Nutrient Rate Management with Limited Dollar Availability.

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High fertilizer prices and grain market volatility, has raised many questions from farmers and agronomists regarding nutrient rate management. Last year the economics of corn, wheat and soybean production were very good. Fertilizer prices were high, but grain prices were at record highs. Now with grain prices down 40-50%, growers are looking at crop budgets and asking the question: What is the right fertility program for my farm? In some situations, farmers may not have the funds to fertilize the crop to optimal levels. Many times given this situation farmers are tempted shift the majority of the fertilizer funds to nitrogen only. If other nutrients are yield limiting, this strategy may reduce yield and profitability. Farmers are looking for help in determining the correct nutrient management strategy. Developing the right nutrient management plan will be challenging this next year. Farmers and agronomists who follow the basics will be the most successful creating a nutrient management plan. When visiting with farmers or agronomist, our approach is to focus on the science of soil fertility and crop production to optimize yield and economic return.

Soil testing is the cornerstone of any fertility program. Soil test results help to estimating the availability of nutrients and the response to applied fertilizer. Having a history of fertility levels of a field can help determine the right rate. It is very important that the soil sample be taken correctly. In order for the sample to be useful, it must be taken so that is representative of the area being sampled. It also must be accurately taken so the test results can be properly interpreted. Soil sampling is the often the weakest link in the recommendation process. Because of the labor involved in sampling, the farmer or the agronomist will take short cuts that limit the usefulness of the sample. One common source of error is the sampling depth. Proper sampling depth for soil pH, organic matter (OM), phosphorus (P), potassium (K) and zinc (Zn) is the surface 6-8 inches since this is the depth that the soil tests were calibrated for in university research. Sampling deeper or shallower than this will provide misleading results. For available nitrogen (N), chloride (Cl) and sulfur (S), samples should be collected to 24 inches since these nutrients are mobile in soils. Figure 1 shows the variation of sampling depth when 100 participants were instructed to take 15 soil cores to a depth of 6 inches. The soils were then collected, weighed, and the percent variation was calculated. The results show a high degree of variability in the samples taken.

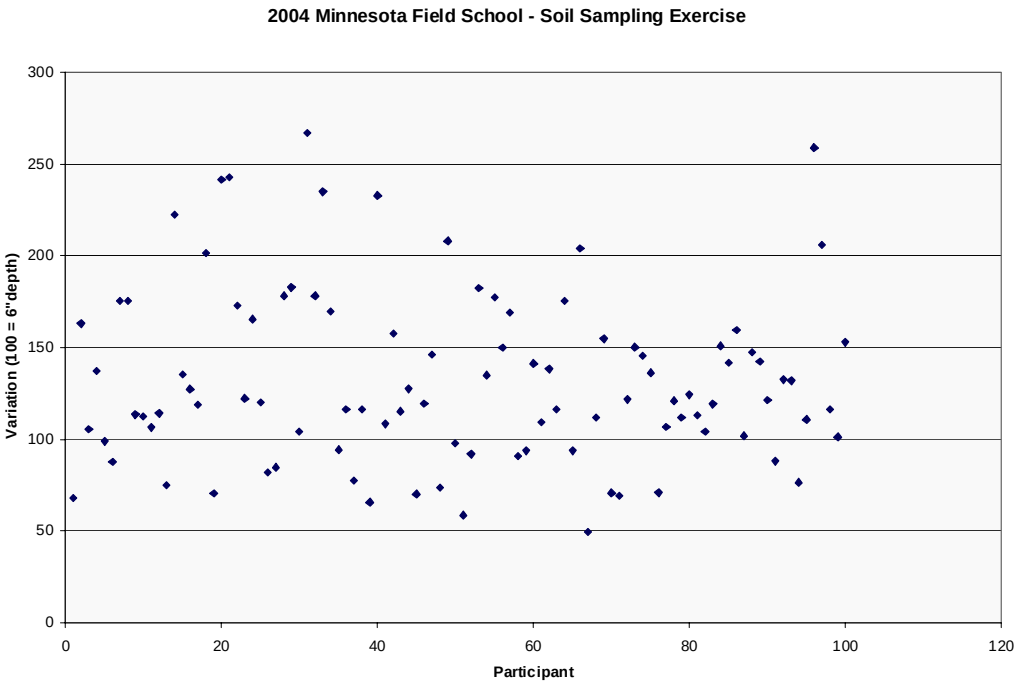

Figure 1. Variation in soil sample weight 15 cores to 6 inches.

