ESCALATING FERTILIZER PRICES AND HIGH PRODUCTION COSTS MAKE TOUGH FERTILIZATION DECISIONS

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Fertilizers are at unbelievably high prices, with reports of tight supplies and potash allocation to dealers. Total crop production costs are causing credit supply issues, which complicates decisions to allocate available funds for production expenses. These issues are causing producers to consider changing production practices, including cutting back on inputs like fertilizer. What can be done? There is a lot of uncertainty and no clear and definitively correct answer for all situations. Also, remember that crop prices are very high. High crop prices certainly help pay for more expensive fertilizer and may result in even greater net return to fertilization when there is a yield response to added fertilizer than when crop prices are low. So there is no simple answer, and sometimes no change is the correct approach.

Consult with Advisers and Dealers
Producers should work closely with their crop adviser and dealer to figure out what the best options and production plans are for this fall and next spring. This is always important, but more so at this time as the fertilizer purchase/supply dynamics are changing dramatically and quickly.

Soil Test
Soil test to know what P, K, and lime applications are really needed. Avoid applications to fields or field areas that don’t need the nutrients or lime. Compared to the cost of nutrient and lime inputs, soil testing is inexpensive and provides a good return on investment. See the ISU Extension publication PM-287, *Take a Good Sample to Help Make Good Decisions*, for soil sampling suggestions. Evaluate soil test results to determine P, K, and lime requirements; see ISU Extension publication PM 1688, *A General Guide for Crop Nutrient and Limestone Recommendations* in Iowa. As stated in that publication, the percentage of P and K applications expected on average to produce a yield response within each soil test category is 80% for Very Low, 65% for Low, 25% for Optimum, 5% for High, and <1% for Very High. This means that as soil test levels increase, the probability of a yield increase to fertilization and the amount of expected yield increase decrease, and net return also decreases and usually becomes negative at High and Very High test levels (Figure 1).

Phosphorus and Potassium Applications
For making fertilization decisions, P and K should be applied where the chance of yield increase is large, and the expected yield increase is sufficient to at least pay for the applied nutrient (Figure 1). Remember, manure can supply P and K (as well as N and other nutrients) but its market value has also increased with high fertilizer prices and is not available to many for various reasons. Due to crop removal, withholding fertilizer or manure applications will result in a gradual soil-test decline (Figure 2). Therefore, if soil tests are in the High and Very High categories, some of the P and K “banked” in the soil can be used for next year’s crop production and no application is needed. Only apply P and K to soils testing Low and Very Low, with optional application when tests are Optimum.

Application to maintain soil-test values in the Optimum category is considered a good practice to sustain profitable crop production over time. However, applications can be withheld until the next year especially when product supply is really short, funds are needed for other more critical inputs, or land tenure is uncertain. This is because the expectation for economical response to P and K application in the year of application is small in the Optimum category and it becomes more uncertain as the price ratio becomes unfavorable (Figure 1). Crop yields in many fields are high again this year, so crop removal will be impacting soil test levels. In fields severely impacted by the wet conditions, lowered yields will result in removal of less nutrients and some fertilizer applied for this year would be available for next year's crop. Therefore, withholding applications may work in some fields or field areas, with the number of skipped years depending on the beginning soil test level, but will not work in some fields or field areas. Soil testing is the only way to know. An option instead of not applying any P or K when the soil test is in the Optimum category would be to apply partial crop removal. This would slow the soil test decline and should provide adequate fertilization for the small and occasional first-year yield response.

Many producers apply once before corn the P and K needs for both crops in the corn-soybean rotation. This is as effective as applying those nutrients ahead of each crop as long as the fertilizer need for both crops is correct. However, if fertilizer price/availability will be better next fall, money could be saved now by applying the nutrient need of one crop and fertilizing again next year. Also, the cost of application, in relation to total fertilizer cost, is less now than in previous years so making single-year applications should be more viable.

