Capture and Recycle Runoff: Water Quality Assessment

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Nursery Operations in New Jersey

Monitoring and assessment of:

- The quality of the captured and recycled water used for irrigating nursery crops
- The quality of leachates collected from container-grown nursery crops

The green industry in New Jersey

The nursery, greenhouse and sod industry has been the fastest growing segment of the New Jersey's agriculture in the last seven years

New Jersey Cash Receipts

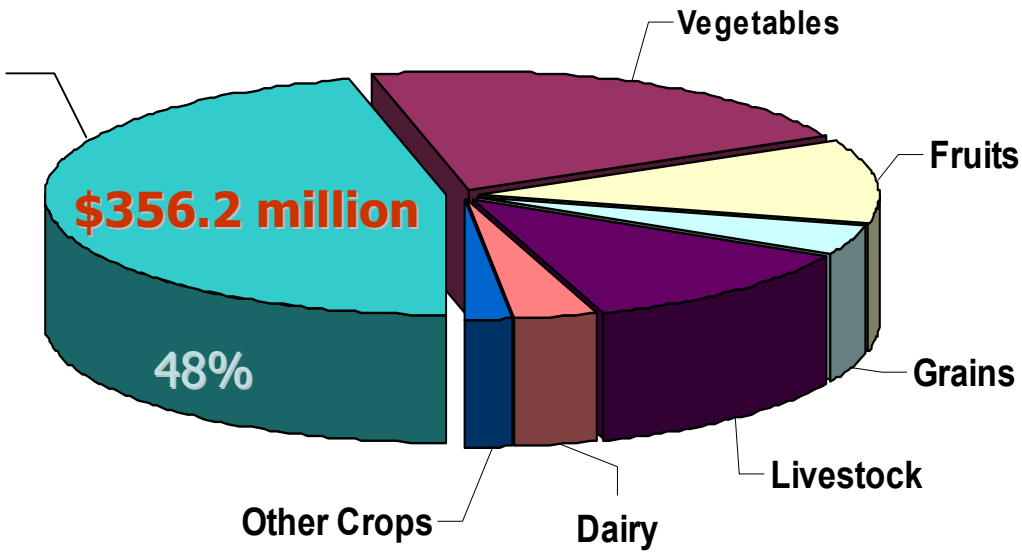
2002 Census of Agriculture

Total agricultural sales $749.87 million

Greenhouse

Sod #1

Nursery



High-value crops (producers and landscapers)

Impact on the economics

Impact on the availability of natural resources and the environment

More and more we see lands that have been used for vegetable production are turned into nursery crop operations

Nursery production in New Jersey

- The climate and the strategic location of the state New Jersey promote the production and marketing of many types of nursery crops:
  - Deciduous and evergreen trees and shrubs, vines, herbaceous perennials, fruits and nuts
- Quick returns

Nursery production systems

Container

Pot-in-pot

Field

Nursery Industry Challenges

- Despite the economic rewards, nursery industry like any other industry face many challenges:
  - **Supply and demand**
  - **Land value**
  - **Labor**
  - **Availability of natural resources and energy**
  - **Environmental regulations**

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Tail-water recovery systems

- The drought conditions
- The stricter environmental regulations that were implemented in neighboring states
  - led few of the large-sized nursery operations to install retention ponds “tail-water recovery systems” to capture the water runoff and recycle it to re-irrigate nursery crops

Why nurseries capture and recycle irrigation water?

- Conserve water
- Reduce water and energy cost
- Steady water supply
- Reduce/prevent pollution to streams and ground water
- Storm water control
- Flexibility in management

What is capture and recycle system ?

- Is a system that has a network of channels and ditches that capture runoff irrigation water from the nursery beds, and divert them to basins to retain water

- The water then can be pumped from these basins back onto the production areas or to a storage basin

Algal bloom growth

Sediment settling ponds

Overflow water from retention ponds drains directly into springs—becomes a point-source pollution

Disadvantages of recycling water

- Distribution of water-borne pathogens back to the nursery crops; e.g. *Phytophthora* spp., and *Pythium* spp.
- Build up of salts, chemicals, nutrients and increase in pH. This may consequently reduce crop quality if water is not diluted with fresh water
- Cost of decontamination
- Extra cost on filtration

Die back on azalea and juniper due to *Phytophthora* spp.

