Using Lysimeters to Evaluate Subsurface Nitrogen Concentrations in Macrotunnel Post Rows

A Study of Post Row Treatment Practices

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Management Practices to Minimize Stormwater Pollution from Macrotunnel Production Systems

Project compares effect of post-row treatments on stormwater-generated outflows

- **Outflows** - *Surface* (Runoff/Effluent) and *Subsurface* (Soil Water)
- Outflow **Quantity** - Relative impact on Outflow volumes
- Outflow **Quality** - Total Nitrogen (TN), Total Phosphorus (TP), Turbidity (NTU)
  - Surface - Passive and Grab samples
    - TN, TP, NTU
  - Subsurface - Lysimeter samples
    - Nitrate & Ammonium
Project Design and Treatments

- 2 project sites, Santa Barbara and Ventura County
- Both sites are Raspberry Macrotunnel Production Systems
- 5 Treatments/Replicate and 3 Replicates/Site

3 Replicates/Site (Triplicated) Random Block Design (i.e., 15 unordered treated post rows)
- **Surface** outflow (runoff water) data - **passive collectors**
- **Subsurface** outflow (soil water) data - **lysimeters**
Nitrogen Sources

❖ Raspberry (Perennial)
  ▪ 2-3 year production cycle
  ▪ 30-45 cm (12-18 in) root depth

❖ Surface Outflows
  ▪ Soil borne (immobilized & soluble)
  ▪ Raspberry litter
  ▪ Faunal detritus

❖ Subsurface Outflows
  ▪ Fertilizer (fertigation)
Lysimeters – Placement and Sampling

- Lysimeters are at both sites
  - Ventura - 20 cm and 60 cm lengths, in all 3 replicates (30 lysimeters total)
  - Santa Barbara - 20 cm, in only 2 replicates (10 lysimeters total)
- No standardized sampling frequency
  - Rainy season, usually before and after rain event
  - Dry season, usually about every other week

Prime Lysimeters  
Extract Samples  
Collect Samples  
Analyze Samples
Lysimeter Nitrate Data – Project Contributions

Did Treatments lead to statistically significant changes on subsurface outflows?
• Indicates Treatment differences - specifically Barley & Mulch vs Untreated
• Indicates Two population pools - 20 cm vs 60 cm depth (varies by treatment)
• Indicates Mode of Action differences - Infiltration vs Uptake (ex, Fabric vs PAM & Barley)
Did lysimeters demonstrate that we need additional information?
- Confirm Nitrate soil profile - add 40 cm (15 in) lysimeter
- Verify infiltration differences - soil moisture sensors
- Standardize sampling - relate pools to uptake vs leaching

**Nitrate (mg/L) versus Treatment**
20 cm and 60 cm Lysimeter Data
Lysimeter Nitrate Data – Conclusions

- Barley and Mulch - Subsurface Outflows differ from Untreated
- Barley and Mulch - Uptake Rates need to be Quantified
  - Barley Seasonal vs. Mulch/Raspberry Suckers Continuous
- Mulch Uptake Mechanism(s) - needs to be Determined
  - Raspberry Suckers/Fungi/Microbial
- Standardize Sampling - Relate pools to Uptake vs Leaching
  - Set Sampling Intervals to Fertigation & Rainfall events
- Soil Moisture Sensors - Monitor wetting front
  - Continuous & at Depths consistent with Lysimeters
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And Thank YOU for your attention.