Limestone Applications

Liming soils and maintaining soil pH is a long-term investment and payback should not be expected in just the year of application. Decisions to apply or not apply should therefore look at expectations for multiple crops as well as potential yield increase from liming (or yield loss if not applied). For row crop production, PM 1688 states that pH 6.0 is sufficient for grass pasture and grass haylands, 6.5 for corn and soybean, and 6.9 for alfalfa. Because of high pH in the subsoil, pH 6.0 is sufficient for corn and soybean in the Clarion-Nicollett-Webster, Galva-Primghar-Sac, Moody, Ida-Monona, Marshall, and Lutton-Onawa-Salix soil associations. For corn and soybean, liming rates are suggested to raise pH to 6.5. If lime is going to be applied, the rate needed to achieve the suggested pH should be used. Corn often is less sensitive to soil acidity than soybean and much less than alfalfa. However, N fertilization is a major cause of soil acidification. Therefore, monitoring soil pH is important with continuous corn.

Nitrogen Fertilization

Nitrogen applications should be tailored for the crop rotation (Figure 3). First-year corn following well established alfalfa often needs no N fertilization, and when required only 30-40 lb N/acre. Unfortunately, corn in other rotations almost always needs N application, and yield increase to fertilization on the long-term is quite good (Figures 3 and 4). Hence, there are not many opportunities to eliminate application when N prices are high or in short supply. Nitrogen can be supplied from manure, but that is also a valuable commodity when fertilizer prices are high and the amount of manure produced in Iowa cannot meet the needs of all corn production. Second-year corn following alfalfa has reduced N fertilization requirement, and similar yield response and rate as with corn following soybean (Figure 3). Compared to continuous corn, corn in rotation with soybean has lower N requirement, on the order of 50 lb N/acre less (Figures 3 and 4). If N fertilizer is in short supply or purchases have to be limited, it is better to apply some N to all fields than to skip fields (other than corn after alfalfa) as the largest yield gains come from the first increments of applied N (Figure 4).

Application rates can be adjusted downward somewhat when N fertilizer costs are high relative to corn prices. However, closely observe both N and corn prices before deciding on reducing N applications. Despite the high N prices, corn prices are also high and therefore the ratio between the two has not changed dramatically. The *Corn Nitrogen Rate Calculator* was updated this summer with Iowa data from N rate trials conducted in 2007. Based on that dataset, the suggested N rates and rate ranges for four N:corn price ratios are listed in Table 1 and shown in Figure 5. The advantage of the calculator is that specific N and corn prices can be compared. The output from the calculator gives suggested N rate ranges that provide similar profitable return. With high N costs, high production costs, and perhaps the need to allocate limited funds for N fertilizer purchase, one can consider using rates in the lower part of the range. Those rates should provide similar yields, but risk of N supply shortage to the crop is greater if N losses occur or if there is greater corn N need. The rates suggested from the *Corn Nitrogen Rate Calculator* are the same whether N is applied in late fall, spring, or sidedress, therefore do not decrease the rate for sidedress application timing. Fall application carries more risk of loss, however, that risk cannot be predicted and it is not appropriate to guess and just increase the rate in an attempt to cover potential losses. When N is expensive, applications above Maximum Return to N (MRTN) result in large economic losses. This can be seen in graphs produced from the *Corn Nitrogen Rate Calculator* (Figure 5).

If possible, grow more corn after soybean than after corn. Yields will typically be higher with the rotation and N application need lower (Figures 3 and 4). If fall fertilization is considered, apply only anhydrous ammonia and wait until soils are cold and remain so, less than 50ºF and cooling (the colder the better), which usually means waiting to apply until mid- to early November. Good application timing helps reduce N loss and allows the best yield return from applied N. Typically best efficiency is obtained with spring or split spring/sidedress application. Having plant-available N in the root zone is important for good early corn growth, and especially for corn following corn.

Resources

The above mentioned publications, as well as other nutrient management information, are available on the ISU Agronomy Extension Soil Fertility Web site.
http://www.agronext.iastate.edu/soilfertility/homepage.html
http://extension.agron.iastate.edu/soilfertility/nrate.aspx

http://www.extension.iastate.edu/Publications/PM287.pdf
http://www.extension.umn.edu/distribution/cropsystems/DC7647.html
http://www.extension.iastate.edu/Publications/PM1688.pdf
http://www.extension.iastate.edu/Publications/PM2015.pdf

