Impacts of recycled water on plant physiology and growth

Bert Cregg, Ph.D.
Michigan State University

Department of Horticulture
Department of Forestry

Is recycled water safe for my crops?

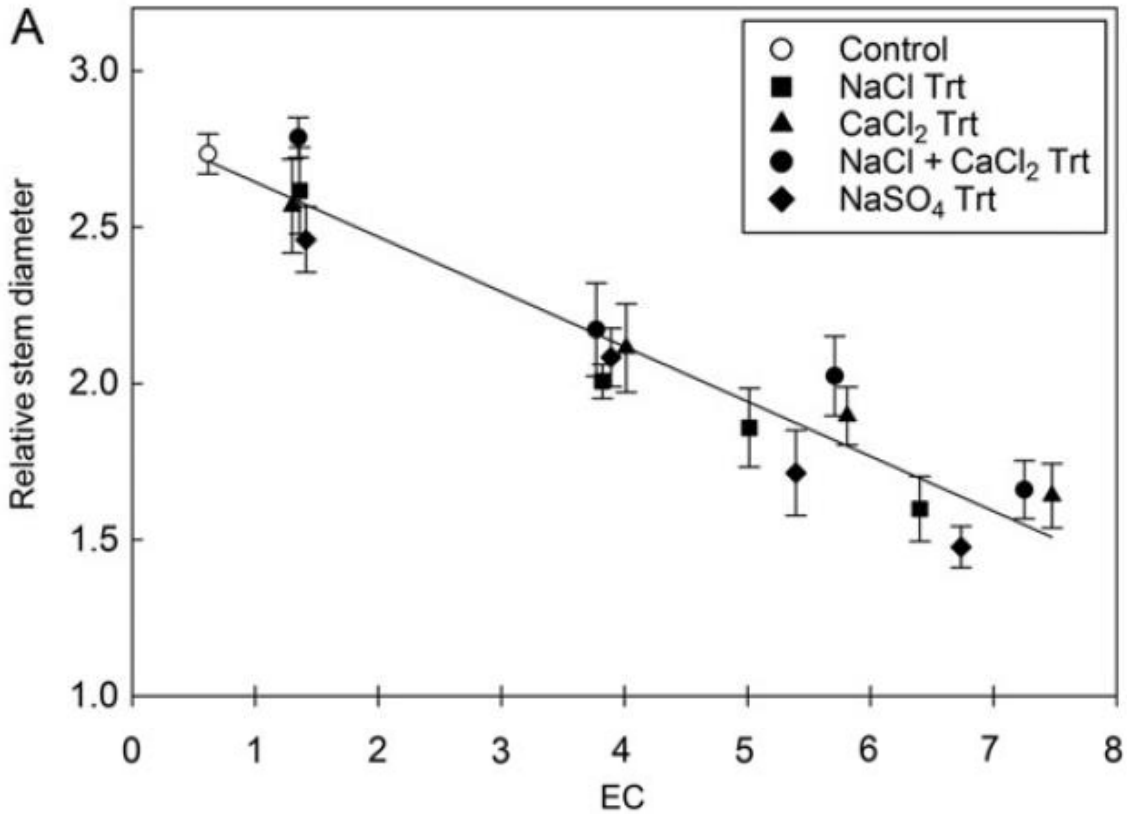
What are potential impacts of recycled water on crops?

- Salts/EC
- pH
- Solids/deposition
- Pesticides
- Pathogens

Salts/EC

- Direct toxicity
- Indirect effects
- Osmotic effects

Irrigation EC impacts growth of *Sequoia sempervirens* 'Aptos blue'



Nackley et al., 2015

pH effects

- pH of retention basins can vary widely
  - Season
  - Time of day
  - Depth within basin

The pH factor

Features - Irrigation: water recycling

Water pH in recycling irrigation ponds changes seasonally. Test the pH regularly to ensure healthy crops.