One-on-one visitations

Advisory Council meetings

Discuss the needs of nursery growers

Growers' needs (wish list)

- Research-based information on reuse of water:
  - The quality of water runoff that is retained in tail-water recovery systems
  - The quality of leachates produced at the production beds
- Evaluation of the current management practices
- Hands-on training workshops on tools and techniques to conserve water, reduce fertilizer rates and nutrient runoff

Assessing Water Quality of Retention Ponds and Leachates Collected from Containers

Water Quality: pathogens and nutrients

The project is driven by nursery growers' needs

Project Description

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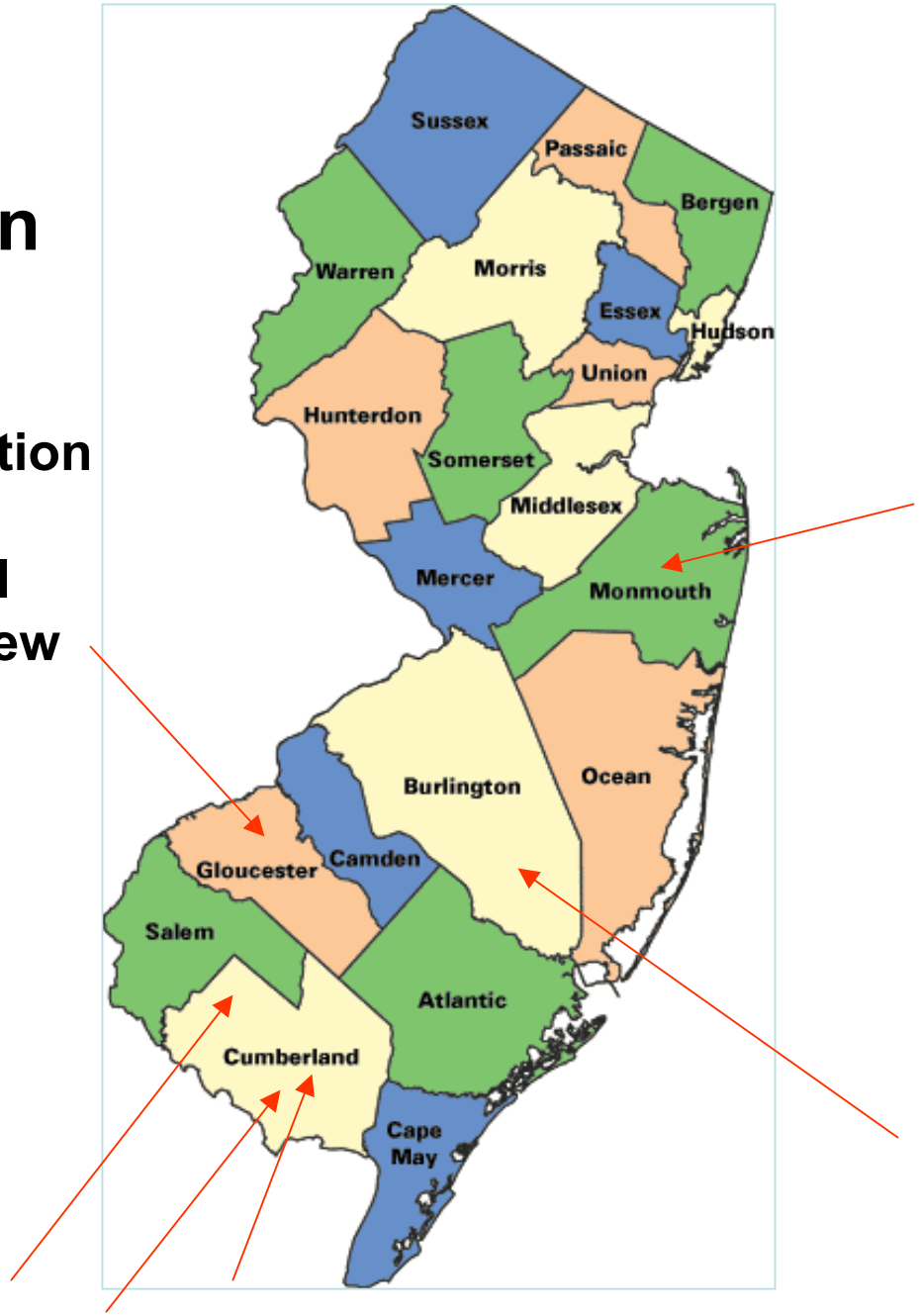
Nursery production is intensively grown in central and southern New Jersey



