

Rethinking Rotations: More Corn and Less Soybean in the Corn Belt? - (Tony J. Vyn)

Many Corn-Belt farmers I have had contact with during this past year have discussed switching away from the traditional 50% corn and 50% soybean rotation to something involving a higher percentage of their land area in corn. Some farmers simply intend to have some of their acreage (e.g., the fields with the highest corn yields) in a rotation of 2 years corn, 1 year in soybean while keeping most of their acreage in the traditional corn-soybean rotation. Other farmers want to switch all of their fields into a rotation of 2 years corn and a single year of soybean. Still other farmers are very intrigued about continuous corn production.

Some common reasons I am given by cash-crop farmers for considering more corn after corn are:

1. The soybean yields on my farm in recent years have been disappointing.
2. In the one field where my neighbor grew corn after corn, yields went over 200 bushels per acre in 2004.
3. With high cash rents for land, and corn yields approaching 200 bushels per acre, corn production is simply more profitable than soybean production.
4. It is easier to complete harvest in a timely fashion with a higher percentage of corn in the acreage mix (because of the increased number of days, in the fall of the year, that a farmer can harvest corn versus soybean).
5. Some record corn yields have “apparently” been achieved by other Corn-Belt farmers in continuous corn production systems.
6. There is a lower yield risk with corn versus soybean.
7. The increased capacity for soybean production in South America means that the long-term prospects for maintaining competitive marketing prices for commodity soybean are less likely than for corn.
8. Rootworm management (whether with transgenic hybrids or insecticides) is just as costly for corn after soybean as it is for corn after corn in a progressively bigger portion of the Corn Belt each year.
9. Today’s corn hybrids are more stress tolerant than those of 20 or 30 years ago.
10. Unlike the situation in the 1970’s, continuous corn production in 2005 doesn’t have to lead to poor soil structure.

Space doesn’t permit addressing the validity of all of the reasons above. Some are more speculative than others. One that is not mentioned, but which may be valid, is that soybean yields may increase if it were planted every third or fourth year rather than every

second year. However, the rotation yield advantage one assumes for corn after soybean is perhaps the key factor in making the economic decisions about rotation changes. One common question from farmers who are rethinking their rotation is whether the accepted standard of a 10% yield reduction for corn after corn still applies today.

My first answer to the latter question (and to some doubters) is that the rotation yield advantage for corn is still just as evident today as it was 10 or 30 years ago. My second answer is that the rotation yield advantage for corn after soybean versus corn after corn has always been dependent on the tillage system that is being assumed. My third answer is that even when corn yields are over 200 bushels per acre, the extent of the rotation advantage can still be the same as for corn yielding less than 150 bushels per acre.

The long-term data from two ongoing experiments in Indiana provide some solid evidence for the 3 conclusions above.

In Table 1, which summarizes results from a 30-year study on a dark prairie soil with high organic matter, the rotation advantage ranged from 5% in a moldboard plow system to 18% in a no-till system. Even in 2004, a year with above-normal yields, the rotation advantage was still from 5 to 16% depending on tillage system.

Tillage System	1975 - 2003		2004		Yield Gain for Rotation (%)	
	Corn/Soy	Cont. Corn	Corn/Soy	Cont. Corn	1975-2003	2004
-----Yield (bu/acre) -----						
Moldboard Plow	176.4	168.5	213	201	5	6
Chisel Plow	176.9	164.0	209	198	8	5
No-till	172.5	146.2	207	179	18	16

*Yield data from a cooperative project involving T.D. West, T.J. Vyn and G. Steinhardt of the Agronomy Department.

In Table 2, results from an 8-year study in Northern Indiana again confirm the 8 to 14% yield advantage for corn after soybean instead of corn after corn. In 2004, even when corn after corn yielded around 210 bushels per acre, there still was a 20 bushel (or 9-11%) yield advantage for corn after soybean. Yes, it is hard to fault a farmer’s management when he or she achieves yields of 210 bushels per acre. But from my perspective, 230 bushels is still more profitable than 210 bushels.

Table 2. Corn Yields Responses* to Tillage and Rotation from 1997 to 2004 in Wanatah, Indiana (Sebewa loam)						
Tillage System	1997 - 2003		2004		Yield Gain for Rotation (%)	
	Corn/Soy	Cont. Corn	Corn/Soy	Cont. Corn	1997-2003	2004
-----Yield (bu/acre)-----						
Fall Chisel	188	174	230	210	8	9
Fall Disk	189	170	234	211	11	11
No-till	184	161	224	206	14	9

*Yield data from a cooperative project involving T.D. West, T.J. Vyn and G. Steinhardt of the Agronomy Department.

The information in both Tables 1 and 2 also emphasize that there is more need for tillage when corn follows corn than when corn follows soybean in sequence. In fact, other than the economic cost of reduced yield, the biggest economic loss associated with corn after corn is that it virtually rules out a no-till system. Moldboard plowing may become more commonplace in the Corn Belt simply because it is such an attractive option for corn after corn on high clay and high organic matter, poorly drained soils. But such a development would involve its own short-term and long-term costs. The short-term costs include equipment depreciation, fuel, and time; the long-term costs include more soil erosion and reduction in future crop productivity. Chisel plowing is not much better; it still leaves just 20 to 25% surface residue cover after planting for corn after corn.

Another economic cost of corn after corn is simply the cost of the additional N fertilizer. Recommended N rates are at least 40 pounds per acre higher for corn after grain corn than for corn after soybean.

Some conservation-minded corn farmers have asked about fall strip tillage for corn after corn. Indeed, our experiments show that strip tillage can yield superior to no-till and just as well as chisel plowing for corn after corn (data not shown). Similar strip tillage operations after soybean have not tended to result in higher yields than the no-till system, though they have enabled much earlier planting in spring and accelerated early growth of corn relative to no-till corn. But even so, corn after corn means more tillage. Furthermore, more tillage also means generally later fall tillage operations than would be the case after soybean harvest.

There are many other agronomic issues involved for the best possible management in corn after corn. For instance, in corn after corn systems, hybrid selection needs to involve much more attention to susceptibility to certain foliar diseases that can increase without rotation. But before Corn-Belt farmers concern themselves with the details, they should consider the major costs of switching to a more corn dominant rotation.

Summary:

Even with the high yields achieved in Indiana in 2004, corn in rotation with soybean yielded from 5 to 15% higher than corn after corn. These increases in corn yield for rotation are in line with those for the last 30 years. Any rethinking of corn-soybean rotations in the Corn Belt must be done with an accurate assessment of the overall costs. Chief among the increased costs that need to be considered for corn after corn are:

1. Yield loss (e.g., 11 to 23 bushels per acre in 2004 alone)
2. Higher tillage costs (no-till no longer possible)
3. Associated higher soil erosion costs
4. Higher optimum nitrogen fertilizer rates
5. Higher pest control costs

My advice: Think very hard, and consider all the costs for any changes in rotations.