June 5, 2017

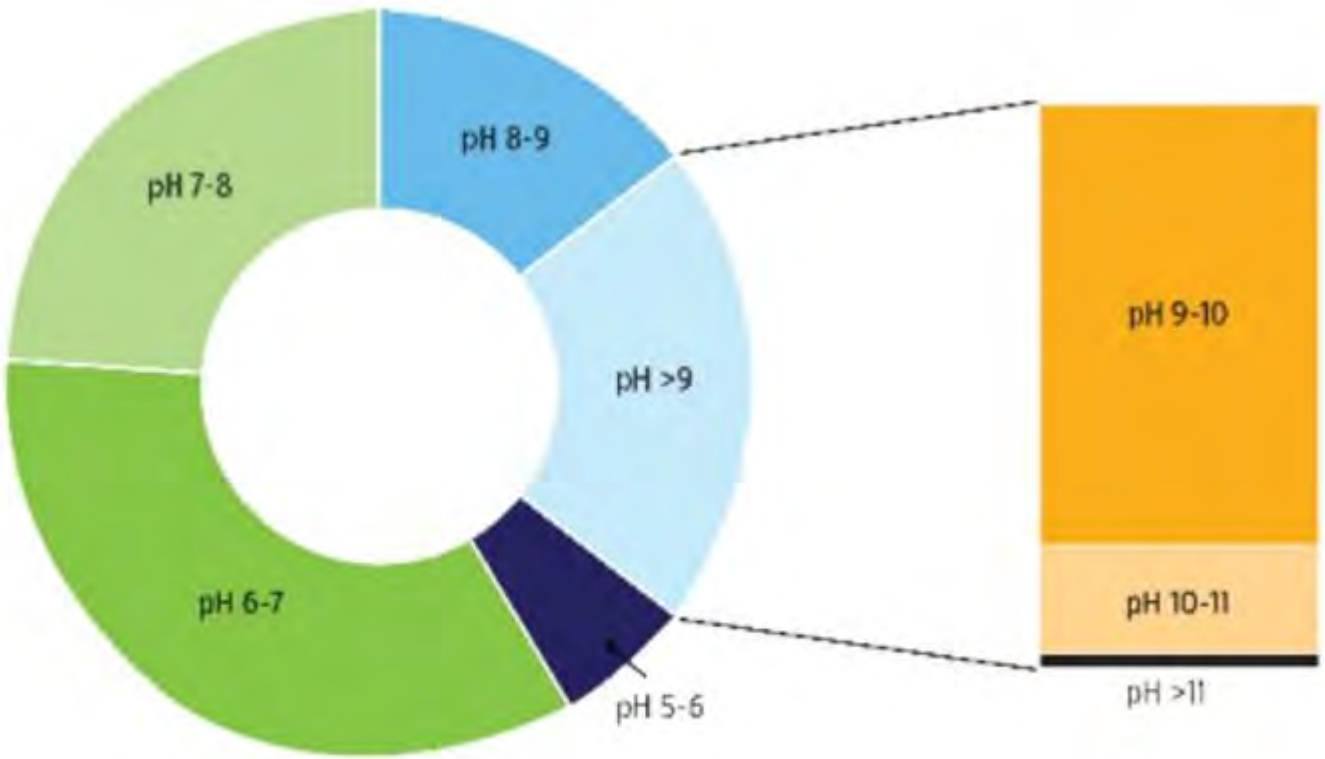
Haibo Zhang and Chuan Hong

pH of water from nursery run-off catchment basins in MD, MS and VA

Waterway[z]	n	pH (unit) Mean[y]	SE
MD11	6	8.13 c	0.16
MD21	5	7.84 c	0.39
MS11	6	8.81 d	0.07
VA10	6	6.61 b	0.23
VA11	5	6.35 a	0.17
VA12	6	6.86 abc	0.08
VA13	5	7.63 c	0.34
VA21	5	7.46 bc	0.35
VA22	5	7.41 bc	0.37
VA23	5	7.23 abc	0.30
		$P < 0.0001$	
Preferred range[x]		5.2–6.8	

