



RODALE
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WATER RESEARCH CENTER



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

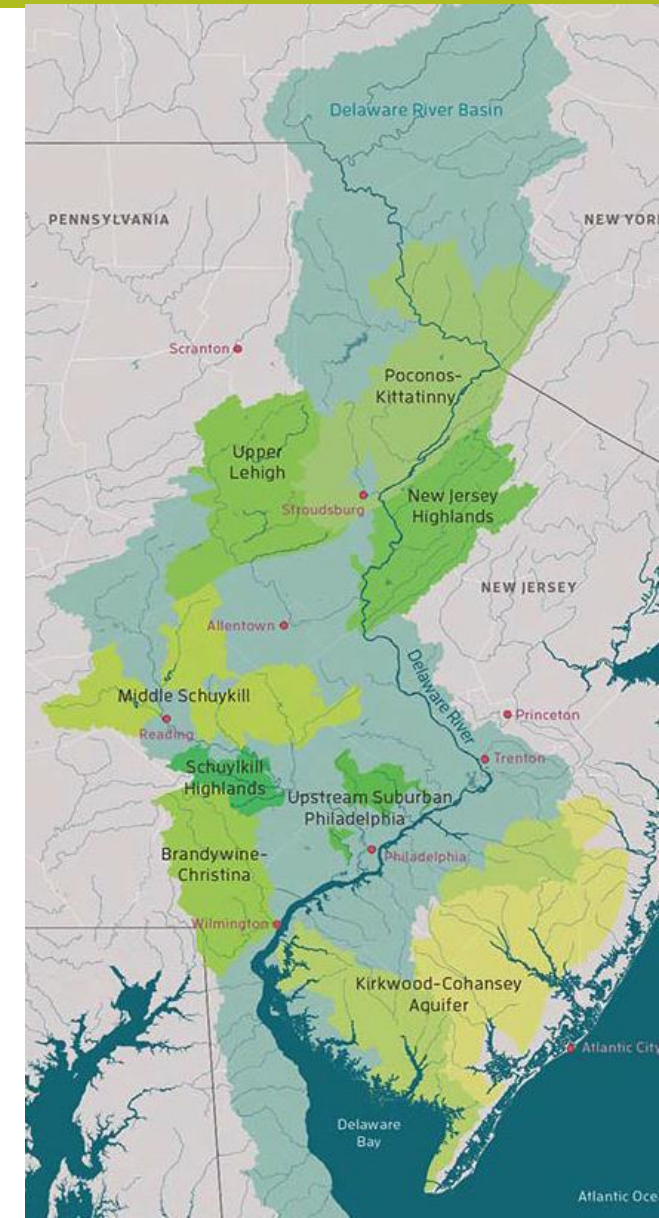


Research Questions:

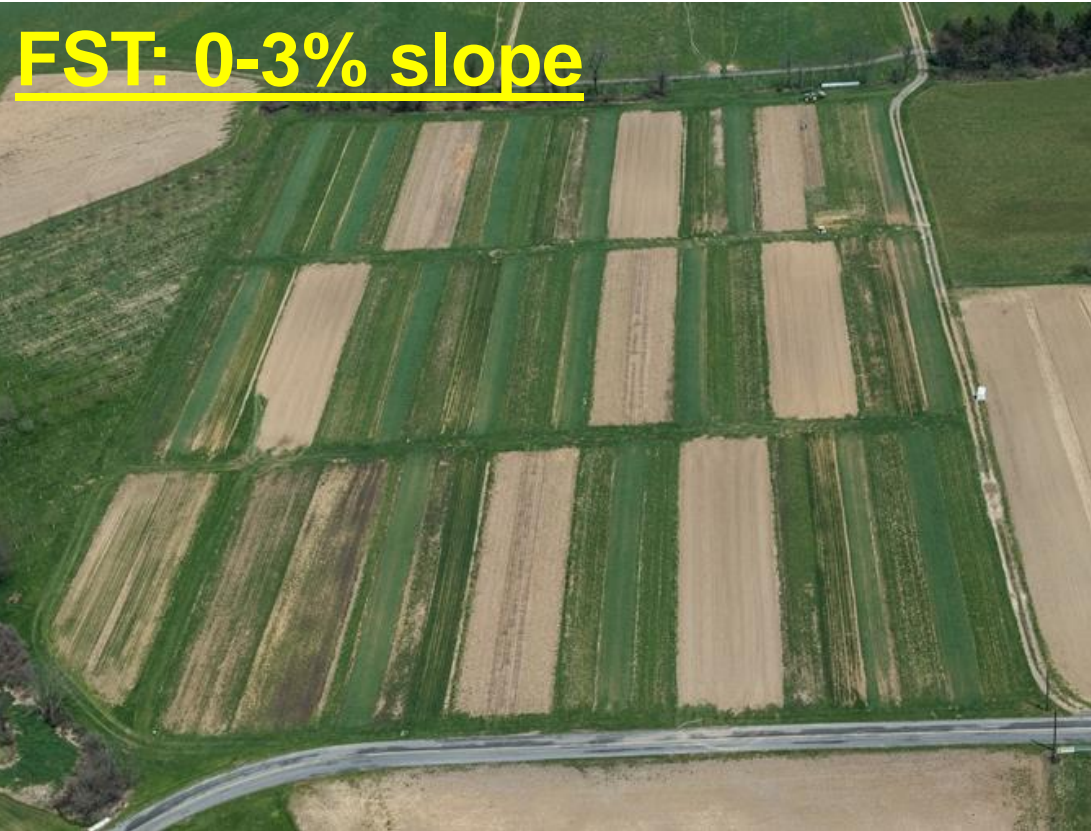
1. Can cover crops and diverse rotations provide enough fertility and weed control to reduce or eliminate synthetic agrochemicals while remaining economically viable?
2. Which systems more resilient to climatic adversity, have healthiest soils, fastest infiltration rates, and least runoff?
3. How to 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

