EFFECT OF ROTATION ON SOYBEAN AND CORN YIELD PLANTED WITHOUT TILLAGE

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Multi-year project

Justification:

Advantages of crop rotation over continuous cropping include: improved soil characteristics, enhanced pest management, better workload distribution, greater stability against weather and price fluctuations, and increased yield. The reasons for the increased yield remain unclear, but numerous experiments conducted in the Midwest have confirmed a yield advantage for both corn and soybean in rotation cropping systems.

The portion of Missouri soybean acreage planted after soybean is about 30%, and this number is larger than all other Midwestern states (Figure 1). So, Missouri has many more continuous soybean acres than other Midwestern states. Because of climate and soil characteristics, soybean has become the dominant grain crop in Missouri. For each of the past 7 or 8 years Missouri farmers have harvested about 5 million acres of soybean. In that same period, Missouri has produced only about 2.5 to 2.8 million acres of corn. Thus, the ratio of soybean acres to corn acres has been about 2:1 (Figure 2). This ratio is twice as large as other Midwestern states such as Iowa or Illinois.

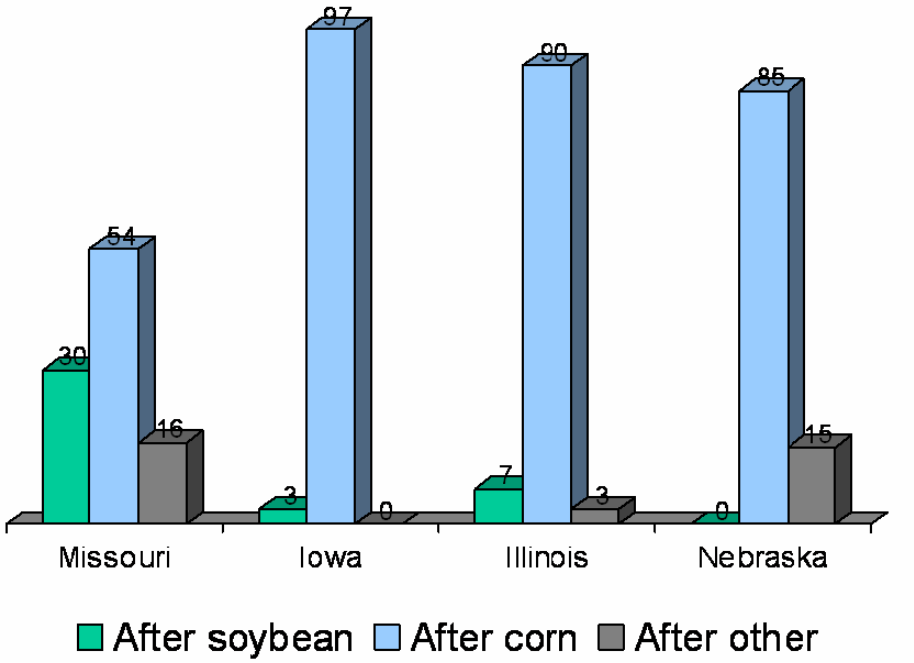

Figure 1. Portion (%) of soybean acreage planted after soybean, corn or another crop for Missouri and three other Midwestern states.

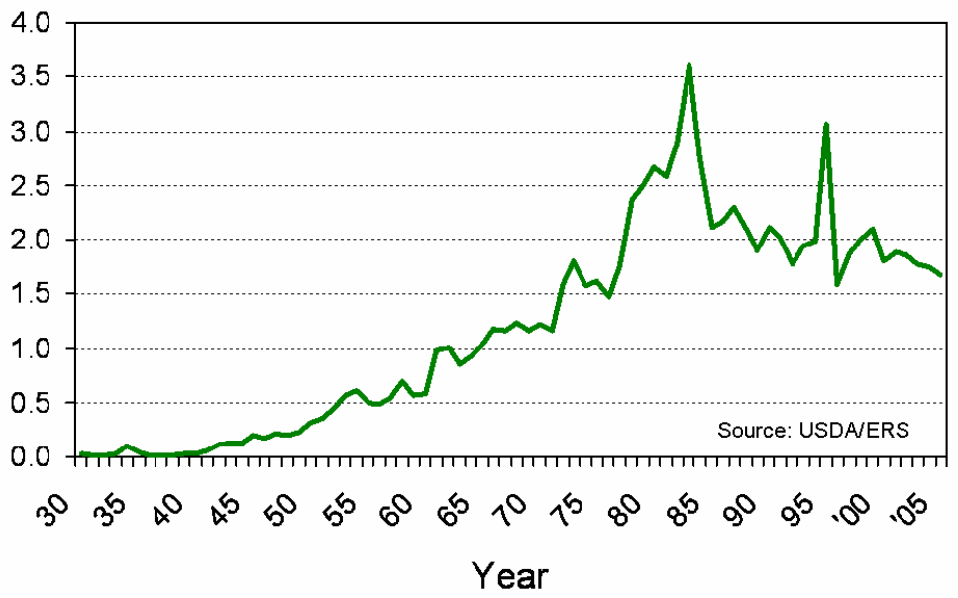

Figure 2. Historical ratio of soybean to corn harvested acres in Missouri.

A phenomenon sweeping across the USA that will affect the amount of crop acreage planted to corn is the rapidly increasing demand for ethanol. Under current technology, corn is the preferred source of carbohydrate for ethanol production in the United States. As demand for ethanol increases, the demand for corn grain will also increase. This increasing demand will increase the price of corn grain, and this will increase the number of acres planted to corn. This increased corn acreage will most likely occur at the expense of soybean acreage.

As crop acreage shifts occur due to market forces, interest has increased in understanding the effects of various cropping system rotations on yield. Accurate yield estimations are essential to appropriate decision making. In 2005, we established an experiment to study yield potentials for five crop rotations involving corn and soybean. These rotations are: continuous soybean (S), soybean-soybean-corn (SSC), soybean-corn (SC), soybean-corn-corn (SCC), and continuous corn (C). We established the rotations with enough plots so that we will be able to collect yield data for each stage of all rotations each year once we complete all sequences in 2007. This year we are able to report information from the C, S, and SC rotations, only.

Because of a variety of conditions including weather and soil properties, many of Missouri's soils are highly erosive. Soil conservation is essential to continued productivity of Missouri cropland. No-tillage is an excellent method for soil conservation. All of the rotations in this experiment are planted without tillage – even the continuous corn rotation. This makes this study unique in the Midwest, and will offer information to farmers who use no-tillage, but are considering increasing the amount of corn in their rotation.

Method:

On April 20, Dekalb brand DKC61-45 was planted in plots for which corn was the appropriate crop in 2006. Corn seeding rate was 27,700 kernels/acre. Dual II Magnum was tanked mixed with Roundup Weathermax and applied to the entire plot area on April 21. Nitrogen was applied by hand at a rate of 160 ponds N/acre as ammonium nitrate to plots in which corn had been planted. Aatrex was applied to corn plots on May 10.

Soybean plots were planted on May 24 with Asgrow brand AG3905. Soybean seeding rate was 169,000 seeds/acre. No additional preemergence herbicides were applied to soybean plots. Roundup Weathermax was used for post emergence weed control on both corn and soybean. Plot size for both corn and soybean were twelve 30-inch rows wide and 38 feet long.

Stand densities were calculated from stand counts made at the 5-leaf stage of corn and the 2-leaf stage for soybean. For corn, all plants in 20 feet of each of the center fours rows were counted. For soybean the length of row for plant counts was 10 feet.

Just prior to harvest, the center four rows were end-trimmed to 30 feet. These rows were harvested with a small plot combine. Yield was corrected to 15 and 13% grain moisture for corn and soybean, respectively.

The experimental design was randomized complete block with four replications. Corn and soybean data were analyzed as two separate experiments.

Results:

In 2006, only information comparing continuous corn and soybean to each crop grown in rotation with other crop is available. Corn stand density was slightly higher (3.3%) in the continuous corn cropping system (Figure 3) than in the rotation cropping system. One concern about continuous corn is that increased residue will reduce stands. This was not the situation in 2006, but there was residue from only one season. Perhaps, we will find an effect in later years.

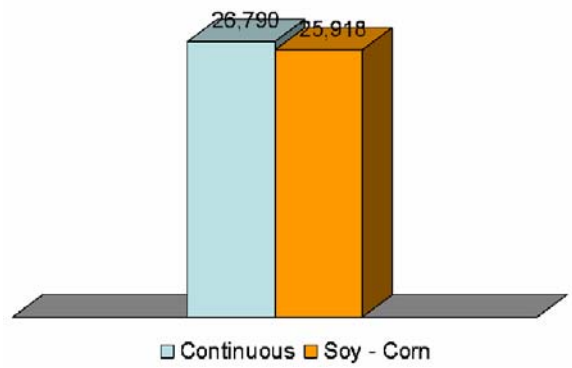

Figure 3. Stand densities for continuous corn (2 years) and corn rotated after soybean.

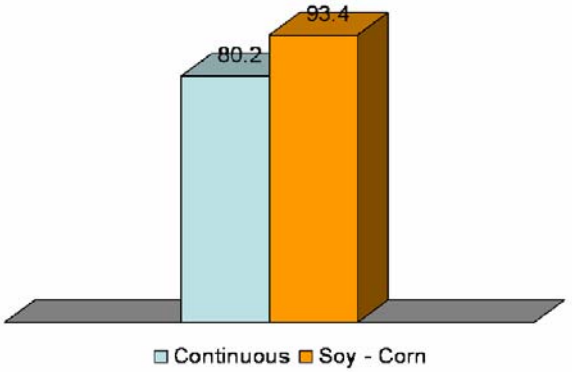

Figure 4. Yields for continuous corn (2 years) and corn rotated after soybean.

Corn rotated with soybean yielded 16% more than continuous corn (Figure 4). Weather conditions were quite dry and hot during silking and early grain-fill and both cropping systems produce yields below normal. Research from other states indicates a 12% yield advantage for corn rotated with soybean. However, most of these other studies used some form of tillage.

Soybean stand densities were nearly identical for continuous soybean and soybean rotated after corn (Figure 5). Yield for rotated soybean was 13.9% more than yield for continuous soybean (Figure 6). In another study conducted on this research farm, we found a long term yield advantage of 6.3%. But, data in that study for 2006 showed a 12% yield advantage, nearly similar to data from this study.

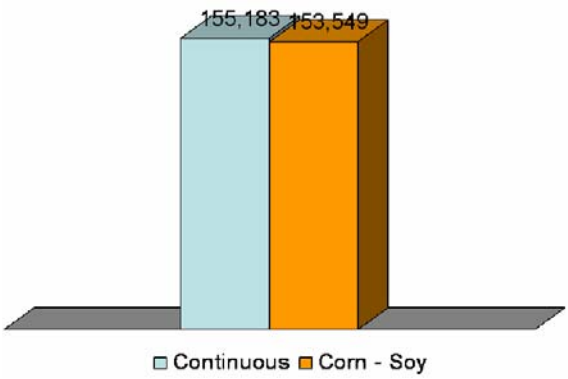

Figure 5. Stand densities for continuous soybean (2 years) and soybean rotated after corn.

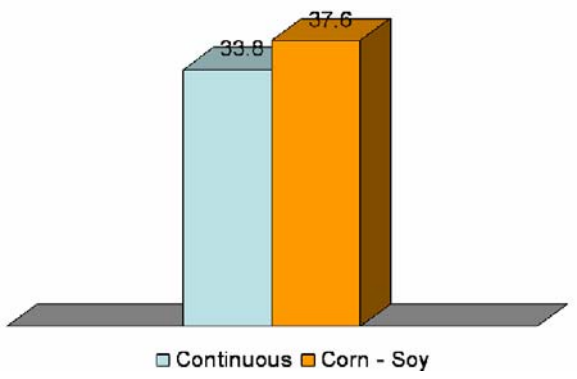

Figure 6. Yields for continuous soybean (2 years) and soybean rotated after corn.

Conclusions:

1. Cropping system had little or no effect on stand densities for either corn or soybean.
2. Corn rotated with soybean yielded 16% more than continuous corn
3. Yield for rotated soybean was 13.9% more than yield for continuous soybean
4. Our results agree with results of other studies in that rotated crops yield more than continuous cropping systems, and that effect on yield should be factored into the economic of changing crop choice.