Getting the Most From Your Fertilizer Dollar

Summarized by Greg LaBarge, Extension Educator, Ag /NR Fulton County
(419)-337-9210 labarge.1@osu.edu

It is no secret that fertilizer prices have risen dramatically and many growers are trying to maximize their fertilizer investment. The information presented in this article is a summary of current information available from Ohio State University publications on fertility and look a overall applications of lime and the macro nutrients N, P, and K. Several valuable fertility management tools and more in-depth information on topics included here can be found at: http://agcrops.osu.edu/fertility/

Considerations for Lime

The focus of bringing pH in line first is a sound strategy. Soil nutrient availability and other soil processes are affected when pH is too acidic or too alkaline. Many of the practices and processes related to agriculture lower acidity. Decomposing organic matter and nitrogen sources such as anhydrous ammonia both are among the ways that more pH is added to the soil and will move pH toward the acidic side (<7.0). Buffer pH or the lime test index from the soil test report is used to make a lime recommendation for most Ohio soils. The exception is sandy soils which are viewed differently and discussed later in this article. Table 1, below, in combination with soil test results can be used to develop lime recommendations.

Table 1. Lime recommendations at various lime test indexes or buffer pH soil test levels and desired pH levels after lime application.

		Desired pH		
Lime Test Index (LTI)	**Buffer pH**	**6.8**	**6.5**	**6.0**
		Tons ag limestone needed per acre for desired pH *		
68	6.8	0.9	0.8	0.7
67	6.7	1.6	1.4	1.1
66	6.6	2.2	2.0	1.6
65	6.5	2.9	2.5	2.0
64	6.4	3.6	3.1	2.5

* based on limestone with ENP of 2000 lbs/ton.

Adjustment for tillage depth – Table 1 provides the basic lime recommendation to correct pH to the desired level when soils are tilled to an 8 inch depth. Application rates can be adjusted when tillage depth is less than 8 inches. At a 3 inch tillage depth, multiply the recommendation by 0.38, for a 6 inch depth multiply by 0.75 or for a 7 inch depth multiply by 0.88.

Sandy soil exception to buffer pH or LTI – For sandy soils (a CEC less than 10) the water pH should be used for lime recommendations. Soil test results from these soils will often have a

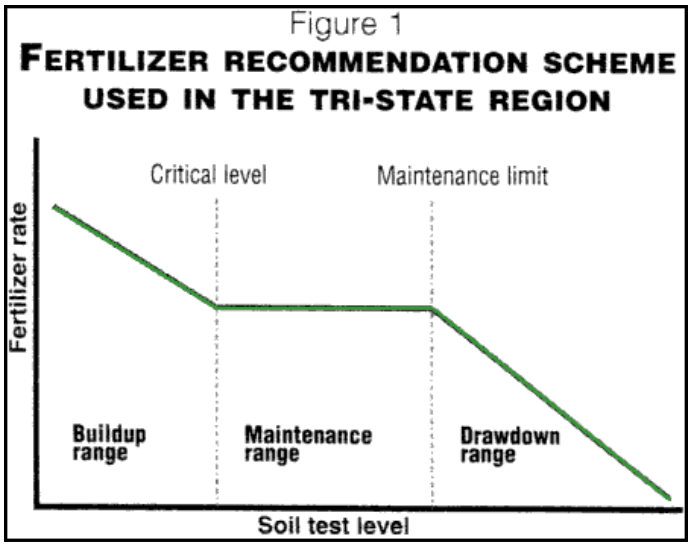
buffer pH of 69 and a water pH of 6.1. Because of the weak buffering capacity, these soils should be limed when the pH is below the desired level. For each 0.3 unit increase in pH desired, 1 ton of lime should be added up to a maximum of 2 tons total. For example, with a water pH of 6.1, to get to a desired pH of 6.7, we would add 2 tons of lime.

Liming materials – There are a variety of liming materials available. Fortunately, any material sold in Ohio as a liming material must be tested and the supplier provides a reported "Effective Neutralizing Power" in units of pounds per ton. This allows farmers to quickly compare alternative sources on a cost basis. For example, if a lime recommendation is 2.0 tons per acre and two sources are offered, with ag limestone (with an ENP of 2000 lbs/ton) at $28 per ton and wastewater lime (with an ENP of 530 lbs/ton) at $8 per ton, we can determine the cheapest source. We would need 2 tons of the ag lime stone (lime recommendation/ENP=needed product) 4000/2000 = 2 tons or $56 per acre. The wastewater lime cost would be 4000/530 = 7.5 tons or a cost of $60 per acre.

For more information on liming and liming materials, refer to *Soil Acidity and Liming for Agronomic Production*– AGF505-07 found at http://agcrops.osu.edu/fertility/documents/AGF505.pdf and the *Ohio Agronomy Guide 14th Edition* - Section 3 - Fertility, at http://ohioline.osu.edu/b472/0004.htm. The Lime Recommendation Calculator is a spreadsheet which provides lime recommendations and allows cost comparison of sources based on ENP and can be found at: http://agcrops.osu.edu/fertility/documents/pH_lime_rec_spreadsheet_000.xls .

Phosphorous and Potassium

The Tri-State Fertilizer Guide continues to be the basis for fertilizer recommendations in Ohio. Many of you are aware of the recommendation scheme used. But the interpretation of the three ranges, plus Critical Level and Maintenance Limit is worth review for a meaningful discussion of prioritizing soils based on expected yield response to phosphorous and potassium fertilization.



