Using Lysimeters to Evaluate Subsurface Nitrogen Concentrations in Macrotunnel Post Rows

A Study of Post Row Treatment Practices

Jamie Whiteford, District Scientist
805-764-5132 ▪ jamie.k.whiteford@gmail.com
Cachuma Resource Conservation District (CRCD)
Ventura County Resource Conservation District (VCRCD)

RESOURCE CONSERVATION DISTRICT
Santa Barbara and Ventura Counties

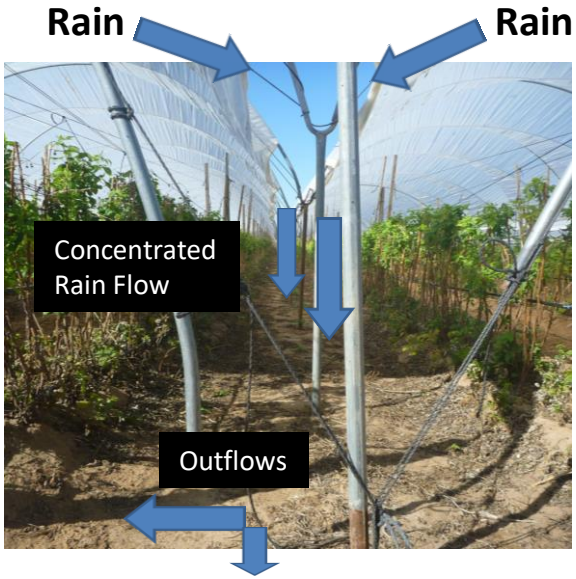
Management Practices to Minimize Stormwater Pollution from Macrotunnel Production Systems