Setting a realistic yield goal is important in determining a correct nutrient management plan. Yield goals should be set on a field-by-field basis or for various management zones within a field. There are many opinions on how realistic yield goals should be determined. Some suggest averaging the past five years, excluding atypical low yields caused by factors such as drought or hail, and adding 5-10 percent to account for continuous yield improvement. It is important to have realistic, but aggressive, yield goals.

Another important step is determining the most limiting nutrients. When faced with limited budgets, they are often tempted to spend all of there fertilizer dollars on nitrogen. The farmer may forget that nutrients often interact to produce a greater crop response than if one nutrient was applied alone. If some other nutrient is yield limiting and not going to be applied, the yield goal should be adjusted to optimize the economic response. If the grower has a limited amount to spend on fertilizer inputs, calculating the correct ratio of nutrients can be challenging. One tool that we have been using with growers is a spreadsheet developed by The Mosaic Company. The Fertilizer Economics Decision Support Tool is based on estimated yield response to fertilizer applications at a given soil test using a fertilizer sufficiency type approach (Tables 1 and 2). The user will input estimated yield goal, the soil test levels of P and K, grain price and the cost per unit of fertilizer (Figure 2). The spreadsheet will then calculate the economic optimum rates of N, P and K. If the user has a limited budget for fertilizer, the

total dollars available for fertilizer can be put into the spreadsheet and using an iteration between tables 1 and 2, it will adjust the yield goals and determine the optimum fertilizer rate of N, P and K, given the limited dollars to work with. In grower meetings this is a powerful educational tool to get growers to think about soil test levels, yield goals and the importance of a balanced fertility approach.

If nutrient rates are reduced below optimum, increasing nutrient efficiency is very important. Consideration of nutrient source, placement and potential loss is key in optimizing yield. Placing nutrients close to the growing plants especially with immobile nutrients such as P, K and Zn will be very important if rates and soil test are low. With mobile nutrients, consideration of potential loss should be incorporated into the nutrient management plan. If only a low rate of a needed nutrient on a responsive soil can be afforded, consider banding where the roots can intercept it early in crop development. Using products which stabilize nutrients should also be considered to increase their efficiency.

