SOIL AND PETIOLE NUTRIENT MONITORING

BY

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Soil and plant analysis have proven valuable tools in nutrient management over the years. Much progress has been made to standardize procedures and promote precision and uniformity among laboratories. However, there is that occasional report you receive from the laboratory that is not exactly what you were expecting. "Laboratory error" is usually the first pronouncement; however, it is seldom the actual cause. The most common sources of perceived "error" in soil and plant test results are field variability, sample contamination and sampling the wrong plant part.

Soil chemical and physical properties vary significantly in space. If insufficient sample numbers are collected, the mean nutrient level of the entire field will not be accurately estimated. It is essential, therefore, that a large enough number of samples be collected. For single composite samples for a typical circle, it is recommended that a minimum of 25 individual sub samples be collected. Non-uniform application of irrigation water is a significant source of variation that should be considered when sampling. Water management is always an essential part of nutrient management in irrigated agriculture. Water application needs to be managed to match crop needs. Irrigation systems should be maintained properly so that they will apply the water uniformly.

An alternative approach to managing field variability is to gather information about the aerial imaging or possibly yield mapping. Sub-regions, or sample units, can usually be identified using these technologies. Subsequent samples can then be collected within each sample unit to minimize variation.

Another source of perceived "error" can arise from sample handling. In both soil and plant sampling it is essential to keep containers and equipment clean and free from contamination. Be sure to mix sub-samples thoroughly and fill out all necessary paperwork accurately. Keep samples cool and deliver to the laboratory as quickly as possible. Nitrate and other nutrient levels in petioles change with time of day. It is best to set up a routine so that at each sampling each field is sampled at approximately the same time of day.

Dr. D. T. Westermann, S.M. Bosma, and M. A. Kay in a recent publication summarized the issues of potato petiole sampling for nutrient analysis quite well as follows:

"Successfully evaluating the nutritional status of a crop during growth and development is dependent upon sampling and identifiable plant part. **Consistently sampling a petiole of the same maturity in potatoes (Solanum tuberosum L.) is difficult...**Accurate sampling techniques, analytical methods and interpretations based on research results are required for any diagnostic test to be effective...Samples must represent the whole plant and the sampling area. A specific plant part is generally used because its nutrient concentration reflects the nutrient available to the plant from soil and fertilizer sources. The nutrient concentration in the plant part must also relate to crop growth and yield up to a "critical concentration," reflecting the nutrient's metabolic relationships in the plant." (Westermann, et al 1994)

The same paper reports how significant concentration gradients exist with petiole and leaf position for various plant nutrients. Nitrate-nitrogen, potassium, and manganese increase in concentration from the top petiole downward. Phosphorus and manganese concentrations were reversed. They decrease in concentration from the top petiole downward. Higher nutrient availabilities to the plant create greater concentration gradients.

These differences cause interpretation problems with petiole analyses, especially when the calibrations for the fourth petiole are used for samples containing significant portions of petioles from other positions. The most recently matured leaf from the growing tip is generally considered the fourth petiole.

Many popular and often used reference publications stress the importance of sampling the fourth petiole. Yet these same publications are not all consistent in the way they define and depict the fourth petiole. The fourth petiole in one publication may be the second, third, fourth, fifth, sixth, or seventh petiole in another publication. This is the source of much confusion.

Partly due to this confusion younger or older petioles are selected for analyses. This is not a serious problem if one consistently samples a younger or older petiole and then properly adjusts and calibrates the nutrients relationships for the particular part sampled. The problem is this is often a neglected and imprecise endeavor.

References

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Figures

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