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Be Cautious When Interpreting Early Fall Soil-Test Results

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Be Cautious When Interpreting Early Fall Soil-Test Results

Abstract

In most Iowa regions, early fall has been characterized by exceptionally dry conditions due to low rainfall in late summer and early fall, especially since corn and soybean physiological maturity. This may affect quality of soil samples and soil-test results.

Keywords

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Be Cautious When Interpreting Early Fall Soil-Test Results

By Antonio P. Mallarino, Department of Agronomy

In most Iowa regions, early fall has been characterized by exceptionally dry conditions due to low rainfall in late summer and early fall, especially since corn and soybean physiological maturity. This may affect quality of soil samples and soil-test results.

Soil sampling issues

Sampling under very dry conditions may increase soil sampling error because it is more difficult to control sampling depth and proper soil core collection. This may be a problem for P and K due to nutrient stratification, which usually is more pronounced in reduced till, no-till and pastures. Both P and K tend to concentrate at or near the soil surface and therefore, the depth control for core collection is very important. Also, when the top inch of soil is very dry and powdery it is very easy to lose this soil portion, which will affect the soil-test result significantly.

Soil-test results issues

Very dry soil conditions may result in more acidic soil pH. Differences from 0.1 to 0.3 pH units are common with very dry conditions. This is because small concentrations of cations or soluble salts present in the soil solution are not leached by rainfall or are not retained by soil particles, which result in higher hydrogen concentration in the soil solution.

Short-term nutrient recycling from plant residues and the equilibrium between soil nutrient pools also may be affected by rainfall, especially for potassium (K). Potassium is present in the soil in water-soluble, easily exchangeable and slowly exchangeable forms, and in mineral (unavailable) K form. Potassium in fertilizer and manure sources is water soluble and application quickly increases the solution and exchangeable K pools, which are readily available for crops. Potassium in plant tissue also is soluble in water, because little or no K combines in organic compounds.

Re-distribution of K among soil pools occurs as K is added to soil with fertilizer, manure or crop residues. Plants take up K from soil solution, which is readily replenished by the easily exchangeable soil K fraction. In moist soils, some slowly exchangeable K can become exchangeable when easily exchangeable K is depleted by plant uptake or leaching. With dry soil at the end of the growing season, this replenishment of the solution and easily exchangeable K fractions, which is what soil tests measure, is limited or does not occur. These processes also occur for phosphorus (P), but to a much lesser extent and through completely different mechanisms.

Therefore, knowing patterns of K release to soil from maturing plants and crop residues could be important to help understand temporal soil-test K variation. Starting in 2009 a project has been focusing on K release from plants and residue in corn and soybean fields. At physiological maturity and at the normal grain harvest time the above-ground portion of plants (grain

and vegetative parts) were sampled, weighed and analyzed for K concentration. After grain harvest, residue left on the ground also was weighed and analyzed for K concentration several times until April of the next year.

Figure 1 summarizes average results for five soybean fields. Available results for two cornfields showed approximately similar trends (not shown). There was a very sharp decrease in the amount of K remaining in vegetative tissue from physiological maturity until harvest. This sharp decrease can be explained by K contained in dropped leaves (which were not collected if they were badly contaminated with soil) and K leaching out of the standing biomass. There was a sharp K decrease in the crop residue from harvest until late fall, and a much smaller decrease in spring. The K content of residue changed little during winter (with snow and frozen ground).

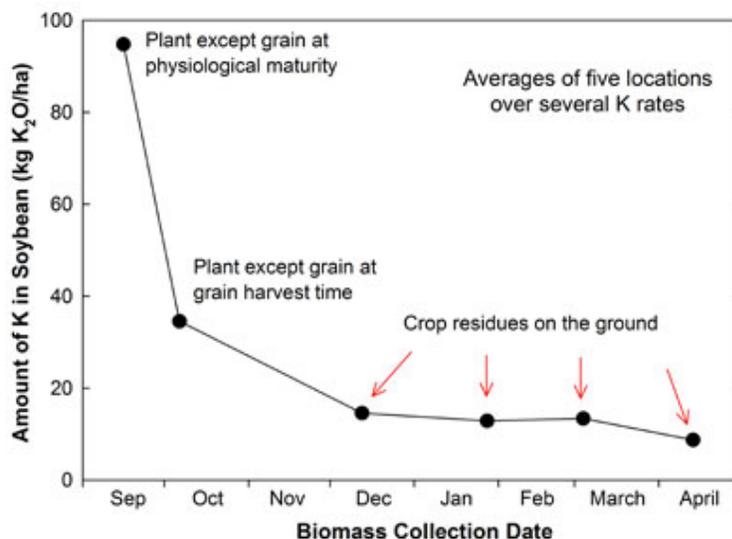


Figure 1. Amount of potassium contained in soybean vegetative plant tissue at physiological maturity (except grain) and in residue from harvest until the following spring.

There was significant variation in patterns of K loss from plant tissue and residue most likely related to rainfall amount and distribution. The study of rainfall patterns along with the K test results has not been completed at this time, and the research continues this year. The preliminary results strongly suggest, however, that with little or no rainfall from crop physiological maturity until soil sampling there is less K recycling from plant tissue and crop residue and lower soil-test K values than with normal rainfall.

Study for P recycling from plant tissue and crop residue began more recently and data are not available at this time. Because most P in plant tissue and crop residues is organic, I don't believe that these processes will be nearly as important as for K.

Soil sampling suggestions

1. Try to delay soil sampling until meaningful rainfall because it will result in a better sample and more reliable soil-test results. At this time it is not possible to say how much rainfall would be helpful, but I believe at least one inch or more.
2. If you have to take soil samples under the current dry conditions:
 - o Be careful with sampling depth control and that you get the complete soil core in the bag.
 - o Soil pH test results may be a bit more acidic than it would in normal conditions.
 - o Soil K test results may be lower than they would be under normal conditions due to less recycling to the soil and less replenishment of soluble or easily exchangeable soil K pools.
 - o Soil P test results probably will be affected little by the recycling issue.

Completion of the ongoing studies have great promise to better understand processes that determine high temporal variation in soil-test results and often poor short-term relationships between soil-test results, crop yield response and nutrient removal with harvest.

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Antonio P. Mallarino is a professor of agronomy with research and extension responsibilities in soil fertility and nutrient management.

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