ANALYZING SITE-SPECIFIC SOIL TEST DATA TO HELP FARMERS MAKE MANAGEMENT DECISIONS

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Introduction

To date, site-specific soil test data are commonly used to create variable rate nutrient application maps. Phosphorus (P), potassium (K), and lime are among the inputs varied. Placing nutrients and liming materials more precisely within the field has brought value to site-specific soil test data. However, once a particular data set is replaced with more recent results, it is often perceived that the older set of data no longer has any value. To the contrary, historical soil test data have much to offer.

Our current approaches to managing P, K, and lime are not exact. Soil sampling, soil testing, product applications, and nutrient recommendations all have margins of error. Many recommendations base rates on expected yields, which can differ markedly from yields attained. In addition, field average yield goals are commonly used when creating variable nutrient application maps. Consequently, what actually happened in a given year and in a given location (yield levels, crop response, etc.) can vary from what was planned. It therefore becomes important to look back and evaluate if progress is being made toward meeting the original management objectives. Examining how soil test levels have been changing over time is an important part of this evaluation and makes appropriate use of soil test data sets.

The collection of two or more samples per field allows us to answer at least two basic questions:

1) How has the overall fertility of the field been changing?
2) How has soil test variability been changing?

Answering both of these questions is basic to making future management decisions. We created a training module entitled “Finding Trends in Soil Test Data” that demonstrates how to calculate an indicator of the overall fertility level of the field (median) as well as an indicator of variability (coefficient of variation, CV). Techniques are also described for visualizing the distribution of soil tests (histograms). The module can be downloaded from the web at the following address: www.farmresearch.com. This module contains step-by-step instructions for performing these calculations in Microsoft Excel. The types of analyses taught in the module are discussed below.

Production Example

A field was chosen that had been subdivided into 14 management zones based upon soil mapping units and agronomic experience. Each soil core comprising a composite sample was geo-referenced. Each sampling period, cores were taken from approximately the same area, using GPS guidance. Approximately 15-30 soil cores were taken from representative areas within each management zone. Three sampling periods were analyzed.

Figure 1 shows how the median soil test K level changed. There was a trend toward overall lower soil test K levels over time. Soil test variability, as indicated by the CV, increased in the second period then fell off sharply during the last one.

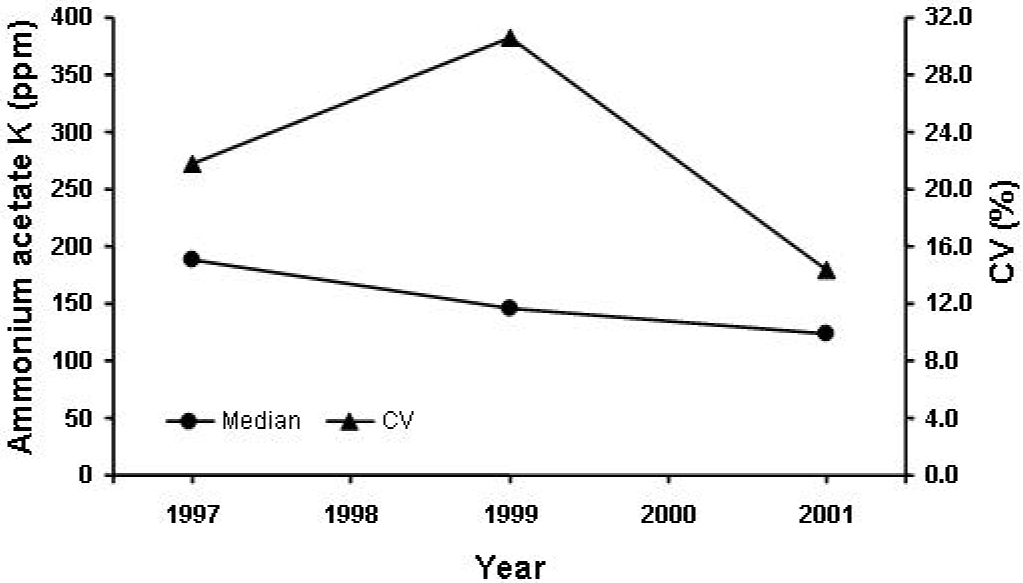

Figure 1. Trends in overall soil test K levels (median) and variability (CV) during a 3-yr period.

Insight into these changes can be gained by looking at the histograms for each sampling year (**Figure 2**). The 1995 histogram shows soil tests were distributed among 6 categories, with 44.4% testing 176-200 ppm. In 1997, soil tests fell into 7 categories with 50% testing 126-150 ppm. In the third year, soil test were distributed among only 4 categories, with 50% testing 101-125 ppm.

Whenever analyses like these are conducted, it is important to remember that the results are only as good as the data going into them. Careful attention must be given to sampling technique and sample handling. A quality lab must be selected for analyses. Enough samples need to be taken to make the histograms and statistical parameters meaningful. As more samples are taken, parameter estimates improve. Recording soil conditions when samples were taken may also prove useful when making sense of trends. A careful and conscientious approach to soil collection and analyses is the first step toward helping farmers make better management decisions.

An important component of trend analysis is determining if the patterns discovered represent true changes or just random events. A future training module is planned to help users determine the statistical significance of the trends they discover.

When these data were presented to a test group of farmers, feedback was very positive. They felt that these analyses were meaningful and understandable. Many of the farmers reinforced the importance of fertility and the need to ensure that this aspect of their management received due attention. The analyses encouraged more farmers to either collect site-specific information or stay in a site-specific nutrient management program.

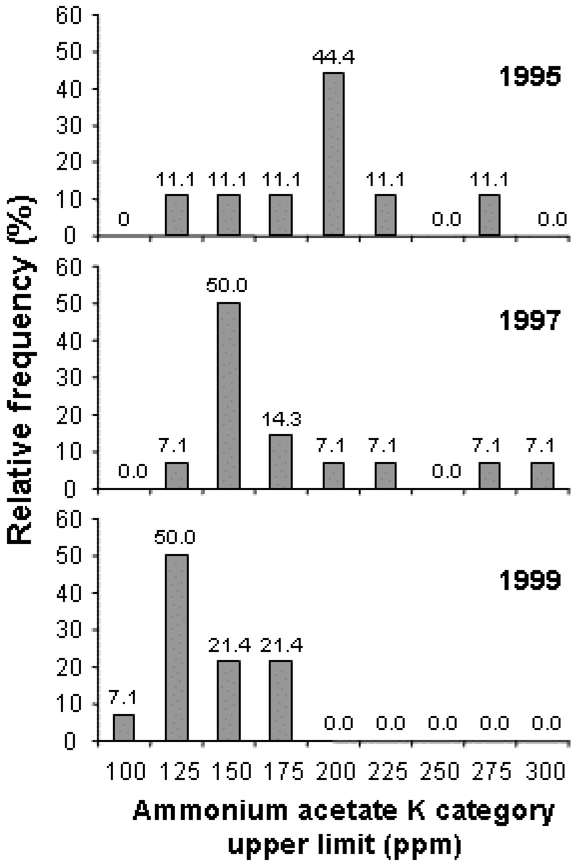

Figure 2. Histograms of soil test K levels for each sampling period.

Summary

We developed a training module that guides users through the steps necessary to determine how soil test levels have been changing over time. Users use Microsoft Excel to calculate indicators of overall fertility levels (median) and the degree of soil test variability (coefficient of variation). They learn how to graph these indicators over time to see if any trends exist. Also taught is the creation of histograms that allow users to visualize soil test distributions and how they change with time.

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