Copes et al., 2017

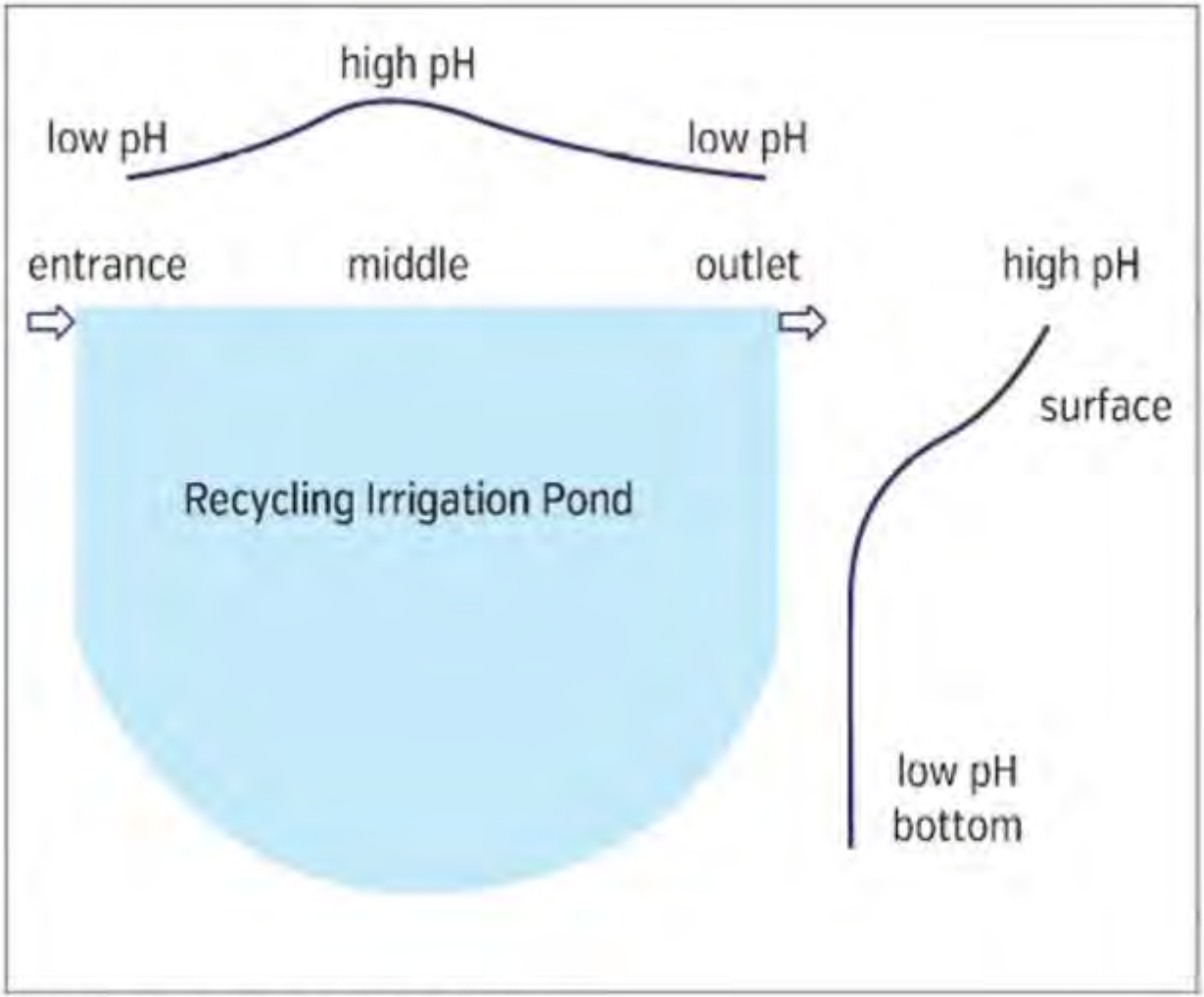
Recycled water pH varies widely



Recycled water pH ranges and relative dominance

Zhang and Hong. 2017

Recycled water pH also varies with depth



Water pH variations within a pond

Zhang and Hong. 2017

Solids/deposition

Solids/depostion

- Various materials in irrigation water can result in deposits on leaves
- Inhibits photosynthesis
- Clog stomatal pores
- Aesthetic issues

