Mitigating Pesticide Runoff at A Large Commercial Nursery

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Outlines

- Problems
- Monitoring setup
- Concentration and loads
- Management practices and effectiveness
- Lessons learned

Problems

- Prevailing toxicities in Upper Newport Bay and San Diego Creek
- Attribution to diazinon, chlorpyrifos and other toxics
  - Diazinon and chlorpyrifos TMDL in 2003
  - Organochlorine TMDL in 2007
- Unknown toxicities
  - Replacement pesticides? - pyrethroids
- Sources:
  - Predominantly urban
  - Commercial nurseries – concentrated use sites

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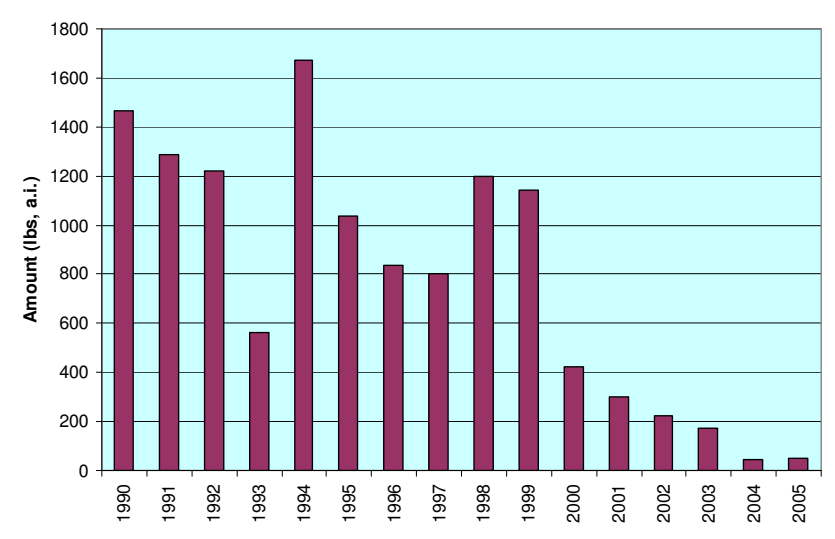
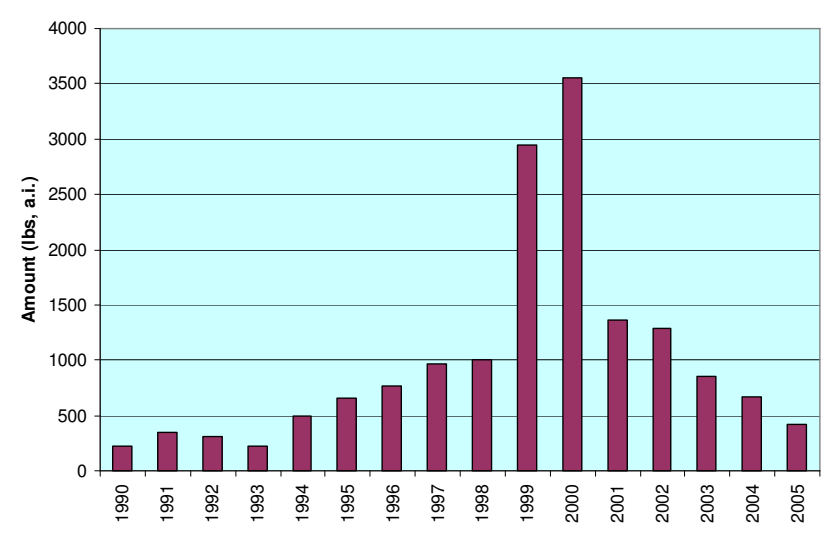
Pesticide use trends at nurseries (Orange County)

Diazinon



Chlorpyrifos



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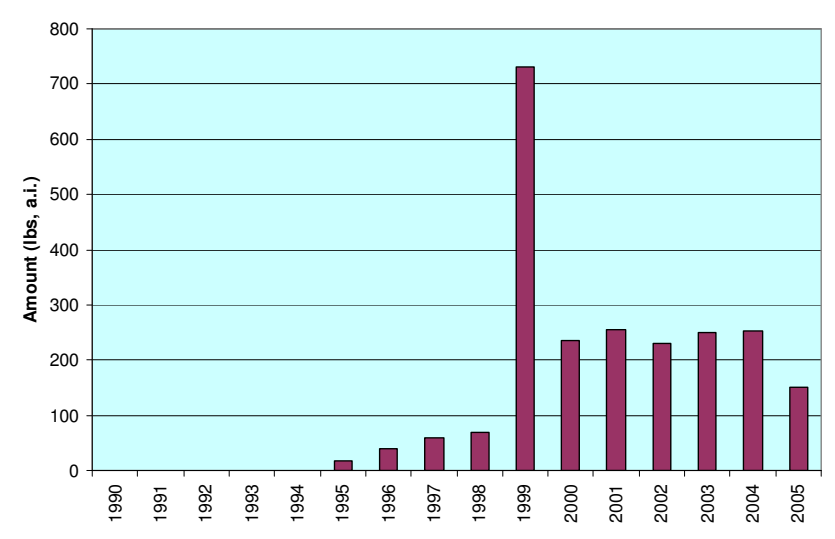
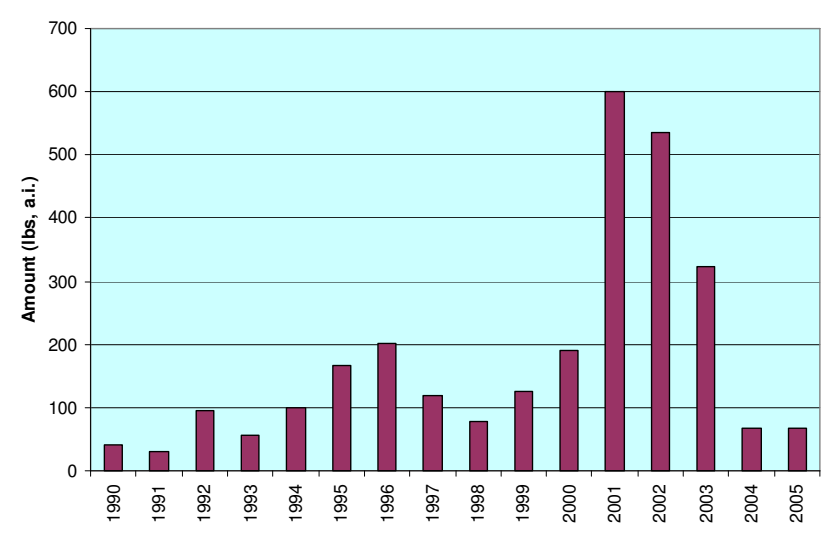
Pesticide use trends at nurseries (Orange County)