Maintenance Range - Medium priority area for fertilizer application

Maintenance range is where crop removal rates of P and K fertilization are recommended to maintain soil test levels. In this range, a lack of additional fertilizer will pull down soil test levels but crop yield would not be limited. Soil near the Critical Level may require some fertilization (starter or broadcast) due to the spatial difference in fertility levels which are not seen by soil sampling. The long run implication of no fertilizer is to pull soil test levels down to the Critical Level where soil fertility could become yield limiting. With a strategy of not applying fertilizer to soils with fertilizer levels in the maintenance range, more frequent soil testing would be suggested to monitor drawdown. The next available fertilizer dollar would be used to maintain soil test levels in this range. Soils in the maintenance range are not likely to see yield improvements from starter

fertilizers.

Maintenance Limit
The Maintenance limit is the other side of the Critical limit. Soil tests at or above this point are not yield limiting from a fertility standpoint. The phosphorous maintenance limit for corn/soybeans is 40 ppm and for wheat/alfalfa is 50 ppm. The potassium critical level is the same for all crops but varies by CEC (Cation Exchange Capacity). For all crops, K critical is (CEC 5) = 138 ppm, (CEC 10) =150 ppm, (CEC 20) = 175 ppm, (CEC 30) = 200 ppm. Multiply ppm by 2 for equivalent critical levels in pounds per acre.

Draw-Down Range - Lowest priority area for fertilizer dollars
Draw-down range is soil test levels above the Maintenance limit. Fertilizer recommendations are made to slow the drawdown of nutrient levels and quickly become 0 as soil test levels increase. Soils above this range number would be of the lowest priority for fertilizer dollars.

How quickly will soil tests drop when no fertilizer is applied?
Soil test levels decrease gradually in most soils. P soil test levels tend to drop 1 ppm for every 20 pounds of P_2O_5 per acre of removal. K soil test drops are CEC dependent. K soil test levels will drop 1 ppm for every 8 pounds of K_2O removed per acre with a 20 CEC soil. K soil test levels will drop 1 ppm for every 5 pounds of K_2O removed per acre with a 5 CEC soil. A very good discussion of the effects of no fertilizer applications on soil test levels can be found at http://extension.entm.purdue.edu/pestcrop/2008/issue24/index.html.

Critical Level
The Critical Level is a number which varies by crop. If a soil test report shows soils with a P or K number below this critical level number, we have a very good chance of increasing yield with a fertilizer application. It could also be stated that the chance of having P or K be a yield limiting factor increases at these low soil test levels. The phosphorous critical level for corn/soybeans is 15 ppm or 30 lbs/acre and for wheat/alfalfa is 25 ppm or 50 lbs/acre. The potassium critical level is the same for all crops but varies by CEC (Cation Exchange Capacity). For all crops K critical is (CEC 5) = 88 ppm, (CEC 10) = 100 ppm, (CEC 20) =125 ppm, (CEC 30) = 150 ppm. Multiply ppm by 2 for equivalent critical level in pounds per acre.

Buildup range – Highest priority area for fertilizer application
Fields or areas of fields below the critical level would be the first areas to spend fertilizer dollars on. The Tristate recommendations build up soil test levels into the Maintenance range with 4 years of application at recommended rates. A decision could be made to just apply a maintenance level of fertility with soils in this range and delay the soil buildup. Broadcast fertilizers can be used as well, but rates should minimally be at a crop removal rate. In many cases, fertilizer dollars can still be saved by banding fertilizers in these soils. Banding reduces fertilizer tie up or binding by low test soils keeping more fertilizer available for plant uptake. Starter fertilizers may be of the greatest benefit with soils in this range.

Table 2 on the next page shows soil sample results from four NW Ohio fields and fertilizer recommendation for those fields.

Table 2. Fertility Recommendation for corn on four NW fields. Actual samples taken in various soil types in Fulton County, Ohio.				
	Field 1	Field 2	Field 3	Field 4
Soil Test Results				
pH	5.4	6.5	6.5	5.9
Buffer pH	6.7	6.9	6.8	6.7
CEC	8.1	14.2	19.0	16.1
P ppm (Bray 1)	92	98	12	3
K ppm	172	291	196	84
Yield Goal				
Corn bu/A	140	185	185	175
Fertilizer Recommendation	—per acre—			
Lime (to 6.5)	3.6 ton*	0	0	2.0 ton
Lbs P_2O_5 per acre	0	0	85 lbs*	125 lbs
Lbs K_2O per acre	0	0		125 lbs
Notes	*Apply 2 tons then test again		* Is the buildup rate	
Source and Cost	—cost per acre—			
Lime $28 per ton	$56	$0	$0	$56
11-52-0 $1120 per ton or $1.08 per pound	$0	$0	$92 (163 lbs of 11-52-0)	$135 (240 lbs of 11-52-0)
0-0-60 $923 per ton or $0.77	$0	$0	$0	$97 (208 lbs of 0-0-60)
Total cost per acre	$56	$0	$92	$288

Nitrogen Recommendations

Midwest Universities have moved toward economic based Nitrogen recommendation as the price of nitrogen has gone from 12-15 cents per pound up to 75 cents per pound ($200 per ton to $1200 per ton Anhydrous Ammonium. The Universities still have different response curves that are state specific as the basis for the recommendations but all have adopted a similar philosophy of using corn price and nitrogen cost as the basis for nitrogen recommendations. For Ohio a downloadable Excel spreadsheet is available at http://agcrops.osu.edu/fertility/ . As new plot data becomes available it is added to the model so check back frequently to be sure you have the latest update.