

# **Comparison of Organic and Conventional Corn, Soybean, Alfalfa, Oats, and Rye Crops at the Neely-Kinyon LTAR Site-2001**

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## **Introduction**

Sales of organic products reached \$8 billion industry in the U.S. in 2001, continuing a 20% annual growth rate. In Iowa alone, reported acreage for all organic crops increased from 13,000 in 1995 to 100,000 in 2000. With support from the Leopold Center for Sustainable Agriculture, Long-Term Agroecological Research (LTAR) sites were established throughout Iowa in 1998 to examine the agronomic, environmental and economic effects of organic practices over the long term. Neely-Kinyon organic LTAR plots became certified organic in 2000. Results from 2001 represent crop yields after one full rotation.

## **Materials and Methods**

Treatments, replicated four times, in the LTAR site included conventional Corn-Soybean, organic Corn-Soybean-Oats/Alfalfa, organic Corn-Soybean-Oats/Alfalfa-Alfalfa, and soybean-wheat/crimson clover. The soybean-wheat/crimson clover rotation replaced the soybean/winter rye rotation that was planted from 1998 to 2000. New certification regulations introduced by the State of Iowa Organic program in 2000 disallowed the soybean-rye rotation because the rye was not grown for a full season. Variety selection and planting methods were as follows: Pioneer '34W67' 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/ac. in conventional plots on May 18, 2001. Northrup King 2412 soybeans were planted at a depth of 2 in. in organic and conventional plots at a rate of 170,000 seeds/acre on May 29, 2001. Soybeans were replanted due to insufficient stands on June 16, 2001. 'Arapahoe' winter wheat was planted on October 24, 2000, at 90 lb/acre and crimson clover was frost-seeded into the wheat plots on March 27, 2001, at a rate of 10 lb/acre. 'Blaze' oats were underseeded with vernal and Pioneer '53H81' leafhopper-tolerant alfalfa at a depth of 0.5 in. at a rate of 3.2 bushels/acre and 20lb/acre, respectively, on April 18, 2001. Following harvest of the organic corn plots in 2000, winter rye was no-till drilled at a rate of 1 bu/acre on October 16, 2000. Compost was applied to organic corn plots at a rate of 12 tons/acre on April 16, 2001. Oat plots were fertilized with compost at 5 tons/acre, on April 16, 2001. Conventional corn plots were fertilized May 16 with 28% urea at 125 lb/acre N. The following pest management applications were made in the 2001 season: 2.5pt/ac Harness® and 1pt/ac Atrazine®, were applied to conventional corn plots on May 16, 2001. Conventional corn plots were also sprayed on June 20 with Buctril® (1pt/acre), Accent (0.67 oz/ acre), AMS (2 lbs./acre), and NIS® (0.4 pt/acre). Conventional soybean plots were sprayed with Prowl® at 2.2pts/acre on June 6, 2001 and 2 pts/acre of Manifest G, 12oz/acre Select®, 2lbs/acre AMS®, and 0.3pts/acre NIS® on July 10. Organic corn plots were harrowed on June 8 and cultivated on June 11, June 13, and June 26, 2001. Soybean plots were field cultivated before replanting on June 16. Organic soybeans were rotary hoed on June 25, and cultivated on July 6, July 13 and 30, 2001. Stand counts were taken in corn plots on June 8 and

in soybean plots on July 5. Weed counts were taken in corn plots on June 8 and July 5 and in soybean plots on June 29 and July 31 using square meter quadrats at three randomly selected areas within a plot. Corn borer populations were monitored on July 12. Soybean plots were sampled for bean leaf beetles on July 19, 26, Aug. 10, and Sept. 13. Soybean cyst nematode sampling was conducted on September 19 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. Soil in corn plots was sampled on June 28 and analyzed for late spring nitrate by the USDA-ARS National Soil Tilth Laboratory, Ames, IA. Stalk nitrate sampling occurred on October 4, 2001. All tissue samples were analyzed in the USDA-ARS National Soil Tilth Laboratory, Ames, IA. Half of each wheat/crimson clover plot was mowed with a disc mower and baled on June 25. Alfalfa was mowed and baled on July 12 and August 8, 2001. Oat and wheat plots were combined on July 25. Corn and soybeans were harvested on October 27, 2001. Samples were collected from each plot for grain analysis. Corn grain quality analyses for protein, oil and starch was conducted at the ISU Grain Quality Lab.

### **Results and Discussion**

Organic corn and soybean yields were significantly greater than conventional yields in 2001, with greatest yields following two years of alfalfa. Organic corn yields averaged 130 and conventional 112 bu/acre. Conventional soybean yields averaged 40 while organic soybeans yielded 45 bu/acre. Wheat yields averaged 39 bu/acre and oat yields averaged 82 bu/acre. Second year alfalfa plots averaged 3.4 tons/acre. Corn and soybean populations were similar among treatments after 3 wk. Early grass weed populations in organic corn plots were greater in plots following 2 years of alfalfa, but broadleaf weeds were greater in C-SB-O/A plots. Weed populations were less in soybean plots, with similar levels in all organic treatments on July 31. Corn borer populations were below economic thresholds and similar among treatments. Bean leaf beetle populations were also similar between conventional and organic plots. Stalk nitrate levels were highest in conventional corn (5,543 ppm), although not significantly greater than organic corn (3,048). Significantly higher levels of protein were found in conventional corn (9.0 vs. 8.5%). Similar levels of protein (33%) were found among soybean plots, but greater levels of carbohydrates were found in organic soybeans. Soil quality analysis is currently underway. Organic crops were sold to Heartland Organic Marketing Cooperative at a 200% premium over conventional prices in 2001.

