Watershed Impact Trial

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J. Kan, M. Daniels, A. Mukherjee, R. Bier, D. Oviedo, A. Smith, J. George, M. Peipoch, T. Caton, D. Martin, L. Garber, M. Pop, J. Lang et al.
THE PROBLEM: Reducing ag. pollution in the Delaware River Watershed

Maxatawny, Berks Co., February 15, 2018
Schaefer Run -> Little Lehigh Creek -> Lehigh River -> Delaware River
SOLUTION - RIPARIAN BUFFERS?

- Riparian Forest Buffer
- Ag Fields
- Level-Spreader
Solution? Ag pollutants at point source – Alter Ag Practices
Cover crops, rotations, perennial crops, etc.

Multi-Species Mixtures:
Crimson clover, cereal rye, hairy vetch, etc
Research Questions:

1. Can cover crops and diverse rotations provide enough fertility and weed control to reduce or eliminate synthetic agrochemicals while remaining economically viable?

2. Which systems more resilient to climatic adversity, have healthiest soils, fastest infiltration rates, and least runoff?

3. How to encourage farmers to transition to improved management practices?
   • Barriers to transition to Best Management Practices?
Project Goals:

• Inform over 15 million people who rely on the Delaware River for clean water
  – Link between agriculture, soil health, and water quality
  – Potential for innovative farm management techniques to improve soil health and provide clean water

• Move 50,000 acres along a spectrum from conventional to conservation to regenerative farming
THE RESEARCH SITES

FST: 0-3% slope

Farming Systems Trial
(Rodale Institute – Berks County)

WIT: 8-15% slope

Stroud Preserve
(Stroud Water Research Center – Chester County)
FARMING SYSTEMS TRIAL (FST)

- Designed by Bob Rodale in 1981 to assist farmers transitioning from conventional to organic
  - Economic, environmental, energy, and conservation impacts
- Grain based – Corn, soybeans, wheat, oat
Organic-Manure
1. Designed to produce grains for livestock, but identical to grain production for consumption
  ─ Long rotations of annual grains and perennial forage crops; - Periodic application composted manure and legume cover crops for fertility

Organic-Legume
2. Organic cash grain system
  ─ Mid-length rotation annual grain and cover crops
  ─ Fertility by legume cover and cash crops

Conventional
3. Most grain farms in U.S.
  ─ Synthetic N fertilizer and herbicides

Changes in 2008
1. No-till introduced in all systems
   ─ Roller crimper in organic rotational no-till and herbicides in conventional system
2. GMO’s introduced in conventional system
1986-2014 Combined grain (wheat, corn, oats and soybean) averages:
1988 and 1999 – 5 drought years

**Corn Yields:** 31% higher in organic

**Soybean Yields:** 100% higher in organic

1995 Drought – 13 inches of rainfall
2016 Corn Yields – Bushels/Acre

MILESTONE achievement
- Berks county average for 2016 - 144 bu/A
- Within conventional yield range

- SOM can hold up to 20X its weight in water (Johnson et al., 2005)
- Greater SOM = greater soil water = better water use efficiency
3.7X higher than conventional
Lysimeters

Schematic

2017 Lysimeter Leachate Atrazine

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Atrazine ppb
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THE RESEARCH

Treatments:

1. Organic Tilled
2. Organic No Till
3. Conservation No Till
4. Conventional Tilled
Monitor and establish link between Soil Health, Soil Microbial Activity, Water Quality, and Crop Productivity

Deep (1M) soil cores in years 1, 3, and 6
0-20 cm annually
Measure soil chemistry, biology, physical properties

Water Infiltration and Surface Runoff Measurements

Measure TSS, Water Chemistry, indicator bacteria
Communications Strategy to Influence Both the Supply and Demand for Lowest-Impact Agricultural Products

- Farmer Trainings & Train the Trainer
- Mass Media Campaign

- Changes to Agricultural Practices that Improve Water Quality
  - Field Days
  - Publications
  - Conferences and workshops
  - Webinars
Discussion & Questions

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