Raising Non-Rotation Soybean

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Introduction
Raising continuous soybean [Glycine max L. (Merr.)] is not very common in Wisconsin. No statistics are kept on the percent acreage of rotated soybean, but a good estimate is that at least 95% of the soybean crop is grown in rotation with some other crop. However, some producers are giving strong consideration to planting soybean after soybean this year. Several reasons include lower input costs compared to corn (Zea mays L.) and an expected increasing demand.

A key consideration is that the yield penalty for continuous soybean is too great in most areas to consider continuous cropping. This is often related to the benefit of the rotation effect such as the negative effect associated with the buildup of plant pathogens. This research project determined the rotation effect on corn and soybean and its interaction with tillage system and row spacing. Additionally, visual rating of brown stem rot (Phialophora gregata) severity was conducted in 2000. Only soybean data is presented.

Materials and Methods
This experiment was conducted from 1998 to 2000 at the University of Wisconsin-Arlington Agricultural Research Station on a Plano silt loam (fine-silty, mixed, mesic, Typic Argiudoll). The experimental design was a randomized complete block in a split-split plot arrangement with four replications. Main plots were no-tillage (NT) and conventional tillage (CT) that were established in 1986. Tillage operations for CT were chisel plowing in the fall and field cultivation in the spring before planting. For NT, crops were planted directly into the residue of the previous crop. Subplots consist of 14 rotation sequences involving corn and soybean. The sequences were initiated in 1983 on land previously planted to corn. The sequences allow comparisons to be made during 1998, 1999, and 2000 of (i) first¹-year corn or soybean (after 5 consecutive years of the other crop); (ii) corn and soybean alternated annually with the other crop; and (iii) 2, 3, 4, and 5 years of continuous corn and soybean. The sub-sub plots were row spacings 7.5", 15", and 30", which were used for both crops.

Soybean was planted at 225 000, 175 000, and 125 000 seeds acre⁻¹, respectively for the three row spacings. The soybean variety (AG2301) used is moderately resistant to brown stem rot. Plot size was 10 ft by 35 ft. The 15" and 30" row spacing plots were planted with a Kinze Interplant Planter (Kinze Manufacturing Inc., Williamsburg, IA). The planter was equipped with rippled coulters in front of the double disk openers with dual press wheels for planting in the NT system. A John Deere 750 No-till drill (Moline, IL) was used for the 7.5" row spacing plots. Weed control was done pre-plant burndown on no-till plots.

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with 1 pt acre\(^{-1}\) 2,4-D (1/2 lb a.e. acre\(^{-1}\) of (2,4-dichlorophenoxy) acetic acid) and 1 qt acre\(^{-1}\) glyphosate (3/4 lb a.e. acre\(^{-1}\) of \(N\)-(phosphonomethyl)glycine), and post-emergence on all plots with 1 qt acre\(^{-1}\) glyphosate. BSR disease rating was done at the R7 growth stage using the Horsefall-Barratt Scale (0 = 0% foliar symptoms, 5 = 25-50% foliar symptoms and 11 = 100% foliar symptoms). The center 5 feet by 31 feet of each plot was harvested with an Almaco plot combine (Allen Machine Co., Nevada, IA). Soybean grain yields were adjusted to 13% moisture.

**Results**

Studies conducted for three years (1998 to 2000) compared the effect on yield and disease of rotating soybean with corn (Figure 1). First-year soybean yields (65 bu acre\(^{-1}\)) were 8% higher than the other 6 rotation sequences (avg. 60 bu acre\(^{-1}\)). First year soybean and soybean rotated annually with corn (63 bu acre\(^{-1}\)) yielded 9% and 6%, respectively, more than continuous soybean (59 bu acre\(^{-1}\)).

![Figure 1. Effect of rotation sequence on soybean yield (bu acre\(^{-1}\)) rotated with corn (1998-2000). 1 = 1\(^{st}\)-year soybean (after 5 consecutive years of corn); 2, 3, 4, and 5 = 2, 3, 4, and 5 years of continuous soybean; Cont. = continuous soybean since 1986; C/S = corn and soybean alternated annually.](image)

There was an interaction with rotation sequence and tillage system on soybean yield (Figure 2). Soybean planted in CT yielded (64 bu acre\(^{-1}\)) 13% more for 1\(^{st}\) year soybean than the continuous grown soybean (56 bu acre\(^{-1}\)). Soybean planted NT yielded 8% more for first year soybean (66 bu acre\(^{-1}\)) than continuous grown soybean (61 bu acre\(^{-1}\)). Overall soybean yields were 5% higher averaging 62 bu acre\(^{-1}\) with NT than compared to an average of 59 bu acre\(^{-1}\) with the CT system (data not shown).
Figure 2. Interaction of rotation (R) and tillage (T) on soybean yield (Bu acre\(^{-1}\)), 1998-2000. 1 = 1\(^{st}\)-year soybean (after 5 consecutive years of corn); 2, 3, 4, and 5 = 2, 3, 4, and 5 years of continuous soybean; Cont. = continuous soybean since 1986; C/S = corn and soybean alternated annually.

Row spacing had an effect on yield but no interaction was found for either row spacing and rotation sequence or row spacing and tillage system. Overall yield increased 5% as row spacing decreased from 30” to 7.5” (59 bu acre\(^{-1}\) to 62 bu acre\(^{-1}\)). Yield increased 3% as row spacing decreased from 15” to 7.5” (60 bu acre\(^{-1}\) to 62 bu acre\(^{-1}\)).

Tillage had an effect on BSR severity (Figure 3) but no interaction was found for either row spacing and rotation sequence or row spacing and tillage system. The highest disease severity was observed in the NT system. BSR severity for first year soybean in the NT system (2.9) was 26% lower than all other 6 rotation sequences in the NT system (avg. 3.9). BSR severity for first year soybean in the CT system (2.8) was 13% lower than all other 6 rotation sequences in the CT system (avg. 3.2).

Summary
- First year soybean and soybean rotated annually with corn yielded greater than continuous grown soybean.
- There was an interaction of soybean yield with rotation sequence and tillage system.
- Averaged over all plots soybean yields were greater with no-till than with conventional tillage.
Summary (Continued)

- Row spacing had an effect on yield. Soybean yield increased as row spacing decreased from 30" to 7.5".
- Tillage had an effect on BSR severity. The highest BSR severity was found in the NT system.

Conclusion

We can conclude that rotating soybean with corn will result in soybean yield improvements. Our data indicate that we can control the effects of brown stem rot using a moderate resistant variety. Our data also indicate that besides brown stem rot, other pathogens or factors are causing the rotation effect since we cannot explain all the yield variation among the seven rotation sequences.

Related references


Soybean Plant Health Website: www/plantpath.wisc.edu/soyhealth/index.htm

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