

2009

Comparison of Organic and Conventional Crops at the Neely-Kinyon Long-Term Agroecological Research (LTAR) Site, 2008

Kathleen Delate

Iowa State University, kdelate@iastate.edu

Andrea McKern

Iowa State University

Cynthia A. Cambardella

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

Jeff Butler

Iowa State University

Randy Breach

Iowa State University

Follow this and additional works at: http://lib.dr.iastate.edu/farms_reports



Part of the [Agricultural Science Commons](#), [Agriculture Commons](#), [Agronomy and Crop Sciences Commons](#), and the [Horticulture Commons](#)

Recommended Citation

Delate, Kathleen; McKern, Andrea; Cambardella, Cynthia A.; Butler, Jeff; and Breach, Randy, "Comparison of Organic and Conventional Crops at the Neely-Kinyon Long-Term Agroecological Research (LTAR) Site, 2008" (2009). *Iowa State Research Farm Progress Reports*. 453.

http://lib.dr.iastate.edu/farms_reports/453

This report is brought to you for free and open access by Iowa State University Digital Repository. It has been accepted for inclusion in Iowa State Research Farm Progress Reports by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.

Comparison of Organic and Conventional Crops at the Neely-Kinyon Long-Term Agroecological Research (LTAR) Site, 2008

Abstract

The Neely-Kinyon LTAR site was established in 1998 to study the long-term effects of organic production in Iowa. Treatments at the LTAR site, replicated four times in a completely randomized design, include the following rotations: conventional CornSoybean (C-S), organic Corn-SoybeanOats/Alfalfa (C-S-O/A), organic CornSoybean-Oats/Alfalfa-Alfalfa (C-S-O/A-A), and Soybean-Wheat (S-W). Arapahoe winter wheat was planted on October 30, 2007, at 85 lb/acre and Cardinal red clover was frostseeded into the wheat plots on March 12, 2008, at a rate of 15.5 lb/acre. On April 21, Kame oats were underseeded with Bluejay alfalfa at a rate of 93 lb/acre and 16 lb/acre, respectively. Following harvest of the organic corn plots in 2007, AC Remington winter rye was no-till drilled at a rate of 70 lb/acre on November 8, 2007.

Keywords

Horticulture, Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences | Horticulture

Comparison of Organic and Conventional Crops at the Neely-Kinyon Long-Term Agroecological Research (LTAR) Site, 2008

Kathleen Delate, associate professor
Andrea McKern, research assistant
Departments of Horticulture and Agronomy
Cynthia Cambardella, soil scientist
USDA National Soil Tilth Lab
Jeff Butler and Randy Breach, ag specialists

Materials and Methods

The Neely-Kinyon LTAR site was established in 1998 to study the long-term effects of organic production in Iowa. Treatments at the LTAR site, replicated four times in a completely randomized design, include the following rotations: conventional Corn-Soybean (C-S), organic Corn-Soybean-Oats/Alfalfa (C-S-O/A), organic Corn-Soybean-Oats/Alfalfa-Alfalfa (C-S-O/A-A), and Soybean-Wheat (S-W). Arapahoe winter wheat was planted on October 30, 2007, at 85 lb/acre and Cardinal red clover was frost-seeded into the wheat plots on March 12, 2008, at a rate of 15.5 lb/acre. On April 21, Kame oats were underseeded with Bluejay alfalfa at a rate of 93 lb/acre and 16 lb/acre, respectively. Following harvest of the organic corn plots in 2007, AC Remington winter rye was no-till drilled at a rate of 70 lb/acre on November 8, 2007.

Hoop-barn swine compost was applied to organic corn plots at a rate of 12 tons/acre and 4 tons/acre to oat plots on April 21. Corn and soybean variety selection and planting methods in 2008 were as follows: Blue River 63H07 corn was planted at a depth of 1.75 in. as untreated seed at a rate of 32,000 seeds/acre in the organic plots and as treated seed in conventional plots, on May 20, 2008. Blue River 34A7 soybeans were planted at a depth of 2 in. in organic and conventional plots at a rate of 200,000 seeds/acre on May 20, 2008.

