

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 U.S. and continues to expand approximately 20% annually. In Iowa alone, organic acreage for all crops has increased from 13,000 in 1995 to 120,000 in 1998. Organic corn production in 1997 was reported at 9,920 acres. International demand for organic products, particularly from the 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 organic trials at the Southeast Research Farm, we examined the performance of four soybean and corn varieties, and two barley varieties under organic management. A locally produced, inexpensive, renewable resource for fertilization (hog manure), and mechanical methods for weed control were used, as required for certified organic production.

Materials and Methods

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

Corn seed was provided by NC+ Organic and 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 per acre. Corn was planted in 30-in rows to a depth of 2 inches in plots measuring 5 x 185 ft.

The 2000 corn plots were planted to a cover crop of rye (1bu/ac) following harvest on October 16, 2000. The rye was killed in the spring by mowing the rye then disking on June 11, 2001. Three clear-hilum soybean varieties were planted on June 18. These varieties included IA 3011, IA 3006 and Pioneer 9305. Soybeans were planted in 30" rows to a depth of 1" in plots

measuring 12.5 X 180'. Planting densities varied with the Iowa State varieties at 243,000 plants per acre and Pioneer 9305 planted at 218,000 plants per acre.

Barley and red clover plots were interseeded on April 13, 2001. Barley was planted at 2bu/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 pounds of nitrogen per 1,000 gallons of manure to supply approximately 120 pounds of N/ac. No insecticides, fungicides or herbicides were applied in keeping with organic standards. Weeds in corn plots were managed through two rotary-hoeings on June 18 (5 DAP) and 23, and three row cultivations on June 30, July 6, and 13. Soybean weeds were managed through two rotary-hoe operations on June 23 (5 DAP) and 27, and four row cultivations on July 6, 13, 23 and 31.

A core set of measurements was taken on three subsamples per plot for crop stand counts (July 3) and weed counts before the first cultivation and after the last cultivation (July 3, 18, Aug. 10). Insect damage was quantified by observing corn borer damage in corn (July 18) and counting bean leaf beetles in soybean (Aug. 10, Sept. 7). Stalk nitrate content and soybean cyst nematode samples were both taken on Oct. 11. Soybean plots were harvested on October 19, while corn was harvested on October 26, 2001, 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 ± 1.70 bu/acre (Fig. 1). There were no significant differences among varieties in stand counts at 20 days after planting (Fig. 2). 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 (Fig. 3 and 4, respectively). 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 to NC+ 3448 (Fig. 5). Grain analysis found significant differences in protein, oil, starch, and density (Fig. 6). The highest protein content was found in NC+ 3448 ($7.5 \pm 0.10\%$) while NC+ 2919 had the lowest oil content (2.9 ± 0.05). The greatest starch content was found in variety NC+ 2919 ($60.18 \pm 0.13\%$).

Soybean variety P9305 yielded significantly greater than varieties IA 3006 and IA 3011 (Fig. 7). Soybean yields ranged from 37.5 - 42.7 bu/ac. Plant stands on July 3 (15 DAP)

were greatest in variety P9305 with $158,000 \pm 3449$ plants per acre, after two tillage operations (Fig. 8). Weed populations were not significantly different among the varieties on July 3 (Fig. 9), before the first cultivation and Aug. 10, after the last cultivation (Fig. 10).

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. The bean leaf beetle population on Aug. 10 had an average of 3.25 ± 0.5 beetles per 20 sweeps with no significant differences among the varieties (Fig. 11). By Sept. 17, the second generation of bean leaf beetles had emerged and there was an average of 224.1 ± 22.7 bean leaf beetles per 20 sweeps (Fig.12). Pioneer 9305 had significantly lower staining than both Iowa State soybean varieties (Fig. 13). The numbers of soybean cyst nematode was not significantly different among the varieties. The average population, 170.8 ± 79.9 eggs/100 cc, remained below the economic threshold (Fig. 14).

Significant differences in grain quality were found among the varieties for the percentage of protein, oil and carbohydrates (Fig. 15). Variety IA 3011 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 ± 4.9 and Robust yielded 28.3 ± 3.7 .

