# Comparison of Organic and Conventional Crops at the Neely-Kinyon Long-term Agroecological Research (LTAR) Site, 2002

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## Materials and Methods

The Neely-Kinyon LTAR was established in 1998 to study the long-term effects of organic production in Iowa. Treatments, replicated four times, at the LTAR site 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). Variety selection and planting methods were as follows: Pioneer 34M94 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 at a rate of 30,200 seeds/acre in conventional plots on May 14, 2002. Northrup King 2412 soybeans were planted at a depth of 2 in. in organic and conventional plots at a rate of 200,000 seeds/acre on May 29, 2002. 'Wesley' winter wheat was planted on October 29, 2001, at 90 lb/acre and crimson clover was frost-seeded into the wheat plots on February 28, 2002, at a rate of 10 lb/acre. 'Blaze' oats were underseeded with Pioneer 53H81 leafhopper-tolerant alfalfa at a depth of 0.5 in. at a rate of 2 bushels/acre and 16 lb/acre, respectively, on April 10, 2002. Following harvest of the organic corn plots in 2001, winter rye was no-till drilled at a rate of 1 bushel/acre on October 29, 2001. Compost (local hoop-house swine manure) was applied to organic corn plots at a rate of 12 tons/acre on April 3, and 4 tons/acre to oat plots on April 4, 2002. Conventional corn plots were fertilized May 3 with 28% urea at 140 lb/acre N. Soil in corn plots was sampled on June 19, 2002, and analyzed for late spring nitrate by the USDA-ARS National Soil Tilth Laboratory, Ames, IA. On May 3, 1.75 oz. of Balance™ was applied to conventional corn plots. Conventional soybeans received applications of Prowl™ (2.2 pint/acre) on May 30, 1.44 oz/acre Pursuit™ on June 12, and 8 oz/acre of Select™ on June 26, 2002. Organic corn plots were harrowed on May 20, rotary hoed on May 28 and cultivated on May 31 and June 14, 2002. Organic corn plots were also flamed with a propane flame cultivator on June 20. Organic soybeans were harrowed on May 31, cultivated on June 14, rotary hoed on June 17 and cultivated on July 1 and 23, 2002. Stand counts were taken in corn plots on June 5 and in soybean plots on July 19. Weed counts were taken in corn plots on June 5 and June 19 and in soybean plots on June 11 using square meter quadrants at three randomly selected areas within a plot. Corn borer populations were monitored on July 3. Soybean plots were sampled for bean leaf beetles on July 7, 31, and September 5. Soybean cyst nematode sampling was conducted on September 17 by collecting 1 pint of soil from each soybean plot to a 6-inch depth. Samples were analyzed for SCN populations at the Plant Disease Clinic at ISU. Alfalfa was mowed and baled on May 31, June 30, and July 30, 2002. Wheat plots were harvested on July 8 and oat plots were harvested on July 16. Soybeans were harvested on October 16 and corn on October 18. Samples were collected from each corn and soybean plot for grain quality analysis, which was conducted at the ISU Grain Quality Lab.

## Results and Discussion

Conventional corn yields (179 bushels/acre) were significantly higher than organic corn yields in 2002 (Table 1), although organic yields were excellent at 171 and 161 bushels/acre. A significantly greater level of soil nitrate-N was found in conventional corn plots in late spring compared with organic plots (Table 2). Corn yields were significantly greater after a full year of alfalfa compared with the organic C-SB-O/A rotation. Soybean yields were highest in the C-SB-O/A and C-SB-O/A-A organic plots, averaging 47 bushels/acre (Table 1). Organic oat and wheat yields averaged 116 bushels/acre and 69 bushels/acre, respectively. Alfalfa yields over the two treatments averaged 2.22 tons/acre. Plant populations were not significantly different in corn plots (Table 2), but soybeans in the organic SB-W plots had a significantly lower plant stand compared with soybeans in other rotations (Table 3). Weed populations of either grasses or broadleaves were not significantly different in corn plots on June 5 or June 19 (Table 2). In soybean plots, significantly higher populations of grasses and broadleaves were found in the SB-W rotation (Table 3). No significant differences were found in populations of corn borers in corn plots or bean leaf beetles in soybean plots (Table 4). Significantly less staining was found in the organic rotations C-SB-O/A and C-SB-O/A-A (Table 4). Soybean cyst nematodes were only found in SB-W plots. No significant differences were found in corn grain quality among treatments (Table 5). Significantly higher protein was found in the organic SB-W rotation and in the conventional soybeans (Table 6).