GPS the pond and the plant location

dam5

USGS

Bait the ponds with three types of fruits biweekly

Involved undergraduate students in this project

Collect baits after 3-4 days and incubate in chambers and then plate them on selective media

Symptomatic plants from commercial nurseries are then tested for the presence of Phytophthora

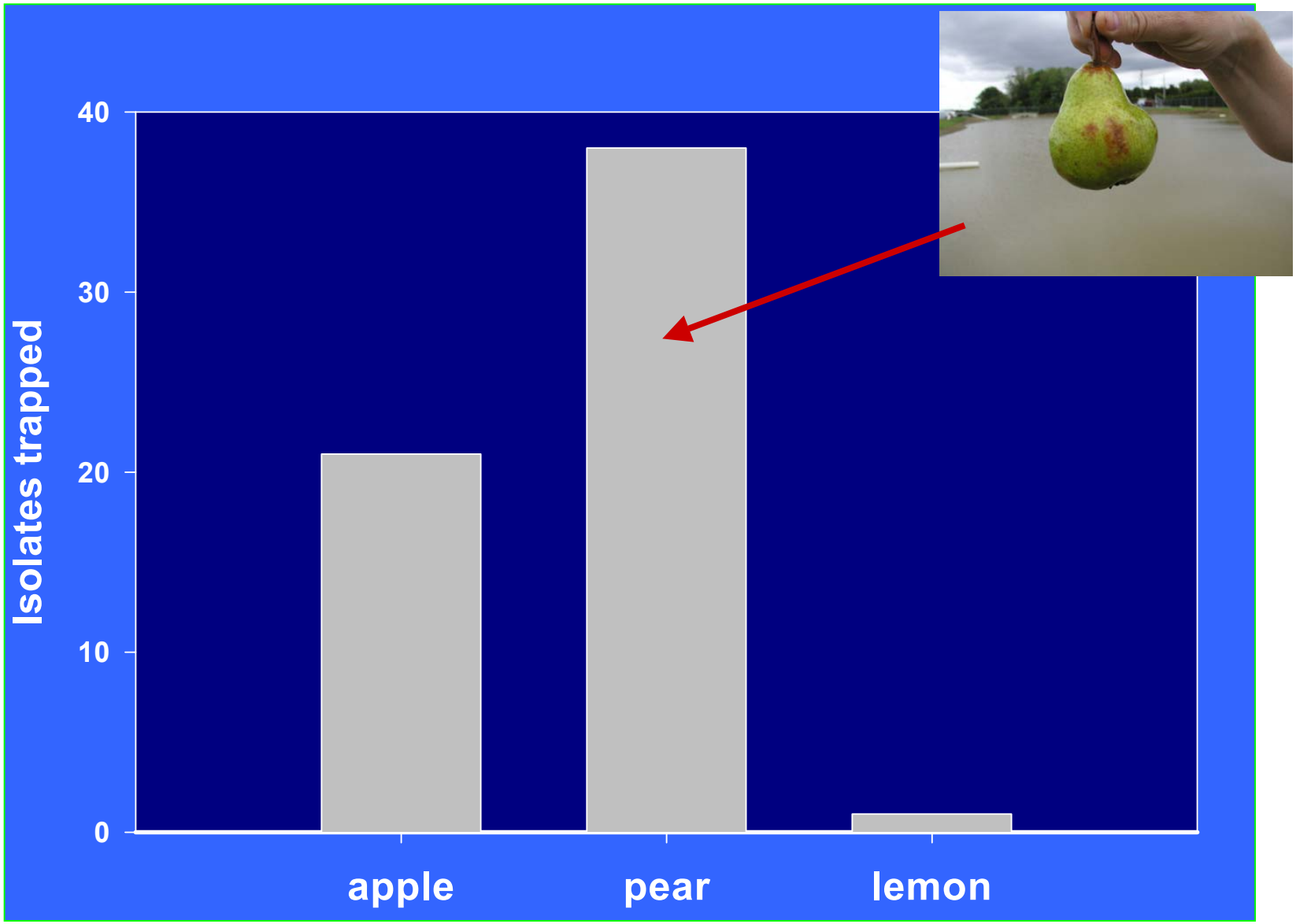
Sampling water from 5 location points per pond

