

# Evaluation of Corn, Soybean, and Barley Varieties for Certified Organic Production—Crawfordsville Trial, 2001

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## Introduction

Organic farming has increased to an \$8-billion industry in the United States and continues to expand at approximately 20% annually. In Iowa alone, organic acreage for all crops has increased from 13,000 acres in 1995 to 120,000 acres in 1998. Organic corn production in 1997 was reported at 9,920 acres. International demand for organic products, particularly from Japanese and European markets, is also on the rise. Farmers interested in transitioning some or all of their land into organic production require information on best management practices for these systems. Once the transition is complete, comparable yields to conventional systems can be obtained. In addition, organic products garner a 20–300% premium price in the marketplace, with organic corn, for example, averaging a 200% premium price over conventional corn in 2001. Soil health—maintained through crop rotations, organic matter additions (manure/compost), and cover crops—has been the basis of successful organic farming. In the fourth year of organic trials at the Southeast Research Farm, we examined the performance of four soybean and corn varieties and two barley varieties under organic management. As required for certified organic production, a locally produced, inexpensive, renewable resource for fertilization (hog manure) and mechanical methods for weed control were used.

## Materials and Methods

Since 1998, organic plots at the Southeast Research Farm follow a rotation of corn–soybean–barley/red clover. Treatments in 2001 at the Southeast Research farm consisted of three varieties of corn and soybeans, and two varieties of barley, with 4 replications of each variety.

Seed corn was provided by NC+ Organic, an organic seed company from Lincoln, Nebraska.

Varieties included NC+ 3869 (108-day maturity), 2919 (103-day), and 3448 (106-day). Corn plots were planted on June 13, 2001, at a population of 29,900 plants/acre. Corn was planted in 30-inch rows to a depth of 2 inches, in plots measuring 5 × 185 feet.

The 1999 corn plots were planted to a cover crop of rye (1 bu/acre) following harvest on October 16, 2000. On June 11, 2001, the rye was killed by mowing then disking. Three clear-hilum soybean varieties were planted on June 18. These varieties included IA3011, IA3006, and Pioneer 9305. Soybeans were planted in 30-inch rows to a depth of 1 inch, in plots measuring 12.5 × 180 feet. Planting densities varied, with the Iowa State varieties planted at 243,000 plants/acre and Pioneer 9305 at 218,000 plants/acre.

Barley and red clover plots were interseeded on April 13, 2001. Barley was planted at 2 bushels/acre and red clover at 12 lb/acre. Barley varieties included "Robust" and "Kewaunee" with "Cherokee" red clover as an underseeding.

Fertilization for the corn plots was provided through liquid hog manure that was broadcast at a rate of 3,000 gal/acre on April 13, 2001. This application period corresponded with the requirement that raw manure be applied at least three months prior to harvest for agronomic crops. Analysis of this manure included 40 lbs/nitrogen per 1,000 gallons/manure to supply approximately 120 lbs of N/acre. In keeping with organic standards, no insecticides, fungicides, or herbicides were applied. Weeds in corn plots were managed through two rotary-hoeings (June 18 [5 DAP] and 23) and three row cultivations (June 30, July 6, 13). Soybean weeds were managed through two rotary-hoe operations (June 23 [5 DAP] and 27) and four row cultivations (July 6, 13, 23, 31).

A core set of measurements was taken on three subsamples per plot: for crop stand counts (July 3); for weed counts before first cultivation and after last cultivation (July 3, 18, August 10). Insect damage was quantified by observing corn borer damage in corn (July 18) and counting

bean leaf beetles in soybean (August 10, September 7). Stalk nitrate content and soybean cyst nematode samples were both taken on October 11. Soybean plots were harvested on October 19, 2001 while corn was harvested on October 26, with a combine equipped with a scale to quantify yields. All measurements were subjected to analysis of variance and Fisher's PLSD test.

### Results and Discussion

Due to weather constraints, planting was delayed in 2001, resulting in lower yields than previous years. Corn yields were not significantly different among varieties, averaging  $119 \pm 1.70$  bushels/acre. There were no significant differences among varieties in stand counts at 20 days after planting. Stand counts averaged 22,000 plants/acre after three tillage operations. Grass and broadleaf weed populations on July 3 (20 DAP) and 18 (36 DAP) were not significantly different among the varieties. There was little damage due to corn borers on July 18, and no corn borer larvae were found.

Stalk nitrate content was significantly greater in variety NC+ 3869 compared with NC+ 3448. Grain analysis found significant differences in protein, oil, starch, and density. The highest protein content was found in NC+ 3448 ( $7.5 \pm 0.10\%$ ), while NC+ 2919 had the lowest oil content ( $2.9 \pm 0.05\%$ ). The greatest starch content was found in NC+ 2919 ( $60.18 \pm 0.13\%$ ).

Soybean variety P9305 yielded significantly greater than varieties IA3006 and IA3011. Soybean yields ranged from 37.5—42.7 bushels/acre. Plant stands on July 3 (15 DAP) were greatest in variety P9305, with  $158,000 \pm 3449$  plants/acre after two tillage operations. Weed populations were not significantly different among the varieties on July 3, before the first cultivation, and August 10, after the last cultivation.

An increasing problem in soybeans in recent years is soybean staining associated with the bean leaf beetle. Bean leaf beetle populations were monitored, and the percentage of staining in the soybeans was determined. Bean leaf beetle populations on August 10 averaged  $3.25 \pm 0.5$  beetles/20 sweeps, with no significant differences among the varieties. By September 17, the second generation of bean leaf beetles had emerged, and there was an average of  $224.1 \pm 22.7$  bean leaf beetles/20 sweeps. Pioneer 9305 had significantly lower staining than both Iowa State soybean varieties. The number of soybean cyst nematodes was not significantly different among the varieties. The average population,  $170.8 \pm 79.9$  eggs/100 cc, remained below the economic threshold.

Significant differences in grain quality were found among the varieties for the percentage of protein, oil, and carbohydrates. Variety IA3011 had the highest level of protein, while P9305 had the highest percentage of oil and carbohydrates.

Barley was harvested on July 10. There were no significant differences in yield between the varieties. "Kewaunee" yielded  $26.5 \pm 4.9$  and "Robust" yielded  $28.3 \pm 3.7$  bushels/acre.