Bifenthrin

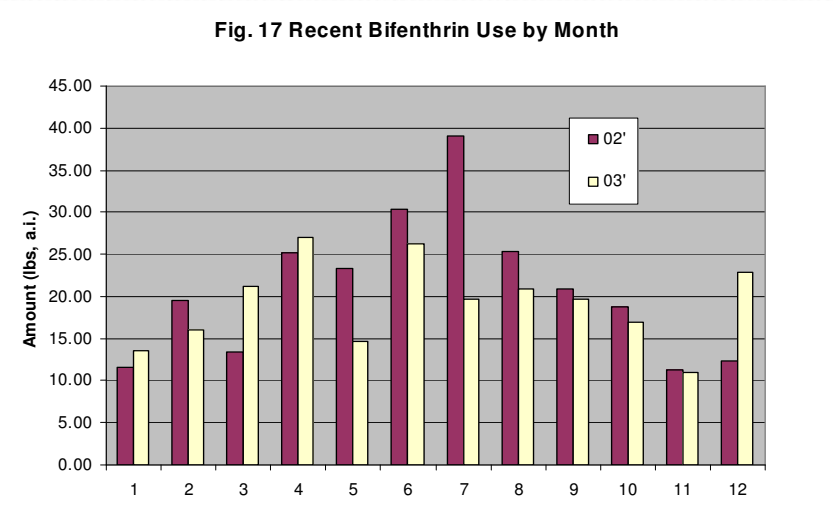


Permethrin

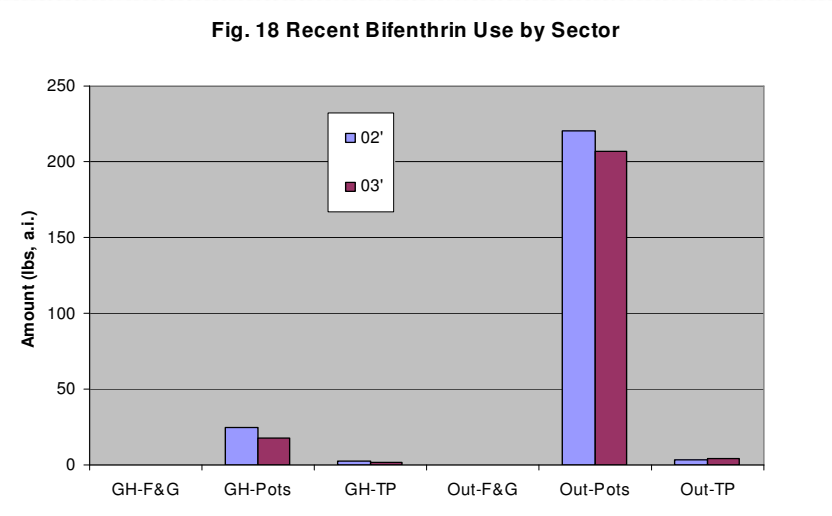


Pesticide use patterns at nurseries (Orange County)

Bifenthrin by month



Bifenthrin by sectors



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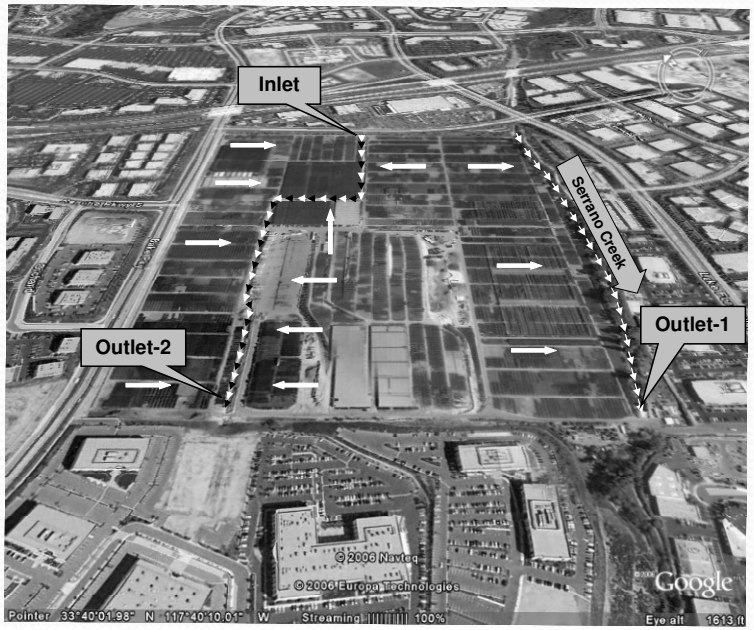
Monitoring Setup



Site:

- 125 acres on flat land
- Mostly outdoor containers
- Receive urban drain/runoff water
- Discharge into small creeks

Flow measurement

Outlet 1

Inlet (receiving urban runoff)

