

## Evaluation of Corn, Soybean, and Barley Varieties for Certified Organic Production, Crawfordsville—2004

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### Introduction

Beginning in 1998, a long-term organic crop rotation experiment was initiated at the Southeast Research Farm (SERF) to examine the effects of organic practices on crop yields, soil quality, and grain quality. Because a soil-building crop rotation is required for certified organic crop production, organic fields at the SERF follow a rotation of corn-soybean-barley/red clover. In addition to the use of certified organic practices at this site, we have used organic seed in this experiment, as the National Organic Program (NOP) requires that organic farmers source organic seed. Results reported here represent the seventh year of production, which includes two cycles of the three-year crop rotation.

### Materials and Methods

Treatments in 2004 at the Southeast Research Farm consisted of three varieties of corn and soybeans and four varieties of barley. Plots were laid out in a completely randomized block design with four replications of each variety. Corn varieties included NC<sup>+</sup>3448, NC<sup>+</sup>58T36, and NC<sup>+</sup>4771. Corn plots were planted on May 3, 2004, at a population of 32,000 plants/acre. Corn was planted at a depth of 2 in. in 30-in. rows in plots measuring 10 × 185 ft. Fertilization for the corn plots was provided through liquid hog manure that was broadcast and incorporated at a rate of 3,400 gal/acre on April 7, 2004. This application period corresponded with the certified organic requirement that raw manure be applied at least three months prior to harvest of agronomic crops. No insecticides, fungicides, or herbicides

were applied in keeping with organic standards. Weeds in corn plots were managed through two rotary hoeings on May 10 and 15 (7 and 12 DAP—days after planting) and two-row cultivations on May 28 and June 8. Corn plots were harvested on October 21, 2004.

Soybean plots were planted to a cover crop of rye (1 bu/acre) the previous fall on October 22, following the harvest of 2003 corn plots. The rye was killed by chisel plowing and disking on April 30, 2004. Three organic soybean varieties were planted on May 27. These varieties included NC<sup>+</sup>2FN93, NC<sup>+</sup>2A83, and NC<sup>+</sup>3F24. Soybeans were planted at a depth of 1 in. in 30-in. rows in plots measuring 20 × 185 ft. Planting density was 206,000 seeds/acre. Soybean weeds were managed through two rotary hoe operations on June 7 and 15 (11 and 19 DAP), and two-row cultivations on June 22 and July 14. Soybean plots were walked for weeds above the canopy on July 20 and were harvested on October 5, 2004.

Barley was planted at 2 bushels/acre on April 5 in plots measuring 20 × 40 ft. Barley varieties included Lacey, Conlon, AC Metcalfe, and Drummond. After barley was harvested on July 15, Red Mammoth red clover was planted as a cover crop in that field.

A core set of measurements was taken on three subsamples per plot for corn and soybean plots. Corn stands were counted on June 16 (44 DAP), and grass and broadleaf weeds were counted on June 16. A cornstalk sampling for stalk nitrate analysis was taken on October 5. Soybean stands were counted on June 16 (20 DAP), and weeds were counted on June 16 and July 7. Insect damage was quantified by observing corn borer damage in corn (July 2), and bean leaf beetles in soybeans (August 11 and September

16). Bean leaf beetles were sampled by sweeping 20 times across each plot with a 15-in.-diameter sweep net. Insects were placed in recloseable bags and transported in coolers to Iowa State University. Insects were frozen until counted in the laboratory. Soybean cyst nematode sampling was completed on October 5. Samples were collected from each corn and soybean plot for grain quality analysis conducted at the ISU Grain Quality Laboratory at Iowa State University. The percentage of stained soybeans was determined by counting the number of stained soybeans in a 200-gram sample that was randomly collected from the harvest of each plot.

