EVALUATING SOIL HEALTH COMPONENTS, THEIR RELATIONSHIP TO YIELD DECLINE, AND POTENTIAL CULTURAL MANAGEMENT OPTIONS

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http://smallfarms.oregonstate.edu/soil-quality-network/workshops

SOIL QUALITY NETWORK 2014

February 13, 2014
8 am to 5pm, $30 includes lunch

Washington State University
Northwestern Washington Research and Extension Center, Mount Vernon, WA

Field Assessment of Soil Quality
Cover crops • Compost • Plant disease

Thank you to our generous sponsors!
Producer Survey

Have you seen a recent decline in raspberry productivity?

- 30% Yes
- 70% No

59% < 7 yrs.
Soil Health Defined...

“The capacity of a soil to function...to sustain productivity, maintain environmental quality, and promote plant and animal health.”

Doran and Parkin (1994)
<table>
<thead>
<tr>
<th>Soil Indicator</th>
<th>Notes</th>
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<tbody>
<tr>
<td><strong>PHYSICAL</strong></td>
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<tr>
<td>Soil Texture</td>
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<tr>
<td>Aggregate Stability</td>
<td></td>
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<tr>
<td>Available Water Capacity</td>
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<td>Soil Strength</td>
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<tr>
<td><strong>BIOLOGICAL</strong></td>
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<tr>
<td>Organic Matter Content</td>
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<td>Active Carbon Content</td>
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<tr>
<td>Potentially Mineralizable</td>
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<tr>
<td>Nitrogen</td>
<td></td>
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<tr>
<td>Plant Pathogen (Soil)</td>
<td><em>P. rubi, V. dahliae, P. penetrans</em></td>
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<td>Soil respiration</td>
<td></td>
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<tr>
<td><strong>CHEMICAL</strong></td>
<td></td>
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<tr>
<td>pH</td>
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<td>Extractable P, K</td>
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<td>Minor Elements</td>
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Trial Details

- 2 X ~1.5-Acre plots
- Monitor soil/plant health over time

Objectives:
- Evaluate changes in soil health indicators over time
- Identify cultural management options that may improve soil health
Treatments

• Compatible with bearing red raspberries
• Main plot – Irrigation
  – Tensiometer driven vs. timed
• Split plot - Ground cover vs. tilled
  – 2 X timings vs. perennial* vs. bare ground
• Split-split plot – Nutrient management
  – Spring soil driven vs. traditional*
  – 2013 includes compost additions*
Building Soil/Plant Relationships

Identify:
- Geo-spatial relationships
- Temporal relationships
- Management options

**PHYSICAL**
- % Clay

**BIOLOGICAL**
- % OM
- V. dahliae
- Primocane

**CHEMICAL**
- pH
Compaction

The process in which a stress is applied to soil that causes densification as air is displaced from the pores within the soil matrix.

Importance – Reduces water infiltration, influences nutrient cycling, tillage “trend mill”
Infiltration

The velocity at which water enters the soil.

Importance: Indicator of field drainage capacity; standing water – potential link to soil pathogen presence.
Compaction

Farm 1

psi

depth (inches)

FALL
NO
SPRING
TURF

8/4/13
PHYSICAL
Infiltration

![Graph showing infiltration rates for different tillage practices on Farm 1.]
P. penetrans
Fruit Weight and Estimated Yield

• Fruit weight:
  – Early-Season, Mid-Season and Late-Season
  – Average fruit weight
  – Weighted average (1:2:1)

• Yield estimate:
  – Yield component analysis (YCA)
  – Canes x laterals x fruit x fruit weight
  – Weighted and non-weighted fruit weight
Treatment Effects

• Irrigation – no significant effects

• Fertility – no significant effects

• Ground-cover:
  – Effect on all measured variables
  – None > Fall and Spring > Perennial Turf
Ground-Cover Effects on Average Fruit Weight on Both Farms

Average Fruit Weight (g/berry)

Ground-Cover Treatment

- Fall Planted
- None
- Spring Planted
- Turf (Perennial)
Ground-Cover Effects on Yield Estimate on Both Farms

Yield Estimate (lbs/acre)

- Fall Planted
- None
- Spring Planted
- Turf (Perennial)

Ground-Cover Treatment

Legend:
- a
- b
- c
- bc
Ground-Cover Effects on Primocane Diameter (2012) on Both Farms

- Fall Planted
- None
- Spring Planted
- Turf (Perennial)
Making the Connection

Yield and vigour over multiple years (What we want to improve)

Soil nutrients, disease pressure and health (The underlying connection)

Field management practices (What we can actually do something about)
Outcomes and Prospects

• What changes over time – underlying variables and plant responses

• Adaptive management – new treatments (compost, seed meal etc.)

• Direct future management
Questions?

This project receives support from:

[Logos of British Columbia Raspberries, Washington Red Raspberries, and Center for Sustaining Agriculture & Natural Resources]