2001

Integrating Organic Soybean Production on Land Formerly in the Conservation Reserve Program (CRP)

Kathleen Delate
Iowa State University, kdelate@iastate.edu

Cynthia A. Cambardella
USDA National Soil Tilth Lab, cindy.cambardella@ars.usda.gov

L. James Secor
Iowa State University

Integrating Organic Soybean Production on Land Formerly in the Conservation Reserve Program (CRP)

Abstract
Objectives of this research and education program included an examination of tillage and weed management operations for organic farming on CRP land. In 1999, an experiment was initiated at the ISU McNay Research and Demonstration Farm at Chariton, Iowa, to evaluate the effect of four tillage methods for organic soybean production on land formerly in CRP. After demonstrating the success of organic soybeans on CRP land in 1999 (average yield–49.3 bushels/acre), an expansion of this experiment was initiated in 2000 as a longer term study to examine crop rotations and weed management in organic systems on CRP land.

Keywords
Horticulture, Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences | Horticulture

Integrating Organic Soybean Production on Land Formerly in the Conservation Reserve Program (CRP)

Kathleen Delate, assistant professor,
Department of Agronomy and Horticulture
Cynthia Cambardella, soil scientist, USDA
National Soil Tilth Laboratory
Jim Secor, farm superintendent,
Iowa State University

Introduction

Objectives of this research and education program included an examination of tillage and weed management operations for organic farming on CRP land. In 1999, an experiment was initiated at the ISU McNay Research and Demonstration Farm at Chariton, Iowa, to evaluate the effect of four tillage methods for organic soybean production on land formerly in CRP. After demonstrating the success of organic soybeans on CRP land in 1999 (average yield–49.3 bushels/acre), an expansion of this experiment was initiated in 2000 as a longer term study to examine crop rotations and weed management in organic systems on CRP land.

Materials and Methods

The 1999 and 2000 experiments were conducted on five-year-old bromegrass and alfalfa fields, typical of CRP land in this area of the state. Forty-eight plots were established in the fall of 1999 measuring 30 x 60 ft. each, with 15 ft. borders. Four tillage treatments were established and examined: Treatment 1 = fall moldboard plowing; Treatment 2 = fall Kverneland® plowing; Treatment 3 = fall and spring tillage with a Howard Rotavator®; Treatment 4 = spring moldboard plowing. Plots were laid out in a randomized complete block design with four treatments and four replications. All crops (corn, soybeans and oats with red clover) will be grown each year of the study. All fall tillage was accomplished on October 10, 1999, for the 2000 season. Winter rye was planted on all plots going to soybeans. Rye was planted on October 15 (1 bushel/acre) to serve as a ground cover to prevent erosion and mitigate weed populations in the spring. Manure was applied to plots going to corn on April 4, 2000, at a rate of 4,500 lb./acre. Plots were disked on March 3 and April 14, 2000. Harrowing occurred on March 25, 2000. The spring plowing treatment was completed on March 16, 2000. Oats (‘Jerry’) were planted at a rate of 2 bushels/acre with an underseeding of ‘Cherokee’ red clover (12 lb./acre) on March 25, 2000. Soybeans (‘Pioneer 9305’) were planted at a population of 175,000 plants/acre on May 16, 2000. Plots were rotary-hoed for weed control on June 6 and 13, 2000. Row cultivation occurred on June 20 and July 10, 2000. Soybean plots were walked on July 21 and 28, 2000, as per local organic practices to remove any potentially staining weeds prior to harvest. Corn (‘Pioneer 34W67’) was planted at a rate of 27,500 plants/acre on May 16, 2000. Sampling for soil, plant performance, weeds, insects and nematodes followed methods developed for the Neely-Kinyon LTAR site. Crop stand counts were taken on June 9, 2000 (24 days after planting). Weed counts (3 square meter quadrats per plot) were taken on June 9, 2000. Bean leaf beetles, which are associated with the soybean staining disease complex, were sampled in soybean plots on July 7, 2000, by sweeping 15 times per plot with a15 inch diameter net. Corn borer populations were sampled by removing 3 randomly selected corn whorls per plot, and recording the number of corn borer feeding holes, and actual larvae. Because of unsuitable weather conditions (long periods of high moisture soil), we could not utilize the propane flame burner in the LTAR plots. A separate organic corn flaming trial was established to evaluate this effect. Corn was flamed on July 3, 2000, when plants were 22 inches in height. Weed counts were taken prior to flaming (July 3) and 37 days following

