Evaluation of Corn, Soybean and Barley Varieties for Certified Organic Production-Crawfordsville Trial, 2000

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Introduction

Organic farming has increased to a $8 billion industry in the U.S. and continues to expand approximately 20% annually (7). 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 (4). 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 (1,6,9,13). 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 1998 (2). Soil health, maintained through crop rotations, organic matter additions (manure/compost), and cover crops, has been the basis of successful organic farming (3,5,8,10). In the third year trials at the Southeast Research Farm, we examined the performance of three corn, soybean and barley varieties under organic management. A locally produced, inexpensive, renewable resource (hog manure) was used for fertilization, and mechanical methods were used for weed control, as required for certified organic production (11).

Materials and Methods

Organic plots at the Southeast Research Farm follow a rotation of corn-soybean-barley/red clover started in 1998. 2000 was the third year following this rotation. Corn plots were planted to a cover crop of rye following harvest on October 16, 1999. The rye was tilled up in the spring, preceding soybean planting.

Three corn varieties and 4 replications of NC+ hybrids corn were planted on May 15, 2000. The varieties included NC+ 3869, 4880, and 5338. Corn was planted in 30” rows to a 1” depth in plots measuring 10 X 185’.

Three soybeans varieties with 4 replications were planted on May 23, 2000. The soybean varieties were all clear-hilum varieties designated for the tofu industry. The varieties included IA 3011, NC+ 2FG2 and Pioneer 9305. Soybeans were planted in 30” rows to a depth of 1” in plots measuring 20 X 185’.

Barley and red clover was interplanted on March 14, 2000. Barley was planted at 2bu/ac and red clover was 12 lb/ac. Barley varieties used were Bounty, Chiltion, and Kewaunee while the red clover variety was Cherokee.

Fertilization was provided through liquid hog manure that was broadcast at a rate of 3,000 gal/acre in the spring. This application period corresponded with the requirement for raw manure to be applied at least four 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 were managed through three rotary-hoeings (May 23, May 31 and June 7) and two row cultivation on June 13 and 20.

A core set of measurements was taken on three subsamples per plot for crop stand counts (June 7), weed counts (June 7), insect damage (July 7,), stalk nitrate content (September 29) Plots were harvested on October 16, 2000, with a combine equipped with a scale to quantify yields. All measurements were subjected to analysis of variance and Fisher's PLSD test (12).

Results and Discussion

Corn Production

Corn yields ranged from 120.4 –131.2 bushels/acre. Average production for each variety is presented in Figure 1. Significantly greater yields were achieved in variety NC+ 3869 (131.2 ± 2.9) compared to the other varieties (ANOVA, P=.05).

There were no significant differences among varieties in stand counts at 24 days after planting (Figure 2). Stand counts averaged 25,000 plants/acre after three tillage operations. Any negative effect from untreated seed was not evident in this trial. There was a higher population on broadleaf weeds than grasses in all varieties and variety 3869 had significantly higher populations of broadleaves than variety 4880 (Figure 3).

Stalk nitrate content was significantly greater in variety NC+ 4880 (Figure 4). Stalk nitrate was less than desired for recommended nitrogen rates for complete grain fill (700 to 2,000 ppm), for varieties NC+ 3869 and 5338, but grain fill did not appear to be a problem in this trial. Greater yields may be obtained with increased hog manure application rates, but pollution problems, in the form of nitrogen and phosphorus leaching, could also result.

Few corn borer larvae were detected in the plants sampled on July 7, although evidence of feeding was noted throughout the crop. Damage levels did not reach the economic threshold (5%) required to justify spraying with *Bacillus thuringiensis*. Grain analysis found no differences among the varieties (Figure 5).

Results from this trial mimicked results obtained by organic farmers in Iowa where yields of 120-160 bushels/acres are common (2). While this corn would be considered “transitional” (in the three year transition between conventional and organic production), the selling price of certified organic corn in 2000 averaged $3.15/bushel. If corn is sold as organic, returns from an average organic corn acre (130 bushels/acre) would be $409.50. Cost of production studies at the ISU Neely-Kinyon Farm in 1998, organic corn

returned a 227% profit over conventional corn (see Armstrong Farm Annual Progress Report, 1999).

