Insights into soil health in US potato production systems

Update from the USDA SCRI Potato Soil Health Project:





2. Identify on-farm indicators of soil health associated with potato crop health, productivity, and quality.



Percent of fields showing correlation among total yield and soil parameters

The Potato Soil Health Project is a large national collaborative effort that seeks to identify soil health indicators (SHIs) and develop management strategies that will enhance soil health in potato production systems (USDA SCRI 2018-51181-28704). Our primary objectives to achieve these goals are to:

1. Optimize soil microbiomes and physiochemical characteristics to enhance potato health, productivity, and quality through soil management practices.





- At the continental scale, SHIs were not consistently associated with high yields, except for soilborne diseases (Figure above)
- Calibration of SHI in potato cropping systems may have to occur regionally since relationships among SHIs vary widely across the US
- 3. Identify incentives and barriers to adopting practices that improve soil health in potato production.

Table 1. Current management	
practices used by surveyed farmers.	
Current Practices	% Farmers
Nutrient Management	69
Crop Rotation	80
Cover Crops	56
Limit Tillage	46
Organic Amendments	38
Habitat for Beneficials	20
Precision Ag. Practices	28

Through surveys (N~128) we found:

- Land rental poses a challenge to adoption of practices that support soil health
- Many farms are already using agricultural practices that support soil health (Table 1)

Table 2. Barriers to adoption of new practices within potato cropping systems

ΡΟΤΑΤΟ ΕΧΡΟ

TEXAS 2024

OM, TC, Nematodes and Verticillium sampled once (AP)

- Microbial communities cluster based on geography (Figure above); soil physiochemical and texture data explain a lot, but not all of the variance in bacterial and eukaryotic microbiomes
- Bacterial communities are more diverse, and more dominated by regionally-distributed taxa than eukaryotic ones
- Microbiomes across sites are taxonomically similar at coarse \bullet taxonomic resolution (Phylum) and different at Genus/ASV
- This suggests functional variation or redundancy among and within \bullet certain soil taxa

4. Share our results with the potato industry to facilitate adoption of soil health best management practices.

Our outreach content centers on the theme of a Potato Soil Health

Barrier	% Farmers
Complexity in implementation	47.3
Uncertainty in short-run economic benefit	45.8
Capital constraints prevent initial investment	40.5
Uncertainty in long-run economic benefits	35.1
Landlord/rental agreement	9.2
Mot compatible with current cropping system	5.3
Incompatible with current insurance requisites	5.3

There is room to improve adoption but some barriers exist (**Table 2**):

- Agricultural practices that do not result in short or medium-term economic benefits are unlikely to be adopted
- Unless there are substantial economic returns, farmers are unlikely to adopt practices that result in increased pest risk, fertilizer requirements, or water use



System (Figure right) and includes the specific research areas and associated extension products for delivery of project information

- We have produced 1-2 page fact sheets on 13 different potato soil health topics (potatosoilhealth.cfans.umn.edu/education)
- A Potato Soil Health Manual has been drafted and is ready to be ulletupdated as project results are synthesized
- To date, over 120 conference presentations, posters, podcasts, lectures, papers, and grower field days and research efforts contributed to 11 peer-reviewed papers



Project participants and collaborators:

Maine: Jay Hao, Katie Ashley, Bob Larkin; Michigan: Kurt Steinke, Jaimie Wilbur, Madelyn Celosky; Wisconsin: Matt Ruark, Deanna Knuteson, Rick Lankau, Ann MacGuidwin, Amanda Gevens, Shan Shan; Minnesota: Carl Rosen, Linda Kinkel, James Crants, Touqeer Abbas, Scott Klasek; North Dakota: Julie Pasche, Andy Robinson, Anna Stasko, Kim Zitnick, Egalatina Echartea; Colorado: Jane Stewart, Jorge Cabellero; Montana: Kate Fuller; Idaho: Mike Thornton, Brenda Schroeder, Jeff Miller, Chris McIntosh, Alex Mass, Deron Beck, Gilbert Kamgan; Oregon: Ken Frost, Amber Moore, Amanda Cox, Bryn Evin (Oregon); Washington: Cynthia Gleason (Washington)

For more detail see potatosoilhealth.cfans.umn.edu