Outlet 2

Flumes and sensors

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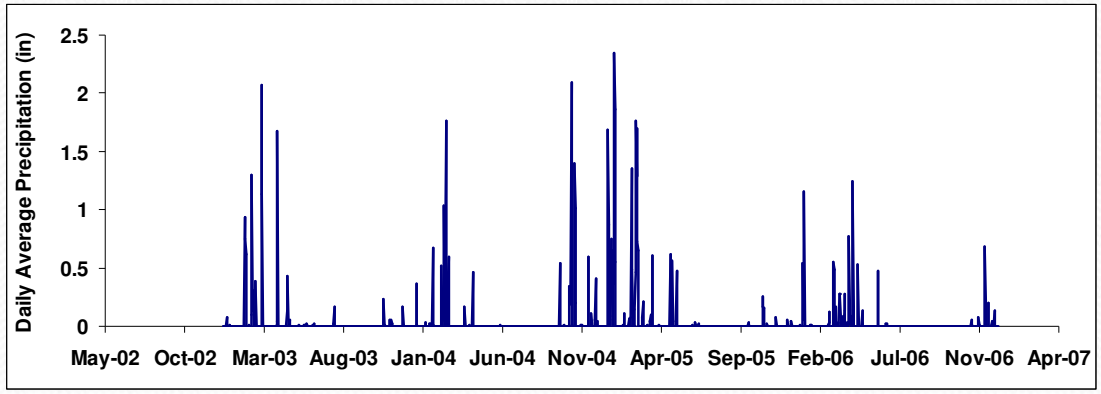
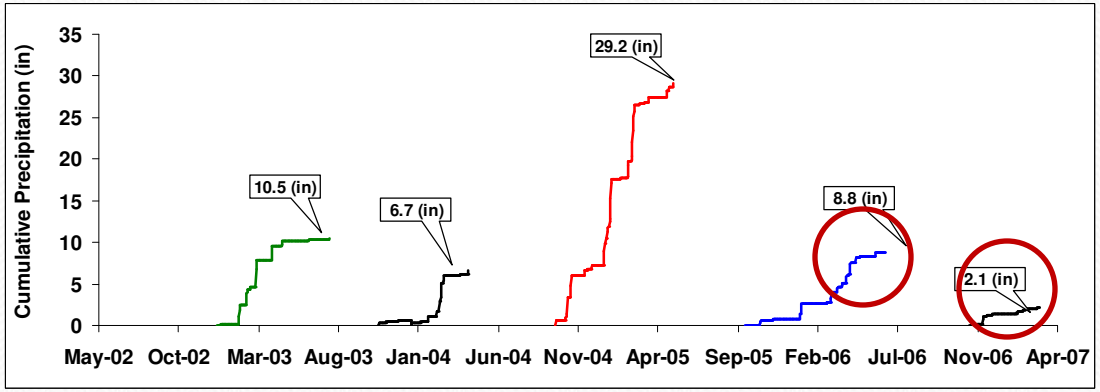
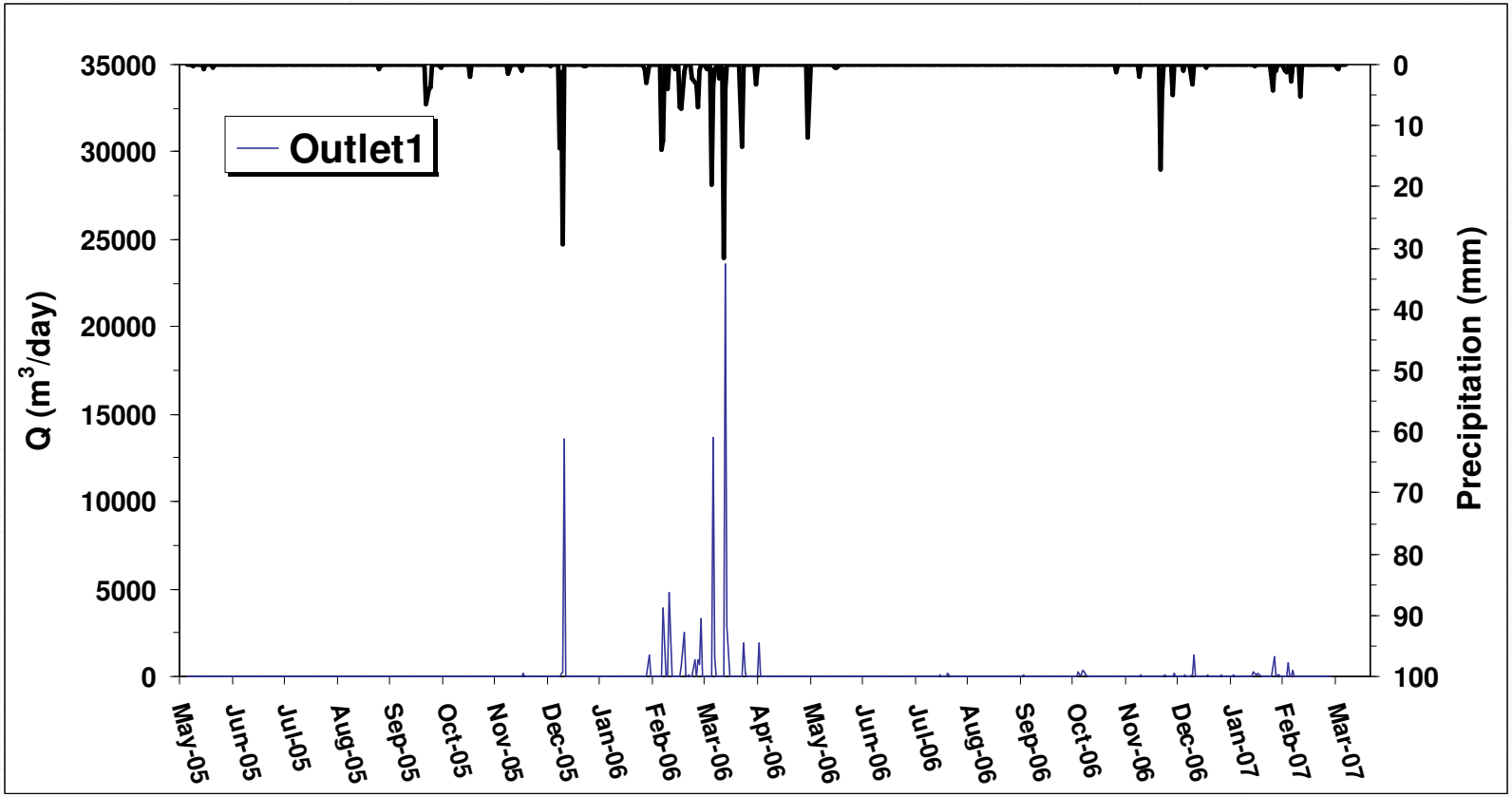
Concentration and Loads





