Water and Pesticides Movement in Container Production as Affected by Irrigation Practices

Tom Fernandez
Department of Horticulture
Michigan State University
fernan15@msu.edu

When broadcast Pesticide or fertilizer
Liquid or granular

Nutrient Leaching

Global Water Distribution

Source: (antribution to/drawn) in "Water or the Environment" by John B. Black (editor), 1993, Institute of Crop Science, A Guide to the World’s Freshwater Resources, 2005. Information and graphics provided by the senior author are not added to 100.
Recycle water
Recycle nutrients and pesticides
Move pathogens
Increase aquatic life (filtering, sanitizer)
Pesticides on sensitive crops

Sand
Pond liner
Native Soil

Sand and Native Soil
Irrigation Treatments:
Control = Overhead ¾ acre-inch
Spray stake at 0.53 gpd
OR
Spray stake at setpoint:
on at 35% moisture, off at
container capacity
All plants fertilized with
complete CRF

2017 Pesticide Treatments

<table>
<thead>
<tr>
<th>Application 1 June 27</th>
<th>Application 2 August 8</th>
<th>Application 3 August 29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acephate 97UP</td>
<td>Lorsban 4E</td>
<td>Thiophanate Methyl 85WDG</td>
</tr>
<tr>
<td>0.5 lb/acre</td>
<td>1 qt/acre</td>
<td>8 oz/acre</td>
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<tr>
<td>Talstar 7.9%</td>
<td>Terraguard SC</td>
<td>Barricade 65WG</td>
</tr>
<tr>
<td>21.8 oz/acre</td>
<td>8 oz/acre</td>
<td>2.3 lb/acre</td>
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<tr>
<td>Mefenoxam 2AQ</td>
<td>Goaltender</td>
<td>Roundup PowerMax</td>
</tr>
<tr>
<td>1 oz/acre</td>
<td>2 pint/acre</td>
<td>1.5%</td>
</tr>
<tr>
<td>Talstar 7.9%</td>
<td>Gallery 75DF</td>
<td>Roundup PowerMax</td>
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Water Sampling from Runoff and Infiltration Tanks:
Tanks emptied 24 hours prior to sampling
Tank volume every time a sample collected
Nutrient samples every 2 weeks
Pesticide samples 0, 1, 2, 4, 8 and 16 days after application

Where the water went
Green squares = Overhead ¾ acre-inch
Red circles = Spray stake 0.53 gpd
Blue triangles = Spray stake to container capacity
37% of OH
31% of OH
77% of OH
53% of OH

Runoff = solid
Infiltration = diagonal

70% of OH
85% of OH
70% of OH
What is in the water
Benefits of delayed movement and on-target irrigation

How to improve
Plant Grouping by Average Daily Water Use

<table>
<thead>
<tr>
<th>Day of Treatment</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
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</table>

Gallons per Acre

June | July | August | September

- 21,700
- 19,000
- 16,300
- 13,600
- 10,900
- 8,100
- 5,400
- 2,700
- 0

Warmer et al., 2009 HortScience

Growth Index - Hydrangea arborescens 'Abetwo'

- 22.0 inches A
- 21.7 inches A
- 22.3 inches A
- 22.2 inches A

- 31.0 inches A
- 32.6 inches A
- 31.7 inches A
- 32.1 inches A

Overhead Irrigation

<table>
<thead>
<tr>
<th>Day of Treatment</th>
<th>Irrigation Against</th>
<th>Control Runoff</th>
<th>100% DWU Runoff</th>
<th>75% DWU Runoff</th>
<th>100-75 Runoff</th>
<th>100-75-75 Runoff</th>
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<tbody>
<tr>
<td>6</td>
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Overhead Irrigation Applied

- Control Runoff
- 100% DWU Runoff
- 75% DWU Runoff

Means in each group showing the same letters are not significantly different from each other (p ≤ 0.05).

Means separated by Tukey's Test.

Growth Index - Hydrangea paniculata 'Limelight'

- 25 inches a
- 24 inches a
- 35 inches a
- 32 inches b

Growth Index - Hydrangea arborescens 'Abetwo'

- 22.2 inches A
- 22.3 inches A
- 21.7 inches A
- 22.0 inches A

Growth Index - Hydrangea paniculata 'Limelight'; Limelight Hydrangea; 29 July 2010
Overhead Irrigation and Runoff

Application Rates: N = 123 lb/ac, P = 15 lb/ac (35 lb P₂O₅)

Amount recovered based on 100% land use with #3 containers spaced 1.5 ft on-center over 4 months.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Irrigation Applied (gal/acre)</th>
<th>Runoff volume (gal/acre) (%)</th>
<th>Nitrates recovered (lb/acre) (%)</th>
<th>Phosphates recovered (lb/acre) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>2.4 million</td>
<td>1.04 million (43%)</td>
<td>12 (10%)</td>
<td>3.1 (21%)</td>
</tr>
<tr>
<td>100% DWU</td>
<td>1.6 million</td>
<td>0.48 million (31%, 20%)</td>
<td>7.2 (6%)</td>
<td>1.7 (11%)</td>
</tr>
<tr>
<td>100-75% DWU</td>
<td>1.4 million</td>
<td>0.29 million (21%, 12%)</td>
<td>5.9 (5%)</td>
<td>1.2 (8%)</td>
</tr>
<tr>
<td>100-75-75% DWU</td>
<td>1.3 million</td>
<td>0.37 million (29%, 15%)</td>
<td>5.7 (5%)</td>
<td>1.2 (8%)</td>
</tr>
</tbody>
</table>

Summary

- Overhead irrigation generates most runoff and infiltration
- Spray stakes at 0.53 gpd had 63% less runoff, 23% less infiltration
- Spray stakes using set-point control had 69% less runoff, 47% less infiltration
- Scheduling based on plant needs reduces water use, runoff volume and N & P in runoff
- So far pesticides mostly detected in runoff, not infiltration. Exception is highly soluble pesticides (Acephate)
- Delayed and less pesticide runoff for spray stake versus overhead irrigation
- Allows more pesticide binding and degradation before entering runoff
Thanks to the team:

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Renewed Earth