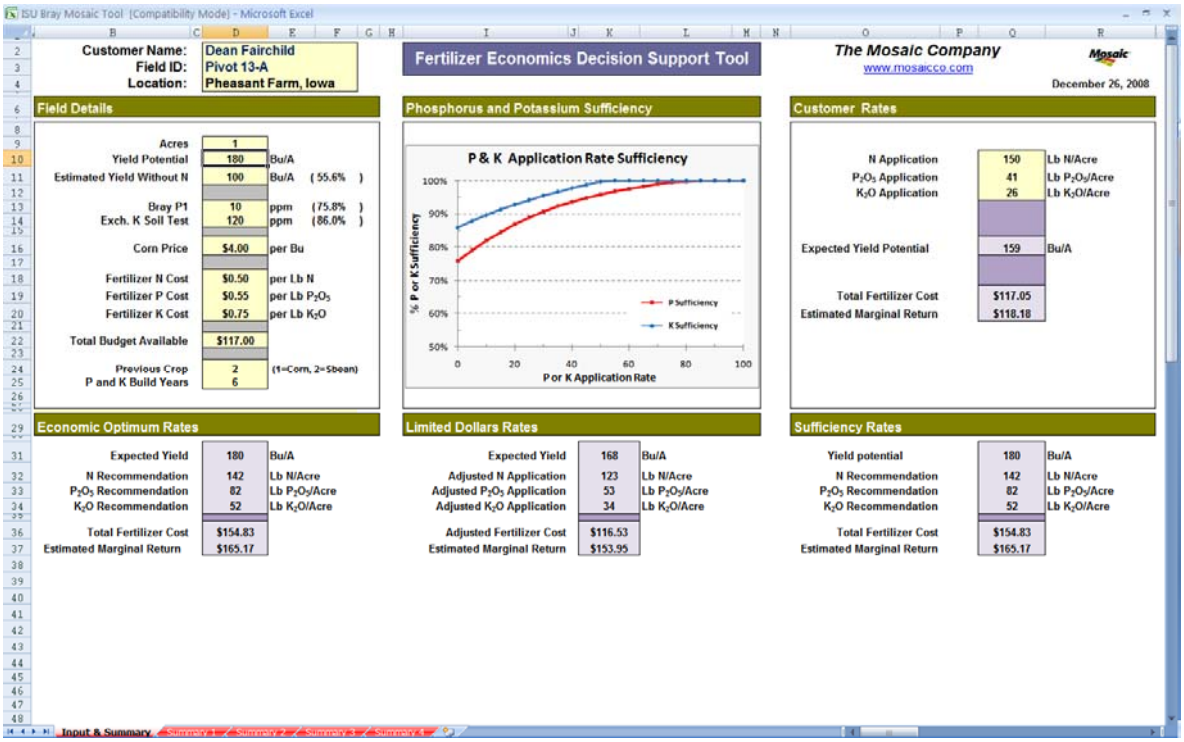

Figure 2. The Mosaic company Fertilizer Economic Decision Support Tool.

Table 1. Estimated yield response to soil test level P and sufficiency P recommendations. The Mosaic Company.

Bray P1 Soil Test (ppm)	Percentage of Maximum Yield	P Recommendations (lb P_2O_5/A) Pounds P_2O_5/A)	
		150 Bu/A	200 Bu/A
0	1.1%	121.0	148.0
1	15.0%	115.5	141.6
2	27.0%	110.2	135.4
3	37.3%	104.9	129.2
4	46.2%	99.8	123.2
5	53.9%	94.7	117.2
6	60.5%	89.8	111.4
7	66.1%	84.9	105.6
8	71.0%	80.1	99.9
9	75.2%	75.5	94.4
10	78.8%	70.9	88.9
11	81.9%	66.4	83.5
12	84.6%	62.0	78.2
13	86.9%	57.8	73.1
14	88.9%	53.6	68.0
15	90.6%	49.5	63.0
16	92.0%	45.5	58.1
17	93.3%	41.6	53.3
18	94.4%	37.8	48.6
19	95.3%	34.1	44.0
20	96.1%	30.6	39.6
21	96.8%	27.1	35.2
22	97.4%	23.7	30.9
23	97.9%	20.4	26.7
24	98.4%	17.2	22.6
25	98.8%	14.1	18.6
26	99.1%	11.0	14.6
27	99.4%	8.1	10.8
28	99.6%	5.3	7.1
29	99.8%	2.6	3.5
30	100.0%	0.0	0.0

Table 2. Estimated yield response to soil test level K and sufficiency K recommendations. The Mosaic Company.

Exch. K Soil Test	Percentage of Maximum Yield	K Recommendations (lb K_2O/A)	
		150 Bu/A	200 Bu/A
0	8.0%	135.0	150.0
10	19.9%	127.2	141.4
20	30.3%	119.4	132.9
30	39.5%	111.8	124.6
40	47.6%	104.3	116.3
50	54.8%	96.9	108.2
60	61.1%	89.7	100.2
70	66.7%	82.5	92.3
80	71.6%	75.5	84.5
90	75.9%	68.6	76.8
100	79.7%	61.8	69.3
110	83.0%	55.1	61.8
120	86.0%	48.5	54.5
130	88.6%	42.0	47.3
140	90.9%	35.7	40.2
150	92.9%	29.4	33.2
160	94.7%	23.3	26.3
170	96.3%	17.3	19.6
180	97.7%	11.4	12.9
190	98.9%	5.7	6.4
200	100.0%	0.0	0.0