

CLEAN WATER³
REDUCE, REMEDIATE, RECYCLE

WATER WISE

EFFICIENT NURSERY WATER USE

Sarah A. White, PhD
Nursery Extension Specialist

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Water challenges & concerns

Contaminants?
Aquatic weeds & Algae
Pathogens
Salts
Pesticides

Availability?
What is my backup water source?
Is it safe to reuse my water?

2

Production challenges & concerns

Irrigation timing? Cultural practices?
Application efficiency?
Plant diseases?

If inefficiencies - how much have I lost?
\$\$\$ and opportunity cost

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Water + fertilizer = saleable crops

Input (in)efficiencies

- Water - 30% to 80%
- N & P - 30% to 60%

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Clean Water³ Reduce, Remediate, Recycle

Enhancing Alternative Water Resource Availability & Use to Increase Profitability in Specialty Crops

\$8.26M 2014 – 2019
NIFA – USDA 2014-51181-22372

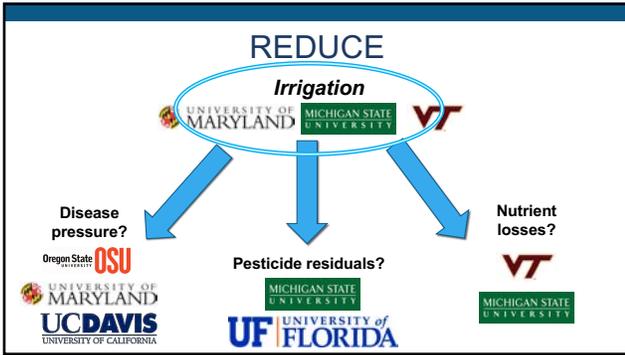
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Purpose of the Clean Water³ project

Ensure water does not limit grower economic sustainability

- conservative use of water resources
- mitigate environmental impact
- use viable alternative water resources

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Calculators available:

- Irrigation
 - Coefficient of uniformity
 - Interception efficiency
 - Irrigation volume
- Reservoir sizing (volume needed)
- Reservoir refill
- Leaching fraction (based on salinity)
- Chlorine contact time
- Dilution - chemical dosage
- Slow sand filter sizing
- Pathogen hazard analysis

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Resources – irrigation management

- Design to supply adequate and uniform application
- Manage to minimize excessive nutrient leaching

Irrigation Management Practices

Matthew S. Chappell
 Jim S. Owen
 Wayne Park
 Sarah A. White
 John Leo-Cox

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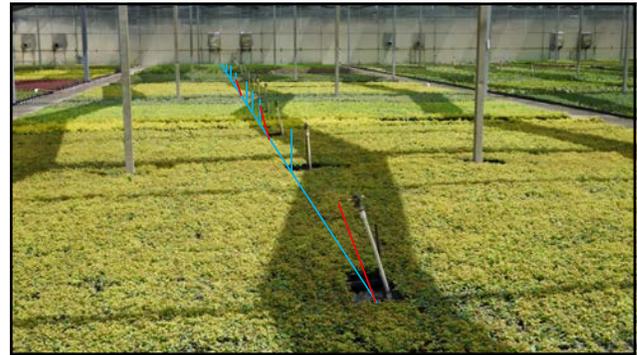
Irrigation Efficiency

The ratio of the volume of water taken up by plants to the volume pumped or delivered for use.

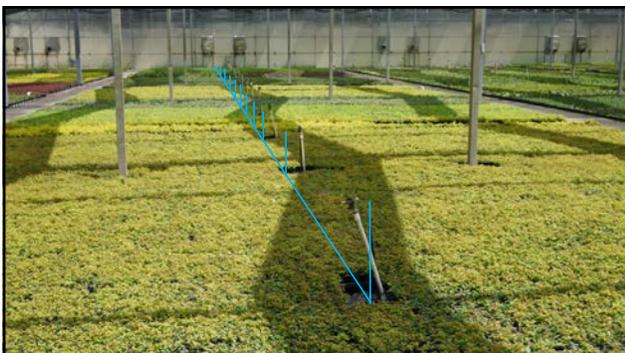
Pressurized irrigation system application efficiencies		
System type	Range (%)	Average (%)
Sprinkler irrigation systems		
Solid set systems - field production	70 - 80	75
For container nurseries	15 - 50	20
Micro-irrigation systems		
Surface	70 - 90	85
Spray systems	70 - 85	80

Slide adapted from Matt Chappell, UGA

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Irrigation uniformity & rate



○ 0.7	○ 0.8	○ 0.9	○ 0.5
○ 0.8	○ 0.7	○ 0.9	○ 0.7
○ 1.0	○ 0.8	○ 0.8	○ 0.9
○ 1.0	○ 0.8	○ 0.9	○ 1.0

Use straight-sided cups of uniform size on grid pattern in a container area to determine irrigation distribution uniformity.