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**Table 1. Organic and conventional grain crop yields at Neely-Kinyon, 2002.**

| Treatment | Corn yield bu/ac | Soybean yield bu/acre | Oat yield bu/acre | Wheat yield bu/acre |
|---|---|---|---|---|
| Conv. C-SB | 179.44 ± 2.05 | 45.98 ± 0.62 | N/A | N/A |
| Org. C-SB-O/A | 160.86 ± 1.25 | 48.30 ± 0.84 | 114.82 ± 4.75 | N/A |
| Org. C-SB-O/A-A | 170.85 ± 4.11 | 50.06 ± 0.52 | 118.10 ± 4.37 | N/A |
| Org. SB-W | N/A | 43.88 ± 1.01 | N/A | 68.79 ± 1.33 |
| LSD (0.05) | 8.09 | 2.37 | NSD | N/A |

**Table 2. Corn stands and weed populations in corn plots at Neely-Kinyon, 2002.**

| Treatment | Corn stands plants/acre | LSNT g/g N-$NO_3$ | Corn weeds/$m^2$ June 5, 2002 | | Corn weeds/$m^2$ June 19, 2002 | |
|---|---|---|---|---|---|---|
| | | | Grasses | Broadleaves | Grasses | Broadleaves |
| C-SB | 25,583 ± 783 | 17.70 ± 1.76 | 5.33 ± 2.95 | 9.08 ± 1.17 | 1.33 ± 0.84 | 7.50 ± 1.45 |
| C-SB-O/A | 24,417 ± 892 | 11.75 ± 1.34 | 3.17 ± 1.02 | 7.08 ± 1.93 | 0.92 ± 0.31 | 3.92 ± 2.25 |
| C-SB-O/A-A | 25,917 ± 679 | 12.63 ± 0.45 | 0.67 ± 0.28 | 6.50 ± 1.53 | 0.67 ± 0.37 | 4.11 ± 1.42 |
| LSD (0.05) | NSD | 4.17 | NSD | NSD | NSD | NSD |

**Table 3. Soybean stands and weed populations in soybean plots at Neely-Kinyon, 2002.**

| Treatment | Soybean stands plants/acre | Soybean weeds/m$^2$ June 11, 2002 | |
|---|---|---|---|
| | | Grasses | Broadleaves |
| C-SB | 116,000 ± 2726 | 2.33 ± 1.80 | 4.83 ± 1.19 |
| C-SB-O/A | 117,000 ± 3601 | 0.83 ± 0.24 | 3.33 ± 0.98 |
| C-SB-O/A-A | 115,000 ± 5473 | 9.83 ± 4.29 | 2.42 ± 1.13 |
| SB-W | 95,500 ± 4831 | 54.75 ± 16.30 | 9.00 ± 5.97 |
| LSD (0.05) | 14,121.199 | 24.15 | 3.67 |

**Table 4. Pest populations and stained soybeans from soybean plots at Neely-Kinyon, 2002.**

| Treatment | Corn borer damage | Bean leaf beetles July 9, 2002 | Bean leaf beetles July 31, 2002 | Stained soybeans (%) | Soybean cyst nematode (eggs per 100 cc) |
|---|---|---|---|---|---|
| C-SB | 0.58 ± 0.15 | 5.75 ± 0.95 | 7.25 ± 0.85 | 12.99 ± 1.27 | 0.00 ± 0.00 |
| C-SB-O/A | 0.17 ± 0.11 | 1.00 ± 0.71 | 12.25 ± 3.79 | 7.33 ± 0.68 | 0.00 ± 0.00 |
| C-SB-O/A-A | 0.33 ± 0.14 | 1.75 ± 0.48 | 10.75 ± 3.47 | 8.22 ± 0.58 | 0.00 ± 0.00 |
| SB-W | N/A | 1.00 ± 0.41 | 8.25 ± 1.25 | 12.59 ± 0.89 | 850.00 ± 753.37 |
| LSD (0.05) | NSD | NSD | NSD | 2.757 | NSD |

**Table 5. Corn grain quality at Neely-Kinyon, 2002.**

| Treatment | 2002 Corn grain quality (%) | | | | |
|---|---|---|---|---|---|
| | Density | Starch | Oil | Protein | Moisture |
| C-SB | 1.25 ± 0.002 | 59.96 ± 0.04 | 3.00 ± 0.00 | 8.00 ± 0.00 | 16.75 ± 0.25 |
| C-SB-O/A | 1.25 ± 0.002 | 60.91 ± 0.14 | 3.00 ± 0.00 | 7.75 ± 0.25 | 16.00 ± 0.00 |
| C-SB-O/A-A | 1.25 ± 0.004 | 60.36 ± 0.20 | 3.00 ± 0.00 | 8.00 ± 0.00 | 16.25 ± 0.25 |
| LSD (0.05) | NSD | NSD | NSD | NSD | NSD |

**Table 6. Soybean grain quality at Neely-Kinyon, 2002.**

| Treatment | 2002 Soybean grain quality (%) | | | | |
|---|---|---|---|---|---|
| | Carbohydrates | Fiber | Oil | Protein | Moisture |
| C-SB | 21.75 ± 0.30 | 4.33 ± 0.05 | 19.40 ± 0.17 | 36.53 ± 0.41 | 11.65 ± 0.13 |
| C-SB-O/A | 22.83 ± 0.13 | 4.45 ± 0.03 | 20.00 ± 0.17 | 34.73 ± 0.24 | 11.82 ± 0.21 |
| C-SB-O/A-A | 22.80 ± 0.08 | 4.54 ± 0.02 | 19.56 ± 0.22 | 35.10 ± 0.27 | 11.69 ± 0.11 |
| SB-W | 22.05 ± 0.22 | 4.45 ± 0.06 | 19.73 ± 0.13 | 35.78 ± 0.31 | 11.53 ± 0.08 |
| LSD (0.05) | NSD | NSD | NSD | 0.973 | NSD |