

Soil and Water Quality Management Issues for the Eco-label Standards

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What are the agronomic and environmental goals?

- Increase nutrient and water use efficiency
- Reduce nutrient and pesticide losses via leaching and runoff
- Reduce wind and water erosion
- Reduce disease incidence/severity
- Increase effectiveness of pesticides applied (reduce pesticide use)
- Increased carbon “sequestration” in soils

Current Questions in the Eco-label Standards

- Did you apply compost or other organic soil amendments to suppress diseases?
- Did you plant a cover crop specifically for suppression of *Verticillium* or plant parasitic nematodes?
- Are you using practices to correct/prevent a hardpan?
- Did you maintain/implement practices to reduce wind erosion?
- Did you use a leaching model?
- Which practices did you use to build soil organic matter? Are you monitoring changes in SOM?

Nature of Questions

- Very general
- No clear link between management practices and effects on specific soil properties
- No clear link between soil properties and desired “ecolabel” effect; e.g. disease suppression, reduction in pesticide use, reduction in nutrient leaching

Our Approach

- Look at the “literature” and case studies to identify management practices that improve soil and water quality.
- Take lessons learned from WI research and demonstrations with cover crops, organic amendments, tillage and crop rotations.

Ultimate goal

Provide a set of detailed questions related to soil and water quality management in the ecolabel certification program.

Post-Doc Position: Soil Quality Indicators in Potato Production Systems

- Review and synthesize literature
- Analyze data from existing field and greenhouse studies in Wisconsin
- Develop matrices of soil properties that are most related to crop disease/health and environmental benefits
- Test the matrices on farms
- Develop set of certification questions

Key Literature Components

Independent variables

- Organic amendments
- Cover crops
- Crop rotation
- Tillage

Dependent variables

- Potato disease incidence/severity
- Potato yields
- Potato tuber quality
- Nutrient and pesticide leaching
- Wind and water erosion

Example of Practices-Soil Properties Matrix

Soil property	Manure	Compost	Cover Crops	Tillage
pH	increase	increase	decrease	No effect
Available nutrients	increase	decrease	Mixed effects	Mixed effects
Total and active C	increase	increase	neutral	Decrease
Water holding capacity	increase	increase	increase	Depends
Aggregate stability	increase	increase	increase	Decrease

Example Of Soil-Disease Matrix

Soil Properties	Potato Early blight	Potato Early dying	Potato Late blight	Aerial Pythium
Total organic matter	Negative; linear	No effect	Positive; non-linear	Positive, linear
Active C	Negative; linear	Negative; non-linear	Positive; non-linear	Positive, linear
Water holding capacity	Positive; linear	Positive, linear		Negative; linear
Microbial diversity	Mixed effects			No effect
Available nutrients	Positive, linear	Positive, linear		No effect

Example of Soil-Environmental Impact Matrix

Soil Properties	Nitrate leaching	Pesticide leaching	Wind erosion	Water erosion
Total organic matter	Reduced	Reduced	Reduced	Reduced
Active C	Reduced, but less	Reduced, but less	Reduced	Reduced
Water holding capacity				
Aggregate stability	Neutral	Increased	Reduced	Reduced
Available nutrients	Increased	Neutral	No effect	No effect

Other matrices

- Soil-crop yield, crop quality
- Management effects on environmental parameters
- Management effects on soil organisms
- Interactions among cropping practices and effects on soil properties; e.g. compost + cover crops or timing of organic amendment applications

Develop Organic Amendment Use Guidelines

- Organic amendment type and application rate effects on fertilizer use (amount, timing)
- Application rates/timing to minimize N leaching
- Changes in irrigation scheduling based on increases in soil organic matter
- Application rates to reduce wind erosion
- Application rates for specific disease suppression and reductions in pesticide amounts

Develop Cover Crop Guidelines

- Cover crop types and planting/killing times to reduce wind erosion
- Cover crop types and planting times to maximize N recovery-reduce N leaching
- Cover crop management to suppress nematodes, fungal diseases

Desired range of farm characteristics for testing matrices

- Soil types: sandy, loam, clayey
- Tillage practices: no-till, ridge-tillage, chisel plowing, moldboard plowing
- Use of cover crops: legumes, grasses
- Use of organic amendments: manure, raw organic wastes, composts
- Timing of amendment application: spring or fall
- Crop rotation duration: 2-year, 3-year, 4+-year and diversity (crop types)

Questions for Growers

- What are most important questions to you related to soil and water quality?
- What level of detail about soil and water quality standards would you like to see in the ecolabel certification program?
- Should we include other parameters in the matrices?