Five-year precipitation patterns

Runoff volume at outlet 2



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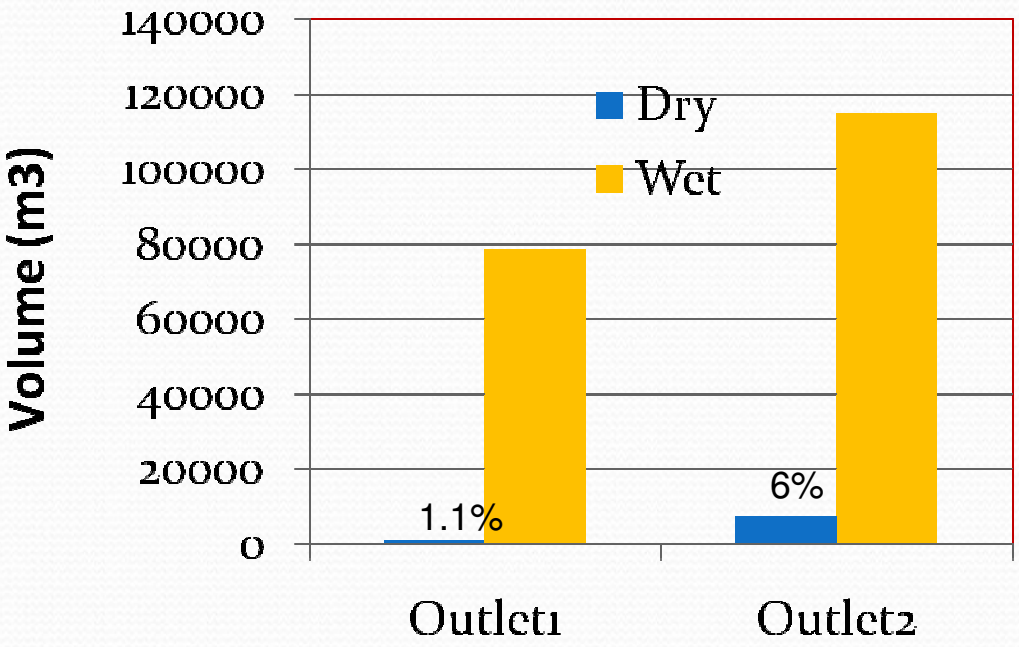
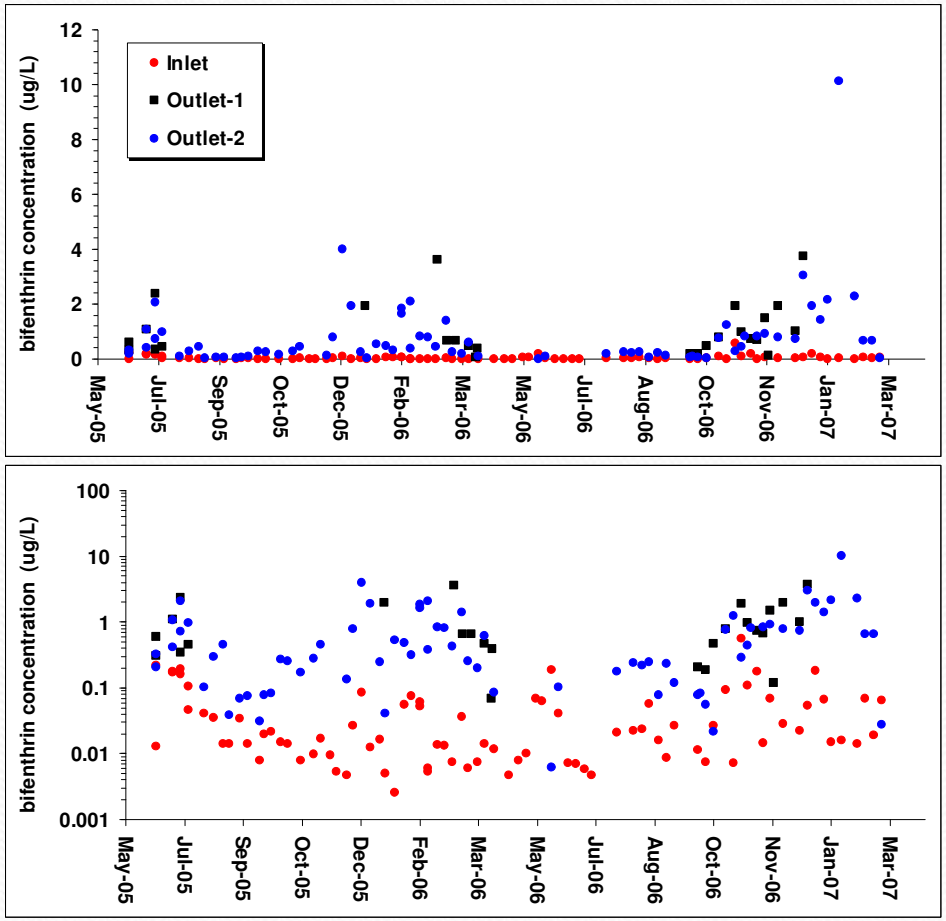
Storm runoff dominance



