Crop rotation considerations for 2004 management season rotation

There are many management strategies for improving soil productivity. Crop rotation or cropping sequence is proven to be very effective in addressing concerns related to soil, water, and environment quality from long- or short-term perspectives. Producers who are innovative in diversifying their cropping systems and management strategies will be more successful than others who are not.

As producers search for better ways to achieve profitability, one management tool that has been largely overlooked for too long is a robust multiple-crop rotation management system. There are several proven benefits of a multiple-crop rotation system.

Crop rotation--a winner from many perspectives

Although extensive crop rotations are largely considered an age-old farming practice, they have many agronomic, economic and environmental benefits over 'continuous cropping.'

Crop rotation can improve yield and profitability over time, control weeds, break disease cycles, limit insect and other pest infestations, provide an alternative source of nitrogen, reduce soil erosion, increase soil organic matter, improve soil tilth, and reduce runoff of nutrients and chemicals, as well as the potential for contamination of surface water.

Improved soil structure

Annual crop rotations (especially in no-till systems) cause dramatic differences in root structure over time. From taproot crops to fibrous-root crops, diversity in root structure will improve the soil's physical, chemical, and biological structure. Soil improvement, in turn, creates a variety of macro pores (the channels in soil that allow infiltration of water, nutrients, and oxygen), and facilitates new root growth of successive crops.

Improvement in soil organic matter and nutrient pools is another benefit as a result of crop rotation, which can improve soil structure and increase the soil's water-holding capacity.

Diminished soil erosion

Soils with good structure improve water infiltration due to increased macro pores. The improvement in microbial communities and soil tilth will also help reduce soil erosion because of more stable soil structure, improved water infiltration, and reduced surface runoff -- the

mechanism by which soils are lost to streams, lakes and rivers.

Access the crop rotation nutrient cycle

Producers can calculate and allow for the impact of additional nutrients (nitrogen, for example) from crops such as soybeans and alfalfa. More nutrients in the field, from crop rotation, means sustaining nutrient availability with fewer inputs, lower costs, and increased margins.

Pest and disease control improves

Diversifying cropping sequences takes away the 'host organism,' and disrupts the annual life cycles of diseases, insects and weeds. For example, nematodes and anthracnose--two big problems in Iowa right now--are highly susceptible to crop rotation. Besides, using crop rotation to control pests and disease means that producers use fewer crop inputs to fight pests, and thus, reduce both costs and environmental repercussions.

The end result -- better soil fertility and carbon storage

The Morrow plots at the University of Illinois were established in 1876, to study the effects of crop rotation and fertilization on yield (see Table 1). Crop sequences, in a single replication, were continuous corn, corn-oats, and corn-oats-clover, with and without lime, manure, and rock phosphate.

The results: Continuous corn with no fertilizer decreased soil organic matter content by 45.6% in 55 years compared to adjacent sod. Removal of carbon from the soil will lead to a decline in soil fertility and aggregate stability. Although the study shown in Table 1 is dated, the principle demonstrated remains applicable today.

Management concerns with crop rotation and some possible solutions

As with any management system, there are some concerns with crop rotation systems. Herbicide carryover is an issue that needs constant attention in the plan and the field. Introducing new crops also means new skills and use of different equipment or increased labor costs. Also, strategies need to be created for marketing multiple crops.

In the end, however, many Iowa producers might find themselves surprised by the results of cost\benefit analysis of crop rotation in their operations. Take the time to establish clear objectives and understand the consequences--pro and con--of choosing any management strategy for producing sustainable and balanced system.

Table 1. Long-term effect of rotation and treatments on soil organic carbon content in Morrow plots (1876-1940), University of Illinois.

Rotation	Treatment	% Organic C	% Organic Matter	% C Change
Corn	none	1.74	2.99	- 45.6
	MLP	2.09	3.59	- 34.7

Corn/oats	none	2.14	3.86	- 33.1
	MLP	2.44	4.20	- 23.6
Corn/oats	none	2.28	3.92	- 28.7
/clover	MLP	3.35	5.76	+ 4.0
Sod	none	3.20	5.50	0.0

[a] MLP = Manure - Lime - Phosphorus

[b] % C changes based on sod C value

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