FST FACTS

- **ORGANIC YIELDS** match conventional yields.
- **ORGANIC OUTPERFORMS** conventional in years of drought.
- **ORGANIC FARMING SYSTEMS BUILD** rather than deplete soil organic matter, making it a more regenerative system.
- **ORGANIC FARMING SYSTEMS ARE MORE PROFITABLE** than conventional farming.

OUR MISSION

Through organic leadership, we improve the health and well-being of people and the planet.

Learn more at

RODALEINSTITUTE.ORG/FST

RODALE INSTITUTE is a 501(c)(3) nonprofit dedicated to pioneering organic farming through research and outreach. For more than 70 years, we've been researching the best practices of organic agriculture and sharing our findings with farmers and scientists throughout the world, advocating for policies that support farmers, and educating consumers about how going organic is the healthiest option for people and the planet.

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RODALE INSTITUTE™

FARMING SYSTEMS TRIAL

THE LONGEST-RUNNING SIDE-BY-SIDE COMPARISON OF ORGANIC VS. CONVENTIONAL AGRICULTURE IN NORTH AMERICA

SINCE 1981

FARMING SYSTEMS TRIAL

The Farming Systems Trial (FST)® at Rodale Institute is America's longest-running side-by-side comparison of organic and conventional agriculture. In 1981, Bob Rodale designed the FST to assist farmers transitioning from conventional to organic agriculture. Now, after nearly 40 years, scientific data from the FST has established that organic management practices match or outperform conventional systems. The FST continues to study the benefits of organic agriculture to soil, human and environmental health.

FARMING SYSTEMS TRIAL

ABOUT

The Farming Systems Trial (FST) was started in 1981 to study the dynamics of transitioning from conventional to organic agriculture. A key objective of the trial was to demonstrate that organic agriculture can produce equivalent yields to conventional. Since inception, the FST has been comparing three core farming systems, each featuring diverse management practices: a manure-based organic system, a legume-based organic system and synthetic input-based conventional (chemical) system. In each system, corn and soybean production was selected as the main research focus because much of the Northeast and Midwest are devoted to growing these crops. In 2008, each core system was divided into two sub-systems to compare traditional tillage with rotational no-till practices. Genetically modified corn and soybeans were also introduced into the conventional system to mirror the majority of conventional growers.

THE DIFFERENT SYSTEMS

ORGANIC MANURE

This system represents an organic dairy or beef operation. It features a long rotation including both annual feed grain crops and perennial forage crops. The system's fertility is provided by leguminous cover crops and periodic applications of composted manure.

ORGANIC LEGUME

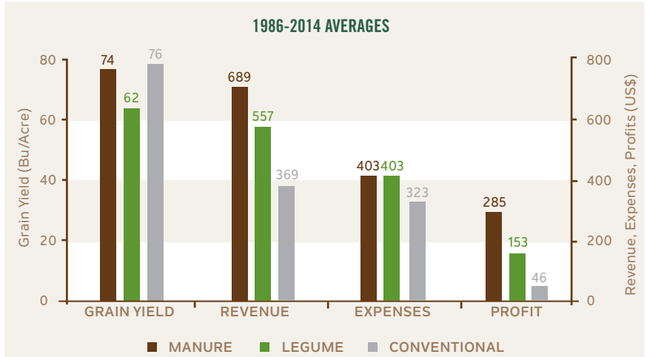
Representing organic cash grain farming, this system features a mid-length rotation consisting of annual grain crops and cover crops. The system's sole source of fertility is leguminous cash and cover crops. Crop rotations provide the primary line of defense against pests.

CONVENTIONAL SYNTHETIC

The conventional system represents the majority of grain farms in the U.S. It relies on synthetic nitrogen for fertility, and weeds are controlled by synthetic herbicides selected by and applied at rates recommended by Penn State University Cooperative Extension. In 2008, genetically modified (GM) corn and soybeans were added to this system.

SUMMARY

After nearly 40 years of existence, the FST continues to demonstrate, through scientific research data, that organic farming outperforms conventional systems with regard to building, maintaining, and replenishing the health of the soil, which is the key to regenerative agriculture.