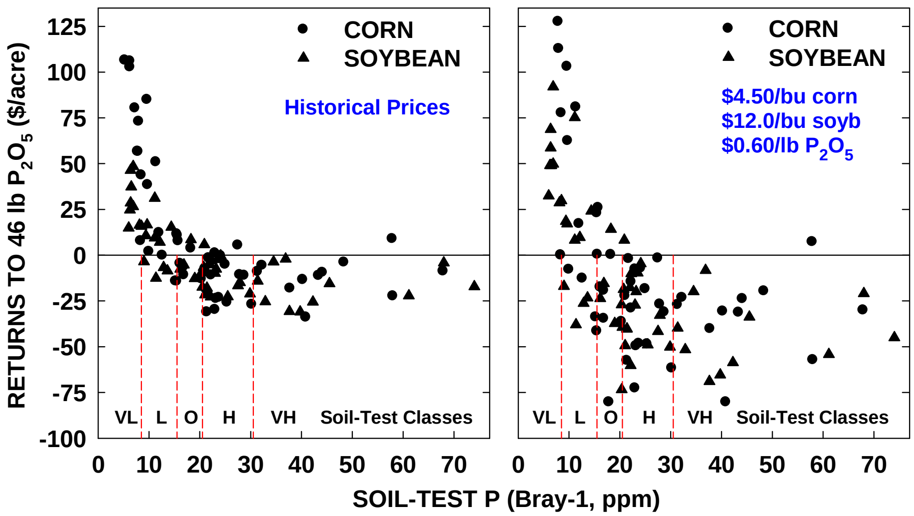

Figure 1. Net return to P application at different soil test levels and crop/fertilizer prices, Antonio P. Mallarino.

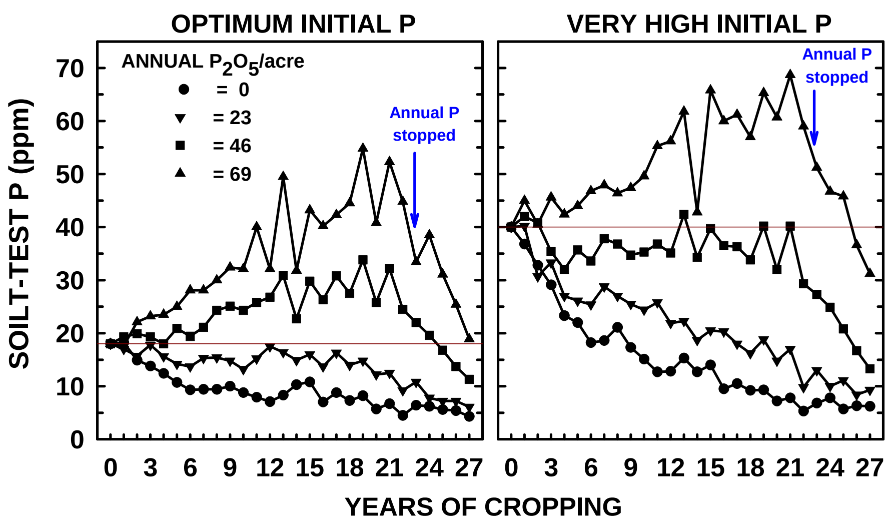

Figure 2. Change in soil test over time with different beginning soil test level and rates of applied P, Antonio P. Mallarino.

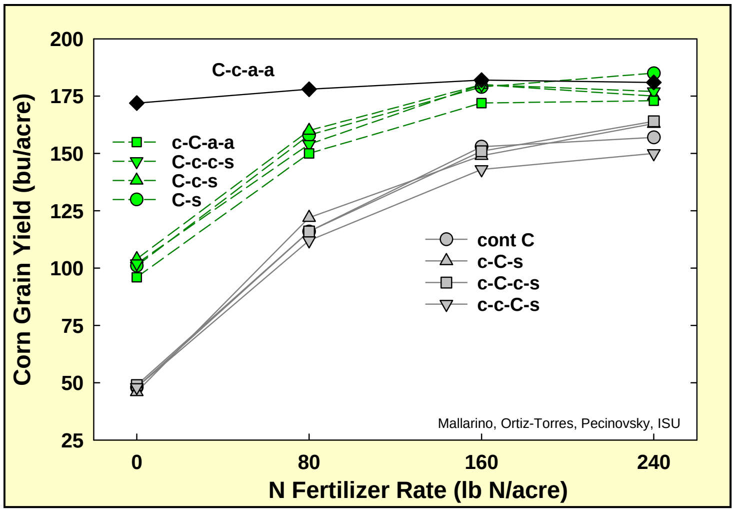

Figure 3. Corn grain yield response to fertilizer N application rate across time with various corn rotation sequences, Northeast Research Farm at Nashua, IA.