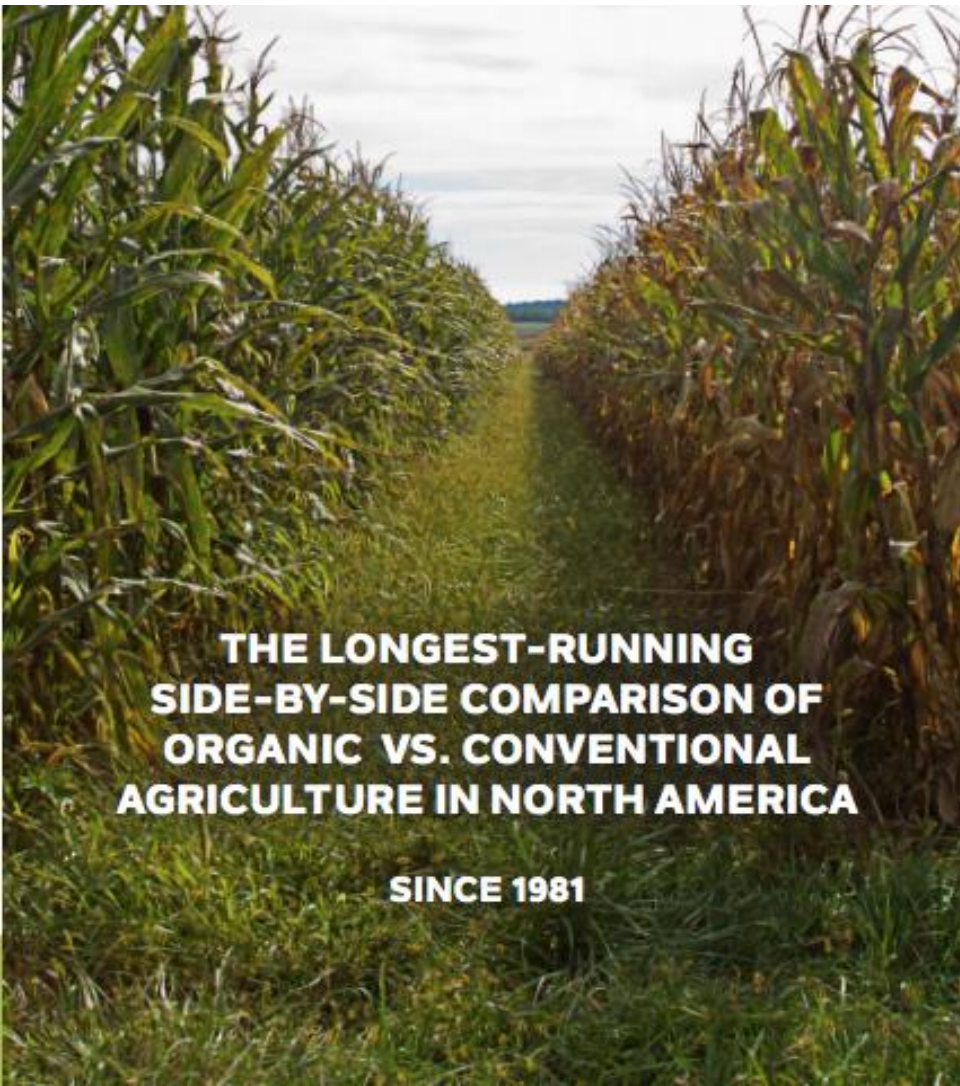


Farming Systems Trial
(Rodale Institute – Berks County)



