Pesticides in Nursery Runoff and Mitigation
(A 319h grant)

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1. UC Riverside
2. UCCE Orange County
3. UCCE Ventura County
Outline

- Dry weather runoff
- Stormwater runoff
- Mitigation practices
A Multi-billion Industry

United States Top 5 Nursery, Flower and Foliage Producing States

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<td><strong>TOTAL U.S.</strong></td>
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<td><strong>$15,193,378,000</strong></td>
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Source: H. Carmen, 2005
A Large Commercial Nursery
Dry Weather Runoff
Inflow Rate Measurement
Outflow Rate Measurement
Daily Inflow and Outflow Rates
(Gallons/day)

Inflow
Discharge
Flow Rate Observations

- Flumes + sensors ideal for dry weather runoff monitoring
- Daily inflow rate > outflow rate
- July 8, 2005 - Mar. 28, 2006
  - 2.93 million gallons outflow volume
  - 4.47 million gallons inflow volume
  - Output = 65% input
  - The nursery served as a sink under dry weather conditions
- Reduced runoff
  - Improved irrigation practices
  - On-site retention
    - Reuse of retained water
    - Percolation
    - Evaporation
Water Retention and Reuse
Bifenthrin Concentrations in Runoff
(ppb, $\mu$g/L)
Weekly Dry Weather Bifenthrin Runoff
(mg)

Date

7/19/2005
8/2/2005
8/9/2005
8/16/2005
8/23/2005
9/1/2005
9/8/2005
9/15/2005
9/22/2005
9/29/2005
10/6/2005
10/13/2005
10/20/2005
10/27/2005
11/3/2005
11/10/2005
11/17/2005
12/4/2005
12/11/2005
12/18/2005
12/25/2005
1/1/2006

mg

Inflow
Discharge
Pesticide Loads Observation

- No OP was detected
- Pyrethroids were frequently detected
  - Bifenthrin always detected
  - Fenpropathrin, cyhalothrin, cyfluthrin, and deltamethrin sometimes detected
- Bifenthrin concentrations higher in outflow than in inflow
  - The nursery is a net exporter of bifenthrin
  - Bifenthrin is used for RIFA control
  - Bifenthrin is always present in potting mix
Pesticide Loads Observation

- Bifenthrin concentrations decreased substantially during the project
- Daily bifenthrin load reduction: 98.7%
  - Daily bifenthrin load with mitigation = 2.06 mg/day
  - Daily bifenthrin load without mitigation = 163.4 mg/day
- Causes for reduction:
  - Reduction in outflow rate
  - Reduction in pesticide concentration
    - On-site retention
      - Settling of loose particles
      - Adsorption to sediment
      - In-situ degradation
Stormwater Runoff
Stormwater Runoff Outflow

![Graph showing stormwater runoff outflow with dates and gallons per day]
Flow Rate Observations

- Large flumes needed for storm flow monitoring
- Storm runoff overwhelms dry weather runoff
- **July 8-March 31:**
  - Dry weather total output: 4.1 million gallons
  - Storm total output: 41.4 million gallons
  - Storm runoff: 90.9% of total output
  - Dry weather runoff: 9.1% of total output
Bifenthrin in Runoff

(ppb, µg/L)

Date

Concentration (µg/L)

Inflow
Discharge
Weakly Bifenthrin Runoff at Outlet 2 (mg)

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<th>Discharge</th>
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The graph shows the weakly bifenthrin runoff at Outlet 2 in milligrams (mg) over the period from July 19, 2005, to April 6, 2006.
Bifenthrin concentrations in storm runoff were higher than in dry weather runoff.

Bifenthrin loads in storm runoff overwhelms dry weather runoff.

July 8-March 31:
- Total dry weather export: 2,104 mg
- Total storm export: 67,029 mg
- Storm runoff loads: 97% of total export

Storm runoff features:
- High initial concentrations
Mitigation Practices

Irrigation Runoff

- Easy to manage
- Efficient irrigation practices
- Retention
  - Retention of particles and organic matter
  - Percolation
  - Evaporation
  - Natural degradation
- Reuse of retained water
- Loose potting mix management
- Vegetative filters in ditches
- Coir filters?
Mitigation Practices

Storm Runoff

- (Extremely) difficult to manage
- Catch and retain runoff from small storms
  - “First flush”
- Pre-storm preparation:
  - Loose potting mix management
  - Containers away from ditches?
  - Clean up ditches
  - Minimize pesticide use in winter months
  - Alternative pesticides in winter months
Acknowledgement

- The no-name nursery
- EPA 319(h) program
- Santa Ana RWQCB
  (Doug Shibberu)
- CA Department of Pesticide Regulation
  (PUR databases)