YIELDS

Following an initial decline in yields during the first three years of transition from conventional, organic yields at the FST have consistently matched or surpassed conventional yields. Organic systems performed better in years of drought, producing corn yields that were up to 31% greater than conventional.

Taken on September 4, 2015 after a long dry spell, these pictures illustrate how corn can perform in the organic system compared to conventional. Conventional corn plants were showing signs of nutrient deficiency while organic corn remained green and robust.

WEEDS

Corn and soybean crops in organic systems tolerated much higher levels of weed competition than their conventional counterparts while producing equivalent yields. This is important given the rise of herbicide-resistant weeds in conventional systems, and speaks to the increased health and productivity of organic soil. However, better and more efficient weed control strategies are being continuously researched to increase crop yields to their maximum potential and encourage more adoption of organic farming.

Rodale Institute utilizes the innovative roller crimper, designed by Jeff Moyer, as the primary weed control tool in the organic no-till system.

The front-mounted roller crimps a cover crop such as cereal rye to form a thick mulch into which a cash crop such as soybeans can be simultaneously planted. The mulch effectively suppresses weeds.

An innovative tractor-mounted high residue cultivator is utilized to manage weeds as a last resort when complete weed control by rolled cover crop is not achieved.

Other innovative weed control satellite trials being evaluated include:

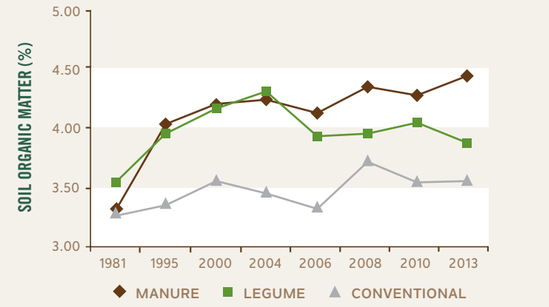
- Assessing combined effects of different cover crops and narrow cash crop row spacing on weed control.
- Determining the economic threshold density of weed species that would justify weed control in organic systems. Below the threshold density, weed management costs would be greater than expected losses, thus unnecessary.
- Utilizing crops' natural shade avoidance response as a means to increase crop tolerance to weeds.

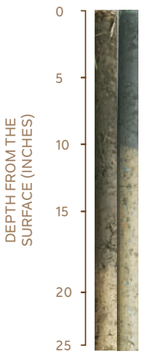
Shade avoidance: evaluating effects of weedy border in increasing weed tolerance in crops.

SOILS

Healthy soil can be defined as soil that allows plants to grow to their maximum productivity without disease, fertility, or pests, and without a need for off-farm supplements. FST data has established that soil health in the organic systems has continued to increase over time while soil health in the conventional system has remained essentially unchanged.

Soil organic matter (SOM) in organic manure and legume tilled systems increased to 4.5% and 3.9% respectively, while SOM changed from 3.3% to 3.6% in the conventional system, as indicated in the figure below.





A soil core from the manure system (left) has a dark brown/black organic matter to a depth of about 18 inches while the conventional system's (right) organic matter only goes down about 10 inches.

Soil organic matter increases soil's water-holding capacity by increasing soil macroaggregates resulting in more micro-and macropores in the soil. Soil organic matter, including root exudates, feed soil microorganisms that convert organic nutrients and minerals into plant-available nutrients to "feed" the plant while producing nets and "glues" to form soil aggregates.

Soils in organic and conventional plots are very different in appearance due to increase in soil organic matter in the organically managed soils. Using organic management practices, we are growing topsoil and regenerating the soil from the top down in just a few decades as the organic matter is moving deeper into the soil.

Soil organic matter is capable of holding up to 20 times its weight in water which is why water volumes percolating through soil were 15-20% higher in organic systems. Rather than running off the surface and taking soil and nutrients with it, rainwater recharges our groundwater reserves in organic systems.

Greater corn and soybean yields in organic systems compared to the conventional system during drought stress periods can be attributed to greater soil water content in organic systems, coupled with greater season-long availability of essential plant nutrients.