Acknowledgements

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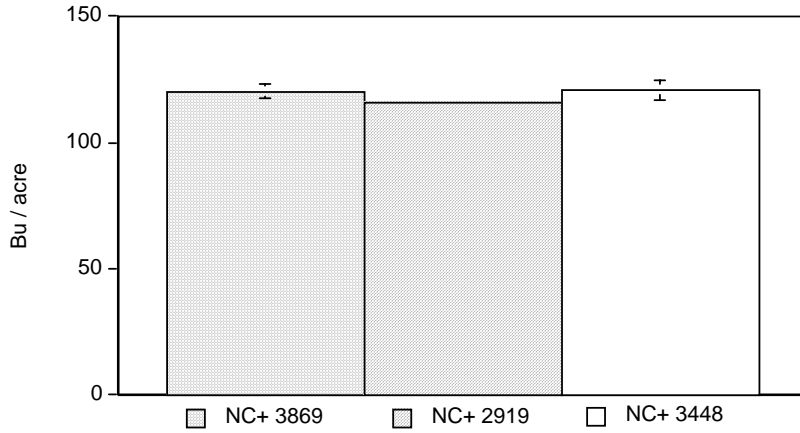


Figure 1. Corn yields, SERF, 2001.

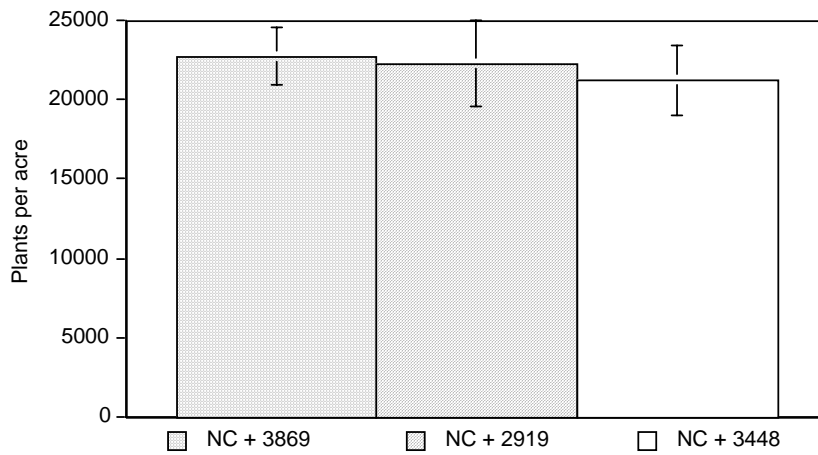


Figure 2. Corn plant population, SERF, 2001.

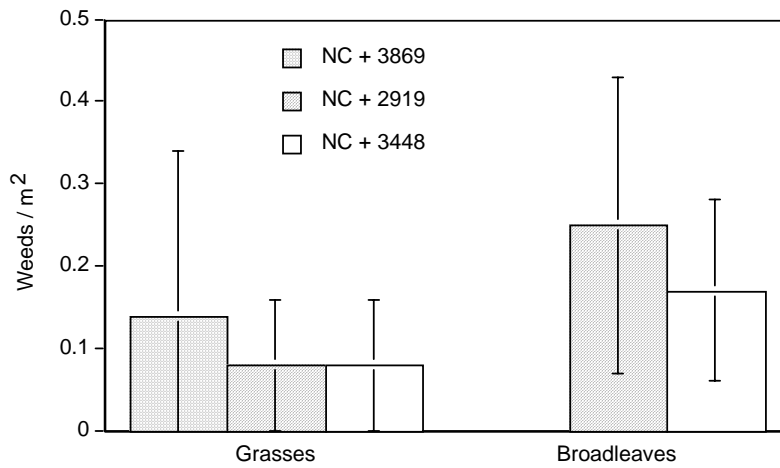


Figure 3. Corn weeds July 3, SERF, 2001.

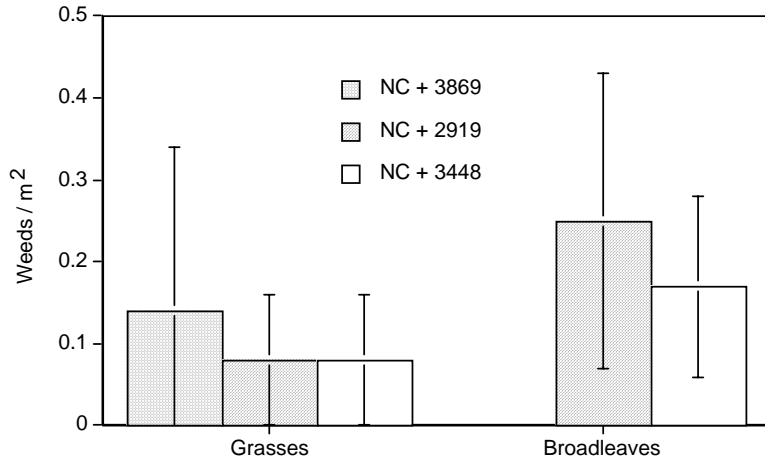


Figure 4. Corn weed population, 7/18 SERF 2001.