Pesticides

- Various pesticides have potential for phytotoxic effects
  - Herbicides
  - Insecticides
  - Fungicides
  - PGR's

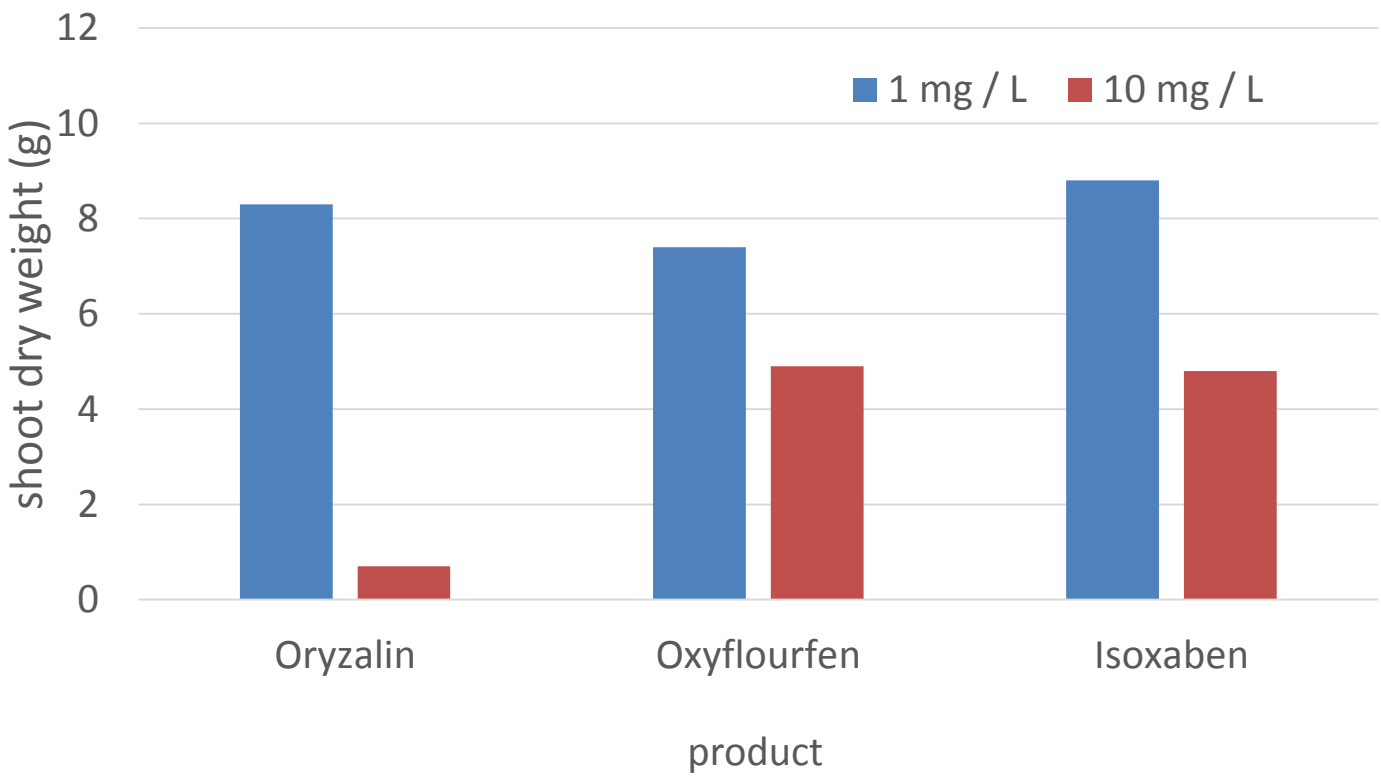