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

FST - CROPPING SYSTEMS



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

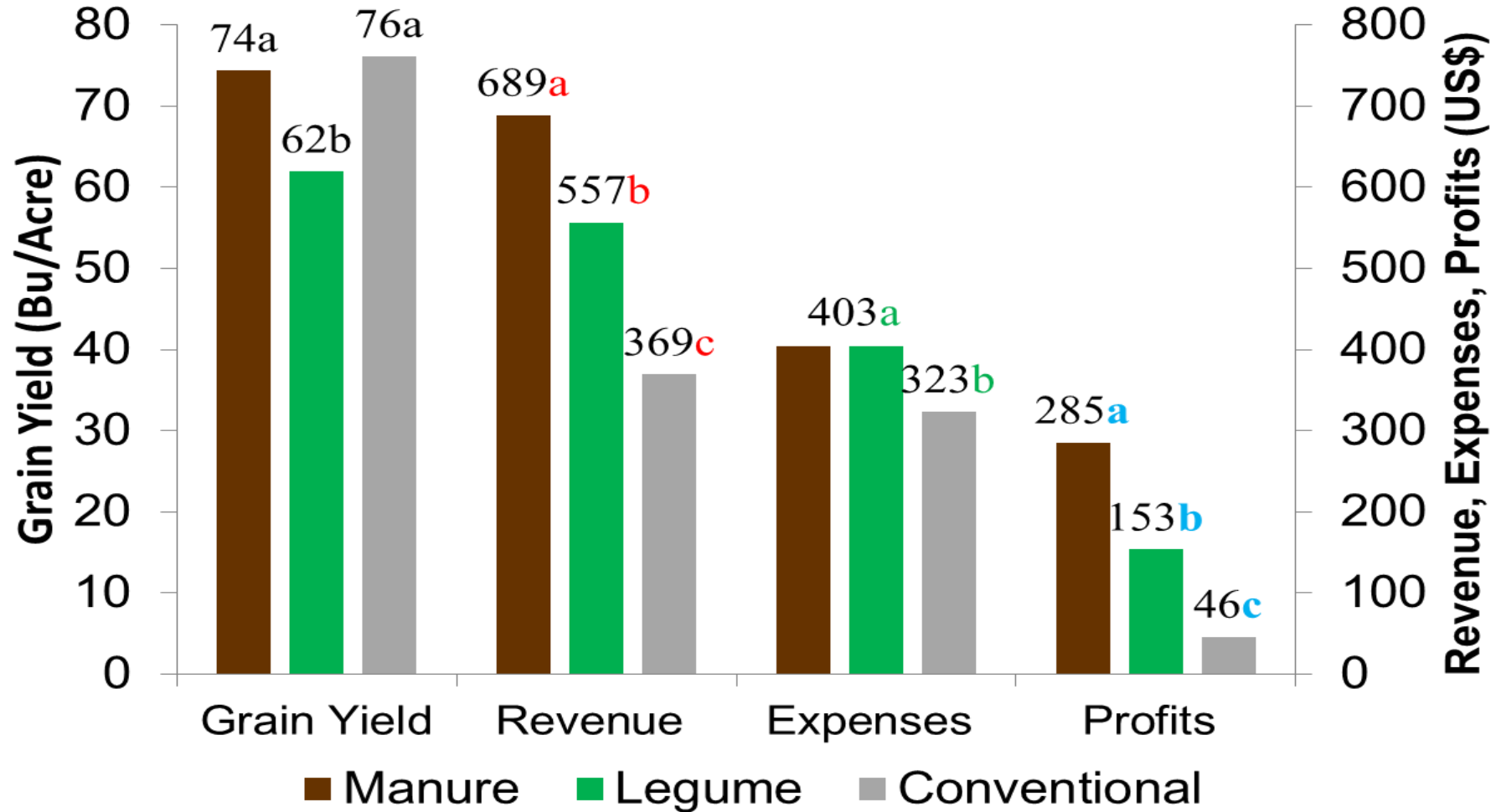
1. No-till introduced in all systems
 - Roller crimper in organic rotational no-till and herbicides in conventional
2. GMO's introduced in conventional system

ORGANIC NO-TILL





1986-2014 Combined grain (wheat, corn, oats and soybean) averages:

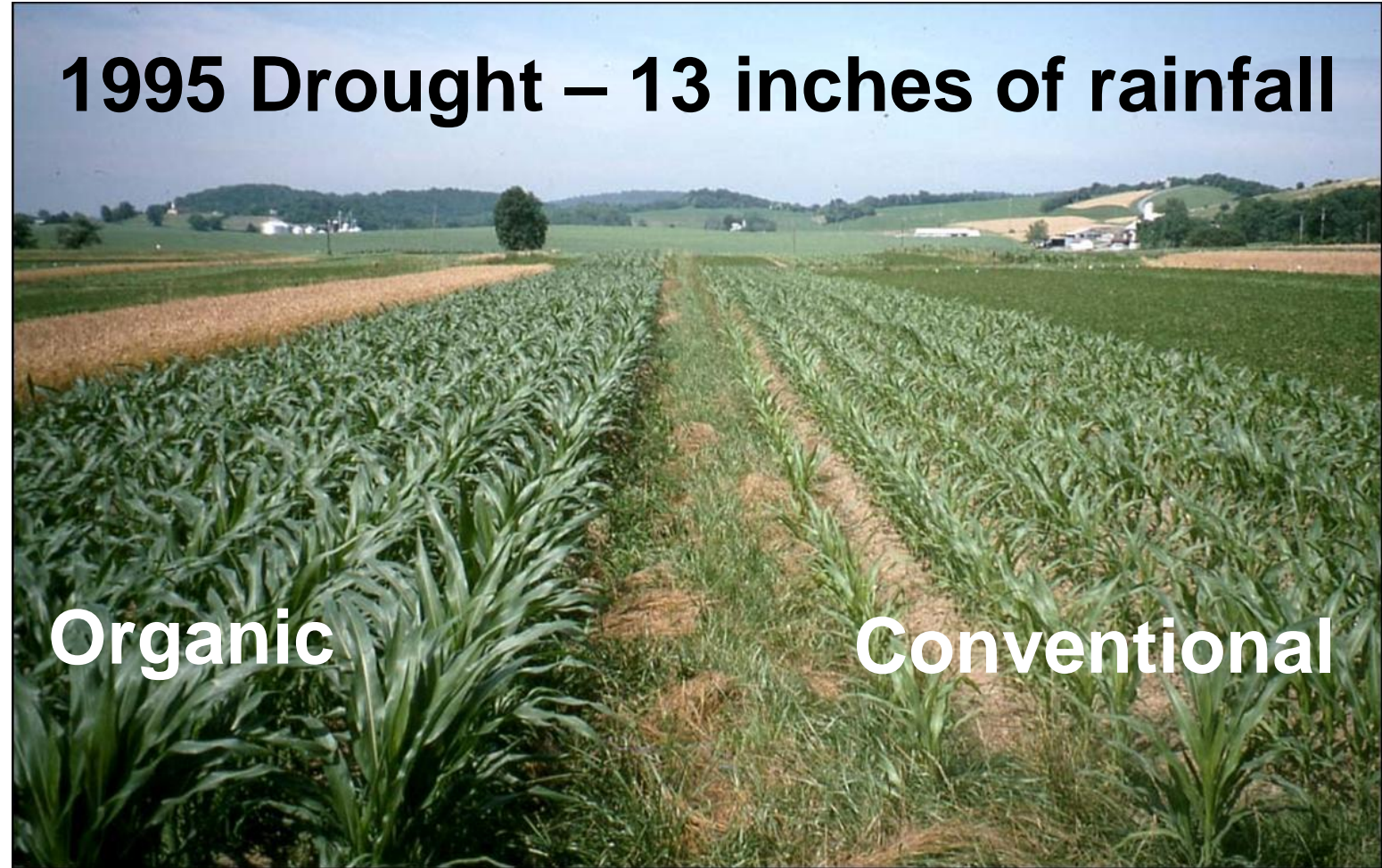


AGROECOSYSTEM RESILIENCE

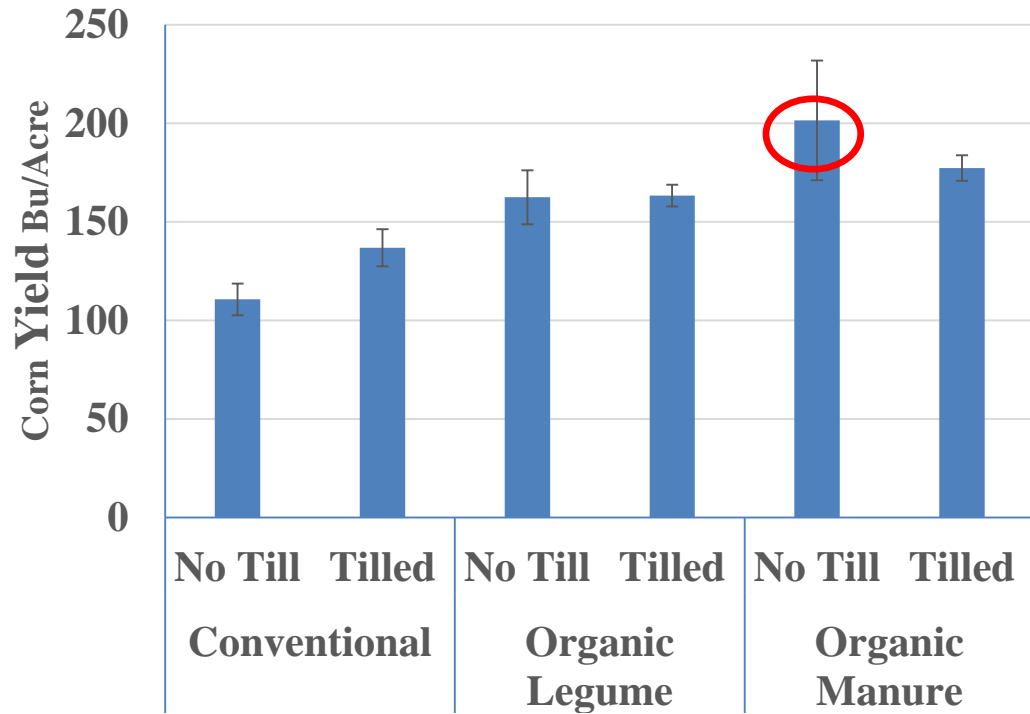
1988 and 1999 – 5 drought years

