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Feasibility of organic soybean production following CRP land

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Feasibility of organic soybean production following CRP land

Abstract
What is the potential for organic crops on land returning to production after being idled in a conservation program? On-farm demonstrations explored the effects of different tillage methods, weed control efforts, and cropping systems on organic soybean growth.

Keywords
Horticulture, Agronomy, Corn-soybean cropping systems, Conservation practices, Organic production practices and comparisons

Disciplines
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Abstract: What is the potential for organic crops on land returning to production after being idled in a conservation program? On-farm demonstrations explored the effects of different tillage methods, weed control efforts, and cropping systems on organic soybean growth.

Background

Across the northern United States there has been great interest in planting organic soybeans on Conservation Reserve Program (CRP) land, where up to a 400 percent premium can be obtained compared to conventionally raised soybeans. Iowa farmers, who have greatly increased their organic acreage in the last five years, are very interested in CRP conversion to organic soybeans and the issue of “long- vs. short-term rotations.” In the short run, compliance with soil conservation programs is mandatory for organic producers involved in a number of federal programs. In the long run, regulation of soil organic matter will determine long-term sustainability.

The objectives of this project were to:
- Establish plots dedicated to organic farming research on CRP land,
- Implement production and management regimes for opening CRP land and for weed control in organic systems on CRP land,
- Evaluate the biological and economic outcomes of the different systems, and
- Encourage technology transfer through demonstrations, field days, and publications for area farmers and agricultural professionals.

Approach and methods

Beginning in 1998, an experiment was established to evaluate the effect of four tillage methods for organic soybean production following CRP land at the ISU McNay Research and Demonstration Farm in Chariton. Concurrent on-farm studies were established at the O’Brien Farm in Clinton, focusing on the effect of winter rye as a cover crop to assist organic soybean production following CRP land.

Plots were laid out in a randomized complete block arrangement with four treatments and four (2000) or eight (1999) replications in Chariton, and as side-by-side comparisons in Clinton. Chariton site treatments consisted of four primary tillage methods:
1. Fall moldboard plowing,
2. Fall Kverneland® plowing,
3. Fall and spring tillage with a Howard Rotavator®, and
4. Spring moldboard plowing.

CRP land was fall-tilled and left fallow or planted to rye at the Clinton location.

Results and discussion

All organic soybean systems yielded well in Chariton, averaging 49.3 bushels/acre in 1999, and 56.4 bushels/acre in 2000. These yields were above the county average both years. Plant populations were reduced significantly by tillage operations, but there were no significant differences among tillage treatments in the final stand counts.
Early weed counts in 1999 demonstrated a significant increase in grass weeds in the rotavated plots, but no significant differences were detected with broadleaf weeds. Despite the grass weed differences early in the season, there were no significant tillage treatment differences between broadleaf and grass weed populations at the end of the 1999 season. Yields were greatest in the spring-plowed plots in 1999 and 2000. Soybean grain quality also was high in all systems, with an average protein count of 42 percent in 1999.

In Clinton, the use of rye as a cover crop reduced weed populations, but did not affect yields. There was an excellent overall yield (43 bushels/acre) for organic soybeans, with particularly high yields on the CRP land in the Clinton area. Grain quality analysis showed no significant difference between treatments. Protein content (average 34.5 percent) was slightly but not significantly greater in soybean grown following a rye cover. Yields were lower in 2000 when the trial was repeated after a late planting and wet weather prevented timely weed management. Based on trial results, the farmers in this project will use winter rye as a cover for all land being planted to soybeans.

Conclusions

Results from the CRP experiments at the McNay Farm demonstrated excellent production of high-quality organic soybeans on land following CRP. Corn yields also were above average in 2000 when a long-term crop rotation of soybean-oats/red clover-corn was established. Oats suffered from a wet spring, which produced high populations of oat rust that lowered photosynthetic capacity in the crop. At the Neely-Kinyon organic plots, conditions were drier in 1999 and oats yielded 85 bushels/acre. Excellent yields and grain qualities were observed in soybean plots that were spring plowed as opposed to fall plowed. Spring
plowing allowed for a winter vegetative cover and minimized the soil erosion associated with fall plowing. Organic farmers in the Midwest, however, prefer fall plowing because:
- Farmers normally have more time for plowing in the fall than in the spring when other tillage, planting, and compost-spreading activities occur.
- Fall plowing allows for a more complete breakup of soil through the winter’s freezing and thawing, and
- Wet springs may preclude spring plowing.

For these reasons, investigation will continue, with U.S. Department of Agriculture funding, to determine yield and weed differences in the case of poor weather in the spring. Flame burning significantly lowered grass weed populations, but there was no effect on yield. Experiments continued with this technique in 2001 and data analysis will be conducted.

Current economics support the superior economic value of certified organic soybeans ($15/bu) compared to organic corn ($3.75/bu) or organic oats ($2.25/bu). In addition, compared with corn crop demands, soybeans can produce adequately on poorer soil more typical of CRP land.

CRP conversion may alter existing ecosystem processes, such as nutrient cycling and biological control. Both CRP program and organic farming practices strive to preserve soil structure and quality on erodible land, and protect waterways from silting and runoff. Regulation of soil organic matter through additions of plant residues and proper crop rotations will determine the long-term sustainability of the system. With the mineralization of soil organic matter in CRP land during tillage operations, nutrient deficiencies may occur in subsequent crops. Excellent yields in 1999 and 2000, however, demonstrated favorable mineralization for corn and soybean crops.

Impact of results

Approximately 7,000 people have been made aware of this project at field days and presentations about the benefits of spring tillage and winter rye cover crops, in addition to other sustainable and organic agricultural practices. The farmers involved in these trials have adopted sustainable practices of using winter rye crops and planting organic crops.

Education and outreach

Kathleen Delate made 197 presentations on organic production, agroecological research, and organic marketing to nearly 10,000 people between 1998 and 2000. Seventeen slide shows and four publications were developed for use at public meetings. Nearly 1,650 Iowa and Midwest producers and Extension staff attended 25 field days where this project was discussed. At the McNay CRP trial, 225 people...
participated in a discussion of trial results with the principal investigator and the cooperators. Fifteen publications with information on this project were prepared and presented between 1998 and 2000. A new Extension publication (PM 1881) entitled “Growing Organic Soybeans on CRP Land” has been developed as a result of this research and demonstration project.

**Question:** What are the effects of different tillage methods on organic soybean production following CRP land? What are the effects of winter rye as a cover crop following opening of CRP land?

**Answer:** All organic soybeans following CRP yielded well in Chariton, averaging 49.3 bushels/acre in 1999, and 56.4 bushels/acre in 2000. These yields were above the county average in both years. Early weed counts in 1999 demonstrated a significant increase in grass weeds in the rotavated plots but no significant differences were detected in broadleaf weeds. Despite differences early in the season, there were no significant differences in weed populations at the end of the 1999 season. Yields were greatest in the spring-plowed plots in 1999 and 2000. Soybean grain quality was also high in all systems. Protein content averaged 42.2 percent in 1999 with soybeans from spring-plowed plots averaging above 42 percent. In the on-farm trial in Clinton, the allelopathic effect of the rye reduced weed populations in 1998, but did not affect yields. Yields averaged 43 bushels/acre, an excellent yield for organic soybeans, particularly on CRP land in the Clinton area. Grain quality analysis also showed no significant difference between treatments. Protein content (average 34.5 percent) was slightly greater in the soybeans grown with a rye cover. Yields were lower in 2000 when the trial was repeated due to late planting and wet weather.