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Corn Production in the Northern Corn Belt: The Tillage X Rotation Interaction

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The corn-soybean rotation has become dominant in the Corn Belt of the U.S in the last 30-40 years. When compared to other systems like the wheat system of the Middle East and the rice systems of the Far East that have been in place for centuries, it is a relatively new cropping system. Many agronomists are concerned about the sustainability of this system and there is some evidence that with the development of resistant weeds and insects that it might be challenged significantly in the near future.

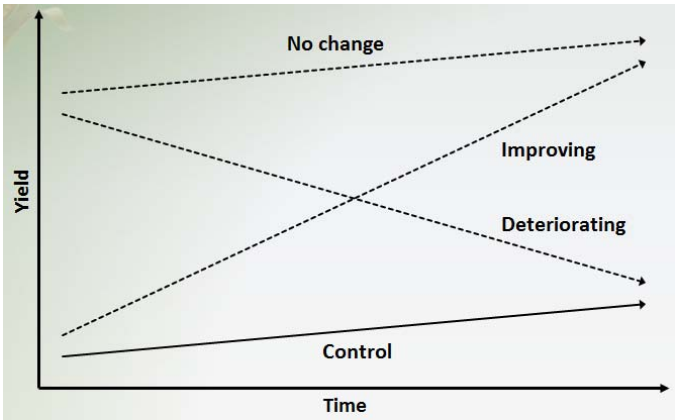

Figure 1. How can you tell if a cropping system is changing?

The objective of this study was to measure the response of tillage in a rotation trial that has increasing amounts of continuous corn. The experimental unit is the plot of ground, so the analysis uses rotation cycles to measure the effect of rotation and tillage on the soil.

The conventional tillage (CT) treatment in this study used a fall chisel plow followed by 2x spring field cultivator tillage treatments. Both CT and no-tillage (NT) treatments were then planted with a no-till planter that used a 13-wave coulter, followed by trash whippers, and double disk openers. For a description of the rotation sequences, see Table 1.

Table 1. Crop Sequence for 2-Crop Rotation Experiment at Arlington, WI (C= Corn, S= Soybean)

Rotation Sequence	Year									
	1	2	3	4	5	6	7	8	9	10
1	C	C	C	C	C	C	C	C	C	C
2	S	S	S	S	S	S	S	S	S	S
3	C	S	C	S	C	S	C	S	C	S
4	S	C	S	C	S	C	S	C	S	C
5	C	C	C	C	C	S	S	S	S	S
6	C	C	C	C	S	S	S	S	S	C
7	C	C	C	S	S	S	S	S	C	C
8	C	C	S	S	S	S	S	C	C	C
9	C	S	S	S	S	S	C	C	C	C
10	S	S	S	S	S	C	C	C	C	C
11	S	S	S	S	C	C	C	C	C	S
12	S	S	S	C	C	C	C	C	S	S
13	S	S	C	C	C	C	C	S	S	S
14	S	C	C	C	C	C	S	S	S	S

Rotated corn has a 13-17% yield advantage over continuous corn (Figure 2). Second-year corn yields 5-7% greater than continuous corn. Third- fourth- and fifth-year corn yields the same yield as continuous corn. Modern corn hybrids and management practices have the same rotation response as older hybrids and practices.

Conventional tillage increases corn grain yield 3-6% compared to no tillage (Figure 3). However, there is an interaction.

Tillage does not affect corn yield the first year following soybean (CS or 1C in Figure 4). In the second and third consecutive year of corn, tillage interacted with rotation less consistently improving yield 3-6% in the second year, and 8-10% in the third year.

In conclusion, if rotation is used, then there is no need to do tillage in the first year of the rotation. As the number of consecutive years of corn increase, tillage may be necessary to maintain corn yield.

