Safeguarding Potato Cropping Systems in the Pacific Northwest Through Improved Soil Health

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Summary

Consumer preferences are driving interest in improving soil health in potato production systems in the U.S. Pacific Northwest (PNW) and beyond. Potato production poses a particular challenge in terms of soil health due to intensive tillage, minimal residue left on fields, short rotations, and the importance of managing soilborne pathogens. We present strategies that improve soil health and address the effects on soilborne pathogens, the yield and quality of potatoes, and net returns in potato production systems. These practices include reducing tillage; adjusting crop rotation length and species composition; reducing fumigation; and using cover crops, green manures, and organic amendments. Selected results from studies conducted in the PNW over the last 25 years are presented.

Soil Fumigant Reduction

- Interest exists in alternatives to chemical fumigation because of fumigation pressures, including Columbia root knot nematode (Charlton et al. 2011), root lesion nematode (Charlton et al. 2011; O’Neill 2016; Riga 2011), and soilborne pathogens, such as Fusarium oxysporum f. sp. radicis-lycopersici and Alternaria solani (Shannon et al. 2018).
- Site specific fumigation with 1,3-dichloropropene for Columbia root knot nematode may offer opportunities to reduce fumigant use (King and Taberna 2013), but the cost of soil sampling may be prohibitive.
- In a comparison of in-row to broadcast fumigation, Hansen et al. (2018) reported broadcast fumigation resulted in greater total and marketable yields and greater net return for ‘Russet Burbank’. Where, yield and quality of ‘Norkotah’ were similar for both methods.

Animal Manures/Compost

- Tillage reduction may offer an opportunity for improving soil health in potato production, however there is little published research from potato production systems in the PNW. Collins et al. found that conventional and reduced tillage treatments did not differ in yield or quality and crop residues protected against wind erosion (Fig. 3).

Research Recommendations

Based on the review of the literature, the following recommendations were made:

1. Develop a soil health assessment approach or calibrate an existing assessment method for use in PNW potato systems and establish a baseline understanding of soil health in PNW potato systems.
2. Gather additional information to characterize distinct potato cropping systems in the PNW and identify specific soil health challenges and opportunities unique to each system.
3. Develop a better understanding of the barriers that currently prevent adoption of practices known to improve soil health and address these barriers. Quantify the tradeoffs that exist for particular practices, or suites of practices, in order to provide PNW potato growers with important decision-making tools for optimizing tradeoffs.
4. Establish long-term research and demonstration sites in the various potato cropping regions in the PNW to provide information on both economic and agronomic changes resulting from these approaches.

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The full report can be downloaded at the CSANR Publications website.

References

Hanninen et al. 2011. Comparison of Broadleaf and In-Row Fumigation with Metam Sodium for Verticillium Wilt Control. Presentation at Pacific Association of America meeting, Boise ID.
Harris, Moore, and Jenkins 2013. Soil-specific management of Nectria fuckeliana in Idaho potato using 1,3-dichloropropene. J. of Nematology 45:323-332.

Strategies for Improving Soil Health

Cover Crops/ Green Manures

Green manures and green manure treatments have been reported, including Columbia root knot nematode (Ahmadi-Rehayeini et al. 1999; Mojtabaei et al. 1993; O’Neill 2016; Riga 2011), root lesion nematode (Hafez and Palsamy, 2003), and stubby root nematode (Charlton et al., 2011).

Crop Rotation

- Potato rotations vary widely across the PNW and may include alfalfa, canola, dry beans, field corn, grasses, green manures, peas, small grains, sugar beets, sweet corn, and vegetable crops.
- Including minimal tillage and crops that produce residue left in the field, or crops with different root architectures than potato; fertilizer opportunities for soil health improvement during the non-potato portions of the rotation.
- Pathogen host status of cash and cover crops are important considerations for each pest or disease species of concern.

Reduced Tillage

- Tillage reduction may offer an opportunity for improving soil health in potato production, however there is little published research from potato production systems in the PNW. Collins et al. found that conventional and reduced tillage treatments did not differ in yield or quality and crop residues protected against wind erosion (Fig. 3).

Figure 1. Mustard green manure being incorporated into soil prior to potato planting. Photo credit: Andy McGuire

Figure 2. Dairy manure offers an opportunity for improving soil health in some areas. Photo credit: Darrell Kigqre, CSANR Communications

Figure 3. Conventional and reduced tillage treatments in a 5-year sweet corn-sweet corn-potato center pivot irrigation in Paterson, Washington. (Photo source: Collins et al. 2010)

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