New Weed Control Strategies for Low Input and Organic Soybean

Project GREEEN No.: GR04-069

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Statement of Challenge

The Michigan Soybean Promotion Committee's number one priority is applied research in the ever-changing area of weed management and their number three priority is the development of tillage/cropping practices and/or alternative production systems to address the agronomics of soybean production and profit opportunities. The Michigan Organic Food and Farm Alliance's (MOFFA) number four priority desires research to evaluate and assess the use of cover crops for nutrient management and for weed and pest control in organic production. Additionally, MOFFA wants to develop new organic systems that reduce tillage since tillage has a negative impact on soil quality.

Most organic farmers use tillage as their weed control strategy. This could entail between six to eight tillage trips across the field during one season. Reduction in tillage operations will save farmers time, increase carbon sequestration and improve soil quality. Cover crops will be an essential tool to improve weed control, soil quality and increase profitability for soybean farmers (Mutch et al., 2003).

At the Rodale Institute, a roller has been designed that kills living crops by crimping their shoots. This roller is placed on the front of the tractor with a three-point hitch, thus planting can be accomplished in one pass. The cover crop is crimped and the mulch serves as a mat for weed control. The no-till planter on the rear of the tractor uses row cleaners to establish good soil to seed contact (Jeff Moyer, Rodale Institute, personal communication). This system would only require one or two trips total across the field, dramatically reducing costs for the farmer.

The MSU/KBS Land and Water Program has been part of a national increase in organic research at land-grant universities, with eight acres of research ground certified organic by Organic Crop Improvement Association (OCIA). Since beginning the transition of that ground to organic in 1997, researchers have sought the advice of organic growers to ensure that practices were consistent with organic standards and to identify the research needs of Michigan's organic community. In 2003, with funding from the USDA Sustainable Agriculture Special Grant, an advisory group was formed with seven Michigan organic farmers. That group has met three times face-to-face and twice by conference call to clarify research objectives for KBS.

Objective

Evaluate a steel roller to control cover crop and weeds in a no-till organic and low-input soybean system.

Results and Accomplishments

In late winter after the GREEEN grant was approved, Todd Martin built a roller/crimper from used steel. Jeff Moyer at the Rodale Institute provided guidance to build the roller/crimper. Originally the roller/crimper was going to be designed for the front of the tractor, but we were unable to get the front end three-point hitch, so we pulled it rather than pushed it.

An experiment was initiated at the MSU/KBS research station in Hickory Corners, Mich. Two studies were evaluated: 1) fall seed rye and vetch crops, and 2) spring seeded cover crops.

In May 2004 we had rainfall every single day preventing early planting and crimping. On June 4, 2004, the rye and vetch cover crop study was crimped and rolled. On June 7, soybeans were no-till planted into this mulch at 180,000 seeds/A.

The spring seeded cover crops included two varieties of oilseed radish, oriental mustard and oats. These cover crops provided adequate biomass and growth. They were rolled/crimped and soybeans were no-till planted into the mulch.

The rye and vetch study resulted in excellent season-long weed control. Soybean yields were above average at this location and we reduced tillage trips by eight times through this process. The spring seeded cover crop study resulted in a weedy mess. This study was destroyed prior to harvest of the soybean crop.

Dr. Adam Davis, a weed ecologist for ARS/USDA in Champaign, Ill., was so impressed with the roller/crimper control of weeds that he contracted with us to build him one in the winter of 2004-2005. Twenty farmers toured our research in August 2004 and 10 stated on their evaluation that they would use this practice if it worked consistently. I have made eight winter educational presentations of the roller/crimper to more than 400 farmers. Four farmers in Michigan have requested design blueprints of the roller.

The New Farm wrote an article on our GREEEN research and it can be accessed at http://www.newfarm.org/depts/notill/features/2005/0602/msuroller.shtml. From this article, I have been contacted by three Michigan farmers, an organic farmer in Oklahoma and a researcher in China.

Impacts

The roller/crimper system can save organic soybean farmers up to five gallons of fuel per acre by reducing tillage operations. If a gallon of fuel costs $2.10, this system could save $10.50/A. There are approximately 20,000 organic soybean acres in Michigan. This could result in a $210,000/yr. savings.

In the first year of experimenting with the roller/crimper, soybean yields were 62 bu. for crimped rye and 58 bu. for crimped vetch. These equate to a 25 and 21 bushel average higher than the five-year state average of 37 bu./A. The average soybean price during that five-year period was $4.82/bu. There are approximately 2,020,000 acres of soybeans planted every year. This system could increase soybean production and return up to $120.50/A or $243,410,000 for the state.

The system also used no fertilizer and no pesticides.

Summary Statement

The roller/crimper control of cover crops rye and vetch for no-till organic soybean showed tremendous potential in 2004. The system needs further testing under different environmental conditions to assure that the more than 20 bushel increase in soybean yield can result consistently.

Funding Partnerships

ARS-USDA $5,200
indirect $2,000

No-till Organic Soybean in Crimped/Rolled Rye and Vetch

Cover crop	bu/A	standard error
Hairy Vetch	58	3.3
Winter Rye	62	2.0

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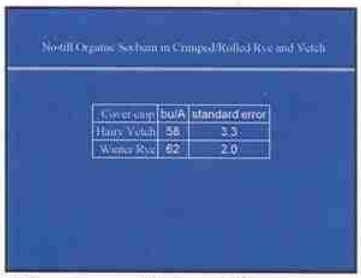

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