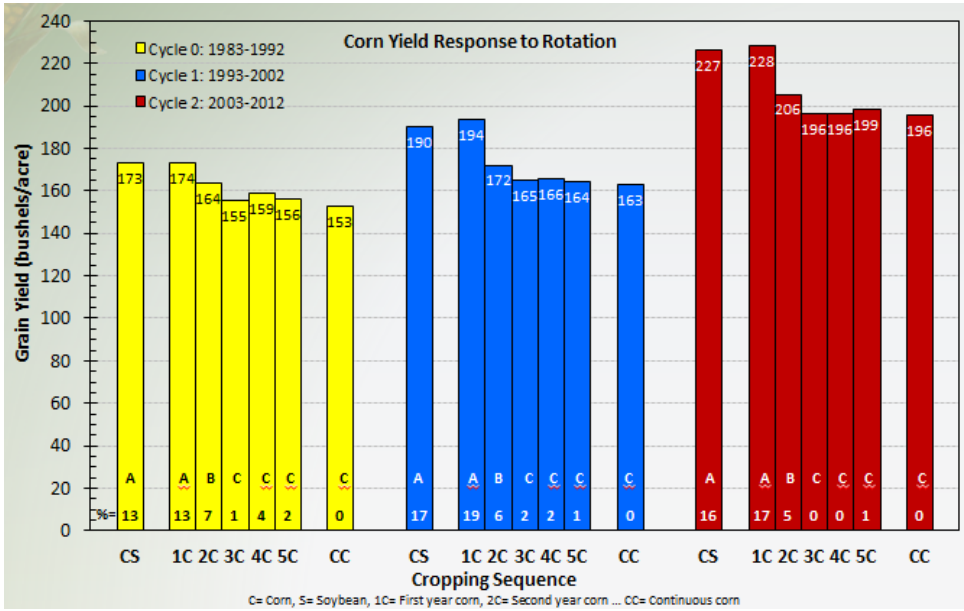

Figure 2. Corn yield response to rotation at Arlington, WI. CC= continuous corn, CS= corn-soybean rotation, xC= number of consecutive years of corn following five years of soybean.

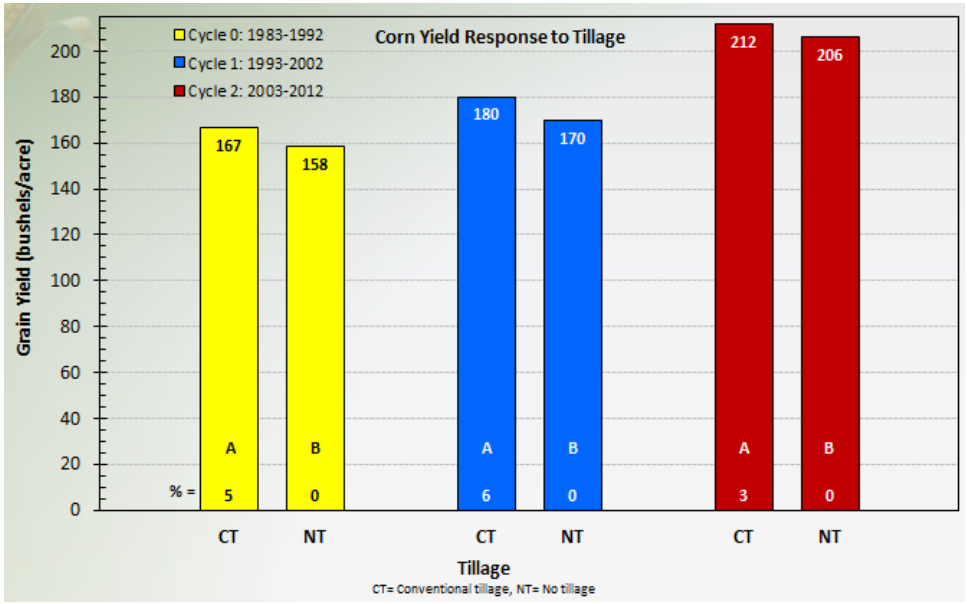

Figure 3. Corn yield response to tillage in a corn-soybean rotation at Arlington, WI.

