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To Rotate, or Not to Rotate —What Are You Going to Do in 2013?

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Crop rotation is a universal management practice that has been recognized and exploited for centuries and is a proven process that increases crop yields. In the Midwestern U.S., a biennial rotation of corn (*Zea mays* L.) and soybean [*Glycine max* (L.) Merr.] produces significant increases in the yields of both crops.

There are clear indications that the current corn-soybean rotation is unstable, easily disrupted by weather, disease, and insects, and rely heavily on foreign trade and biofuel production. Midwest cropping systems although productive, are highly specialized, standardized and simplified to meet increasing demands (Brummer, 1998; Kirschenmann, 2002).

Many of these cropping systems are approaching monoculture systems that need to incorporate technological advances, high fossil fuel based inputs, and genetic engineering to remain sustainable. Cropping systems specializing in one or two crops with little attention to crop diversity could lead to biological and physical soil degradation and ultimately soil chemical degradation (Kirschenmann, 2002). Nature's plant and animal diversity is currently replaced with a small number of cultivated plants and domestic animals (Altieri, 1999).

The mechanism for the rotation effect is unknown. One hypothesis is that one factor causes the effect. Another hypothesis is that multiple factors cause the effect and risk of expression depends upon the environment. Research evidence began mounting in the 1970's, which indicated that in spite of all the management inputs a farmer might impose, there was still a yield advantage to be obtained from rotations. These studies showed that corn yields are usually higher when the crop is rotated with some other crop rather than grown continuously. Yield advantages to corn from rotating with some other crop are at least 10%. In addition, soybean yields also improved by 10% when the crop is rotated out of a continuous pattern.

More research that is recent has shown this increase to be even greater than expected with responses up to 19% (Figure 1). The rotation effect lasts two years increasing corn grain yield 10 to 19% for 1C and 0 to 7% for 2C.

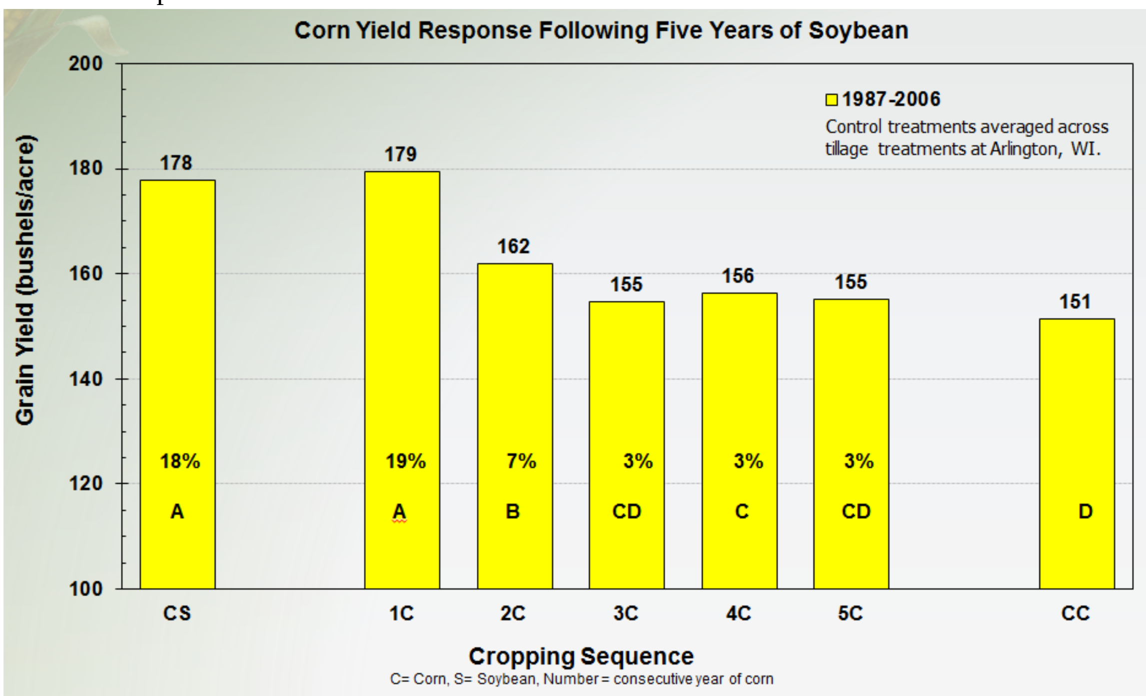

Figure 1. Corn yield response to rotation following five years of soybean during 1987 to 2006 at Arlington, WI. Letters indicate statistical differences at $P \leq 0.05$. Percentage values indicate relative differences compared to continuous corn.

Adding a third crop like wheat (*Triticum aestivum* L.) does not increase corn grain yield, but does improve soybean grain yield (Figure 2).

If there is only a one-year break in the rotation then the second corn phase is equivalent to continuous corn (Figure 3). At least two break years are needed to measure a response in the second corn phase compared to continuous corn (Figure 4).

Modern corn hybrids and management practices have the same rotation response as older hybrids and practices.

Although scientists cannot yet satisfactorily explain the rotation effect, farmers can exploit it every year. In 2013, more acres will likely be planted to a third year of corn. These acres will be at continuous corn yield levels regardless of the number of break years. It will be important for growers to consider getting back to rotating crops. The age-old practice of rotating crops, which for a while was considered unnecessary, has returned to today's agriculture with proven benefits.