Bifenthrin concentrations in runoff



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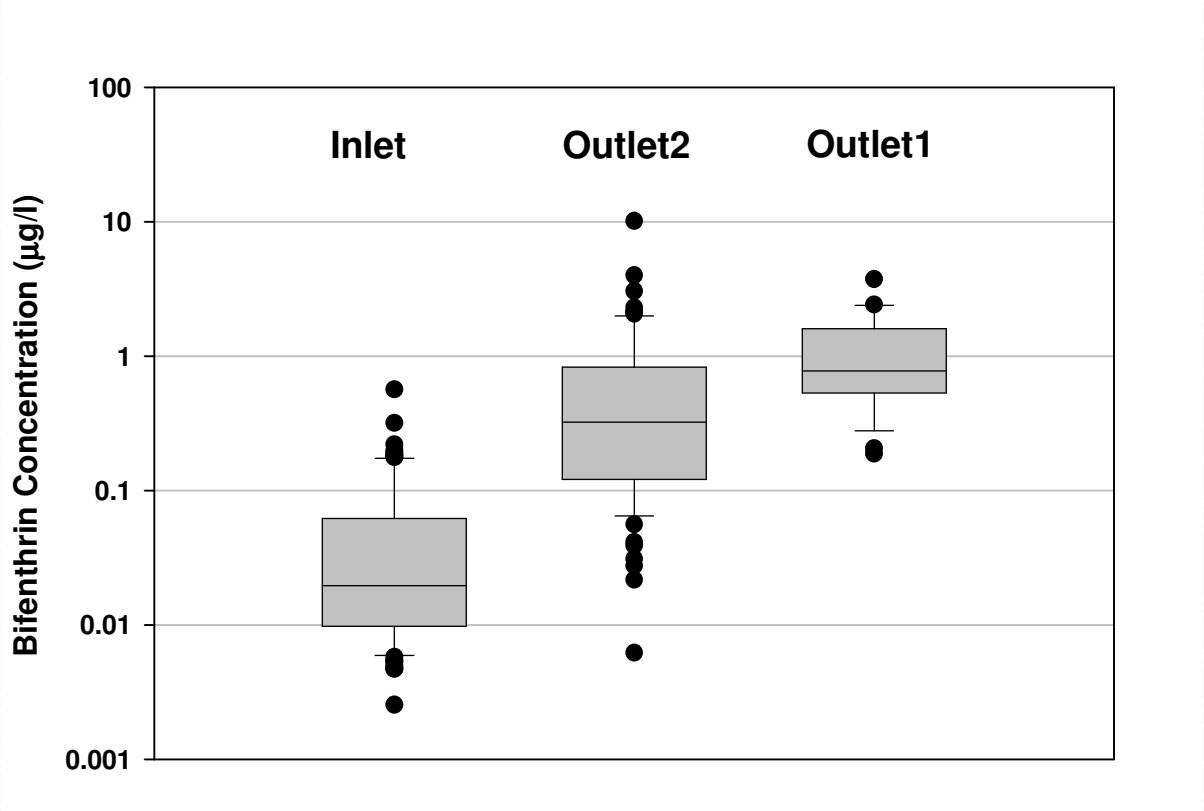

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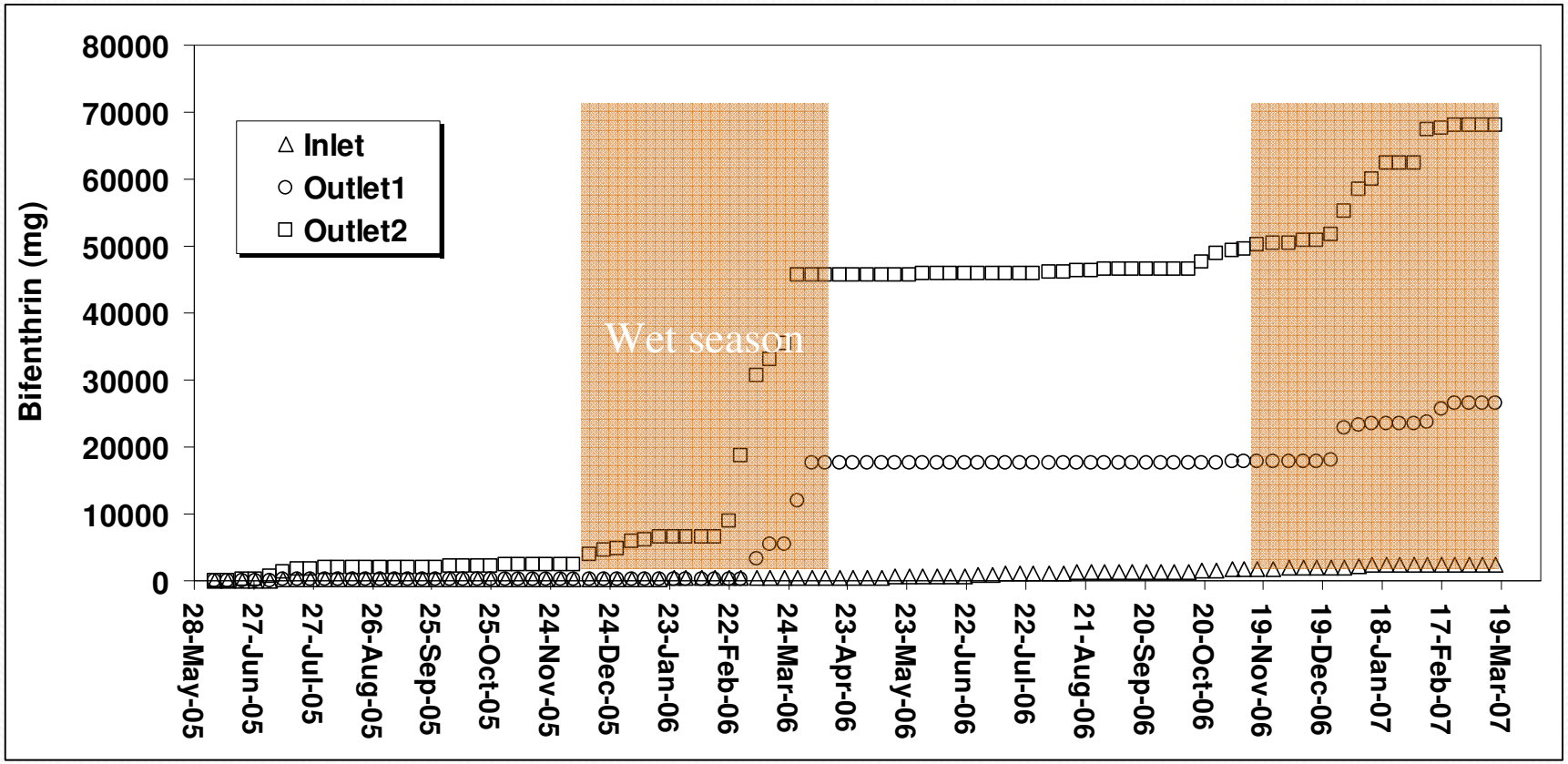
Cumulative bifenthrin loads in runoff



