Corn Following Corn: Potentials and Pitfalls

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Corn following Corn: Potentials and Pitfalls

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Introduction
Economic, political, biological, and environmental forces are all seemingly pushing for more corn planted following corn. This is true not just in Iowa, but across the Midwest. The promise of more ethanol plants and the associated increase in demand for grain as well as potentially stover are obvious factors influencing the discussion relative to increasing corn acres and the need for more corn following corn in our cropping systems. In addition to these economic factors is the concern about the intrusion of Asian soybean rust into the Corn Belt that could potentially reduce soybean yields and increase production costs. All of the talk over the last few years of a 'soybean yield plateau' has added to this discussion and interest in more corn. But now, with the excellent soybean yields in most of Iowa for 2005 and escalating fuel and fertilizer prices following hurricane Katrina, some of the enthusiasm for corn following corn is dampened. Before discussing the newest research data on corn following corn, let's discuss some of the known pitfalls and potentials of this cropping system.

Pitfalls of Corn following Corn: It is well documented that second-year corn yields are often reduced relative to first-year corn yields. Yield reductions over the years often have ranged from 5 to 15% for corn following corn compared to first year corn (Benson, 1985; Nafziger et al., 2005; Pedersen and Lauer, 2003). Input costs for N often increase because of increased N demand and added costs for pest management, especially insect control, are likely higher. Stand establishment is more variable with corn following corn in many cases.

Promises of Corn following Corn: On the positive side, soybean yields may go up; soybeans often respond positively to crop rotation too. More corn grain (and in the future, possibly stover) will be available for ethanol, and with proper management, more residue will remain on the surface and more carbon returned to the soil. Corn following corn is truly a multifaceted issue!

Yield of corn following corn
Al-Kaisi and Licht (2005) have conducted research on corn following corn in different tillage systems at several Iowa locations over the last three years (figure 1). Data from 2003 and 2004 are shown in this figure, 2005 data were not available at the time of this writing. Second year corn yields were either similar or less than first year corn.
Colleagues at the University of Illinois have compared the same corn hybrids at three locations in both corn following corn and corn following soybean cropping systems. This is part of the hybrid testing program at the University of Illinois. Dr. Nafziger presented 2004 results from this trial at this conference last year (Nafziger, 2004). The 2005 data are shown in Figure 2. Yield of most hybrids was reduced in the corn-corn system relative to the corn soybean system at all three locations.
Yield increase with C>SB vs C>C Yield Monmouth IL, 2005

Yield increase with C>SB vs C>C Yield DeKalb IL, 2005
**Corn production and residue**

Part of the reason for lower yields with corn following corn is the increased residue levels. Cooler and wetter soils associated with increased residue levels are often blamed for lower yields in heavy residue systems. Figure 3 presents data from Waseca MN. Corn was planted with different tillage systems following soybeans. Although this data is not from corn following corn, it shows the effect of increasing surface residue levels on corn yield.

Figure 4 shows data from the same location for corn following corn with different tillage systems. Corn yields tend to decrease with increasing soil residue cover. It seems clear that at least in soils like those of Waseca MN, surface residue cover at planting will negatively impact corn yields. This may limit yields on similar Iowa soils as well.

LSD: Yield = 10; Residue = 7.

Figure 3. Corn yield and surface residue as affected by tillage systems for corn at Waseca MN, Four-year averages. Randall and Vetsch. 2005.

Second year corn yield and residue cover, 2004. Randall and Vetsch, MN.

LSD: Yield = 8; Residue = 12

Figure 4. Second-year corn yield and residue cover in 2004 as affected by tillage system for corn in 2003 and 2004. Randall and Vetsch, 2005. MP = moldboard plow; DZT = deep zone tillage; CP = chisel plow; SD = [this is not clear from the text]; ST = strip till; NT = no-till.
Cultural practices of corn following corn

We need to condition this pessimism with some interesting facts. Many corn yield-contest winners obtain their record yields in continuous corn production systems! Yet, specific cultural techniques including tillage, nutrient, insect, and pest management, plant populations, etc. have not consistently (across locations and years) been shown to enhance corn yields in corn following corn. With this in mind, Nafziger et al., 2005, designed a trial to investigate two tillage systems, N fertilizer rates, and plant populations. Ten site-years of data are available now from 2003 to 2005. Figure 5 shows the main effects of the three factors included in the trials. Interactions across sites were not significant. Although deep tillage increased yields across all locations, it was significant at only 2 of the 10 locations. Likewise, extra N enhanced yields at five of ten locations. Increased plant populations reduced yield at 5 sites and increased yields at one site. Thus, results were not consistent leading Nafziger et al., 2005, to conclude, “...we have found not consistent ‘formula’ for raising continuous corn yields.”

![Figure 5. Corn yields as affected by tillage, fertilizer rate, and plant population in continuous corn. Averaged over 10 site years, 2003-2005. Nafziger et al. Univ. of Illinois. 2005.](image-url)

Research needs

It is clear that as we go into the next few years that more research is necessary to discern the implications of cropping systems that include more corn. These research projects could include tillage systems, fertilizer rates, plant populations, as well as insect and disease control. Although these factors have been studied in the past, new developments including hybrid interactions demand investigation. For example, several hybrids at individual sites in the 2005 Illinois trial yield well both following corn as well as soybeans (Figure 2). Also, the impact of the hybrid
planted in year 1 on the next year's corn crop is not understood? Is hybrid selection in year one important? We have much to learn!

**References**