Type of exposure

- Surface (leaf) deposition
- Uptake from media

Herbicides

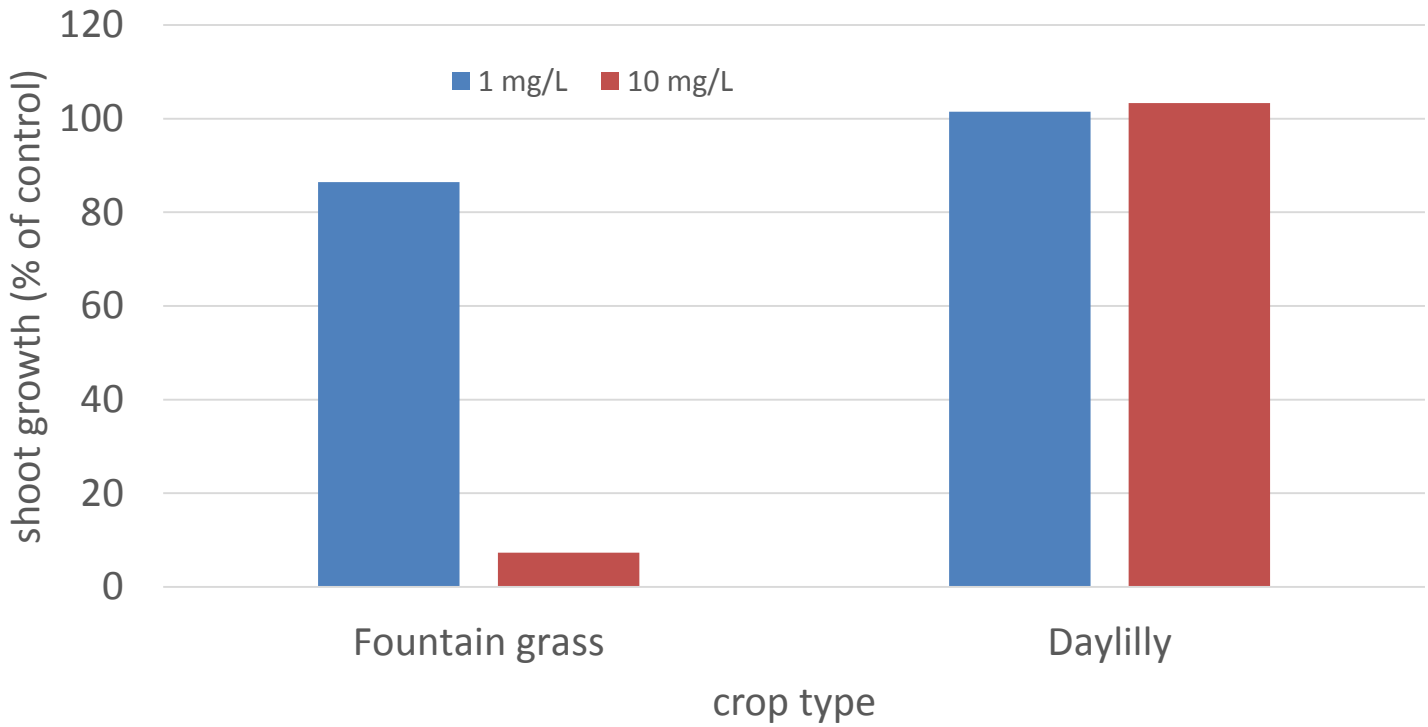
- Basis of herbicide selectivity