Corn Yields: 31% higher in organic

Soybean Yields: 100% higher in organic



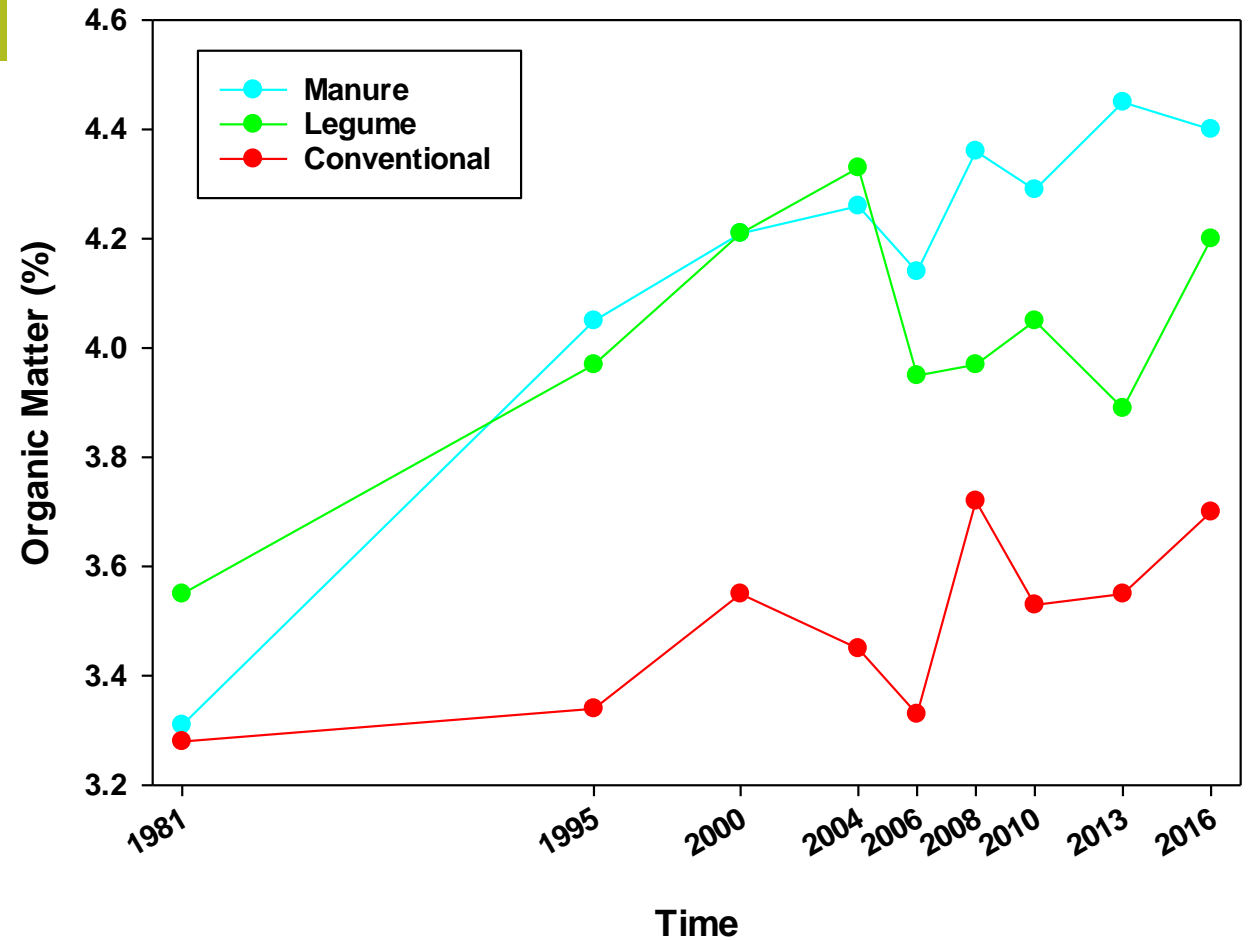
2016 Corn Yields – Bushels/Acre



MILESTONE achievement