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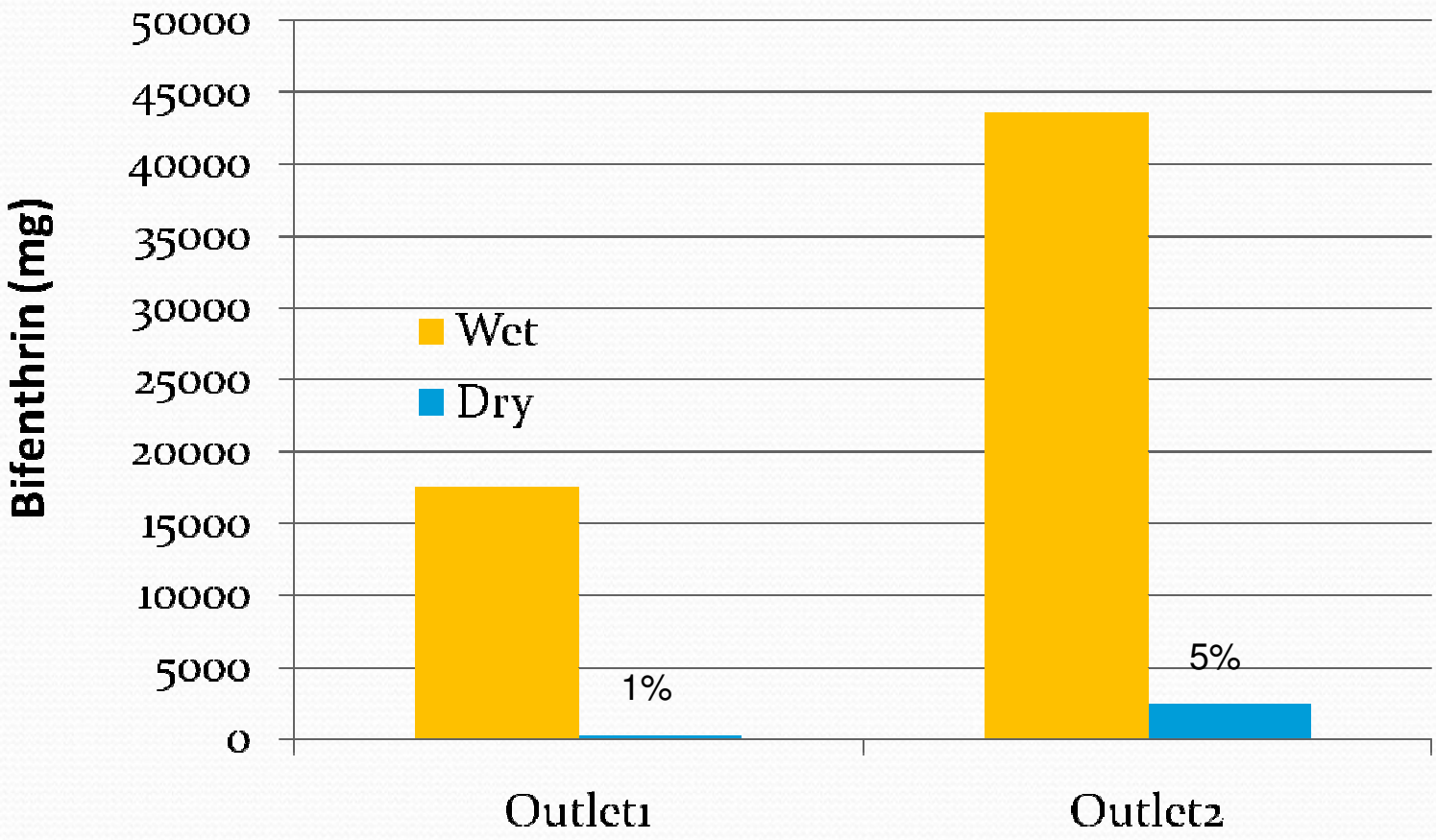

Management Practices

- Irrigation improvement
  - Reduced runoff rates since the inception of project
- Edge control of runoff
  - Berms and sand bags to prevent runoff entering ditches
- Isolation of potting mix handling areas
  - Prevent contamination of runoff by potting mix (containing pesticides)
- Check dams and retention basins
  - Slow down flow, allowing sedimentation
  - Encourage infiltration and evaporation
- Water recycle
- Sediment clean up

Check dams and retention basins

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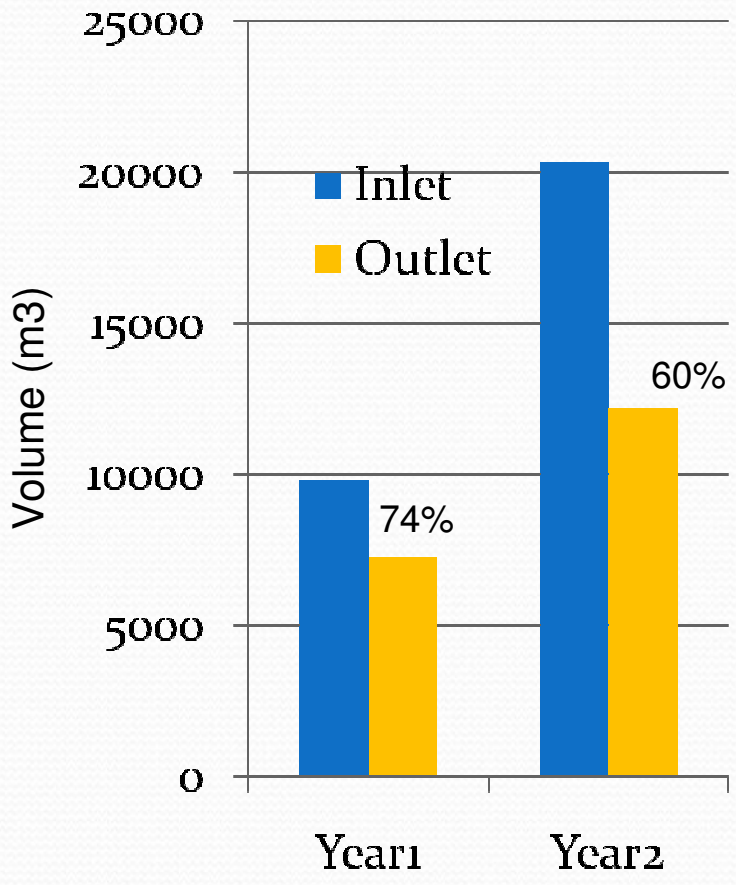
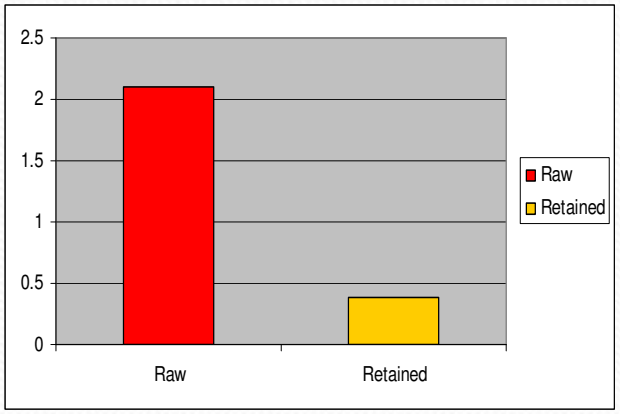
Reduced runoff under dry weather conditions