Soybean Production

Soybean varieties P9305 and NC+ 2FG2 yielded significantly greater than variety IA 3011 (Fig. 6) Soybean yields ranged from22.9 - 33.0 bu/ac. Year 2000 was a dry year in Southern Iowa, which affected soybean yields. 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 NC+ variety 2FG2 contained a significantly greater percentage of stained soybeans compared to the other varieties (Fig. 7). The bean leaf beetle population on July 7 had an average of 1.61 ± 0.39 beetles per 20 sweeps with no significant differences among the varieties (Fig. 8). Grain quality was also measured and the Pioneer variety 9305 had significantly lower level of protein but greater levels of oil and carbohydrate compared to the other varieties (Fig. 9)

Significant differences in soybean stands were shown with P9305 having a greater stand (114,000 ± 9,201) than the other varieties (Fig. 10). Weed counts taken on June 20 showed no significant differences after 4 tillage operations. (Fig. 11).

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Figure 1. Corn yield, SERF 2000.

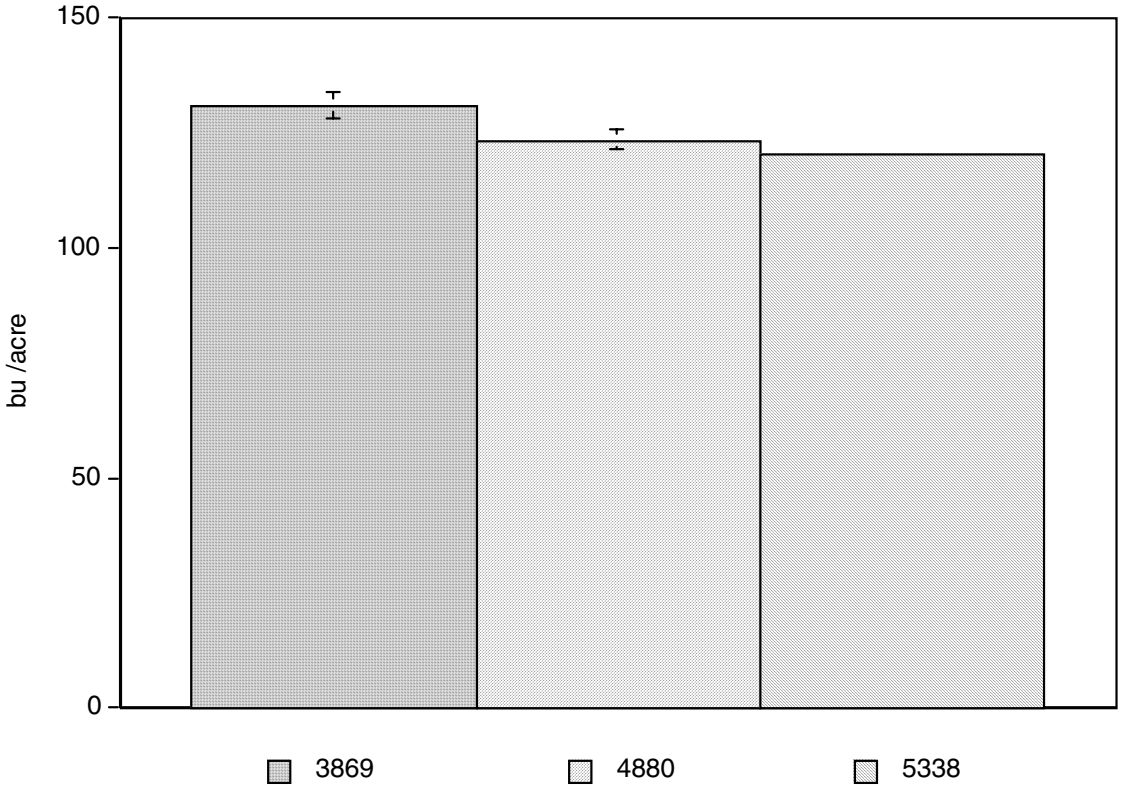

Figure 2. Corn plant population June 7, SERF, 2000.

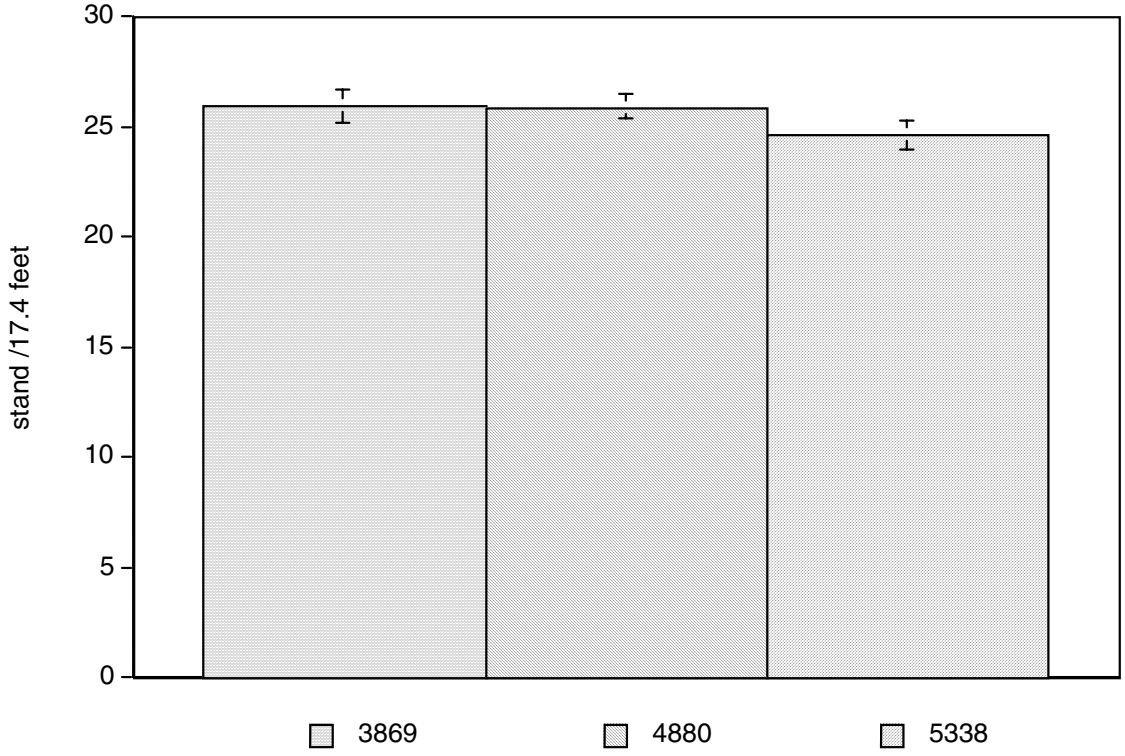

Figure 3. Weed population in corn 6/7/2000, SERF.

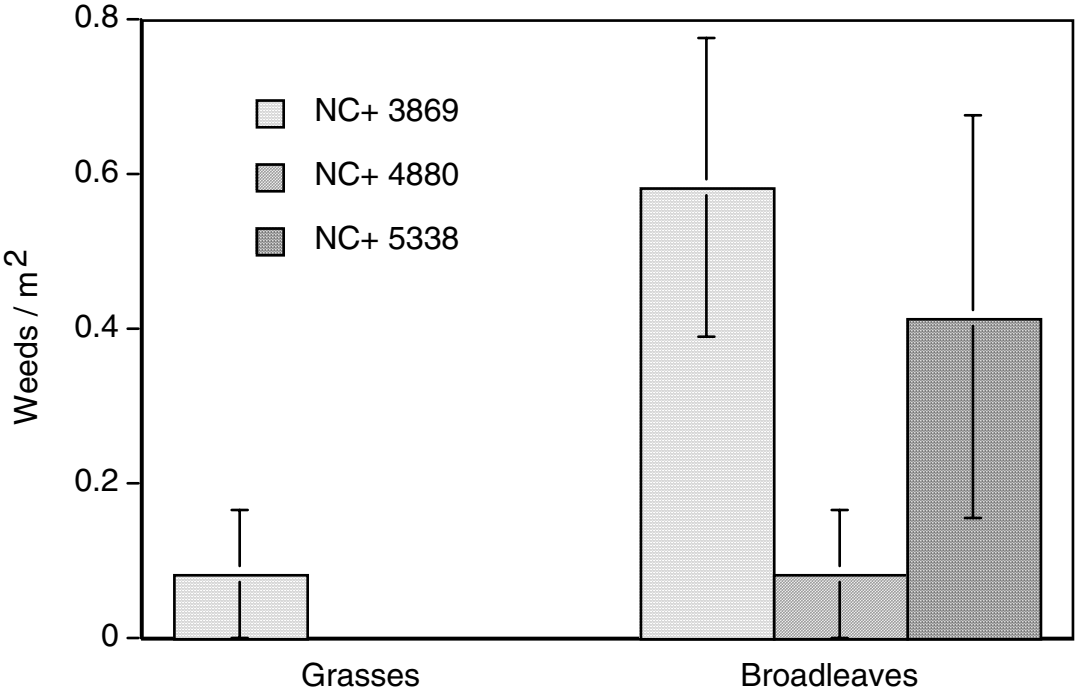

Figure 4. Stalk nitrate values, SERF, 2000.

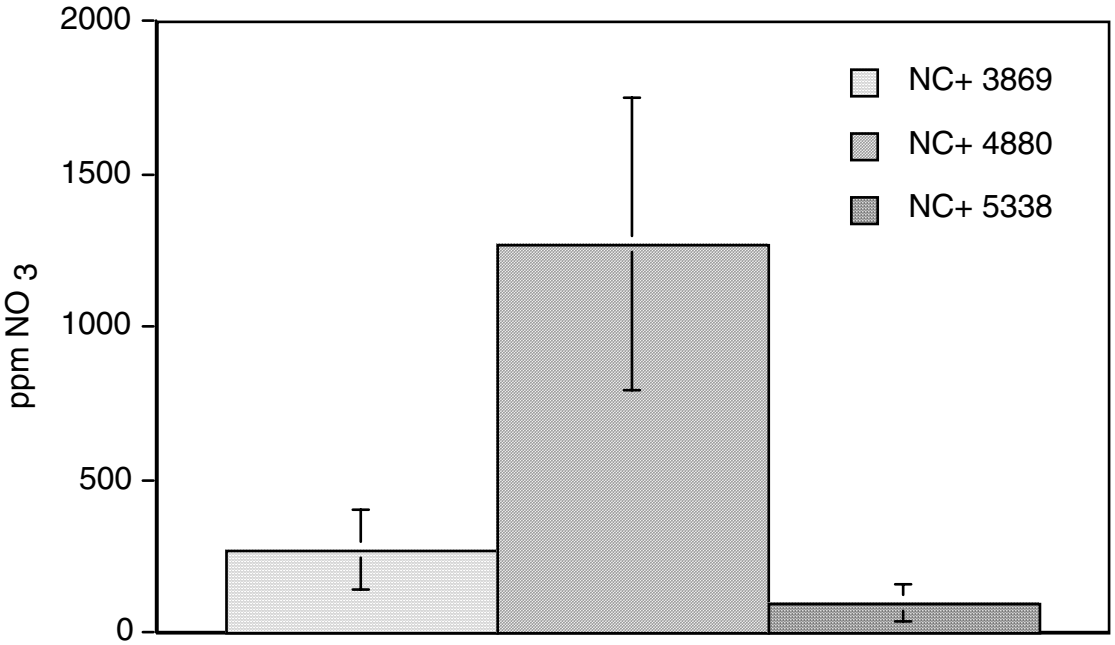

Figure 5. Corn grain analysis, SERF, 2000.

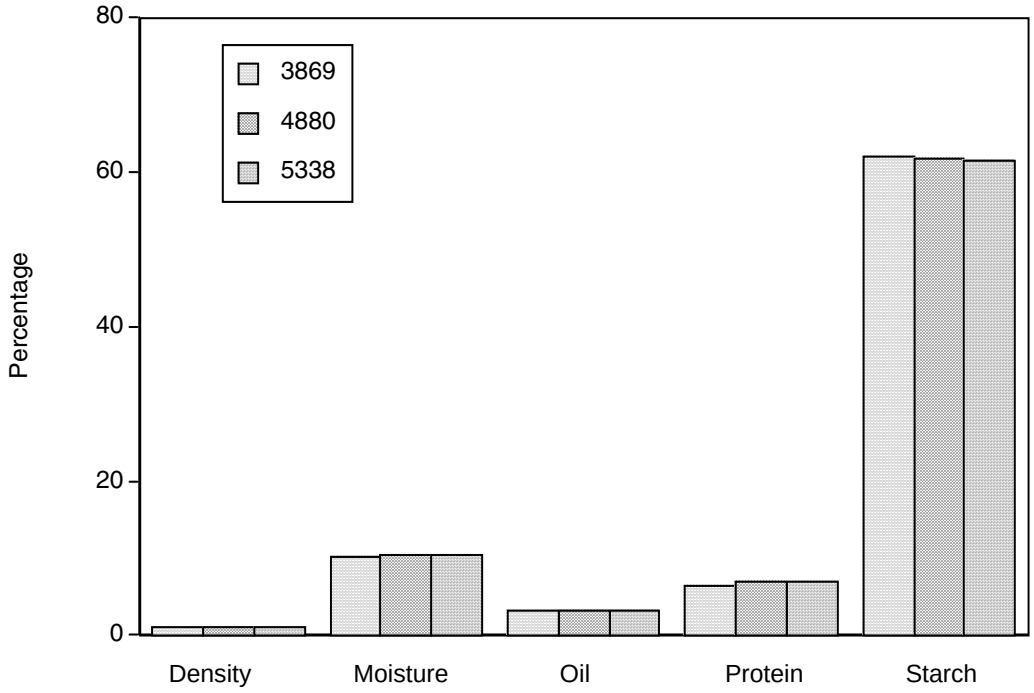

Figure 6. Soybean yield, SERF 2000.

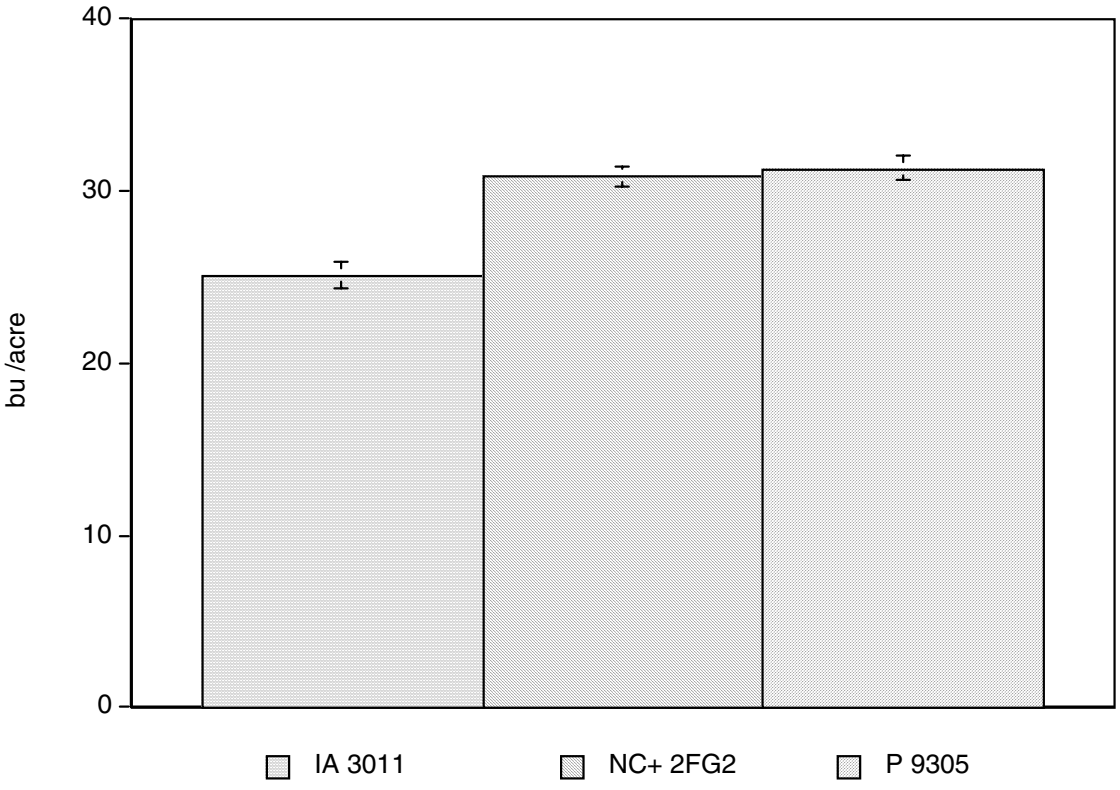

Figure 7. Percentage of staining in soybeans, SERF 2000.

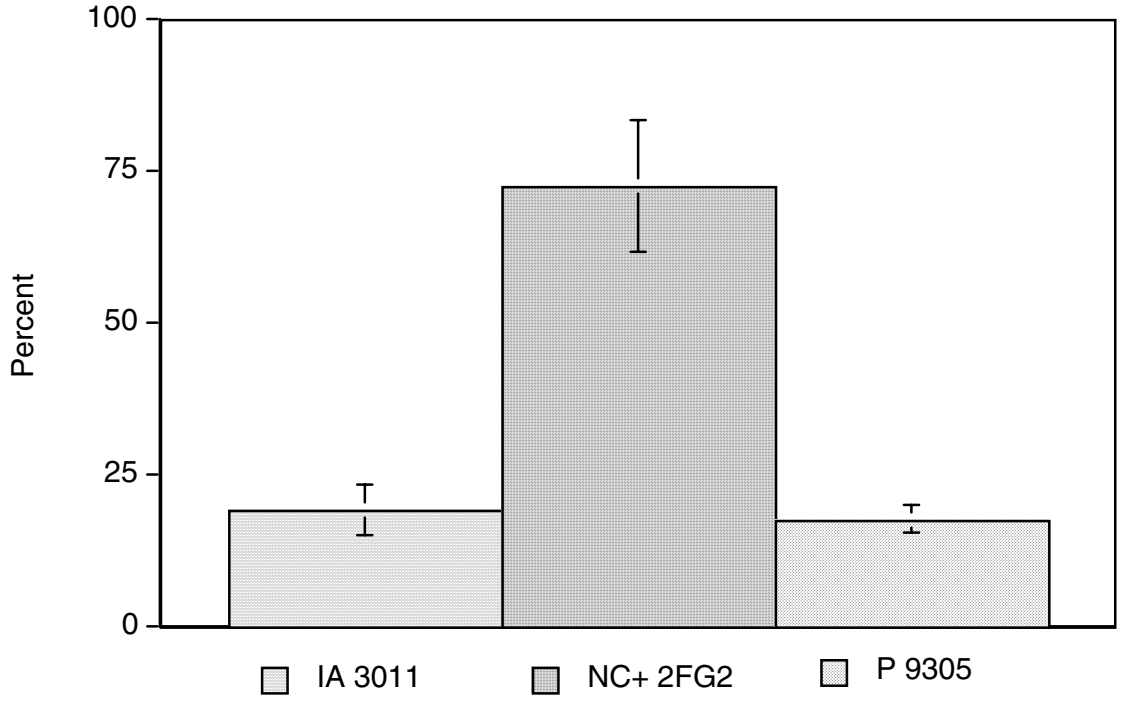

Figure 8. Bean leaf beetle population July 7, SERF 2000.

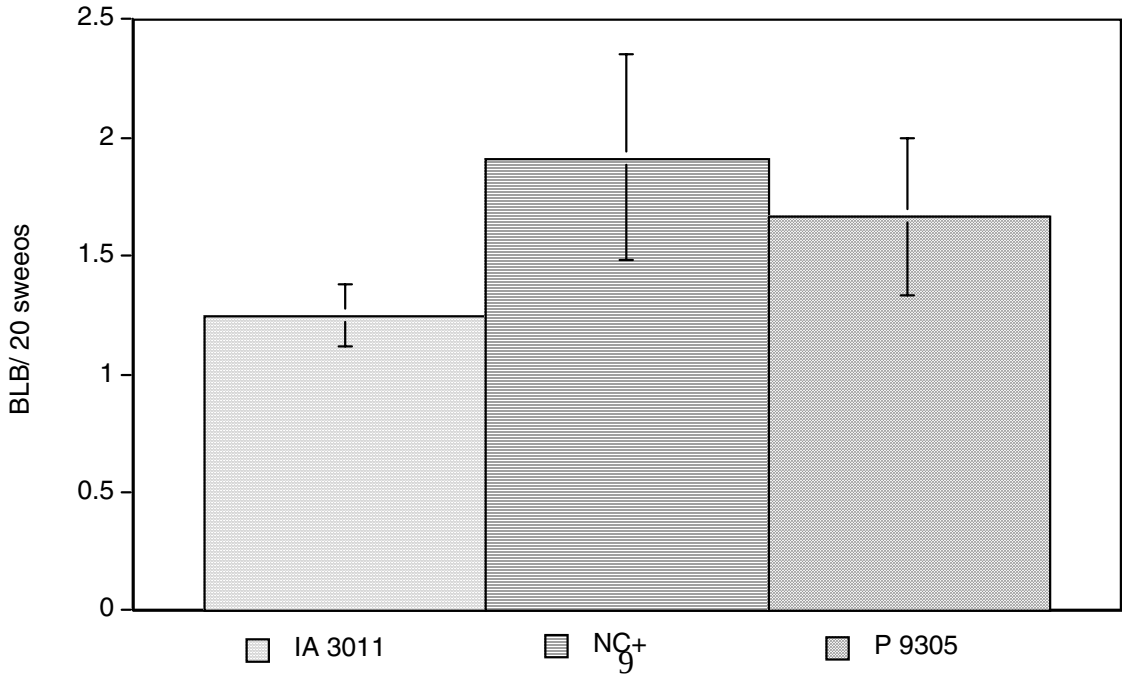

Figure 9. Soybean grain quality analysis, SERF, 2000.