Three of four plots of soybeans in the organic soybean-wheat rotation were replanted on June 25, 2008, at the same initial rate, and because of this change in management, were not analyzed with the other treatments.

Conventional corn plots were fertilized on April 30, 2008, with 32% nitrogen (UAN) injected at 145 lb N/acre. On May 21, the pre-emergence herbicides, Balance Pro™, RoundUp WeatherMax™, and atrazine were applied at 1.25 oz/acre, 16 oz/acre, and 0.75 lb/acre, respectively. Conventional corn was also sprayed on June 23 with 0.75 oz/acre of Steadfast™ and 1.5 oz/acre of Callisto™. Conventional soybeans received an application of Encompass™ at 1 oz/acre, and RoundUp WeatherMax™ at 16 oz/acre on May 21. Post-emergent herbicides included Raptor™ at 4 oz/acre, Resource™ at 4 oz/acre, Flexstar™ at 1 pt/acre, and Fusilade™ at 8 oz/acre, applied on July 9.

Organic soybean plots were cultivated on June 22 and on July 2 and 7. Organic soybean plots were “walked” (hand-weeded) on August 1 and 14. Organic corn plots were rotary-hoed on June 2 and cultivated on June 17, 22, and July 2. Corn and soybean stands were counted on June 13, June 30-July 1, and July 21.

Weed counts were enumerated in corn and bean plots on June 13, June 30-July 1, and July 21 using square meter quadrats at three randomly selected areas within a plot. Corn borer populations were monitored on July 21. Soybean plots were sampled for insects on July 28 and September 4. Corn stalk nitrate samples were collected on October 14, and soybean cyst nematode sampling was

completed on October 14. Samples were collected from each corn and soybean plot for grain quality analysis, which was conducted at the ISU Grain Quality Laboratory, Ames, IA.

Alfalfa was baled on June 22, July 23, and August 4. Wheat plots were sample harvested on July 31 and baled on August 4. Oat plots were sample harvested on July 30 and baled on August 4. Soybean plots were harvested on October 21. Corn plots were harvested on November 5. Corn stalk nitrate analysis was conducted at the ISU Soil and Plant Analysis Laboratory. Soil in corn plots was sampled on June 18 and analyzed for late-spring nitrate content by the ISU Soil and Plant Analysis Laboratory. Fall samples were taken on November 4 for soil quality analysis.

Results and Discussion

There were many challenges in the 2008 season, including a change in management at the Neely-Kinyon Farm; a cool, wet spring with extended periods of flooding; and the latest corn harvest in the 11 years of the LTAR experiment. Conventional corn stands in the C-S rotation at 27,833 plants/acre were greater than the 24,417 plants/acre in the C-S-O/A-A rotation in 2008 (Table 1). Plant populations were intermediate in the C-S-O/A rotation at 25,833 plants/acre at 21 days after planting. Conventional soybean plant stands were statistically greater than the organic rotations by 12,199 plants/acre (Table 1). As a result of weather conditions and a change in management, LTAR plots did not receive the typical organic weed management followed in the previous 10 years of two rotary-hoeings in corn and soybean plots. Instead, corn plots were rotary hoed once and soybeans were never rotary hoed. As a result, weed populations were the highest in 11 years, with grass and broadleaf weeds statistically higher in organic plots compared with conventional corn and soybean plots (Table 2). As an example, with no weed management until

33 days after planting the organic soybeans (compared with the first rotary-hoeing 3 to 7 DAP in previous years), broadleaf weeds averaged 37 plants/sq. meter over the two organic rotations compared with 3 weeds/sq. meter in the conventional plots. Grass weeds were extremely high (highest in 11 years) in organic corn plots that were not rotary-hoed until 13 DAP: populations in organic plots averaged 124 grass weeds/sq. meter compared with <1 weed/sq. meter in conventional plots. By the end of the season, after four tillage operations, weeds were reduced in organic corn plots but the damage from consistent competition throughout the growing season was severe enough to affect yields. Weed populations in organic soybean plots were higher than previous years, but by the end of the season, were lower than organic corn plots. Over three sampling periods in organic corn plots, there were no differences in grass and broadleaf weed populations in the 3- and 4-year rotations, except for less broadleaf weeds on two sampling periods in the 4-year rotation plots (Table 2). In organic soybean plots, grass weeds were lower in the 4-year rotation plots on two of three sampling periods compared with the 3-year rotation plots.