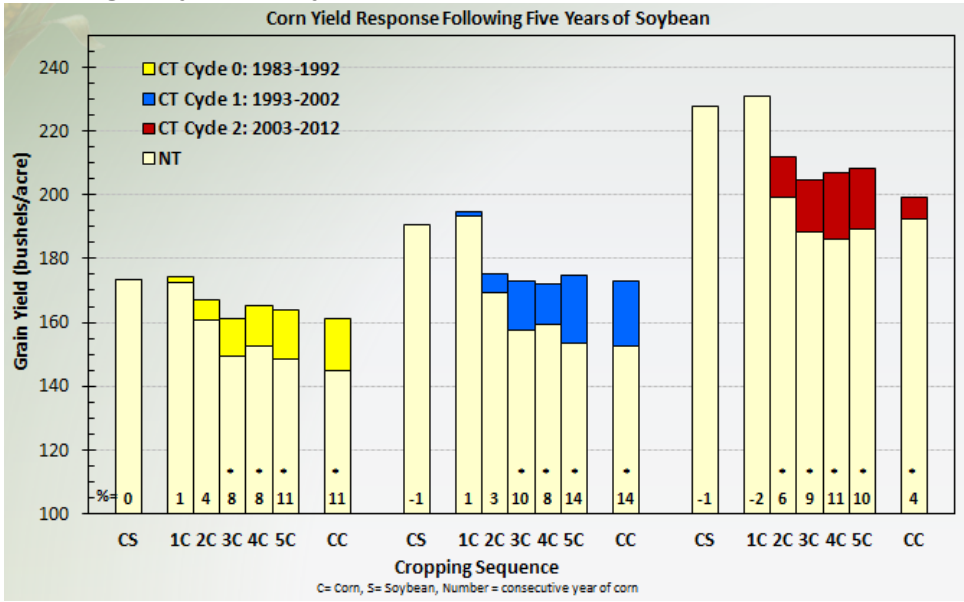

Figure 4. The interaction between rotation and tillage in a corn-soybean rotation at Arlington, WI. CC= continuous corn, CS= corn-soybean rotation, xC= number of consecutive years of corn following five years of soybean.

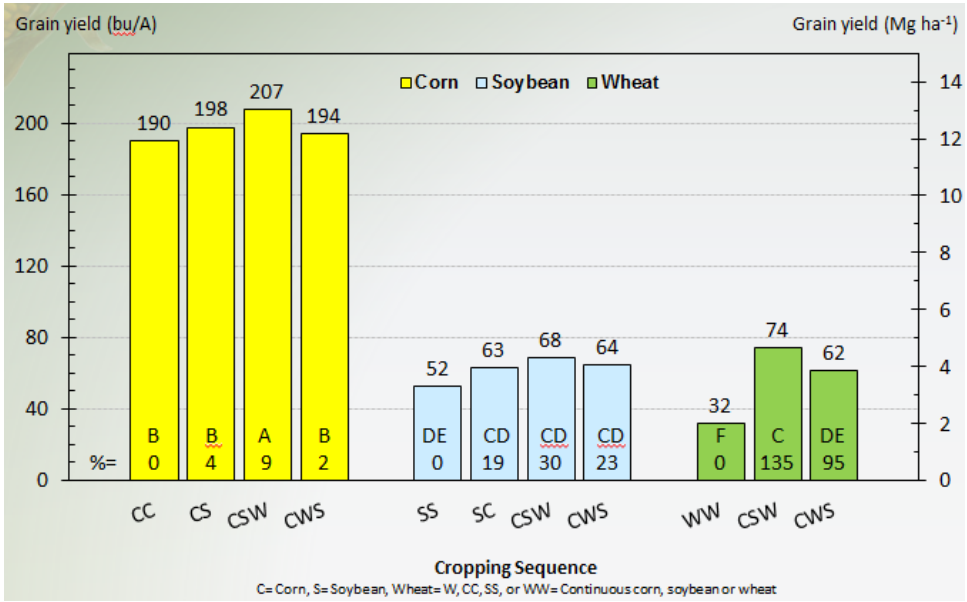

Figure 5. Extending crop rotation improves grain yield of all crops. Data derived from Lauer, 2004-2012 (Arlington, Control treatments).