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Table 1. Organic and conventional grain crop yields at Neely-Kinyon, 2001.

Treatment	Corn Yield Bu/ac	Soybean Yield Bu/acre	Oat Yield Bu/acre	Wheat Yield Bu/acre
Conv. C-SB	112.41 ± 3.46	39.93 ± 0.60	N/A	N/A
Org. C-SB-O/A	127.90 ± 3.50	42.82 ± .058	81.10 ± 1.19	N/A
Org. C-SB-O/A-A	131.43 ± 4.65	46.92 ± 0.70	82.80 ± 3.08	N/A
Org. SB-W	N/A	N/A	N/A	38.19 ± 3.64
LSD (0.05)	11.51	1.85	NSD	N/A

Table 2. Corn stands and weed populations in corn plots at Neely-Kinyon, 2001.

Treatment	Corn Stands Plants/acre	Corn Weeds/m <sup>2</sup> June 8, 2001		Corn Weeds/m <sup>2</sup> July 5, 2001	
		Grasses	Broadleaves	Grasses	Broadleaves
C-SB	28,750 ± 1533	0.00 ± 0.00	2.08 ± 0.95	1.83 ± 0.51	3.42 ± 3.15
C-SB-O/A	29,080 ± 633	10.00 ± 3.28	33.42 ± 7.9	5.50 ± 2.38	0.75 ± 0.58
C-SB-O/A-A	30,170 ± 985	135.42 ± 14.57	21.25 ± 5.9	4.75 ± 1.61	13.83 ± 2.75
LSD (0.05)	NSD	24.81	16.13	NSD	7.00

Table 3. Soybean stands and weed populations in soybean plots at Neely-Kinyon, 2001.

Treatment	Soybean Stands Plants/acre	Soybean Weeds/ m <sup>2</sup> June 29, 2001		Soybean Weeds/ m <sup>2</sup> July 31, 2001	
		Grasses	Broadleaves	Grasses	Broadleaves
C-SB	124,330 ± 3424	0.17 ± 0.11	1.67 ± 0.64	0.00 ± 0.00	2.58 ± 0.61
C-SB-O/A	112,080 ± 6751	2.58 ± 0.57	4.42 ± 0.87	0.67 ± 0.26	1.00 ± 0.49
C-SB-O/A-A	121,333 ± 3970	6.08 ± 1.55	5.58 ± 1.32	1.00 ± 0.60	1.67 ± 0.72
LSD (0.05)	NSD	2.74	2.84	NSD	NSD

Table 4. Pest populations and stained soybeans from soybean plots at Neely-Kinyon, 2001.

Treatment	Corn Borer Damage	Bean Leaf Beetles	Stained Soybean (%)	Soybean Cyst Nematode (Eggs per 100 cc)
C-SB	0.22 ± 0.15	2.75 ± 0.95	8.16 ± 0.84	387.50 ± 283.12
C-SB-O/A	0.18 ± 0.18	1.75 ± 0.63	11.93 ± 1.89	62.50 ± 62.5
C-SB-O/A-A	0.17 ± 0.11	1.75 ± 0.48	17.70 ± 2.02	150.00 ± 150.0
LSD (0.05)	NSD	NSD	5.33	NSD

Table 5. Corn stalk nitrate and grain quality at Neely-Kinyon, 2001.

Treatment	Stalk Nitrate (ppm)	2001 Corn Grain Quality (%)				
		Density	Starch	Oil	Protein	Moisture
C-SB	5542.5 ± 1136.2	1.31 ± 0.002	59.68 ± 0.11	3.63 ± 0.05	9.00 ± 0.07	18.65 ± 0.26
C-SB-O/A	2664.5 ± 1213.4	1.31 ± 0.002	60.10 ± 0.14	3.73 ± 0.08	8.43 ± 0.08	18.23 ± 0.29
C-SB-O/A-A	3430.0 ± 1109.3	1.32 ± 0.001	59.93 ± 0.09	3.70 ± 0.04	8.60 ± 0.12	18.25 ± 0.2
LSD (0.05)	NSD	NSD	NSD	NSD	0.296	NSD

Table 6. Soybean grain quality at Neely-Kinyon, 2001.

Treatment	2001 Soybean Grain Quality (%)				
	Carbohydrates	Fiber	Oil	Protein	Moisture
C-SB	24.00 ± 0.16	4.63 ± 0.06	20.60 ± 0.49	32.78 ± 0.63	12.50 ± 0.11
C-SB-O/A	24.08 ± 0.05	4.63 ± 0.09	20.70 ± 0.09	32.60 ± 0.20	12.50 ± 0.06
C-SB-O/A-A	23.50 ± 0.08	4.58 ± 0.03	20.05 ± 0.1	33.88 ± 0.14	12.43 ± 0.18
LSD (0.05)	0.34	NSD	NSD	NSD	NSD