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

Macrotunnel

Production System



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

Barley

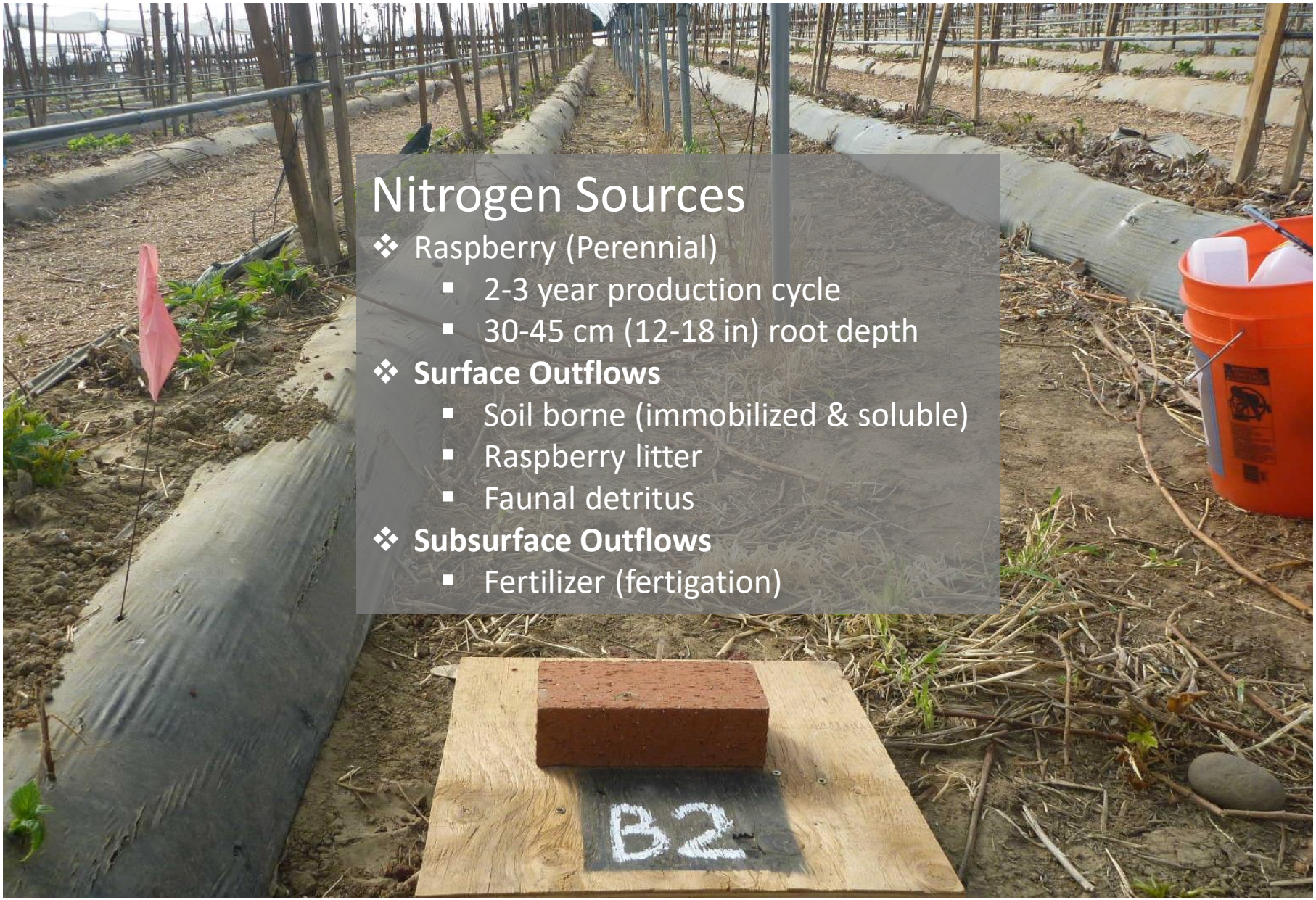
Mulch

PAM

Fabric

Untreated

- 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

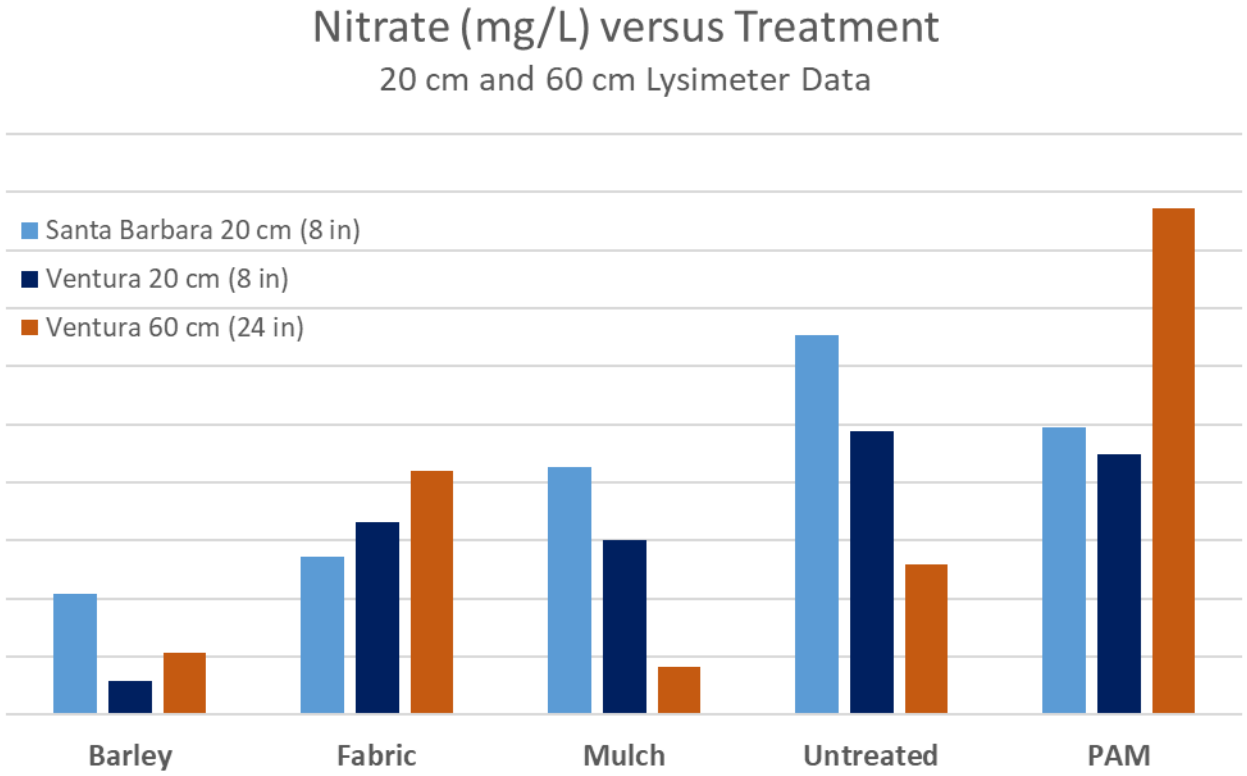
Collect Samples

Analyze Samples

Lysimeter Nitrate Data – Project Contributions

Did Treatments lead to statistically significant changes on subsurface outflows?