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Irrigation uniformity & rate – measuring example

○ 0.7	○ 0.8	○ 0.9	○ 0.5
○ 0.8	○ 0.7	○ 0.9	○ 0.7
○ 1.0	○ 0.8	○ 0.8	○ 0.9
○ 1.0	○ 0.8	○ 0.9	○ 1.0

- Catch cans spaced between 4 sprinklers in a square grid pattern
- Value below each circle = depth / volume captured per unit time (hour) at that location

$(0.7 + 0.8 + 0.9 + 0.6 + \dots + 0.9 + 1.0 + 0.8 + 0.9 + 1.0) / 16 = 0.83 \text{ in/hr}$

Slide adapted from Matt Chappell, UGA

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Irrigation uniformity & rate – automatic calculations

↓
<https://www.cleanwater3.org/growertools.asp>
↓

- The **Coefficient of Uniformity** tool can help you determine if your irrigation is being applied uniformly in a given block. (Video guide).

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Irrigation uniformity & rate – automatic calculations

English Español

John Majsztrik, Bruno Pitton, Lorence Oki, and Saurav Kumar (2019). Coefficient of Uniformity. <https://occviz.com/CW3/CU/CU.html> [access date: 2020-08-18]

Coefficient of Uniformity

Enter the water volume of at least 24 containers. Values should be separated by commas. Make sure that the units (cups, ounces, etc.) to the right are correct

7,8,9,6,8,7,9,7,10,8,6,9,10,8,9,10,8,8,6,9,10,6,9,7

- ✓ ounces
- ml
- liters
- cups
- pints
- quarts

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Irrigation uniformity & rate – automatic calculations

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- ✓ ounces
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Irrigation uniformity & rate – automatic calculations

To determine your irrigation application rate enter either the diameter of your container (circular containers) or length and width (for square or rectangular containers)

Diameter in ±

Length in ± Width in ±

Enter Irrigation Time ⓘ

Time (minutes)

Recompute

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Irrigation uniformity & rate – automatic calculations

Mean value of volumes entered:
8.08 ounces

Computed coefficient of uniformity:
86.4 %

Rate of application
1.548
inch/hr

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Scheduling irrigation

Maximize distribution uniformity

Container placement for water interception

Leaching fraction to gauge:
1. application efficiency
2. water volume to leach salts from the substrate

Water use/loss
1. soil moisture
2. daily water use

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Leaching fraction

Leachate

Total water applied

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Measuring leachate

Leachate

Total water applied

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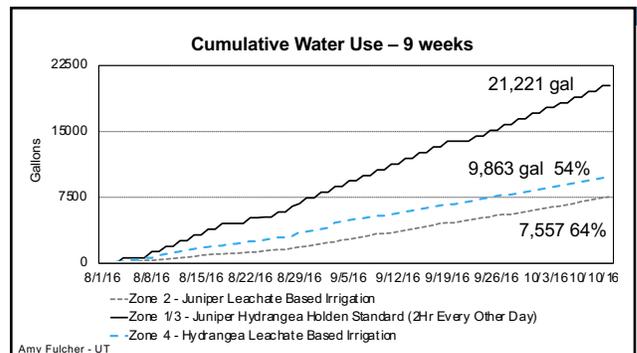
Applied irrigation research

- Irrigation scheduled based on leaching fraction
- Leachate fraction (LF) target = 15% (could be 10%, 20%, or more depending upon LF goal)
- Compared to grower's standard 2 h / 48 h

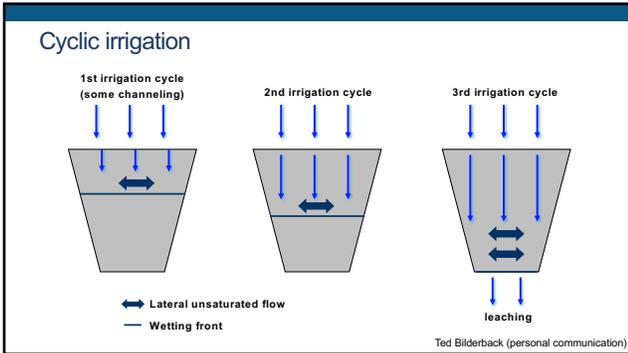
$$LF = \frac{\text{Amount leached}}{\text{Amount applied}} \times 100$$

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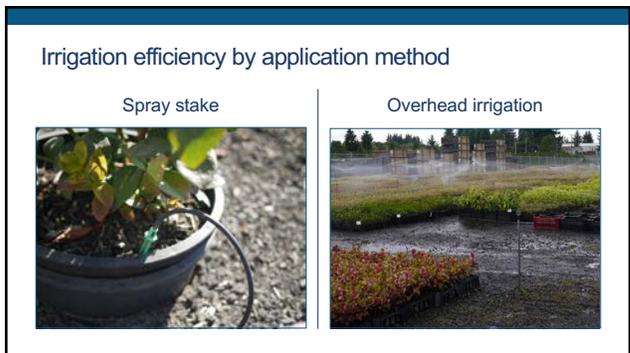
Daily water use-based irrigation

- Reduce
 - irrigation volume
 - water cost
- Overhead irrigation already in place
- Use of moisture sensors to apply only the amount of water necessary