- The nursery absorbed water in dry season
  - Retention basins
    - Infiltration
    - Evapotranspiration
    - Recycle
  - Better irrigation practices



Retention is the solution



- Allowing particles to settle – along with pesticides
- Allow time for in-situ degradation
- Allow time for adsorption

Edge control of runoff

Isolation of potting mix areas

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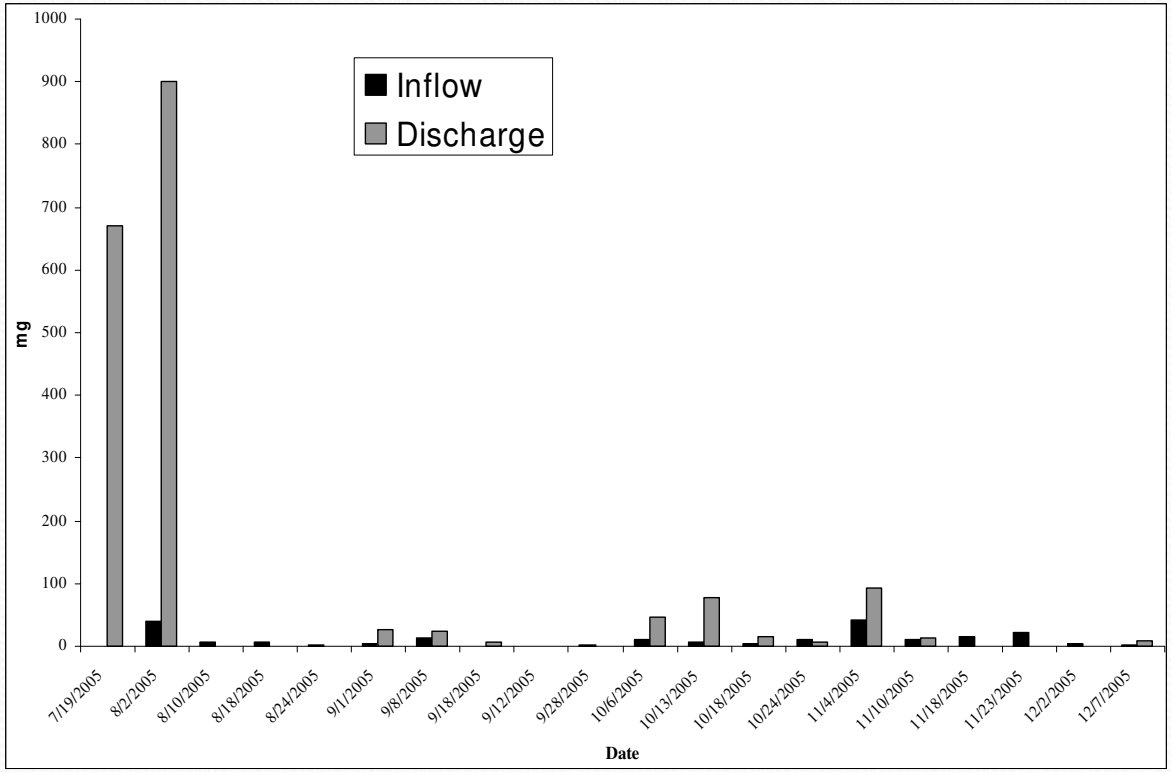
Vegetated ditch banks

Collective effect of mitigation practices



Weekly bifenthrin export through outlet 2

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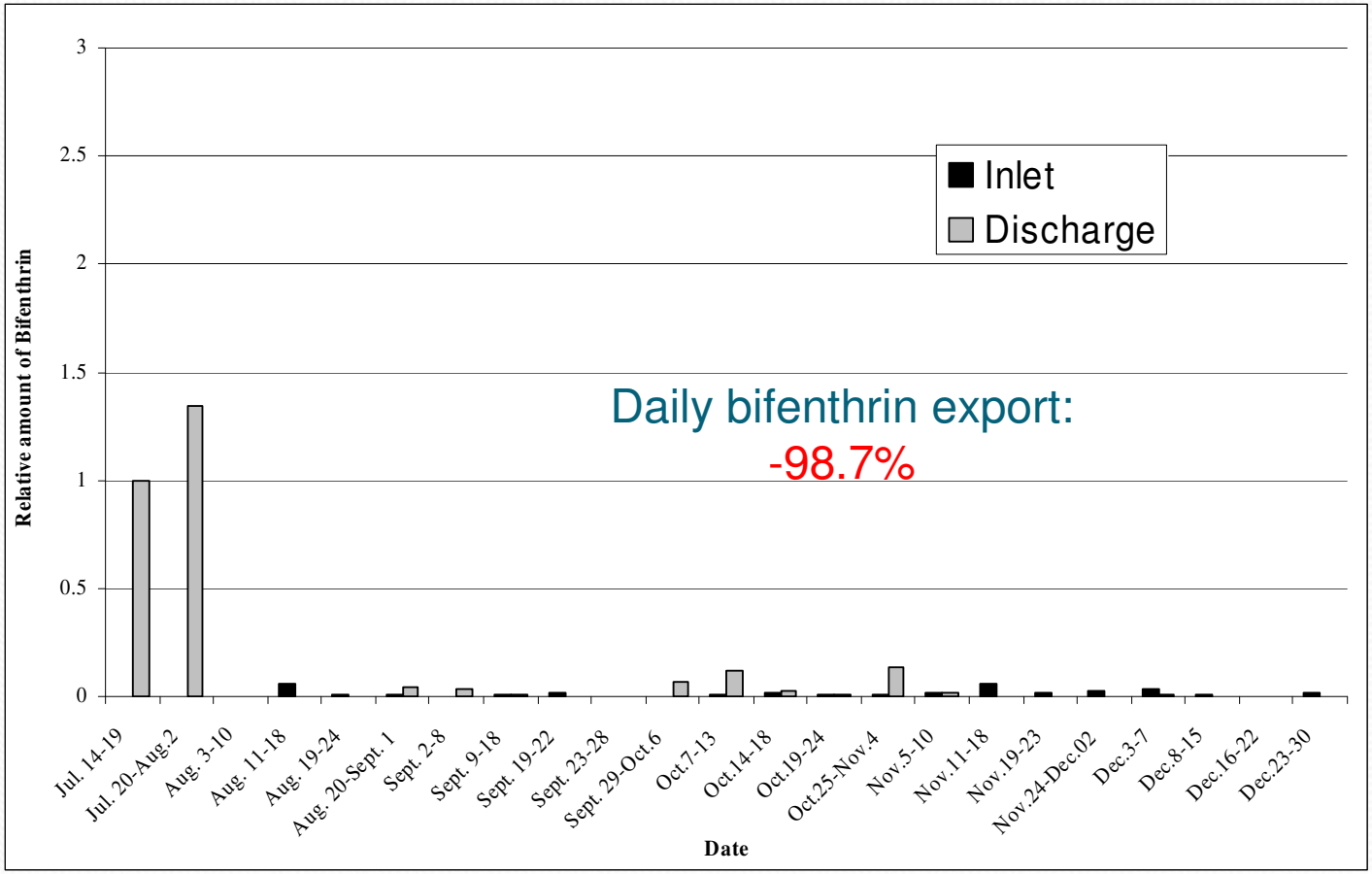
Relative reductions in bifenthrin concentrations