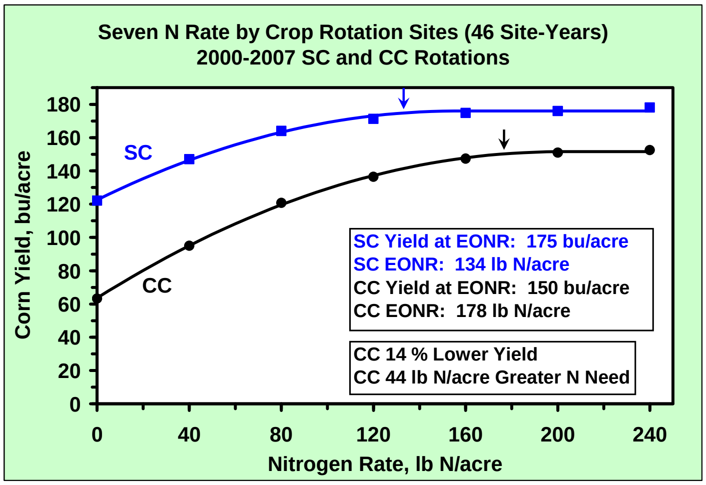

Figure 4. Direct comparison of corn grain yield response to N fertilizer rate for corn following soybean (SC) and continuous corn (CC) across seven sites in Iowa, John Sawyer and Daniel Barker.

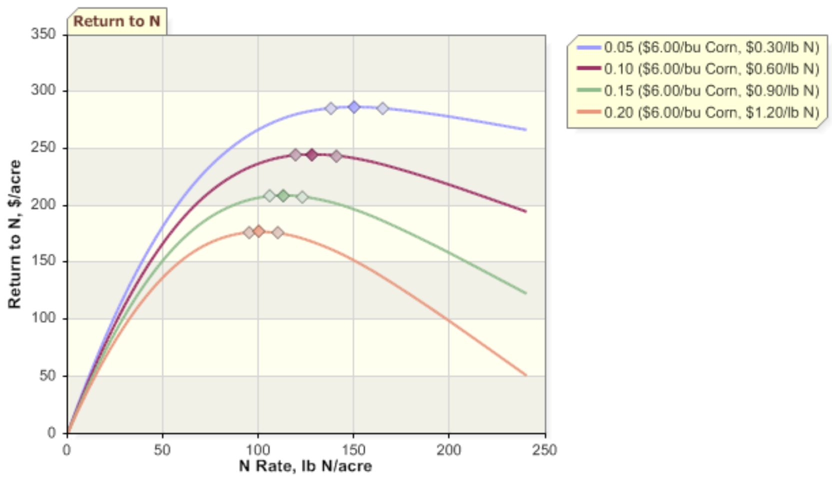

Figure 5. Effect of N:corn grain price ratio on return to N application with corn following soybean, based on the current Corn Nitrogen Rate Calculator dataset.

Table 1. Nitrogen rates suggested for corn following soybean and continuous corn based on the current Corn Nitrogen Rate Calculator dataset.

Nitrogen rate guidelines in Iowa for different N and corn grain prices.				
Price	Corn Following Soybean		Corn Following Corn	
Ratio[1]	Rate[2]	Range[3]	Rate[2]	Range[3]
$/lb:$/bu	- - - - - - - - - - - - - - - - - - lb N/acre - - - - - - - - - - - - - - - - - -			
0.05	150	138 - 164	209	196 - 234
0.10	128	117 - 140	183	173 - 197
0.15	113	104 - 123	163	152 - 176
0.20	100	92 - 110	147	138 - 157

[1] Price per lb N divided by the expected corn price. For this table, corn was held at $6.00/bu and N varied from $0.30, $0.60, $0.90 to $1.20/lb N (for example, anhydrous ammonia at $492, $984, $1476, to $1968/ton).

[2] Rate is the lb N/acre that provides the Maximum Return To N (MRTN). All rates are based on results from the Corn N Rate Calculator as of July 1, 2008 (http://extension.agron.iastate.edu/soilfertility/nrate.aspx).

[3] Range is the range of profitable N rates that provides a similar economic return to N (within $1.00/acre of the MRTN).