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

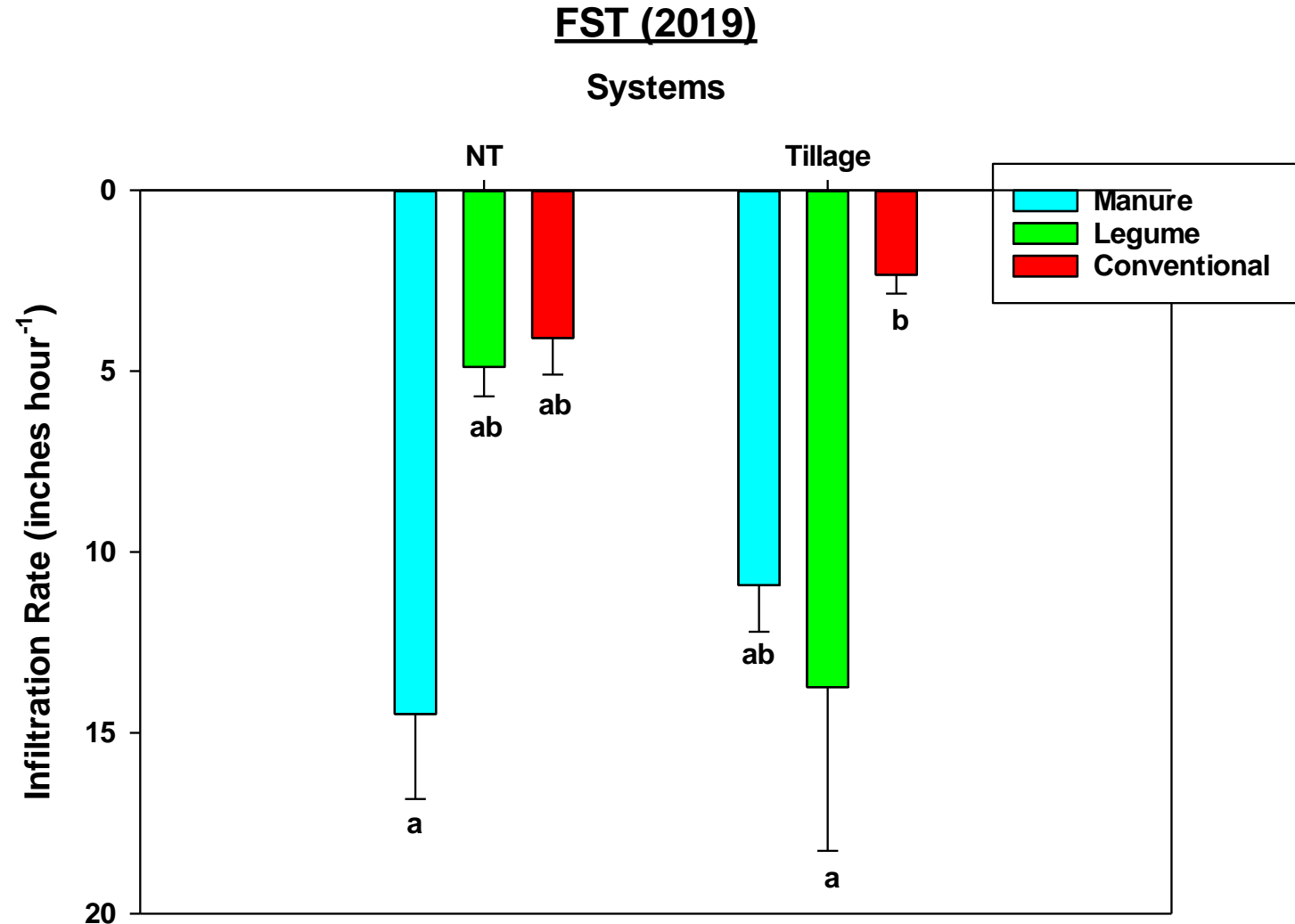
Changes in Organic Matter over Time