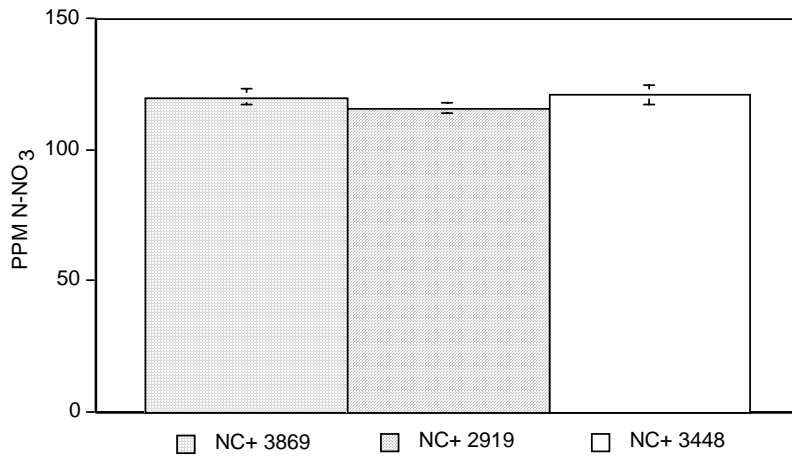


Figure 5. Stalk nitrate content, SERF, 2001.

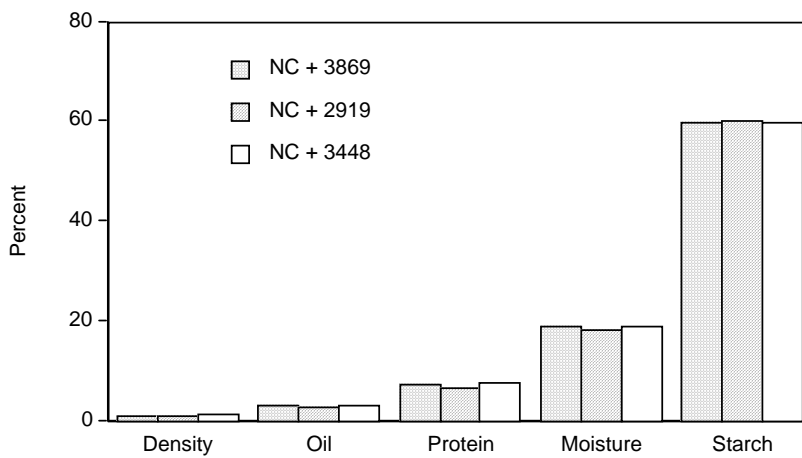


Figure 6. Corn grain analysis, SERF, 2001.

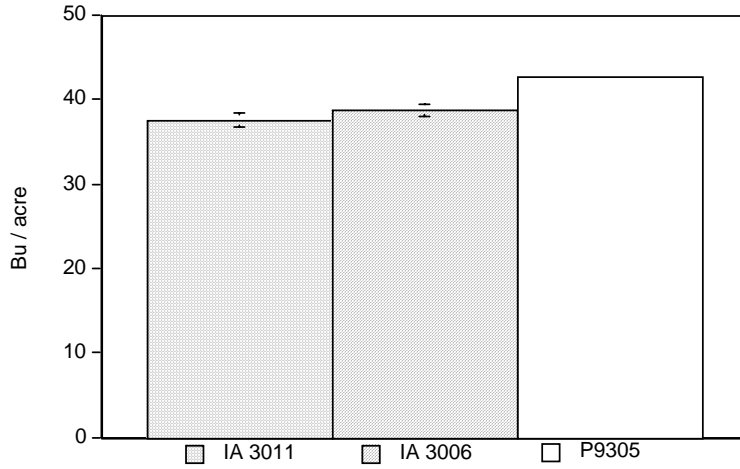


Figure 7. Soybean yields, SERF, 2001.

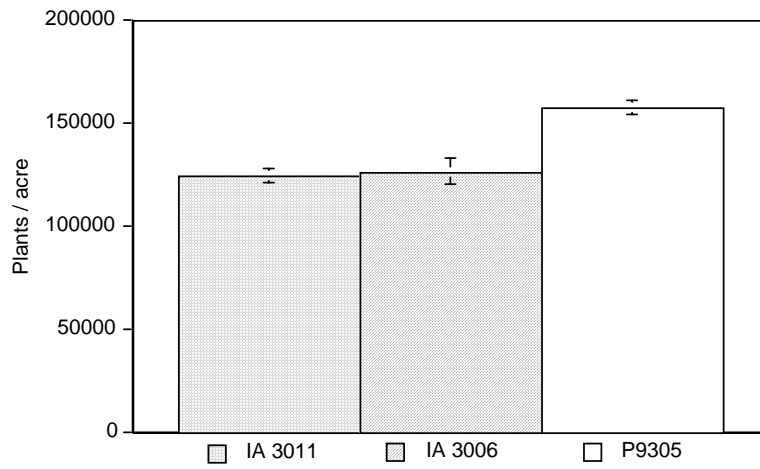


Figure 8. Soybean plant population, SERF, July 3, 2001.