Residual herbicide impacts shoot growth of fountain grass



Adapted from Bhandary et al., 1997

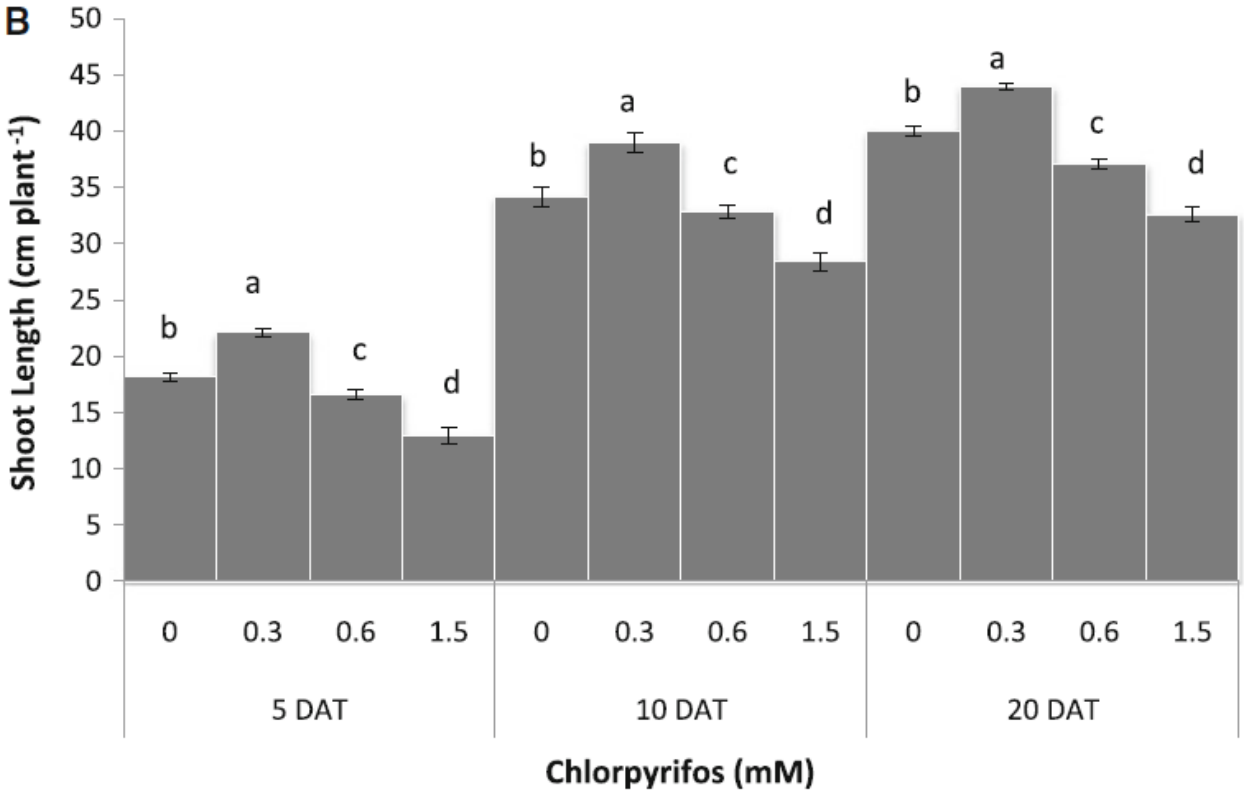
Variation in crop sensitivity to residual Oryzalin