### **Results and Discussion**

There were no significant differences among corn varieties in stand counts, weed counts, percent borer damage, and stalk nitrate levels in 2004 (Table 1). Soybean plant populations after two rotary hoeings were significantly larger in the 2FN93 and 2A83 plots (Table 2). There were no significant differences among varieties in soybean broadleaf and grass weeds on both sampling dates. Although there were no significant differences in soybean insect populations and staining, there was a trend toward larger bean leaf beetle populations on September 19 in the 3F24 plots as well as a higher percentage of staining (14% compared

with an average of 10% in the other soybean plots) (Table 3). Organic corn yields ranged from 156 bushels/acre in the NC+4771 plots to 169 bushels/acre in the NC+3448 plots, but there were no significant differences among varieties (Table 4). Soybean yields were significantly higher in the 2FN93 plots (53 bu/acre) compared with the other soybean plots (averaging 48 bu/acre). Barley yields were significantly lower in the Conlon plots at 31 bushels/acre compared with an average of 46 bushels/acre in the other barley plots. There were no significant differences in corn protein levels, averaging 6.4% (Table 5). Significantly higher protein levels were found in the 2A83 soybeans (40.5%), with the lowest protein levels in the 3F24 soybeans (34.0%) (Table 6).

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**Table 1. Corn plant stands, weed and insect populations, and corn stalk nitrate, SERF, 2004.**

Treatment	Corn stands (plants/acre)	Corn weeds/m <sup>2</sup>		Corn borer damage (%)	Corn stalk nitrate (ppm NO <sub>3</sub> -N)
		Grasses	Broadleaves		
NC <sup>+</sup> 3448	24,417	39.67	13.25	0.00	413.00
NC <sup>+</sup> 58T36	23,500	32.50	8.42	0.00	118.50
NC <sup>+</sup> 4771	24,000	30.17	9.67	0.00	74.00
LSD <sub>(0.05)</sub>	NS	NS	NS	NS	NS

**Table 2. Soybean stands and weed populations, SERF, 2004.**

Treatment	Soybean stands (plants/acre)	Soybean weeds/m <sup>2</sup> June 16, 2004		Soybean weeds/m <sup>2</sup> July 2, 2004	
		Grasses	Broadleaves	Grasses	Broadleaves
		2FN93	161,080a	1.17	3.25
2A83	155,250a	0.42	0.42	1.17	0.17
3F24	126,083b	0.17	1.33	3.42	0.17
LSD <sub>(0.05)</sub>	11,153	NS	NS	NS	NS

**Table 3. Insects in soybeans, SERF, 2004.**

Treatment	August 11, 2004			September 19, 2004			Stained soybeans (%)
	Bean leaf		Beneficials	Bean leaf		Beneficials	
	beetles	Aphids		beetles	Aphids		
2FN93	1.0	0.0	1.0	12.0	0.75	2.25	8.97
2A83	0.0	0.3	2.3	12.0	1.25	1.50	11.72
3F24	0.5	0.0	1.5	19.0	1.00	1.00	14.01
LSD <sub>(0.05)</sub>	NS	NS	NS	NS	NS	NS	NS

**Table 4. Corn, soybean and barley yields, SERF, 2004.**

Treatment	Corn yield		Soybean yield		Barley yield	
	Bu/ac		Treatment	Bu/ac	Treatment	Bu/ac
NC <sup>+</sup> 3448	169.13		2FN93	53.44a	Lacey	49.19a
NC <sup>+</sup> 58T36	158.87		2A83	48.28b	Conlon	31.17b
NC <sup>+</sup> 4771	156.37		3F24	47.80b	AC Metcalfe	41.20a
					Drummond	48.28a
LSD <sub>(0.05)</sub>	NS		LSD <sub>(0.05)</sub>	2.71	LSD <sub>(0.05)</sub>	8.18

**Table 5. Corn grain quality, SERF, 2004.**

Treatment	Moisture (%)	Protein (%)	Oil (%)	Starch (%)	Density (%)
NC <sup>+</sup> 3448	16.96b	6.35	3.70	61.99	1.27a
NC <sup>+</sup> 58T36	16.89b	6.31	3.61	62.00	1.24b
NC <sup>+</sup> 4771	18.04a	6.59	3.74	61.74	1.28a
LSD <sub>(0.05)</sub>	0.53	NS	NS	NS	0.01

**Table 6. Soybean grain quality, SERF, 2004.**

Treatment	Moisture (%)	Protein (%)	Oil (%)	Fiber (%)	Carbohydrate (%)
2FN93	11.53a	37.70b	17.66a	4.80a	21.84a
2A83	11.01a	40.51a	16.54b	4.71a	20.24a
3F24	19.20b	33.96c	16.58b	4.41b	27.05b
LSD <sub>(0.05)</sub>	3.15	1.34	0.61	0.21	2.09