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Getting the most from nitrogen fertilizer dollars

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Abstract
For some producers, high fertilizer nitrogen (N) prices will add significant costs to corn production this year. What management options can producers take to get the most return from added N? Where to apply N and at what rate? Allocate more N to where it is needed most. If your N costs are high, or products are in short supply, then allocate more N to the situations with greatest potential response to applied N. This allocation would be to the most responsive crops and rotations.

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Getting the most from nitrogen fertilizer dollars

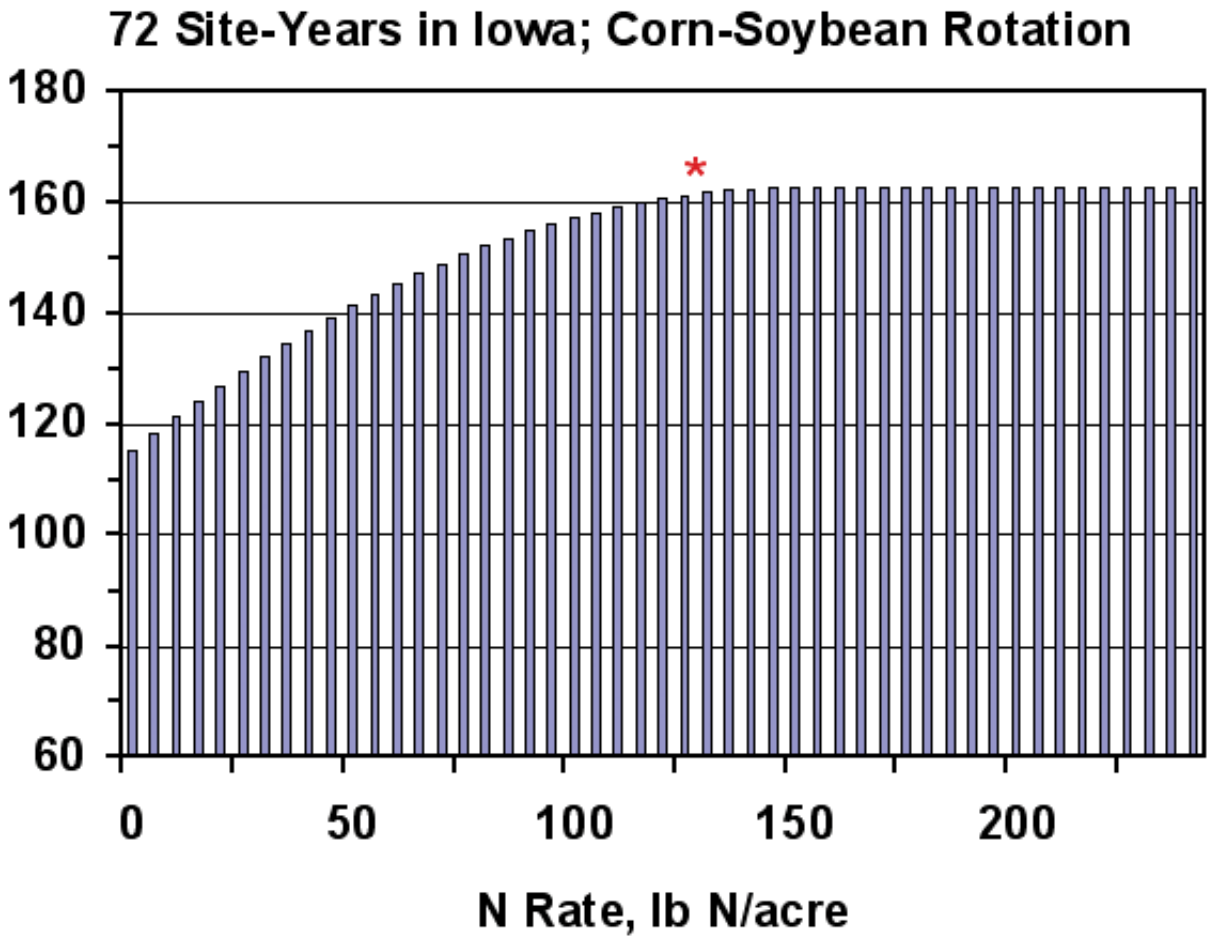
For some producers, high fertilizer nitrogen (N) prices will add significant costs to corn production this year. What management options can producers take to get the most return from added N?

Where to apply N and at what rate? Allocate more N to where it is needed most. If your N costs are high, or products are in short supply, then allocate more N to the situations with greatest potential response to applied N. This allocation would be to the most responsive crops and rotations. Table 1 gives recommended preplant corn N rates for various rotations. Also closely evaluate the rate required in each rotation for your soils and geographic location. If you have been applying N at rates above the ranges suggested in Table 1, reduce them into the suggested range. If you are already within the range and have not observed N deficiencies in the past, consider decreasing rates to the lower part of the range. Research conducted in Iowa often indicate that N rates in the lower part of the ranges are adequate.

Because corn is so responsive to N and because the largest return occurs to the first increments of applied N, if fertilizer N supply is short it is probably better to apply a lower rate of N to all corn acres than to skip fields. Exceptions are 1) fields with adequate rates of manure, 2) first-year corn after alfalfa, and 3) fields receiving adequate rates of other forms of N such as by-products or biosolids. Because corn rotated with other crops requires less N and returns higher yields than continuous corn, consider rotating corn after soybean or after alfalfa instead of planting corn after corn. An example of a long-term rotation study from the Iowa State University Northeast Research and Demonstration Farm is shown in Table 2. Decisions to change rotation should be weighed carefully. Not growing corn and instead planting soybean after soybean, for instance, can lead to lower soybean yield and increased potential for disease and nematode problems.