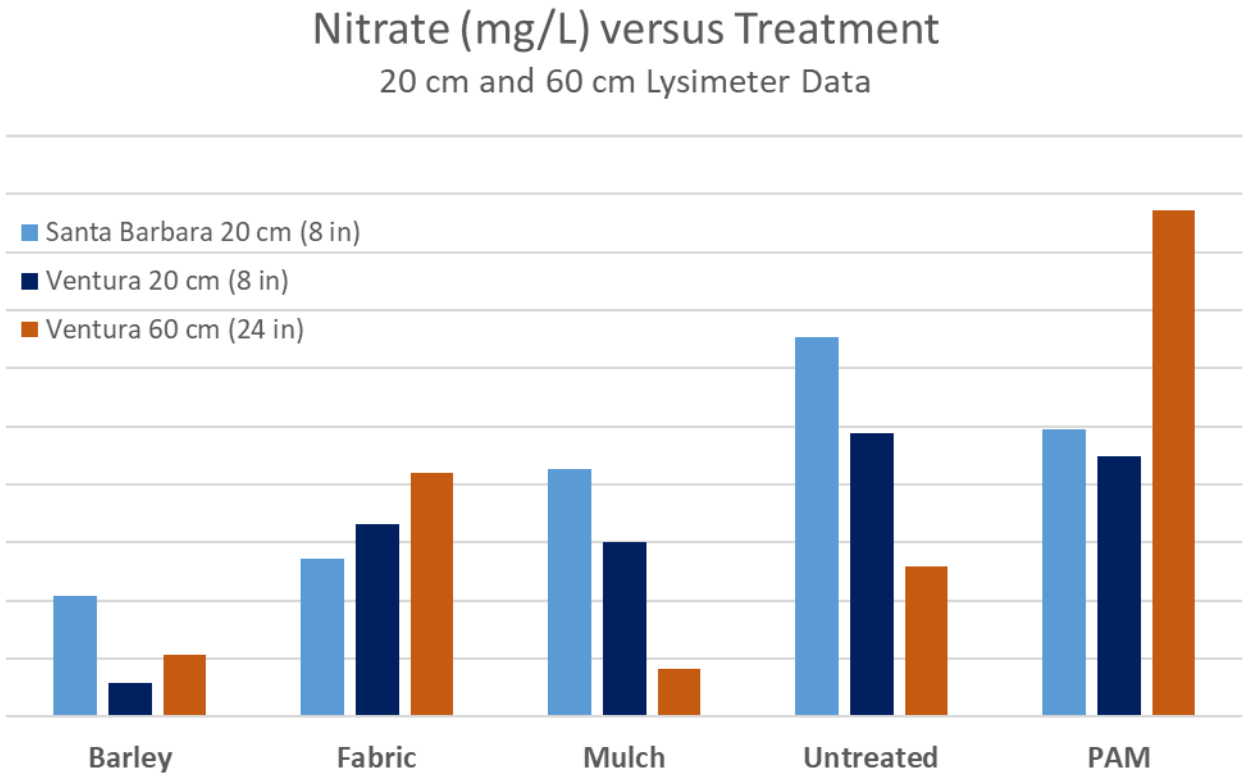
- Indicates Treatment differences - specifically Barley & Mulch vs Untreated
- Indicates Two population pools - 20 cm vs 60 cm depth (varies by treatment)
- Indicates Mode of Action differences - Infiltration vs Uptake (ex, Fabric vs PAM & Barley)



Lysimeter Nitrate Data – Additional Project Insights

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



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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Driscoll's Only the Finest Berries

Simplot

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And Thank YOU for your attention.

Questions?