Row Spacing is Critical for High Yielding Soybeans

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There are fundamental management decisions that give the best opportunity to maintain high yield. Understanding how a soybean plant develops through the season will provide insight into selection of management decisions that should lead to maintaining the soybean genetic yield potential. Row spacing is the third most important variable for maximizing soybean yield after variety selection and planting date. Most research from the Midwest documents that narrow (less than 30 inch) yield greater than wide rows (30 inch or greater). Despite this, the majority of the acres in Iowa are still planted in wide rows. Why? There are many reasons to this but probably the biggest one is that very little research on row spacing has been conducted in Iowa over the last two decades. Research was therefore initiated in 2004 to investigate if we were losing yield in Iowa using predominately wide row spacing in our current production system.

Introduction

Soybean row spacing experiments in Iowa by Hughes and Wilkins began as early as 1917. Because of lack of proper planters and cultivators and problems with weed control they did not advise farmers to use rows closer than 36 inches (Benson and Shroyer, 1978). In the early 1960’s, soybean acreages began to increase dramatically. Improved varieties, better cultural practices and the development of herbicides made the use of closer row spacing more realistic (Benson and Shroyer, 1978). In the period from 1960 to 1977, significant amount of research was conducted in Iowa on soybean row spacing. It was concluded that in most cases row spacing less than the traditional row width of 30 or 36 inch produced higher yields (Benson and Shroyer, 1978).

The benefit of narrow row soybeans over wide row soybean is mostly a quicker canopy development (Costa et al., 1980; Oplinger and Philbrook, 1992; Mickelson and Renner, 1997). Soybean canopy development, which is a function of row spacing, seeding rate, and environmental conditions, is also an effective weed control tool (Peters et al., 1965; Duncan, 1986). The canopy will close in wide row spacings; however, Wilcott (1984) found it to take about 15 days longer in 30 in. vs. 10 in. rows. Rapid soybean canopy development is extremely important especially during early vegetative growth stages for high yielding beans (Pedersen, 2004). Increased canopy development will also provide greater shading of weed seedlings and better crop competition, decreasing weed interference (Forcella et al., 1992). Yelverton and Coble (1991) found that as row spacing decreases, the number of weeds that emerge after herbicide application decreases linearly as a result of more light being intercepted by the soybean canopy. Finally, narrow row soybeans are easier to combine since combine efficiency is increased because the more even distribution of plants makes them easier to cut and feed into the combine.

Despite the positive finding to row spacing two decades ago it took many years to get farmers to adopt the system. In 1977, a survey conducted by the Iowa Crop and Livestock Reporting Service estimated that the average soybean row width in Iowa was 34.4 inch. Compare that to recent estimate from the National Agricultural Statistics Service the average row spacing for Iowa in 2005 was 21.9 inch (Figure 1; NASS, 2006). Since the 1970’s very little research has been published from Iowa. The most recent large study from the upper Midwest was conducted in
Wisconsin from 1997 to 1999 at six locations (Bertram and Pedersen, 2004). They documented that 7.5 inch and 15 inch yielded equally but greater than 30 inch row spacing in southern, central, and northern Wisconsin.

![Iowa Soybean Row Spacing Trends (1995-2005)]

Figure 1. Iowa row spacing trends from 1995 to 2005 (NASS, 2006).

Recent advances in tillage and planting equipment offer producers additional opportunities today to take advantage of the yield advantage from narrow rows to maximize production and profitability. Many farmers have therefore converted to the intermediate row spacing (15, 20, and 22-inch) row planters that allow soybeans to be planted at a more uniform depth than drills. Using intermediate row spacing allow the grower to get some of the benefits of drilled soybean but at a lower seeding rate and production cost.

**Material and Methods**

Since 2004 we have been working on two large projects investigating the advantage of 15 inch over 30 inch row spacing. Most of these studies were initiated to evaluate current soybean seeding rate recommendations.

**Experiment 1**

The experiment was set up at three locations from 2004 to 2006. The experimental design was a randomized complete block in a split-plot arrangement with four replications. The main plot was 15 vs. 30 inch row spacing and the sub-plot was four different seeding rates (75 000, 125 000, 175 000, and 225 000 seeds per acre). The variety used was Ag2801.

**Experiment 2**
The experiment was set up at five locations from 2005 to 2006. The experimental design was a randomized complete block in a split-split plot arrangement. Main plot was 15 inch vs. 30 inch row spacing, sub-plot was three different seed treatments, and sub-sub-plots was six different seeding rates (75,000, 100,000, 125,000, 150,000, 175,000, and 200,000 seeds per acre). This study will continue in 2007.

Results and Discussion

The data available for row spacing from the past three years in Iowa was environmental dependent but show that narrow row spacing does improve yield. While a few studies have shown little to no response of yield to row spacing, none of our studies have shown a yield increase with wider row spacing. That is consistent with the literature as well (Bertram and Pedersen, 2004). Average across the 19 experiments that we have conducted since 2004 we have seen an advantage of 3.7 bu/acre yield advantage of 15 inch over 30 inch row spacing. All our experiments were conducted in tilled environments. In addition, the optimum seeding rate for either 15 inch or 30 inch row spacing was 125,000 variable seeds per acre. That means that we do not need to increase our seeding rate as our row spacing decrease as long as we use a planter.

This data set is one of the largest data set ever collected on row spacing comparisons across numerous environmental conditions. The question is why the predominately acres still are planted in 30 inch row spacing in Iowa when we see a yield advantage like this out there. Probably the biggest reason is that without proper management decisions there can be some problems with narrow row spacing. The disadvantage with narrow row spacing was previously related to diseases, higher seed cost, and then the increased planter cost.

An increase in planter cost is still a question that we need to consider but with an average farmer in Iowa having at least 600 acres of soybean a year and with $6 per bushel then it should not take more than three years before the money is returned. Our data does support a study from Purdue University that strategies with narrow row soybean will always be more profitable (Lambert and Lowerberg-DeBoer, 2003).

This project from Iowa over the last three years has documented that an increased seed cost is not necessary as long as we use a planter. Row spacing should be the driver on seeding rate when you use a planter today (Pedersen, 2004).

Diseases on the other hand are probably the most important thing that we need to consider. White mold or Sclerotinia stem rot (Sclerotinia sclerotiorum (Lib.) de Bary) is the largest concern. This fungus has spread quickly due to the short rotations, decrease in tillage practices, and narrow row spacing. Once the fungus is present in a field, little can be done to remove the pathogen and management practices to lessen the impact of the fungus must be implemented. A more important factor determining the potential for white mold is environmental conditions. Cold and cloudy conditions in combination with high rainfall during flowering are optimal for pathogen infection. Current recommendations are to use a variety with tolerance to white mold and not drill soybean or plant high seeding rates (> 150,000 seeds per acre) if a specific field that has a bad history of white mold (Kurle et al., 2001).
Conclusion

Based on the last three years it is concluded that narrow row spacing (anything less than 30 inch) will yield greater than wide row spacing (30 inch). On average a 3.7 bu/acre yield advantage have been found across Iowa. It is important to recognize that row spacing is influenced by the field environment. All our research was done in tilled seedbeds.

Over the next three years starting in 2007, new research projects will be initiated with the help from the checkoff and the Iowa Soybean Association, to investigate why we have cases sometime where we do not see a yield response. It is because of environmental conditions in the spring? Or is it because of variety selection and SCN? Or is it because something else? We will look into this. Another large project that we will start working on, also with the support from the Iowa Soybean Association, is to work on the narrow row spacing system in a tilled vs. a no-tilled environment.

References


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