Crop Rotation

Understanding the potential benefits of a crop rotation system.

Benefits of crop rotation.

Crop rotation—especially an extended crop rotation using three or more crops—is an age-old sustainable farming practice capable of maintaining crop yields. As shown in Table 1, the inclusion of soybean or forage legumes in crop rotations reduces the need for nitrogen (N) fertilizer.

Improved weed, insect, and plant disease control, and lower input costs.

Using Integrated Pest Management (IPM) may help lower your crop pest management input costs. Crop rotation is part of an IPM strategy designed to manage pest populations. Scouting crops to determine economic thresholds (where you may need to use a pesticide to control a pest population) is another IPM strategy. Implementation of an extended crop rotation of three or more years is particularly helpful in breaking the developmental cycles of pests. Diversifying crops in an extended rotation changes the host plants of potential pests, which in turn disrupts the life cycles of plant diseases, insects and weeds.

Improved soil structure.

Rotations using three or more crops—combined with a conservation tillage program—improves soil structure, which in turn increases soil organic matter and water infiltration rates.

Key Points

- Benefits of crop rotation
- Improved weed, insect, and plant disease control, and lower input costs
- Improved soil structure
- Reduced soil erosion
- Nitrogen contributions from perennial legume crops
- Crop rotation concerns
- Where to go for more information

Reduced soil erosion.

Soil with improved structure is more resistant to soil erosion. Keeping soil in the field instead of in streams, lakes and rivers helps improve surface water quality.

Nitrogen contributions from perennial legume crops.

Corn planted after established alfalfa may only need 0 to 30 pounds of N per acre. Corn following soybeans or other annual

Table 1. Effect of crop rotation on average yield and response to applied N for the period of 1979 to 1998, Northeast Research and Demonstration Farm, Nashua, Iowa.

		Nitrogen Rate (lb. N/acre to corn only)*			
Rotation	**Crop**	**0**	**80**	**160**	**240**
	bu/acre for corn, oats, and soybean; tons/acre for hay				
C-C	Corn	55	106	128	135
C-S	Corn	100	141	148	151
	Soybean	43	45	44	44
C-C-S	Corn (first)	101	137	148	150
	Corn (second)	56	106	129	135
	Soybean	47	46	47	47
C-C-C-S	Corn (first)	100	135	147	147
	Corn (second)	58	108	131	136
	Corn (third)	57	103	127	134
	Soybean	49	48	48	48
C-C-O-A**	Corn (first)	122	144	149	151
	Corn (second)	74	116	137	142
	Oats	57	60	65	69
	Alfalfa	3.8	3.9	3.8	3.7
S-S	Soybean	36	37	39	38

C, corn; S, soybean; O, oats; A, alfalfa.
*The nitrogen source is spring-incorporated urea.
**Oats are sown with alfalfa, and no alfalfa hay is harvested that year. Three harvests are made in the "hay" year (year after seeding).
Adapted from *Effects of crop rotation and nitrogen fertilization on crop production over a 20-year period,* by Antonio Mallarino and Ken Pecinovsky. pp. 13-16. Northeast Iowa Research and Demonstration Farm report, ISRF98-13.

crops require less N than a corn-corn rotation (Table 1). Following a crop rotation lowers nitrate-N loss to tile and ground water, since less corn is grown in the rotation (lower rate of N used and less frequent application over time). Crop rotations including perennial forages are more sustainable and environment-friendly, because less N moves to surface and ground waters. For more information, see NMEP 7, Nitrogen Application.

Table 2 presents the results of a study that looked at return to land and management under different crop rotations with respect to energy input use (fuel, equipment, seed, nitrogen, etc.). The C-C and C-C-C-O rotations, respectively, have the highest energy input use and lowest return to land and management. The C-S rotation has the third highest energy input use and the highest return to land and management. The C-O-A-A rotation has the lowest energy input use and ranked third in return.

Crop rotation concerns.

There are management concerns with crop rotation systems. Examples include potential herbicide carryover, the need for specialized equipment, increased labor and management associated with diverse cropping systems, and having a market for your crops.

Where to go for more information.

Visit with an independent certified crop consultant or certified crop

Table 2. 1984-1997 Crop Rotation-Fertility Study, Northern Research and Demonstration Farm, Kanawha, Iowa.

Crop Rotation	Nitrogen (N) (lb/acre, corn only)	Return to Land and Management ($/acre/year)*	Diesel Fuel Equivalents Used by Rotation and N (gal/acre/year)
C-C	240	66.47	76.04
C-C-C-O	240	61.66	59.68
C-S	160	99.37	35.64
C-S-C-O	160	88.49	34.70
C-C-O-A	0	70.64	35.00
C-O-A-A	0	83.73	14.20

C, corn; S, soybean; O, oats; A, alfalfa
*Government payments not included
Table 2 data provided by Michael Duffy, professor of economics, Department of Economics, Iowa State University

adviser, or contact your county Extension office to make an appointment to visit with an Extension crop and/or farm management specialist.

For more IPM information, visit the following web pages:

Integrated Pest Management (http://www.ipm.iastate.edu/ipm/)

Pest Management and the Environment (http://www.pme.iastate.edu)

Best Management Practices, or BMPs, utilize the most effective and practical means available to reduce or prevent water pollution from farm operations. BMPs are selected based on assessment, analysis of the impact of alternative practices and their economic considerations. They are implemented using current available technologies, management skills and available resources. BMP information sheets available from ISU Extension include:

NMEP 1, *Soil Testing*
NMEP 2, *Phosphorus Application*
NMEP 3, *Manure Resources*
NMEP 4, *Residue Management*
NMEP 5, *Crop Rotation*
NMEP 6, *Crop Yields*
NMEP 7, *Nitrogen Application*
NMEP 8, *Nutrient Management Plan*
NMEP 9, *Equipment Calibration*
NMEP 10, *Conservation Reserve Program*
NMEP 11, *Conservation Practices*

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