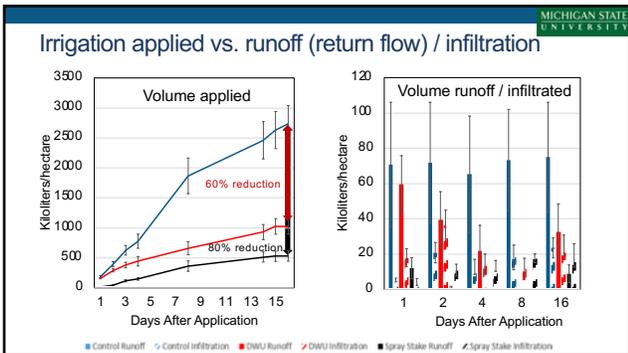
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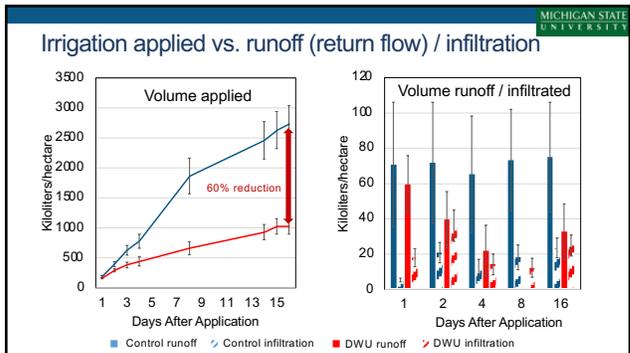
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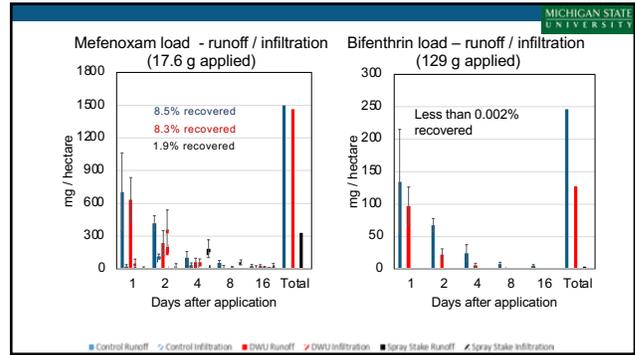
Pesticides kept in production areas

- More capacity to protect crops
- Prevent export to recycling reservoirs/ environment
- Allow degradation on-site (photolysis, volatilization)

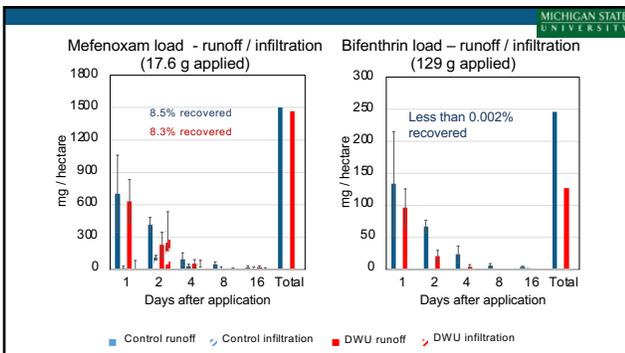


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REMIATE: physical treatment technologies

Rapid physical filters



Bark, peat, algae

Granular activated carbon



Pesticides, PGRs, color

Filter socks



Sediment

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REMIATE: Biological treatment technologies

Floating treatment wetlands



Carbon wall



Vegetated buffers



Slow sand filter

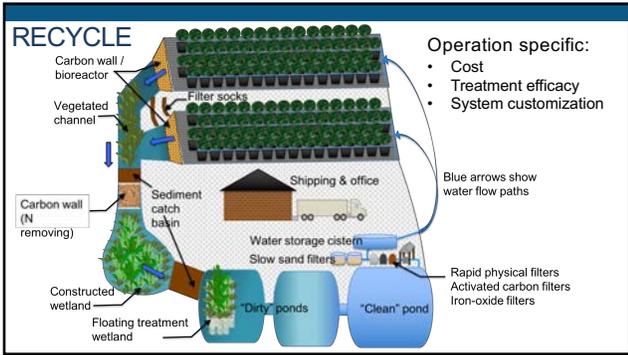


Bioreactors



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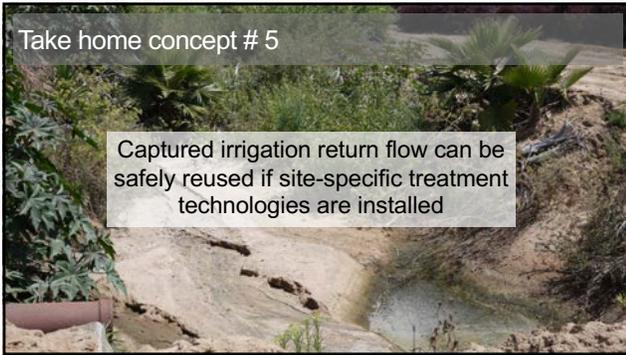
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