Water and sediment recycling

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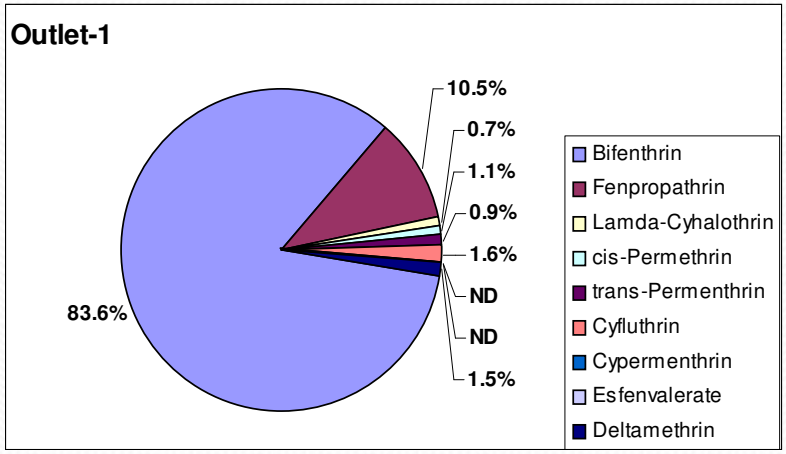
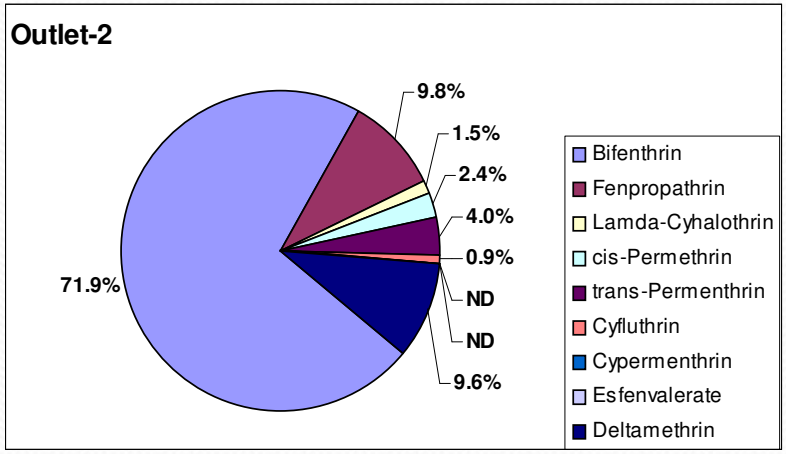
Pesticides in removed sediments





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Pesticides found in excavated sediments

Pesticide	Outlet1	Outlet2
	ng/g dry sediment	
Bifenthrin	486.6	118.2
Fenpropathrin	61.3	16.1
Lamda-Cyhalothrin	4.2	2.5
cis-Permethrin	6.4	3.9
trans-Permethrin	5.3	6.6
Cyfluthrin	9.5	1.4
Cypermenthrin	ND	ND
Esfenvalerate	ND	ND
Deltamethrin	8.7	15.8

Lessons Learned

- Nurseries are a source of pesticides and nutrients in runoff
- Permit requirements achievable for dry seasons
  - Best BMP – permit and monitoring
- Storm runoff dominates
  - Mitigation of storm runoff should be the focus

BMP Recommendations

- Dry season:
  - Improved irrigation practices
  - Onsite retention of runoff
  - Reuse of retained water
  - Isolation of potting mix handling areas
  - Runoff edge control
  - Vegetation in runoff ditches
  - PAM application

BMP Recommendations

- Wet months:
  - Sediment removal before first rain storms
  - Clean up of loose potting mix on property
  - Use of low risk pesticides during winter months
  - Collection of "first flush"

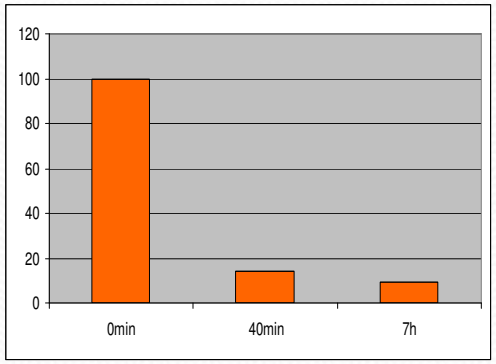

PHOTO: GORDON ENGLAND

Acknowledgement

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- The nursery owner, field manager and workers

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