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Soil Fertility Fact Sheet

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Environmental concerns over nitrate contamination of ground water, and the desire of land managers to increase the efficiency of their fertilizer investment, can both be satisfied more completely through diagnostic testing for nitrogen (N) soil fertility. The soil sampling and analytical procedures, and soil test N interpretation for different crops, have been available for some time. However, the practice of N soil testing is not widely applied. The purpose of this fact sheet is to explain the strengths and weaknesses of diagnostic soil N testing and to show how it may be used to advantage in many agricultural situations.

What is Diagnostic Soil Testing?

Diagnostic soil testing consists of three distinct phases: (a) Soil sample collection in the field, (b) soil analysis in the laboratory, and (c) interpretation of the soil test result for specific crop and soil situations. It cannot be over emphasized that, if the soil sample does not truly represent the field being tested, the laboratory test may be useless or even misleading. Therefore, soil sampling technique is of prime importance.

Nitrate-N is mobile in soil, moving with soil water. Soil testing for N is therefore based on the amount of nitrate-N in the crop root zone, requiring samples from the subsoil. This is in contrast with diagnostic testing for phosphorus (P) and potassium (K), nutrients that are immobile in sol, that require only a sample of the surface 8 to 10 inches of soil.

Research under Utah irrigated conditions has shown that analysis of the surface soil layer is very poorly correlated with fertilizer N needs. By contrast, analysis of the second and third foot depths is highly correlated with soil and crop nitrogen needs. The most efficient diagnostic soil sampling and testing program is one based on the analysis of the surface foot for nitrate-N, P and K. Then analyze the second and third foot depths for nitrate-N only. Add the measured nitrate-N for all depths analyzed. This total is the soil test N index upon which N fertilizer recommendations are based.

Obviously, the need to sample subsoil is an important deterrent to diagnostic N soil testing. Mechanical assistance, in the form of a hydraulic auger mounted on a truck or other vehicle, is needed to facilitate the process of field sampling. Farmers would likely subscribe to this service if it were made available in a timely and economical basis.

The diagnostic N soil test is recommended for field corn, both silage and grain, for fall and spring wheat and barley.

Limitations of the Diagnostic N Test

Sampling and analysis for soil fertility N should be done in the spring since winter rain and snowmelt will likely redistribute the nitrates in the soil, tending to nullify a fall soil sample. Also, the diagnostic N test does not function if there are large amounts of organic N that will be mineralized during the growing season. This includes (a) alfalfa as the preceding crop, and (b) manure applied the previous fall or the current spring. Diagnostic soil test N is based only on nitrate-N in the root zone.

Summary

Diagnostic testing for nitrogen soil fertility can provide a very effective guide to nitrogen fertilizer management. Diagnostic N testing requires sampling of the subsoil, at least to the third foot depth. The soil test N index is the total of nitrate-nitrogen from the surface layer to the depth sampled. If properly sampled, this soil test N index can minimize the risk of nitrate movement to ground water and also optimizing the nitrogen fertilizer investment.

Diagnostic N testing is not effective if alfalfa was the preceding crop or if manure was applied the previous fall or the current spring.

For further information see Chapter 2 “Soil Sampling” and Chapter 3 “Field Crops” in the Utah Fertilizer Guide, AG 431.