flaming (August 7) in the organic corn flaming trial. Oats were harvested on July 14, 2000. Corn and soybeans were harvested with a combine with an enclosed scale on October 8, 2000.

Results and Discussion

Results from this CRP experiment demonstrated excellent production of high quality organic soybeans on land coming out of CRP. Corn yields were also well above average. Oats suffered from a wet spring, which led to high populations of oat rust that lowered photosynthetic capacity in the crop (77 bushels/acre). In a drier year (1999), at the Neely-Kinyon organic farm, oats yielded 85 bushels/acre. We were pleased to obtain excellent corn and soybean yields and grain quality in fields that were spring plowed as opposed to fall plowed (Tables 1 and 2). There were no significant differences in grass weed populations among treatments (Table 1). At peak population levels (July 7), bean leaf beetle populations were not significantly different among treatments (Table 2). There were no corn borer problems detected in 2000. Soybean and corn grain quality were high in all systems. In 2000, spring plowed soybean plots had significantly greater yields, but there were no significant differences in grain quality.

Table 1. Effect of primary tillage following CRP on weed populations and yield in organic corn, 2000

Treatment	Grass Weed Populations/Square Meter	Statistical Significance	Yields (Bu/acre ± SE)	Statistical Significance
Corn-Fall Plowed	1.5 ± 0.6	NSD*	220.1 ± 5.3	
Corn-Spring Plowed	1.5 ± 0.5		227.2 ± 11.4	Sig. greater than other tmnts.
Corn-Kverneland®	2.1 ± 0.8		207.1 ± 5.0	
Corn-Rotavator®	5.1 ± 1.3		193.6 ± 4.8	

*NSD = No significant differences among treatments, unless designated ($P \leq 0.05$)

Table 2. Soybean pest populations, grain quality, and yields, 2000.

Treatment	Bean Leaf Beetle (Per 15 sweeps)	Protein (%)	Oil (%)	Fiber (%)	Yields (Bu/acre)
Soybeans-Fall Plowed	0.17 ± 0.11*	38.59 ± 0.17*	18.24 ± 0.14*	4.66 ± 0.04*	56.3 ± 0.9
Soybeans-Spring Plowed	0.08 ± 0.08	38.65 ± 0.21	18.18 ± 0.14	4.68 ± 0.03	59.8 ± 1.6 [1]
Soybeans-Kverneland®	0.17 ± 0.11	38.29 ± 0.16	18.28 ± 0.14	4.65 ± 0.04	55.8 ± 0.9
Soybeans-Rotavator®	0.17 ± 0.11	38.51 ± 0.27	18.18 ± 0.22	4.68 ± 0.04	53.6 ± 0.5

*NSD between treatments

[1] Significantly greater than Kverneland®, Rotavator® and Fall MB Plowed treatments

Flame weeding demonstrated a significant effect on grass weed populations post-flaming (Table 3), but yields were not significantly increased when corn was flamed. The experiments will be repeated in 2001.

Table 3. Effect of flame weeding on organic corn yield and weed populations, 2000.

Treatment	Yields (Bu/acre)	Statistical Significance	Post- Flaming Grass Weed Populations/Square Meter	Statistical Significance
Flamed Corn	132.9 ± 5.5	NSD*	4.9 ± 1.2	Sig. lower
Non-Flamed Corn	137.9 ± 3.0		21.8 ± 6.3	

*NSD = No significant differences between treatments ($P \leq 0.05$)