Adapted from Bhandary et al., 1997

Insecticides

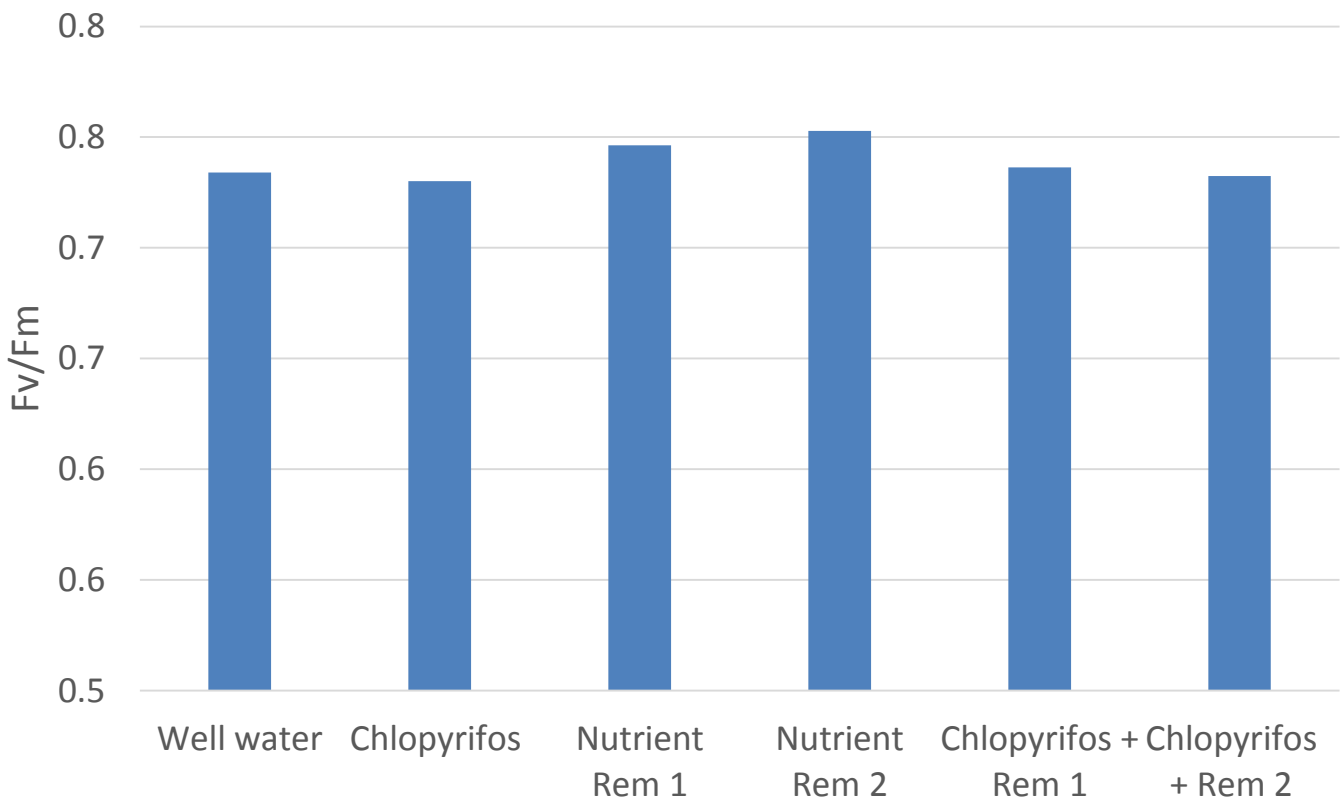
Effect of residual chlorpyrifos on crop growth



Parween et al., 2011

Growth and physiology of *Hydrangea* in response to chlorpyrifos application

Irrigation with simulated run-off did not affect photosynthetic efficiency



Pathogens

Pathogens

- Largest risk to crops from water recycling
  - Fungi
    - Phytophthora
    - Fusarium
  - Bacteria
  - Viruses
  - Nematodes

Minimizing potential adverse impacts of recycled water

- Follow BMP's
  - Reduce inputs from run-off

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Minimizing potential adverse impacts of recycled water

- Follow BMP's
  - Filtration

Summary

- Is recycled water safe for nursery crops? Yes
- Main potential issues are pathogens, salts, pH effects, and pesticides
- Risks can be minimize by following BMP's


Thank you!
SCRI - CLEAN WATER3
REDUCE, REMEDIATE, RECYCLE