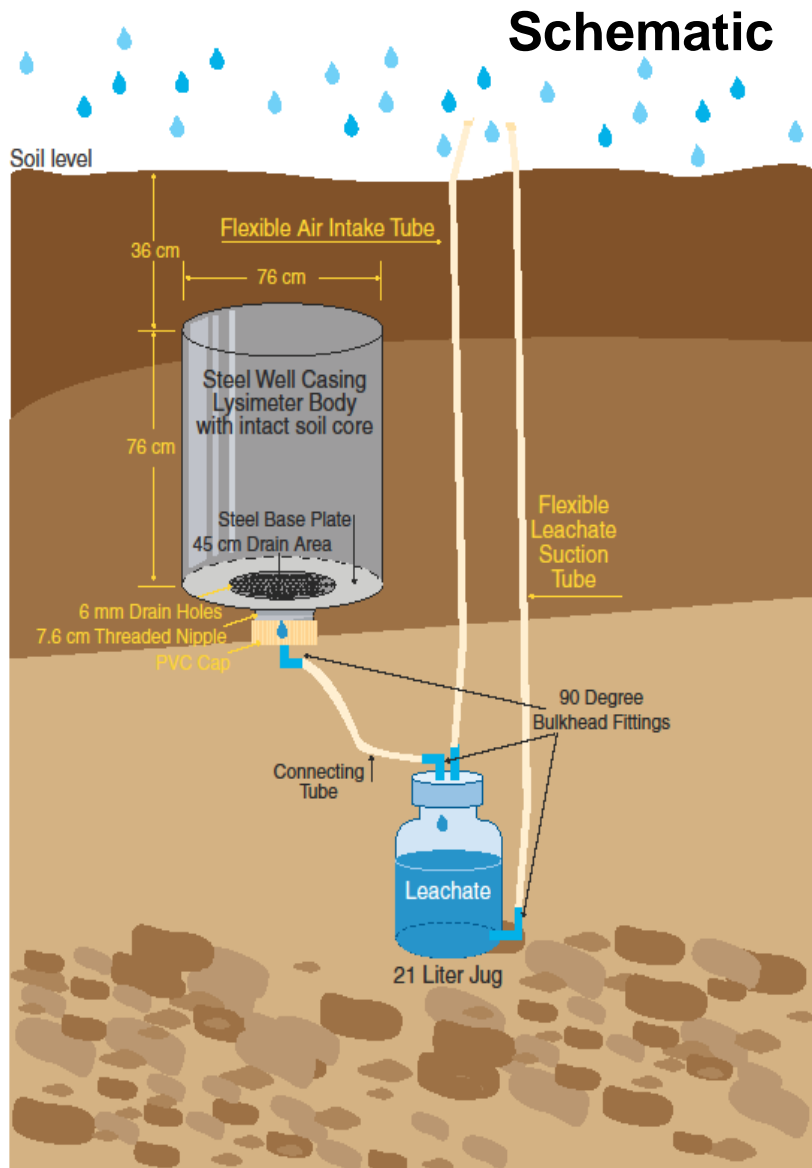
- SOM can hold up to 20X its weight in water (Johnson et al., 2005)
- Greater SOM = greater soil water = better water use efficiency

