Paul C. And Edna H. Warner Endowment Fund for Sustainable Agriculture
Report Form

Successful Transitioning to No-Till Corn-Soybean Rotation with Cover Crops for Home-Grown N, Weed Control, and Soil Quality Improvement

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Summary and Objectives:
Understanding the factors (crop rotation, nutrients, and protection) that create and recycle nutrients, control weeds, and improve soil quality are important to define economically viable, socially responsible and ecologically sound agroecosystems that support food security and human nutrition. Integrated management practices (**as C3** = crop rotation, conservation tillage and cover crops) have several advantages over high input (energy, chemicals and time) conventional (tilled) production systems, and depend primarily on methods which reduce soil disturbance, create and recapture inputs, control weeds and soil-borne diseases, reduce energy requirements, and provide ecosystems services. The end result is increased farm profitability, better soil quality, and stable agroecosystems.

Objectives:
Our main objective was to conduct on-farm research and educate farmers on how to use C^3 integrated management approach for sustainable no-till corn-soybean agriculture in Ohio. Specific research purposes of the study were:
(1) To identify appropriate mixing of cover crops for efficient creation and recycling of nutrients to support no-till grain crops
(2) Determine the effectiveness of cover crops to control weeds in no-till crop rotation
(3) Evaluate the temporal effects of no-till and cover crops on selected biological, chemical, and physical indicator properties of soil quality, and
(4) Provide sites to demonstrate the effectiveness of the integrated management approach for economically viable, socially responsible and ecologically sound agroecosystems.

What was done?

The proposed on-farm research study will be conducted at Aaron Lemaster and Robert Hartman's farms at Jackson and Hancock County, Ohio. A randomized complete design with and without tillage and cover crops in 6 different corn-soybean-wheat rotation will be established at the 2 farm locations. Treatments will be replicated 4 times @ 200 ft x 100 ft). The integrated approach of experimental treatments will be for a 3-year period. Soil health data, weed data, agronomic data, and cover crop data will be collected and analyzed.
(1) Conventional till corn-soybean-wheat rotation with regular plowing and standard chemical fertilizers (NPK) and herbicides.
(2) No-till corn-soybean-wheat rotation with standard chemical fertilizers (NPK) and herbicides without any plowing.
(3) No-till corn-(rye)-soybean-wheat-(cowpea) rotation with cowpea and cereal rye as cover crops.
(4) No-till corn-(rye)-soybean-wheat-(winter pea) rotation with winter pea and cereal rye as cover crops
(5) No-till corn-(rye)-soybean-wheat-(Cow pea + oilseed radish) rotation with Cow pea, oilseed radish and cereal rye as cover crops.
(6) N0-till corn-(rye)-soybean-wheat-(winter pea + oilseed radish) rotation with winter pea, oilseed radish and cereal rye as cover crops.

What were the results?

While initial crop yields were not significantly different, crop biomass, cover crop biomass N% and cover crop N in pounds per acre was significantly higher than the control in no-till and conventional tillage. The winterpea treatment did not survive the winter. However, NT-CP, NT-CP/OR and NT-WP/OR had significantly higher crop biomass (3.32, 6.06, and 4.04 tons/acre), higher %N (2.97, 2.13, and 1.61%N), and higher total pounds of N per acre (98.6, 129, and 65) than either the conventional or no-till crop rotation without a cover crop which was zero for all three measures. The effect on corn yield will be measured in 2010.

How have the results contributed or will they contribute sustainable agriculture?

Justification of the proposal arises from the farmers/producers in Ohio being concerned about the high prices of fertilizer and chemical inputs. Ohio farmers have the opportunity to grow cover crops with traditional grain crops in their fields at rates very competitive with commercial fertilizers. Several innovative farmers have expressed their desire to introduce cover crops on their no-till fields to reduce chemicals expenses with an expected increase in farm profitability.