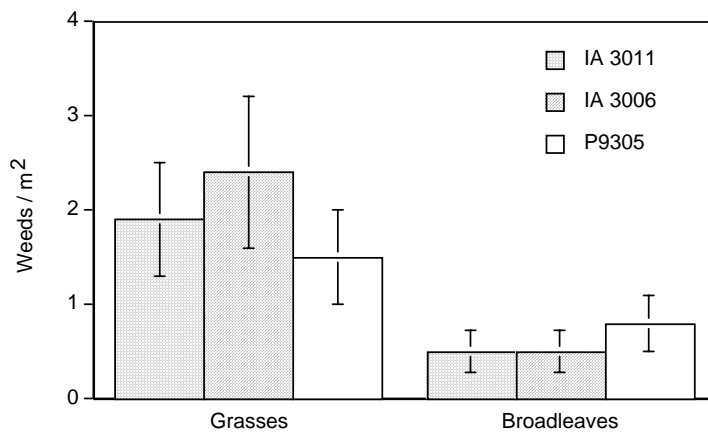


Figure 9. Soybean weed population, SERF, July 3, 2001.

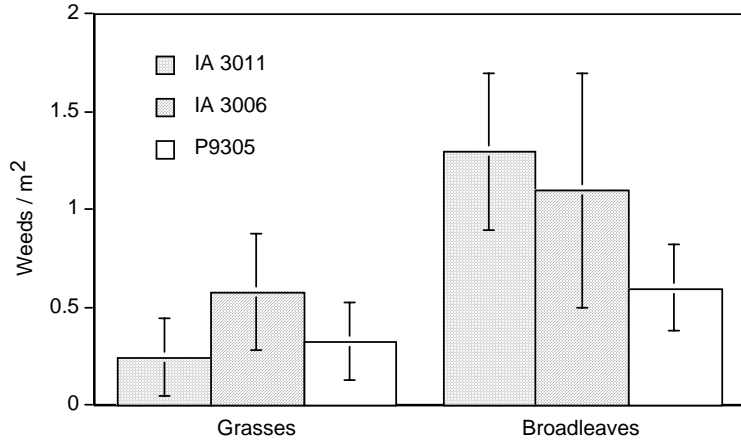


Figure 10. Soybean weed population, SERF, August 10, 2001.

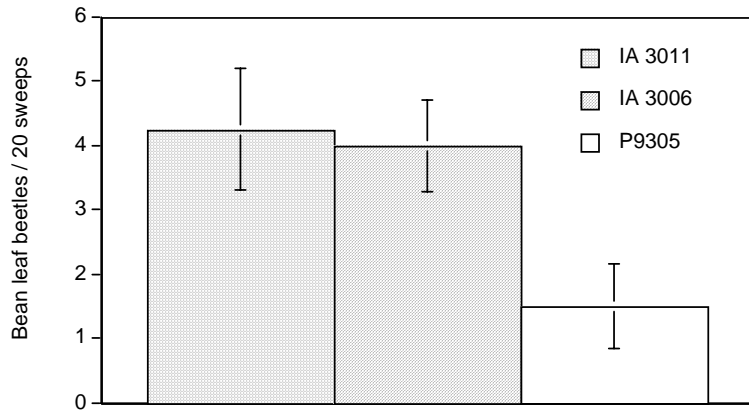


Figure 11. Bean leaf beetle population, SERF, August 10, 2001.

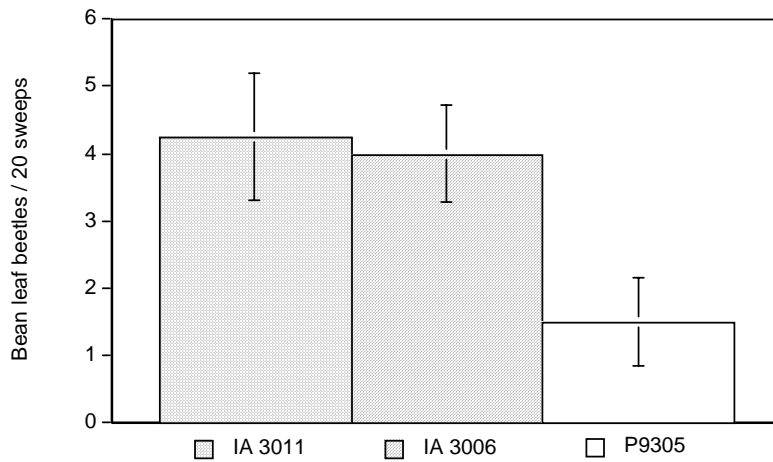


Figure 12. Bean leaf beetle population, SERF, September 17, 2001.