With increased N prices, it would be justified to reduce rates somewhat. However, when fields are very responsive to applied N, reductions should not be dramatic and in general perhaps not more than 10 to 20 percent less. Remember, greatest yield increase comes from the first units of applied N, and least from the last. Looking at the yields in Table 2 for the corn-soybean (C-S) rotation, the first 80 lb N returned 42 bu corn/acre ($98.70/acre at $2.35/bu corn at a fertilizer cost of $16.00/acre at $0.20/lb N). The second 80 lb N returned 9 bu/acre ($21.15/acre at a cost of $16.00/acre). The last 80 lb N returned only 4 bu/acre ($9.40/acre at a cost of $16.00/acre, a losing application). Using an average response from 72 site-years where corn followed soybean across Iowa the past 24 years (data from research farm and on-farm trials, Figure 1), produces an economic N rate of 127 lb N/acre at 161 bu/acre (using a corn:N price ratio of 10:1, $2.00/bu corn and $0.20/lb N). Increasing or decreasing prices results in an associated change in economic N rate, and yield increase or

decrease (Table 3). The corn response may justify economic application of high-cost N, but there will be both lowered productivity and increased N cost, thus lower return.



What N is being applied?

Take into account all N being applied to cornfields. Nitrogen recommendations are for the total amount of N needed. Therefore, add up the N coming from various fertilizers such as diammonium phosphate (DAP), weed and feed urea-ammonium nitrate (UAN), and starters. These amounts should then be subtracted from recommendations such as those shown in Table 1.

What are alternative N sources?

Use alternative N sources such as manure, biosolids, and N-containing by-products (such as liquid ammonium sulfate). Closely measure the nutrient content of animal manure and carefully apply agronomic rates.

How can productivity be improved?

Adopt proven crop management practices: soil conservation; IPM; adapted high-yielding hybrids; crop rotations; and optimal soil pH, phosphorus, and potassium levels. These practices help to ensure optimal N use efficiency.

How well is N applied?

Calibrate applicators, apply fertilizer products and manure accurately, and use the correct method and placement to avoid losses.

In summary, applying these management options can help increase returns from dollars spent on N. Increased fertilizer costs will detract from overall profitability, but carefully assessing needs and application options will help minimize expenses and increase overall return on fertilizer N investments.

Table 1. Recommended N rates for corn production based on crop rotation.

Rotation	Nitrogen Rate, lb N/acre
Corn after established alfalfa	0-30
Second-year corn after alfalfa	0-60
Corn after corn	150-200
Corn after soybean	100-150

Adapted from Table 1 of Iowa State University publication PM 1714, Nitrogen Fertilizer Recommendations for Corn in Iowa.

Table 2. Effect of crop rotation on average yield and response to applied N for the 23-year period of 1979 to 2001, Northeast Research and Demonstration Farm, Nashua, IA.

		N Rate (lb N/acre to corn only)[a]			
		0	80	160	240
Rotation	Crop	bu/acre for corn and soybean			
C-C	Corn	54	106	129	137
C-S	Corn	100	142	151	155
	Soybean	44.7	45.9	45.4	44.7
C-C-S	Corn (first)	100	139	152	153
	Corn (second)	54	106	129	137
	Soybean	48.3	47.6	48.3	48.1
C-C-C-S	Corn (first)	99	136	149	151
	Corn (second)	56	106	131	138
	Corn (third)	56	102	127	136
	Soybean	50.3	49.7	49.8	49.2
S-S	Soybean	37.5	38.0	39.3	38.5

C, corn; S, soybean.

[a] The nitrogen source is spring incorporated urea.

Adapted from Effects of crop rotation and nitrogen fertilization on crop production, by Antonio Mallarino and Ken Pecinovsky. pp. 24-25. Northeast Research and Demonstration Farm report, ISRF01-13.

Table 3. Effect of corn and N price on economic N rate and corn yield, corn-soybean rotation. Data developed from yield response shown in Figure 1.

Corn Price $/bu	Nitrogen Price, $/lb N							
	$0.10	$0.15	$0.20	$0.25	$0.30	$0.35	$0.40	$0.45
	Economic N Rate, lb N/acre							
$1.50	135	127	119	111	103	95	87	79
$1.75	137	130	124	117	110	103	96	89
$2.00	139	133	127	121	115	109	103	97
$2.25	140	135	130	124	119	114	108	103
$2.50	141	137	132	127	122	117	113	108
$2.75	142	138	134	129	125	120	116	112
$3.00	143	139	135	131	127	123	119	115
Corn Price $/bu	Nitrogen Price, $/lb N							
	$0.10	$0.15	$0.20	$0.25	$0.30	$0.35	$0.40	$0.45
	Corn Yield at Economic N Rate, bu/acre							
$1.50	161.9	161.2	160.3	159.1	157.6	155.8	153.8	151.6
$1.75	162.0	161.5	160.8	159.9	158.9	157.6	156.1	154.4
$2.00	162.1	161.7	161.2	160.5	159.7	158.7	157.6	156.3
$2.25	162.2	161.9	161.4	160.9	160.3	159.5	158.6	157.6
$2.50	162.2	162.0	161.6	161.2	160.7	160.0	159.3	158.5
$2.75	162.2	162.0	161.8	161.4	161.0	160.4	159.9	159.2
$3.00	162.3	162.1	161.9	161.6	161.2	160.8	160.3	159.7

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