Infiltration rate significantly higher Organic system

3.7X higher than conventional

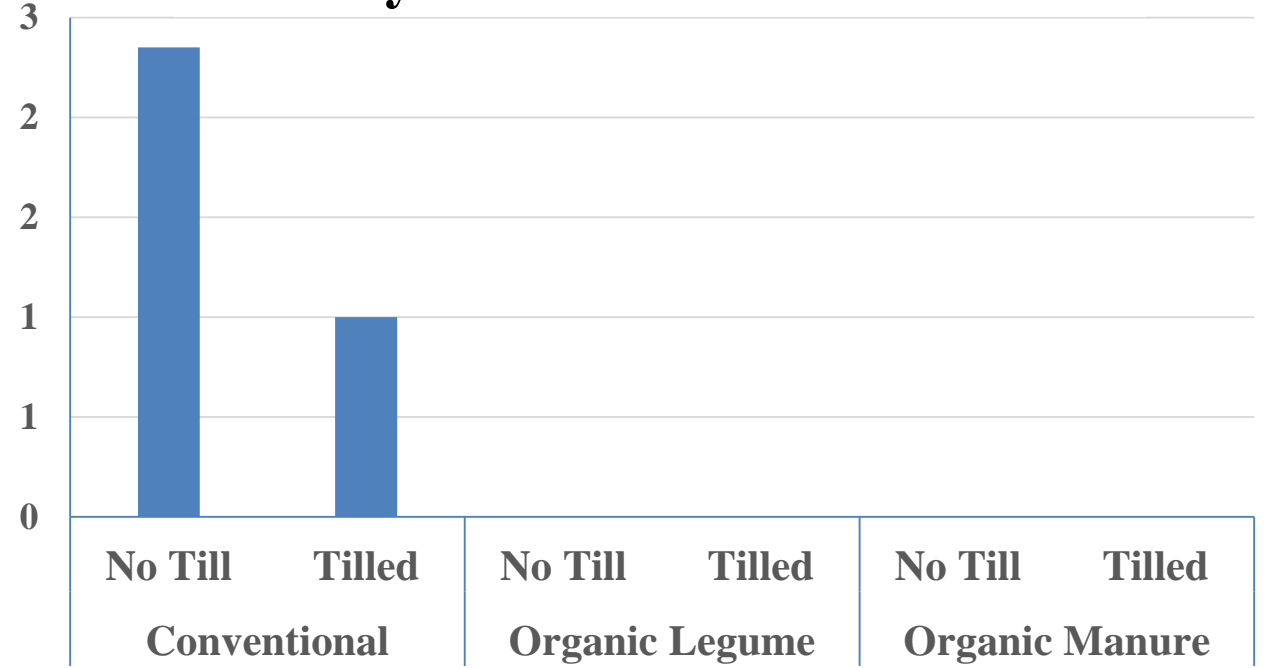


Lysimeters



2017 Lysimeter Leachate Atrazine

Atrazine ppb



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

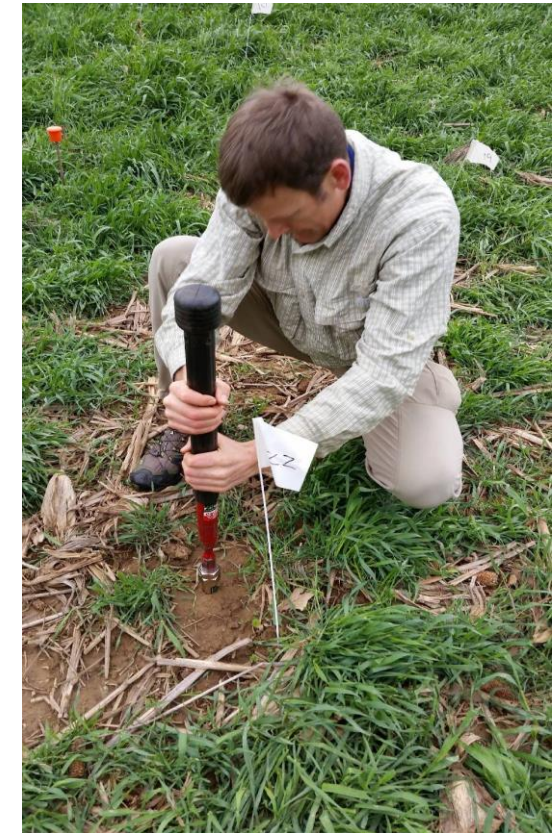


Deep (1M) soil cores in years 1, 3, and 6

0-20 cm annually
Measure soil chemistry, biology,
physical properties



Water Infiltration and Surface
Runoff Measurements



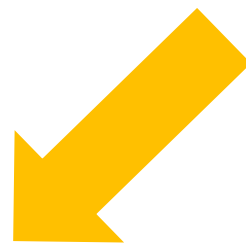
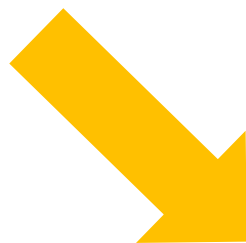
Measure TSS, Water
Chemistry, indicator bacteria

Science Demonstrating Best Ag Practices to Improve Water Quality

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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