Collected leachates from plants grown in containers

Replicated samples per crop species

Results: Pathogens

- Pear fruit is useful indicator of pathogen existence in water
- No *Phytophthora cinnamomi*
- *P. parasitica* (*nicotianae*) and *P. cactorum* are present
- Irrigation ponds carry several species that are potential pathogens


Isolates trapped
40
30
20
10
0
apple
pear
lemon

Results

Two nurseries

Juniper plant

Results -Two nurseries
Juniper plant

Tail-water recovery – Pond water

nutrients, EC and pH

Results: Water Quality in Pond

- **Pond Water**
  - **EC** was within the acceptable range <0.75 dS/m
  - **pH** was very high (8.3 - 9.7)
  - **Nitrate** (NO_3-N) ranged from 0.28 to 12 ppm
  - **Ortho-P** ranged from 0.03 to 0.8 ppm

Leachates from container-grown nursery crops

Nutrients, EC and pH

Results: Water Quality in Leachates from Containers

- **Leachates**
  - **EC** ranged from 0.2 to 2.5 dS/m
  - **pH** ranged from 6.4 to 7.3

  - **Nitrate** ranged from 0.8 -17 ppm, 10 – 325 ppm
  - **Ortho-P** ranged from 0.1- 0.5 ppm, 2 – 25 ppm

Summary

- Definitely the baited tailwater recovery systems had water mold pathogens and were in part a source for dissemination of pathogens that affected plant production
- Acidification of recycled water seemed to be necessary before recycled water can be used for irrigation
- Tail-water recovery systems had high levels of phosphate
- Phosphate concentrations in leachates were high irrespective of fertilizer and irrigation system
- Nitrate was higher in nursery 2 due to type of fertilizer used and irrigation system

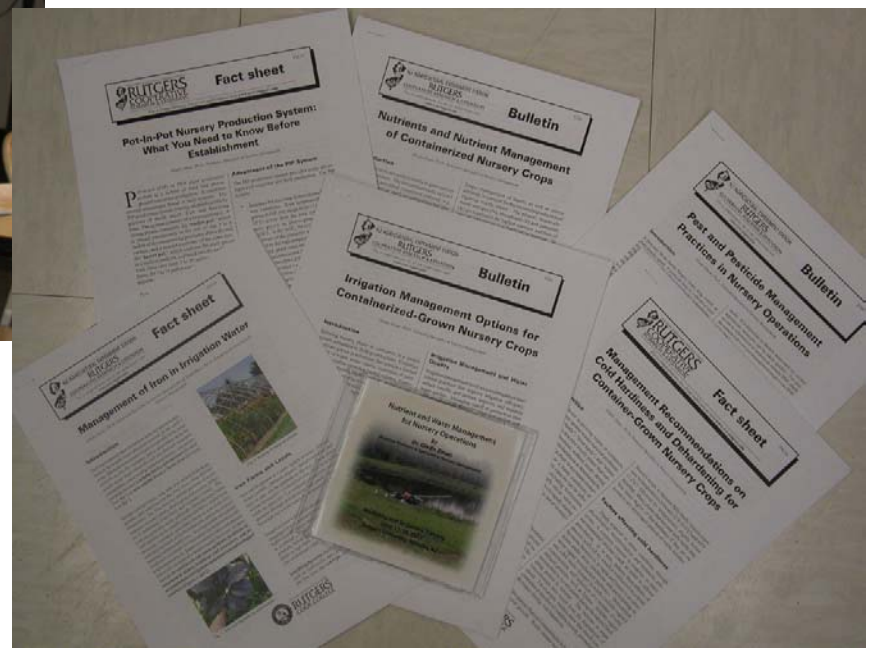
Impact of this study

- Increased awareness of nursery growers to nutrient loading and presence of plant pathogens

- Changed nursery growers behavior in that, they reduced fertilization and irrigation rates

- Provided basis for future work on developing more effective techniques on reducing nutrient leaching and loading, and investigating better and effective approaches for decontamination

Extension Outreach



Practices for Nursery Operations
Dr. Gladis Zinati
Specialist in Nursery Management

KUBOTA

CUMBERLAND COUNTY
THE GARDEN SPOT

Thank you