THE HANEY SOIL TEST: GOOD FOR WHAT, EXACTLY?

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The Haney (not to be confused with Hagny!) soil test has taken the stage by storm. But how does it work, and are the recs it generates any good?

Traditional soil-N testing in drier regions (roughly less than 20 inches of annual precip) has generally relied on nitrate, either in the topsoil or to a depth of 24 inches, or both. When I make N fertilizer recommendations, I also take into account the previous 2 crops, including how well they grew, and if they had plenty of N or were N-deficient. Of course, essentially everyone I work with is low-disturbance no-till, but if there is tillage involved (even shallow tillage), that changes things.

In wetter regions, soil testing to predict N release for the crop has generally relied on soil OM. The assumption is that much of the current nitrate will leach (or denitrify) before the crop has a chance at it, so we need to predict how much is going to be released from soil OM once the crop is established.

The Haney test (developed by Rick Haney of TX) uses measured nitrate, measured ammoniacal N (ammonium in the soil — either from fertilizer sources or soil OM — that hasn't yet converted to nitrate*), plus an estimate of N to be released from water-soluble organic N during the season. This nitrogen release is calculated based on a 24-hr CO2-burst test to measure soil respiration, water-soluble organic N, and the water-soluble C:N ratio. This organic-N-release component may or may not improve N recommendations — but the only way it could possibly do so is if the test is calibrated to crop responses, which hasn't been done yet.

Whatever soil test we're talking about — standard or Haney — will generate some number, and that number has no meaning until someone figures out what it means (i.e., the likelihood of a fertilizer response at that level, and how much of the fertilizer nutrient is needed to achieve a certain yield level on average). Standard fertilizer lab tests have been calibrated many thousands of times in the field — indeed, each state once had (and a few still have) programs for dozens of calibration trials to be conducted each year. This went on for many decades (SDSU lab alone did thousands of calibrations back in the day, but not many anymore). We know fairly well how to interpret those results, and how reliable they are.

Unfortunately, the Haney test has very little calibration. Or at least not adequately calibrated over the immense geography where it is attempted to be used. One top-notch no-till farmer reports: "We did 700 tests here on my cover-crop research plots and did not have consistent results when we did what they recommended vs other N rates — both higher and lower — all taken to yield and replicated 3 times. They couldn't explain why it was not consistent. Not ready for commercial use yet IMO, unless you are trying to measure soil health parameters."

Additionally, the fertilizer recommendations that Rick uses are often faulty. For instance, he figures that wheat requires 1.2 lbs of N per bushel, whereas most traditional labs figure N

requirement to be 2.2 – 2.4 lbs N per bushel (it varies depending on wheat type and protein goals). And in no-till, because of lower temps and slower mineralization, we often find we need to be at the upper end of this N requirement for wheat. However, Ward Laboratories (Kearney, Neb) has changed their Haney program to use the crop nutrient requirements used with their traditional tests for making recommendations for the Haney test. So at least that problem is fixed, but there's still the elephant in the room of utter lack of calibration.

The original Haney recommendations for P & K also needed to be improved. They weren't calibrated either, and Rick's recommendation calculations didn't take into account basics such as soil depth, according to Ray Ward, PhD and founder of Ward Labs. And, Ward says that Rick doesn't take into account that these are relatively immobile nutrients, so that diffusion rate becomes important. P and K nutrients are relatively immobile (attached to soil particles) with only a few of the ions in soil solution at any given time. As the plant takes up P and K from the soil solution, chemistry tries to move back towards equilibrium, and so more P and K come off the soil particles and into solution. Ward Labs has changed the P and K recommendations to the diffusion principle as has been done with the regular soil testing methods. Ward Labs has added recommendations for sulfur, zinc, copper, manganese and magnesium to the Haney test to make the test more viable. Ward Labs has compared the Haney H3A extract with their standard Mehlich P3; ammonium acetate for K, