

# **EFFECT OF STAND DENSITY AND ROW SPACING ON WEED OCCURRENCE AND SOYBEAN YIELD**

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Year 3 of 4 year project

## **Justification:**

Interest in understanding the relationship between stand density and soybean yield has increased over the past several years. Most soybean varieties have been patented, and saving back soybean grain for planting is illegal for these patented varieties.

Biotechnology license fees are incorporated into seed costs so the average price of soybean seed has increased since the mid 1990s. One reason given by some farmers for planting extra seed is improved weed control. They believe that sparse stands from reduced seeding rates might encourage weed growth.

Data from this experiment might be used to help farmers set soybean seeding rates. But, the most likely use for these data is to help crop management advisers make appropriate replant recommendations if problems arise during germination, emergence and/or stand establishment.

## **Methods:**

Eleven days prior to planting, the entire plot area was treated with a tank mix of Roundup WeatherMax, Dual II Magnum, FirstRate, and Authority. Dekalb brand NKB 38-52 was planted on 19 May 2007. Each of three row spacings was planted with a different planter. The planter for the 30-inch row spacing was a 4-row Kinze planter equipped with double disk openers and 3/4"-13 fluted coulters. We used two planters to plant plots for the 15-inch row spacing. First, two outside (border) rows were planted with a planter with movable row units set 79 inches apart. This was the closest we could move the units. Then, a specially designed planter equipped with John Deere row units was used to plant the center four rows. The distance from the outside rows of this planter to the border rows planted with the first planter was 17 inches. An Almaco heavy duty drill was used to plant the 7.5-inch row spacing. The drill planted eight rows, so each plot consisted of two passes with the drill. Six seeding rates (40000, 75000, 110000, 145000 180000 and 215000 seeds/acre) were used to produce a variety of stand densities. All plots were planted without tillage.

At approximately V2 stage of development, stand densities were calculated from stand counts made for each plot. For the 30-inch row spacing, plants were counted for 10 feet in each of the two center rows. For the 15-inch row spacing, 10 feet in each of the center four rows were used. Plants were counted in three 10-square foot areas randomly selected within plots of the 7.5-inch row spacing.

Two weed density treatments were imposed. For the "clean" treatment, all weeds were controlled with post emergence applications of Roundup WeatherMax and hand weeding. No post emergence weed control was conducted for the "weedy" treatment. The plot area was irrigated on 11 July, 1 August, and 17 August for a total water application of 2.75 inches.

On 2 August, weed control ratings were recorded for plots of the weedy treatment. Two weeds, tall waterhemp and fall panicum, were rated separately, and then an overall weed control rating was recorded.

All plots were end-trimmed just prior to harvest. Harvest was conducted using a small plot combine. The numbers of rows harvested were two, four, and eight for the 30-inch, 15-inch, and 7.5-inch row spacings. Yields were corrected to a grain moisture of 15%. Yield losses from weeds were calculated by subtracting the yields of the weedy treatment from the yields of the clean treatment for each row spacing-seeding rate combination within a replication

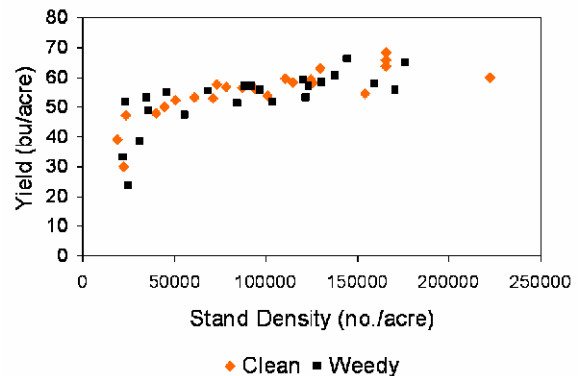
Yield data were analyzed according a split-split-split plot arrangement. Whole plots were the two weed density treatments. Split plots were the three row spacings. Split-split plots were the six seeding rates. Weed control data were collected for the weedy treatment only, so the design was a split plot.

### Results:

Figure 1, 3, and 5 are photographs taken on the same day shortly after flowering began. The canopies are closed and capturing most of the available sunlight for both the 15- and 7.5-inch row spacings. The canopy of the 30-inch row spacing is not capturing all of the available sunlight.



**Figure 1.** Picture taken of a 30-inch row spacing plot planted with 180,000 seeds/acre.



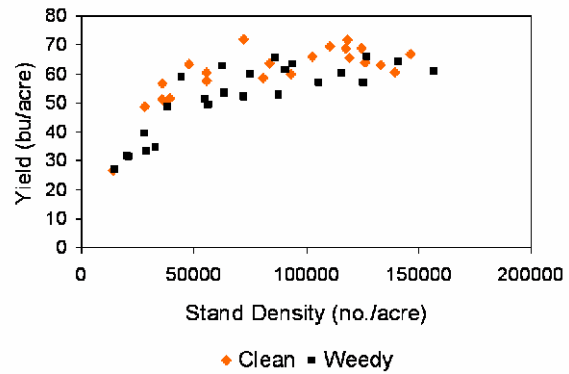
**Figure 2.** Effect of stand density on soybean yield for the 30-inch row spacing. Points on graph represent individual plots.

Figure 2 presents individual plot data for the 30-inch row spacing. Plant density had a large effect on yield within sparse stands up to approximately 40,000 plants/acre. There was a slight increase in yield as stand density increased, but the increase was quite subtle. Figures 4 and 6 present the same type of data for the 15- and 7.5-inch row spacings. In

general, most of the yield potential was captured by stand densities that were quite sparse, perhaps 50,000 plants/acre.



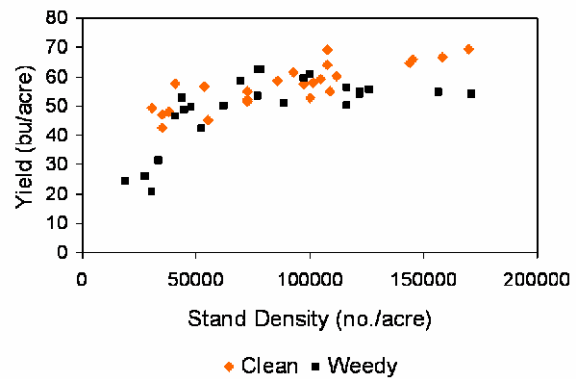
**Figure 3.** Picture taken of a 15-inch row spacing plot planted with 180,000 seeds/acre.



**Figure 4.** Effect of stand density on soybean yield for the 15-inch row spacing. Points on graph represent individual plots.

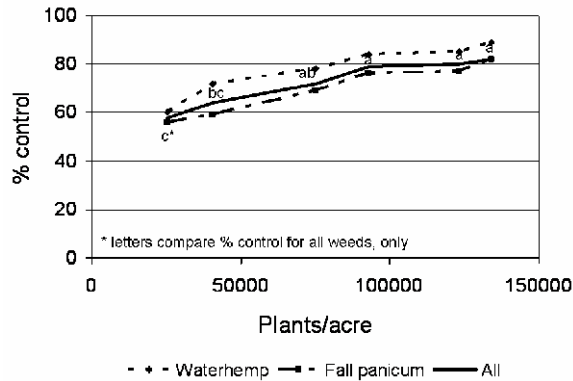


**Figure 5.** Picture taken of a 7.5-inch row spacing plot planted with 180,000 seeds/acre.

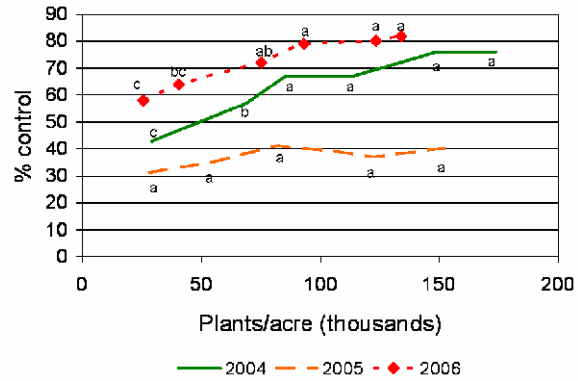


**Figure 6.** Effect of stand density on soybean yield for the 7.5-inch row spacing. Points on graph represent individual plots.

There was a significant effect on weed control from stand density, but not row spacing (Figure 7.) Weed control increased as stand density increased up until about 90,000 plants/acre. So, the stand densities needed for yield and weed control were about the same and there is little evidence that farmers should increase seeding rates solely to improve weed control. Weed control data from three years are presented in Figure 8. Plots were heavily infested with weeds in 2005 and weed control was similar across all stand densities in that year. Plots in 2004 and 2006 were less severely infested and results were similar in these two years.

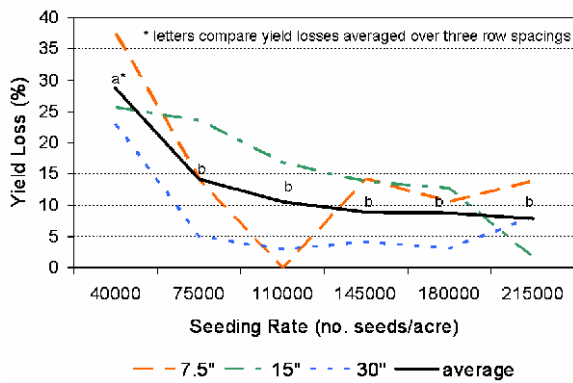


**Figure 7.** Effects of soybean stand density on fall panicum, tall waterhemp, and all weed control in 2006. Data were averaged over three row spacings. Letters are for comparing values for all weed control, only

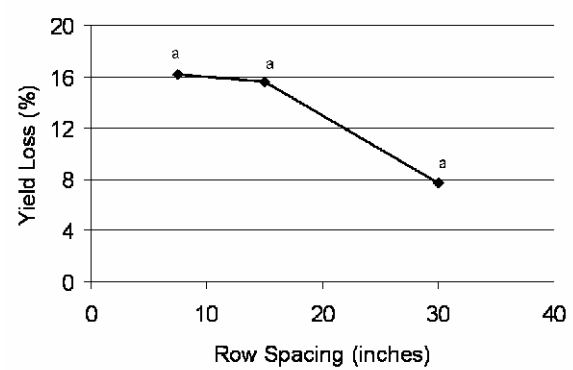


**Figure 8.** Effects of soybean stand density on weed control for 2004, 2005, and 2006. Data within each year were averaged over three row spacings. Letters are for comparing values within a year.

Soybean yield loss from weeds was affected by stand densities, but only within sparse stands (Figure 9). The 40000 seeds/acre seeding rate exhibited greater yield loss than all other seeding rates. Row spacing did not affect soybean yield loss from weeds (Figure 10).

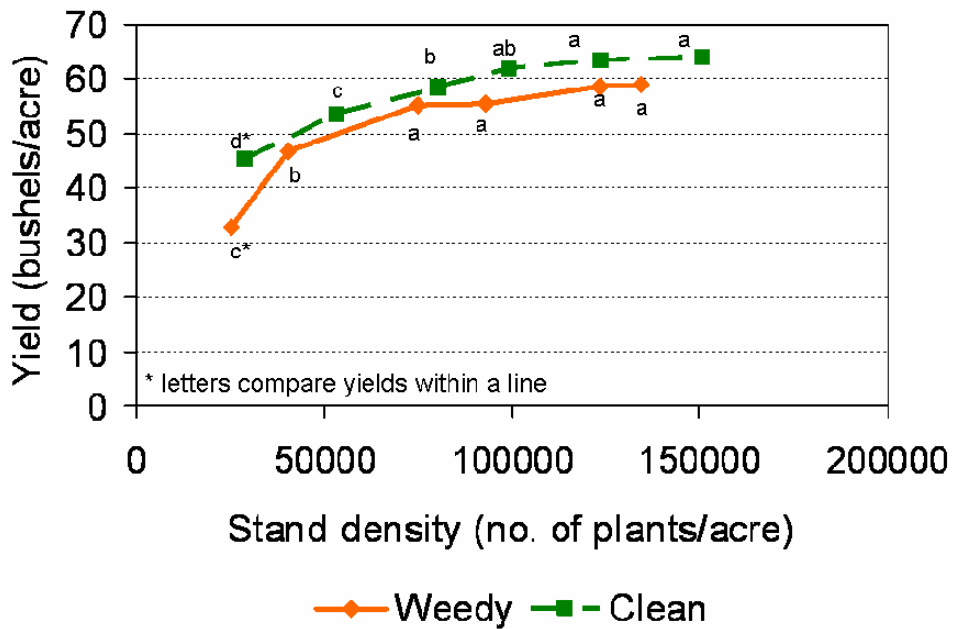


**Figure 9.** Effects of seeding rate on yield loss from weeds. Letters are used to compare values averaged over the three row spacings.

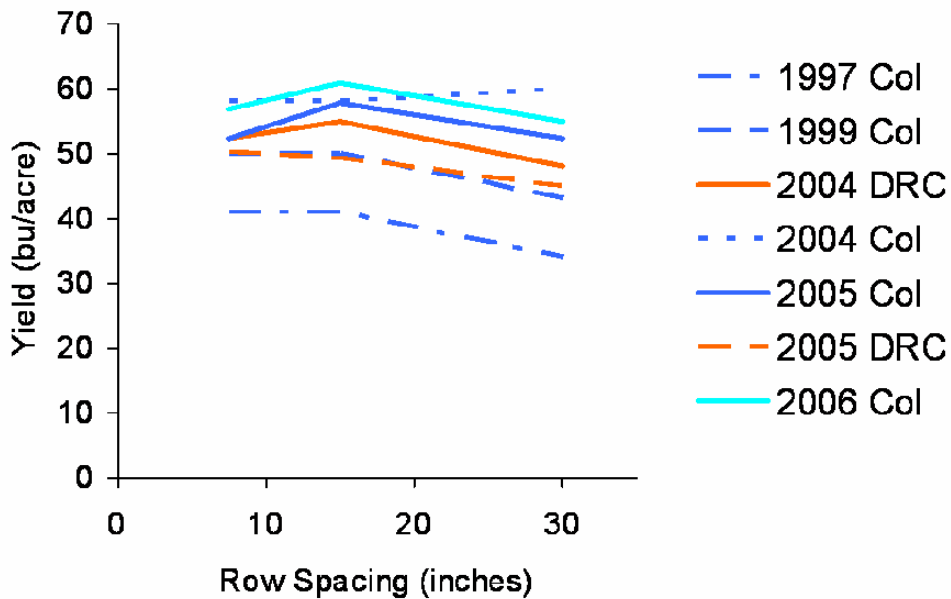


**Figure 10.** Effect of row spacing on yield loss from weeds. Data are averaged over all six seeding rates.

Yield responses to stand densities were similar for the weedy treatment compared to the clean treatment (Figure 11). For both treatments, yield increased until stand densities were about 90,000 plants/acre. In five of seven experiments, row spacing affected soybean yield (figure 12). In general, yield for 7.5-inch and 15-inch row spacings do not differ, but both these row spacings yielded more than 30-inch row spacing.



**Figure 11.** Effects of stand density on soybean yield within weedy and clean treatments. Points represent the average stand density and yield for four replications and three row spacings. Letters compare values within a treatment.



**Figure 12.** Effects of row spacing on soybean yield for seven experiments conducted at Columbia (Col) and Portageville (DRC). Experiments vary for other treatments including varieties except all represent weed free environments.

## **Conclusions:**

1. Soybean yield response to stand density is similar regardless of row spacing.
2. Soybean yield does not increase or increases only slightly at stand densities greater than 90,000 plant/acre.
3. Percent soybean yield loss from weeds was greatest in the sparsest stands.
4. Assuming normal emergence levels, there was no evidence that increasing seeding rates would increase weed control.
5. Soybean yield loss from weeds was not affected by row spacing.
6. In most instances, but not in every instance, farmers would increase soybean yield potential from planting in rows 15 inches or narrower.