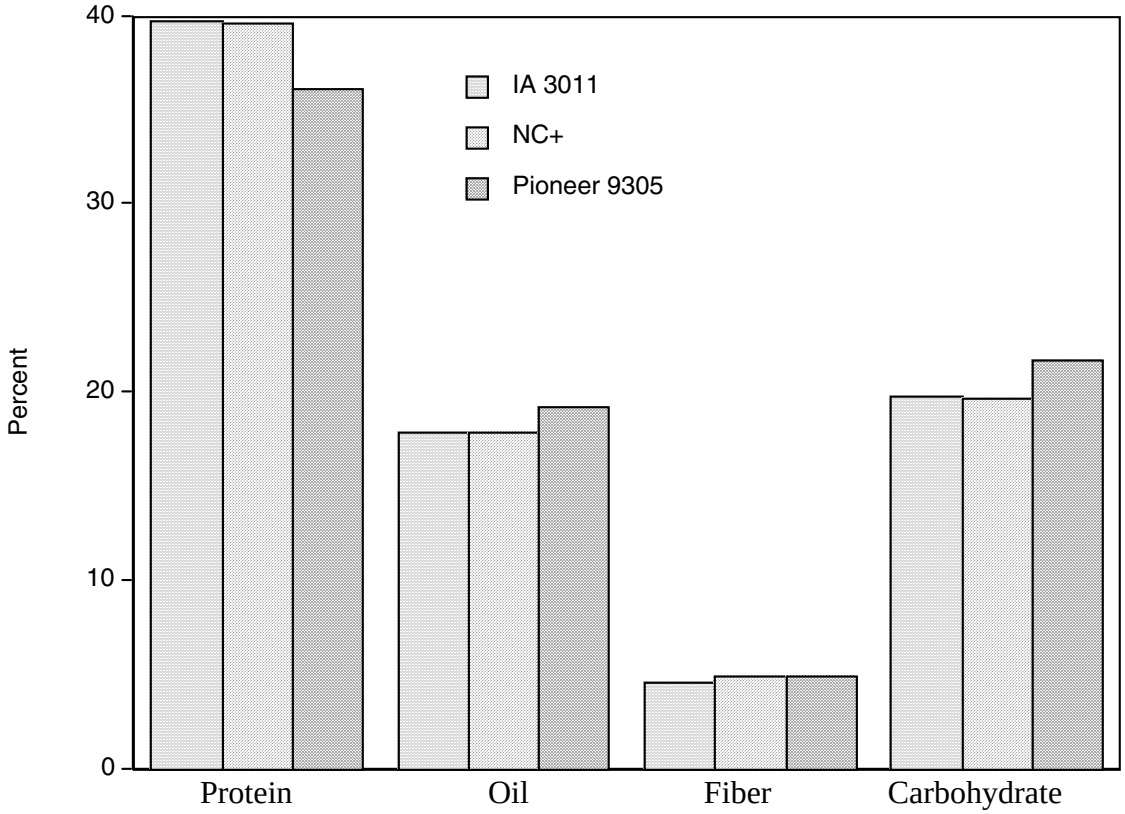

Figure 10. Soybean plant population June 20, 2000, SERF.

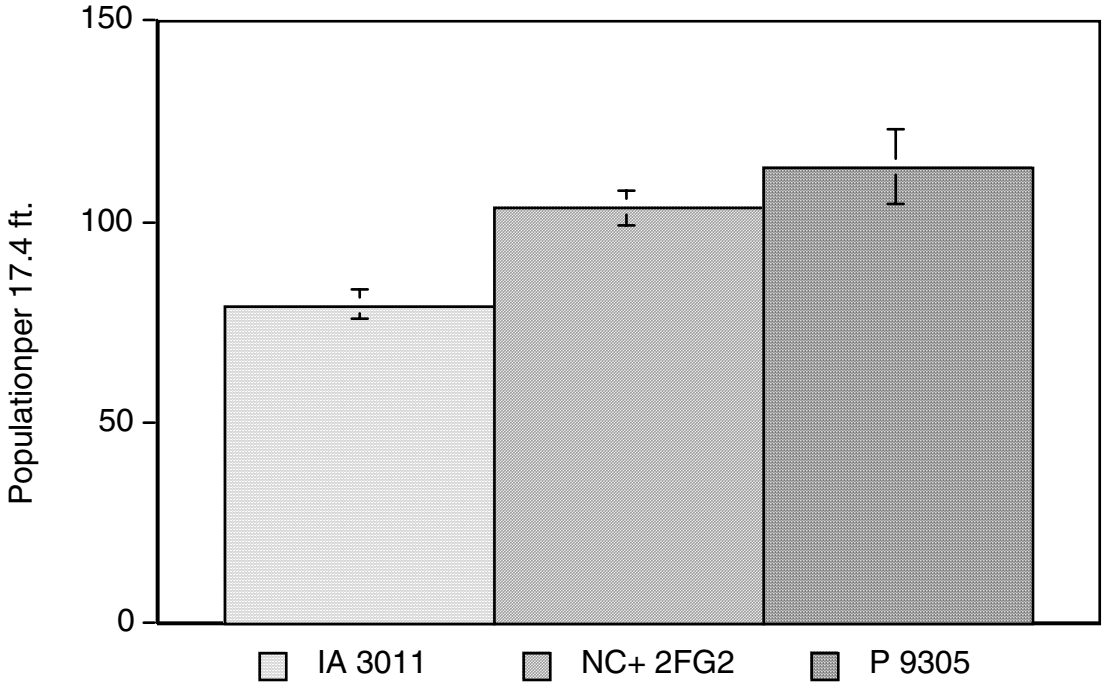

Figure 11. Weed population in soybean on June 20, 2000, SERF.