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Evaluating Opportunities for Second-Year Soybean

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In a bean pod:

- **Second-year soybeans can be a viable option**
- **One year of success does not guarantee consistency**
- **Carefully consider and amend soil nutrient levels**

Introduction

Planting soybeans in the same field consecutively is generally not recommended. Most growers avoid this practice due to lower yields, increased disease prevalence, and the desire to capture the rotational credits available to a subsequent corn crop. Research on growing soybean following soybean is limited; therefore, our goal is to develop best management practices (BMPs) for cultivating second-year soybean. The objective of this research is to evaluate second-year soybeans compared to soybeans rotated with corn and other crops for seed yield and disease incidence and severity. Two experiments were conducted in 2024 at the Arlington Agricultural Research Station near Arlington, WI.

Experiment 1

An existing long-term corn/soybean rotation study at Arlington was utilized for this experiment. The rotation study has been in place since 1983 and offers seven long established rotations with soybean, including 1st through 5th year soybean (following 5 years of corn), continuous soybean, and soybean rotated with corn (Table 1). In each rotation, there is a tillage split with no-till (NT) and conventional till (CN). Within each tillage by rotation block, 3 specific treatment combinations were tested (Table 2). All plots were planted on May 13th, 2024 with Asgrow AG22XF3 at a rate 140,000 seeds per acre in 30" rows. A custom planter was used for seeding and applying in-furrow treatments. Foliar fungicide was applied at the R3 growth stage using a tractor mounted sprayer. Plots were harvested with a research plot combine equipped with weighing and moisture sensors.

Table 1. Cropping rotations in long-term rotation study.

Crop rotation
5th year soybean after corn (5S)
4th year soybean after corn (4S)
3rd year soybean after corn (3S)
2nd year soybean after corn (2S)
1st year soybean after 5 years corn (1S)
Rotated corn-soybean (CS)
Continuous soybean (SS)

Table 2. Fungicide and insecticide treatments applied according to product label.

Treatment	Seed applied fungicide/insecticide	In-furrow fungicide	Foliar fungicide
1	Acceleron F/I	none	none
2	Acceleron F// ILEVO	Priaxor	none
3	Acceleron F// ILEVO	Priaxor	Delaro Complete

Results

For soybean seed yield, there was a significant interaction ($P < 0.001$) between crop rotation and treatment (Table 3). Continuous soybean was the only rotation where all 3 treatments yielded similar to the lowest rotation by treatment combination. There was also a significant interaction ($P = 0.031$) between tillage and treatment (Table 4).

Table 3. Interaction between crop rotation and treatment on soybean seed yield. Yields followed by the same letter are not statistically different, determined by Tukey-Kramer ($\alpha = 0.05$).

Rotation	Treatment	Grain yield (bu/a)
2S	3	71.1 a
3S	1	69.4 ab
1S	2	67.5 abc
2S	1	67.5 abc
5S	1	66.9 abcd
4S	3	66.6 abcd
3S	2	66.5 abcd
1S	1	66.3 abcde
3S	3	66.3 abcde
CS	1	66.0 abcde
1S	3	65.8 abcde
4S	2	65.1 abcde
4S	1	63.2 bcdef
5S	3	63.0 bcdef
5S	2	63.0 bcdef
CS	2	62.8 bcdef
CS	3	61.2 cdef
SS	1	60.1 cdef
SS	3	59.3 def
2S	2	58.6 ef
SS	2	56.8 f

Late season drought-like conditions posed a challenge to soybeans. Moisture conservation from increased surface residue in the no-till plots may explain some yield variation. No visual symptoms of disease or insect pressure were observed in the plots. While differences were found in the rotations and treatments, this data represents only one year. To draw significant conclusions, it's important to analyze results over multiple growing seasons and conditions. We plan to repeat this experiment in 2025 and 2026.

Table 4. Interaction between tillage and treatment on soybean seed yield. Yields followed by the same letter are not statistically different, determined by Conservative Tukey-Kramer ($\alpha = 0.05$).

Tillage	Treatment	Grain yield (bu/a)
NT	1	71.1 a
NT	3	69.4 ab
CT	1	67.5 b
CT	3	67.5 b
NT	2	66.9 b
CT	2	66.6 b



Image 1. Aerial view of long-term rotation study at Arlington, WI.

Experiment 2

Utilizing a field with a history of corn-soybean rotation, which had been planted with soybeans the previous year, 5 treatments in a structured additive design were applied to soybean (Table 5). All plots were planted on May 6th with Asgrow AG22XF3 at 140,000 seeds/acre in 30" rows. A custom planter was used for seeding and applying at planting treatments. Foliar applications at the V4 and R3 growth stage were applied with a hand boom. Plots were harvested with a research plot combine equipped with weighing and moisture sensors.

Table 5. Seed, in-furrow, and foliar treatment combinations applied according to product label.

Treatment	-----At planting-----				-----V4-----	-----R3-----	
	Seed treatment	In-furrow fungicide	Starter fertilizer	Plant growth regulator (PGR)	PGR and/or fertilizer	PGR and/or fertilizer	Foliar fungicide
1	Acceleron F/I	--	--	--	--	--	--
2	Acceleron F/I/ILEVO	--	--	--	--	--	--
3	Acceleron F/I	Priaxor	--	--	--	--	--
4	Acceleron F/I	Priaxor	--	--	--	--	Delaro Complete
5	Acceleron F/I	Priaxor	Nachurs TO	--	Nachurs TO	Nachurs TO	Delaro Complete
6	Acceleron F/I	Priaxor	Nachurs TO	Cygin Pro	Cygin Pro/ Nachurs TO	Cygin Pro/ Nachurs TO	Delaro Complete

Results

Seed yield, protein, oil, and test weight measurements were analyzed, but only seed yield had a significant difference ($P < 0.001$) among treatments (Table 6). Treatments 5 and 6 had similar yields and were significantly higher (~25%) than the rest of the treatments. Treatments 5 and 6 included three applications of fertilizer (Table 7). According to UW recommendations, the soil test phosphorus level in the experiment field (14.6 ppm) was low to optimum, and the potassium level (68.6 ppm) was very low. Additionally, the pH level was 5.8 and organic matter 2.9%. No visual symptoms of disease, insect pressure, or nutrient deficiency were observed in the plots. Soil test nutrient levels may have affected the outcome of the treatments. We are further exploring this data as the magnitude of this result was largely unexpected. We plan to repeat this experiment in 2025 and 2026.

Table 6. Soybean seed yield response to treatments. Yields followed by the same letter are not statistically different, determined by Tukey-Kramer ($\alpha = 0.05$).

Treatment	Grain Yield (bu/a)	
5	62.5	a
6	61.8	a
2	49.9	b
1	49.8	b
3	49.7	b
4	47.2	b

Table 7. Nutrient analysis and amount of fertilizer applied.

Nutrient	Lbs/gal	Gal/acre	Applications	Season total (lbs/acre)
Nitrogen (N)	0.45	2	3	2.70
Phosphate (P_2O_5)	1.46	2	3	8.76
Potash (K_2O)	1.91	2	3	11.46
Sulfur (S)	0.11	2	3	0.66