Wisconsin

Costs Associated with Variable Rate Phosphorus and Potassium Applications

By N.C. Wollenhaupt and R.P. Wolkowski

SOIL SAMPLING, fertilizer application and data management are costs associated with variable rate application of phosphorus (P) and potassium (K) fertilizers. These costs must be subtracted from any change in gross returns attributed to variable rate (VR) fertilizer application in order to evaluate VR profitability.

Initial grid soil sampling is a substantial cost associated with site-specific fertilizer management. Grid soil sampling studies conducted in Wisconsin show that soil test map accuracy depends on sampling method and sampling density. Soil sampling points in a field on a systematic grid improve mapping accuracy over sampling cell areas on a grid. Increasing the number of sample points also improves mapping precision.

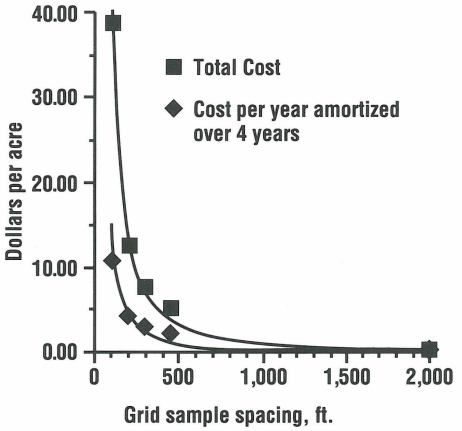

Figure 1. Costs associated with variable rate P and K applications. Soil sampling and soil testing costs increase with a decrease in grid spacing.

The costs in **Table 1** are based on the authors' experiences and limited data shared by fertilizer and fertilizer equipment dealers. Labor was billed at $25.00 per hour and soil testing at $6.00 per soil sample. Our goal was to develop a cost estimate that included a profit margin for the fertilizer dealer and/or crop consul-

Table 1. Variable-rate soil sampling, fertilizer application, and data management costs.[1]

	Grid spacing			
	450 ft. (=5 acres)	300 ft. (=2 acres)	200 ft. (=1 acre)	100 ft. (=0.25 acre)
	$/acre			
Sampling				
2 hr (20 samples)	$1.70	–	–	–
5.7 hr (48 samples)	–	$4.29	–	–
10.9 hr (106 samples)	–	–	$9.09	–
36 hr (436 samples)	–	–	–	$35.16
Data summary and mapping	$2.00	$2.00	$2.00	$ 2.00
Fertilizer application (additional variable-rate charge)	$1.50	$1.50	$1.50	$ 1.50
Total Cost	$5.20	$7.79	$12.59	$38.66

[1] 100-acre field with labor @ $25.00/hr and soil testing @ $6.00/soil sample

The authors are with the Department of Soil Science, University of Wisconsin, Madison.

tant, and soil testing laboratory. Note the fertilizer application charge is annual and represents the additional charge for variable rate application versus use of a single rate applicator.

Costs associated with variable rate P and K applications increase rapidly at grid spacings smaller than 200 feet **(Figure 1)**. The costs are easier to accept if they are amortized over a period of four years or longer. We speculate that intense (expensive) grid sampling is required only once if soil test information, fertilizer applications, and crop removals (yield) are georeferenced so that a nutrient balance budget can be maintained. Additional soil sampling at a later date may be needed in fields with contrasting soil types (textures) where the general fertilizer response function may not apply equally well to all soil types or to spot check for changes in soil test levels.

One cost not shown is mis-application of fertilizer based on random soil sampling which can lead to an incorrect map of soil test variability. We have observed yield and income losses when soils were classified as not needing additional fertilizer when in fact they were nutrient deficient. Any assessment of the profitability of variable rate fertilizer application must also include an evaluation of the effects of soil test map accuracy. ■

Grid Soil Sampling . . . from page 7

of cells, this time keeping the Y coordinate the same, but changing the X coordinate in each successively lower coarse cell.

- The remaining positions are determined by the X coordinate of the point in the left-hand square of its row and the Y coordinate of the point in the uppermost square of its column.

With this procedure a constant interval both along the rows and down the columns is maintained without alignment. A more complete discussion on sampling and estimation can be found in the reference by R. Webster and M. A. Oliver cited on page 7. ■

Note: Soil sampling for variable rate application is different from soil sampling to determine the field average for a single rate application. Many Extension soil sampling guidelines for field-average recommendations call for dividing fields into smaller areas (five acres according to UW recommendations), but it is recommended that the soil cores within small areas be collected while walking a zigzag pattern across each area. The intent is to obtain a representative soil sample which averages out soil test variability within each small field area. An average or median value is calculated from the multiple soil test results to arrive at a single rate fertilizer application for the field.

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