Soil sampling after a dry season

Soil sampling in the fall, after a dry season should present several economic opportunities, as there may be places where nutrient input dollars can be saved. With current high prices, simply maintaining some application rates will be more costly than normal. So farmers and agronomists will eagerly await results from their fall soil sampling. The following are several things to keep in mind:

Sampling:

1. Conduct standard sampling of the 0-6 inch and 6-24 inch depths. Anytime we have such extreme moisture conditions it is important to "measure", not "estimate" what nutrients are in the soil. Nitrate-N levels may be high in the top 6 inches if fertilizer is stranded there due to lack of incorporating rain, or a lack of root growth in dry surface soil. Hand probes have proven inadequate to penetrate the dry soil, but truck mounted probes are easily able to penetrate a range of clay to sand soils. Savvy samplers often have experience dealing with dry soils and can change probe tips, or techniques to get a suitable sample.
2. Sample cereal fields first and others later. Recent experience has indicated that nitrate-N content tends to stay stable in cereal fields through the fall. This may be due to a balance in microbial activity, where any mineralization of nitrogen is offset by immobilization. However, for legumes (like peas) or oilseeds (canola), nitrogen accumulation tends to occur through the fall. A more appropriate nitrate-N measurement may result from delayed sampling until soils cool to 10^0C. Sampling fields before any tillage ensures better depth of cores and allows identification of problem spots that may warrant specific separate sampling.

What might we expect after a dry growing season?

1. Residual nitrogen (N) will be higher. With lower yields, less nitrogen is removed from the field. And, since nitrogen losses by leaching and denitrification are associated with excessive rainfall, much of the applied N may still be assessable for the following season. Initial summaries of soil testing cereal fields indicates up to 2X the residual N compared to the long-term normal (of 30-45 lb nitrate-N/ac)[1]. Although a quarter of these fields already tested exceed 100 lb N/ac, a high proportion of this sampling is from fields with a history of manure application.
2. Under dry conditions, microbial activity will slow considerably or even cease altogether. Generally, in-season mineralization of soil organic matter can release up to 40 –100 lb N/ac, depending on soil moisture, warmth, and microbial activity. As we receive our first rewetting rains on droughty soil, we sometimes see a burst of nitrate-N as desiccated microbes are consumed by their surviving neighbours. Generally, this burst (called the "Birch effect") is temporary until the nitrogen is immobilized again, and will be minor compared to the residual nitrogen resulting from droughty crops.

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3. Do NOT expect to see much difference in soil phosphorus (P) levels. Although droughty crops may have removed less phosphorus, the applied P fertilizer will have been "fixed" in the soil and show up as only small increases in soil test P. In our Prairie soils, approximately 20-40 lb P_2O_5/ac above crop removal is required to change the Olsen P test by 1 ppm. So expect soil test levels to change slightly, if at all, and phosphorus fertilizer rates should be maintained.
4. Soil potassium (K) levels may be reduced. Under very dry conditions, potassium tends to be trapped between clay sheets and is not as readily available or measurable as in a normal year. As soils rewet, these values will return closer to normal. Similarly, rainfall will wash soluble K out of the crop residue and into the soil.
5. Potassium removal from field to field may vary significantly during dry years, depending on how the crop was harvested. Fields with low grain yields will see low potassium removal; however, fields that were harvested as green feed may see potassium removal up to 150 lb K_2O/ac, as there is no crop residue returned to the field. The impact of high potassium removal on soil tests will vary dramatically depending on the soil type and starting K levels. It generally takes a surplus or deficit of 10 lb K_2O/ac to change the soil test by 1 ppm (exchangeable K). On a clay soil with several hundreds of ppm K, this is rarely observed. However, sandy soils are naturally low in potassium, and will be more affected by high removal rates, especially when done repeatedly. It will be important to recycle potassium back to sandy soils through manure application, or use proper K fertilizer rates.

What to do with results?

After a dry year is the time to exploit those residual nitrogen levels in fields. We have done enough demonstrations and on-farm-tests in the past to verify that the nitrate-N measured by soil testing is there and available. At this point, losses will only be expected if heavy rain and saturated soils occur in the fall or the following spring. With current high fertilizer prices, the soil test may let you reallocate input dollars. While your nitrogen needs may be less, you may be required to invest more in phosphorus fertilizer. If soils test high in nitrogen, target those fields for high N use crops – like canola, corn and wheat. When you add soil test results to your files, or plot the soil test trends, remember to note that it was a dry year. When the next generation farms that land they will be curious about the effects of the drought.

References:

[1] https://www.agvise.com/understanding-high-residual-soil-nitrate-nitrogen-following-drought