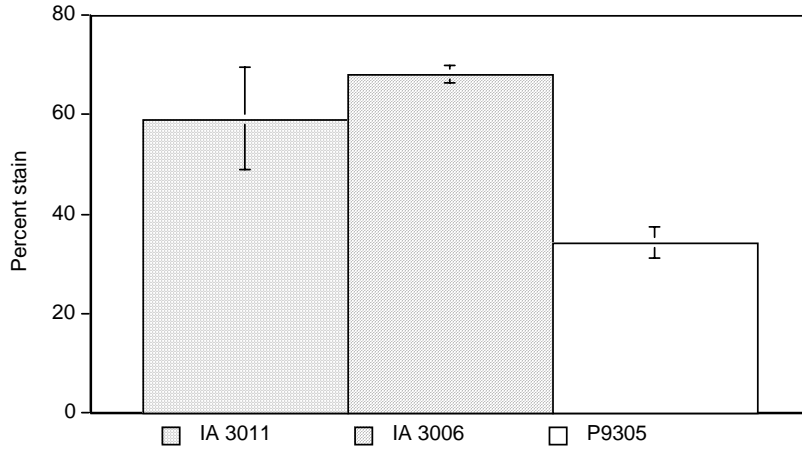


Figure 13. Percentage of stained soybeans, SERF, 2001.

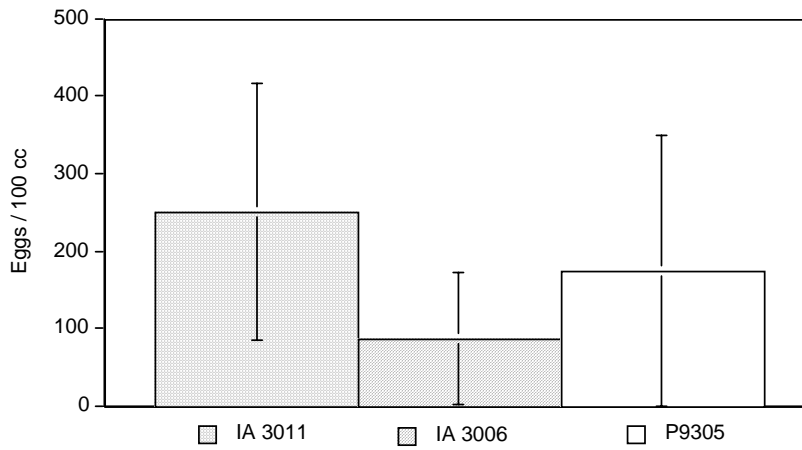


Figure 14. Soybean cyst nematodes, SERF, 2001.

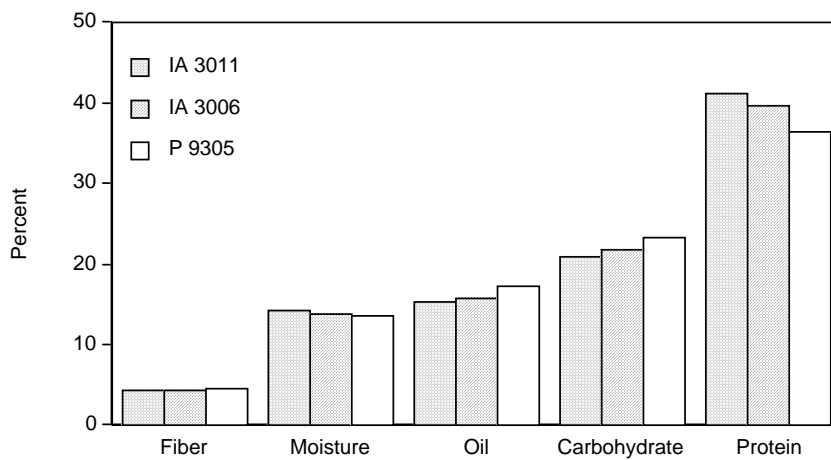


Figure 15. Soybean grain quality, SERF, 2001.