Late-spring soil nitrate levels in the C-S-O/A-A and C-S-O/A plots averaged 13 ppm $\text{NO}_3\text{-N}$, statistically less than conventional corn plots (Table 1). This level was lower than all previous years and suggested inadequate distribution of N from composted manure applications, excessive leaching from flooding conditions, or a combination of both problems. Corn stalk nitrate levels at the end of the season were extremely low in the C-S-O/A rotation, but averaged $1136 \mu\text{g}\cdot\text{g}^{-1}$ N- NO_3 in the C-S-O/A-A rotation (Table 1). The corn stalks in the C-S rotation, having received 145 lb/acre of synthetic N, had $2211 \mu\text{g}\cdot\text{g}^{-1}$ N- NO_3 at the end of the season.

As a result of low levels of N and poor weed management, organic corn yields averaged 177 bushels/acre compared with 202 bushels/acre in conventional plots (Table 1). There was no difference between the conventional corn yield and the organic yield of 184 bushels/acre in the 4-year rotation, however. The organic C-S-O/A corn yield at 169 bushels/acre was equivalent to the organic C-S-O/A-A corn yield. With an average ear weight of 215.7 grams/ear, ear weight from the C-S-O/A-A rotation at 233 grams was equivalent to the conventional ear weight, but greater than ears from the 3-year rotation (data not shown). Organic soybean yields averaged 54 bushels/acre with statistically lower yields in the conventional C-S rotation at 48 bushels/acre (Table 1). Contrary to previous years, soybeans in the 4-year rotation plots yielded more than those in the 3-year rotation plots. There were no statistically significant organic oat yield differences between rotations, averaging 109.2 bushels/acre of grain in harvested samples, and 1.72 tons/acre of oat baleage. Wheat yielded 34.5 bushels/acre and 698 lb/acre baleage (Table 1). Alfalfa plots yielded 4.1 tons/acre.

Pest populations were variable in 2008, with low corn borer damage and no differences in damage levels among rotations. Bean leaf beetle (BLB) numbers were intermediate compared to previous years, with populations averaging 11 beetles/20 sweeps (Table 3), and 16 beetles/20 sweeps at peak populations. There were no differences between organic

and conventional plots. Total pest insects (including aphids, BLBs, and stink bugs) averaged 21 insects/20 sweeps (Table 3), and 26 insects/20 sweeps at peak populations, with no differences between organic and conventional plots. Beneficial insects averaged 6.3 insects/20 sweeps with similar populations in organic and conventional plots. Soybean cyst nematodes were not found in any plots in 2008 (Table 3).

As a result of higher N in the C-S corn, higher protein levels (7.2%) were found compared with the two organic rotations (6.1%) (Table 4). Cornstarch content at 62% was higher in the organic rotations. Soybean protein (33%), carbohydrate (26%), and oil (18%) content were equivalent among rotations (Table 4).

Acknowledgements

We would like to thank the Leopold Center for Sustainable Agriculture and the USDA-SARE program for their support of research at the Neely-Kinyon LTAR site. We also thank the Wallace Foundation for their input and support. Thanks also go to Mark Rosmann, Francisco Rosas, Bernardo Thompson, Chloe Poitral, Diego Viteri, Guillermo Cubas, Bob Turnbull, Greg Tylka, Jerry DeWitt, John Kennicker, Kathy Rohrig, and Deb Hall of Iowa State University; Charles Hurburgh and Glen Rippke of the ISU Grain Quality Lab; Kerry Culp of the ISU Soil and Plant Analysis Lab; and Maury Johnson of Blue River Hybrids and Albert Lea Seed House for providing seed for this study.