemical treatment of recycled water

- Efficacy is dependent on:
  - Chemical used
  - Organic mater in water
  - Contact time
  - Cost is a major factor
  - Installation
  - Maintenance
  - Supplies
  - Other considerations
    - Value (cost vs profits)
    - Volume to treat
    - Land availability
    - Changes in practice

Chlorine calculator

If you would like to determine how much it costs to fill your tank, fill in the table below.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Volume</th>
<th>Molality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hypochlorite</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>Percent active ingredient</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Tank volume gal</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

This is how much of chlorine you need to add to your tank. (Use 1 gallon. Total is ounces.)

- Pool water
  - 0.1
  - 0.1
  - 0.1

Phosphorus removal

- Efficacy is dependent on:
  - Chemical used
  - Organic mater in water
  - Contact time
  - Cost is a major factor
  - Installation
  - Maintenance
  - Supplies
  - Other considerations
    - Value (cost vs profits)
    - Volume to treat
    - Land availability
    - Changes in practice

Containment pond

Production Area

Pre-sample

Post-sample

Pond

Pre-filter

Phosphorus removal

- Efficacy is dependent on:
  - Chemical used
  - Organic mater in water
  - Contact time
  - Cost is a major factor
  - Installation
  - Maintenance
  - Supplies
  - Other considerations
    - Value (cost vs profits)
    - Volume to treat
    - Land availability
    - Changes in practice
Iron Oxide

Calcined clay

Future tools

Water:
- Water budget
- Rainfall capture
Irrigation:
- Distribution uniformity
- Leaching fraction

Water problems and Solutions:
- Sediment
- Filter socks
- Sediment basins
- Nutrients
- Vegetated buffers
- Bioreactors
- FTW
- Wetlands
- Pathogens
- Slow sand filters
- Serial ponds

Pesticides:
- Slow sand filters
- Bioreactors
- Activated charcoal

Questions?????

Stay tuned at www.cleanwater3.org

- This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award # 2014-51181-22372