SOIL HEALTH WITH OILSEED CROPS IN A CEREAL GRAIN ROTATION

PHOSPHOLIPID FATTY ACID ANALYSIS TO MONITOR MICROBIAL COMMUNITY CHANGES

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JUSTIFICATION:

When growers were asked what research is needed to improve their oilseed production, some of the suggestions included the following:

• varieties with improved pod shatter control, oil and meal content and quality, shorter stems, adaptation to marginal land, and improved herbicide resistance
• farm-scale variety testing
• rotational effects on soil health and biology
• more weed control options and seed treatment efficacy
• reduced oilseed yield variability
• the economic feasibility of growing different oilseed crops with fluctuating market prices (currently under investigation at WSU)
Experimental Design

- Canola (Amanda) - Winter Wheat (Finch) 6 replications.
  - Complete Randomized Block located in Davenport, Washington.
- Typical Rotation: Winter Wheat > Spring Cereal > Fallow.
- Sampling
  - 3 Sampling times. Within crop, 1 year after plot, 2 years after plot.
  - Composite bulk soil samples at 3 depths (0 to 5 cm, 5 to 10 cm, 10 to 15 cm).
Analyses

• Phospholipid Fatty Acid Analysis (PLFA)
  • Microbial Biomass
  • Bacteria to Fungi Ratio
  • Changes in Saturation (Stress Indicators)
• Carbon, Nitrogen
  • Soil Organic Matter
  • Carbon to Nitrogen Ratio
• Microbial Enzyme Assays
  • Dehydrogenase
  • Beta-Glucosidase
    • Soil Microbial Heath indicators
PLFA (The Soil Micro Census)

- Pop 652 K
- White Caucasian 69%
- Asian 13%
- H.S.D. 93%
- B.A. 57%
- Mean House Value 433 K
- Crime Rate 40/10k

- Pop 31 K
- White Caucasian 79%
- Asian 11%
- H.S.D. 97%
- B.A. 66%
- Mean House Value 219 K
- Crime Rate 7/10k

Washington - The Evergreen State
Soil Micro Census Data Collection
Preliminary Results
Canola vs WW CY 2011 Spring 2011

- Differences in the surface 0to5 cm
- Less significant differences in subsurface soil to 15 cm
• A closer look indicates there are differences in microbial communities
- Differences in microbial communities 1 year following the plots returning to the growers rotation.
A closer look indicates some separation but leans more toward commonality.
• Differences in microbial communities 2 years following the plots returning to the growers rotation.
- Differences at all three depths indicating a shift in microbial communities.
A closer look at differences
Canola vs WW CY 2012 Spring 2013 (Spring Wheat)

- Differences in the surface 0 to 5 cm, with difference diminishing with depth
A closer look at differences
Conclusions

• There are differences in microbial communities under a canola crop when compared to communities under a winter wheat crop.
• Differences are greatest in the crop year.
• This data represent preliminary analysis. The extent of microbe differences and the cause of those differences needs further exploration.
Future Work

• Additional samples this spring
• Statistics of PLFA Data.
  • Stress indicators
  • Bacteria to Fungi Ratio
  • Microbial biomass
• Carbon analysis
• Rhizosphere soil microbes, comparing canola and cereal grain.
• Lipid analysis for a tool to ID cold tolerant canola varieties.

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