Literature Cited

Altieri, M.A. 1999. The ecological role of biodiversity in agroecosystems. Agric. Ecosyst. Envron. 74:19-31.

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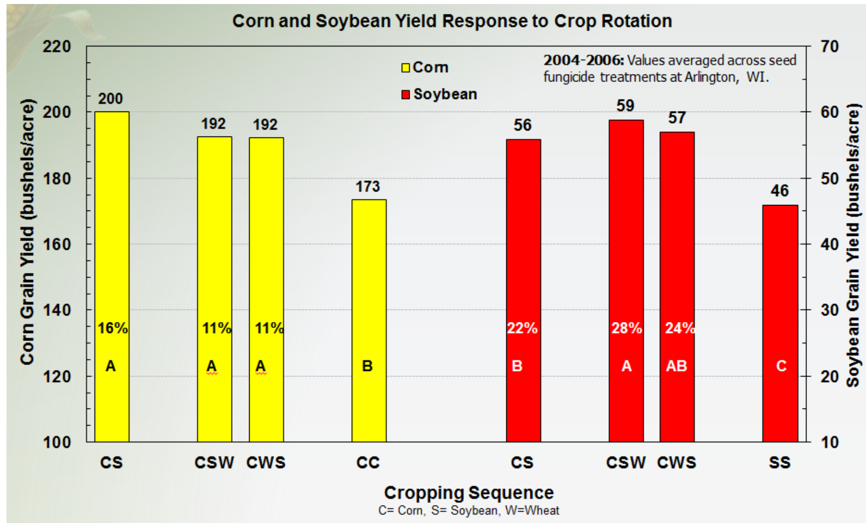

Figure 2. Corn and soybean yield response in a corn-soybean-wheat rotation during 2004 to 2006 at Arlington, WI. Letters indicate statistical differences at $P \leq 0.05$. Percentage values indicate relative differences compared to continuous corn or soybean.

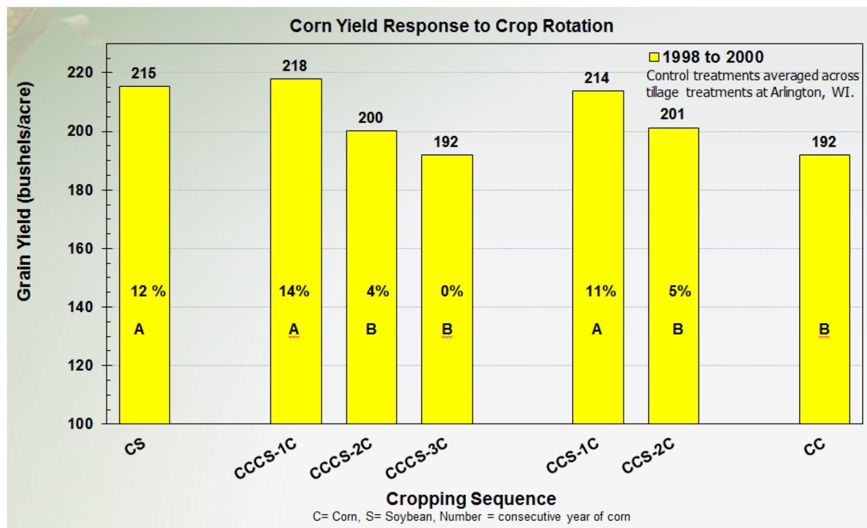

Figure 3. Corn yield response in various corn-soybean rotations during 1998 to 2000 at Arlington, WI. Letters indicate statistical differences at $P \leq 0.05$. Percentage values indicate relative differences compared to continuous corn.

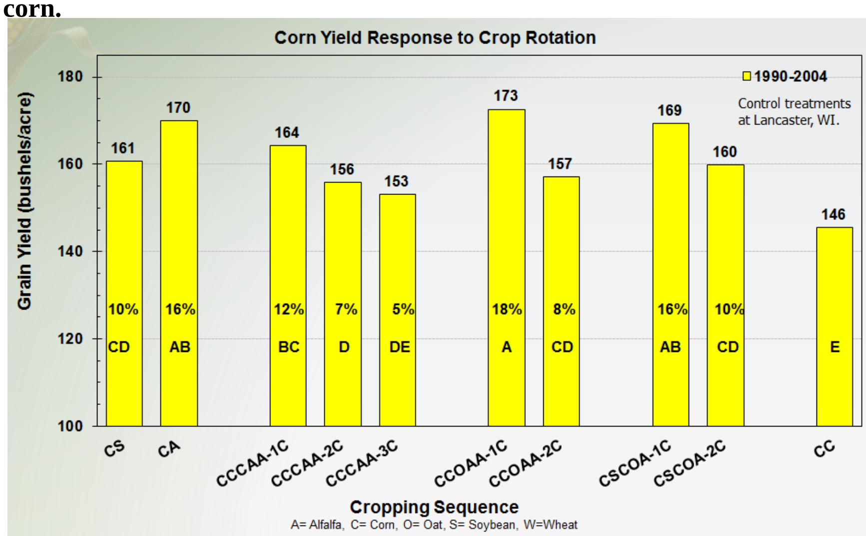

Figure 4. Corn yield response in various rotations during 1990 to 2004 at Lancaster, WI. Letters indicate statistical differences at $P \leq 0.05$. Percentage values indicate relative differences compared to continuous corn.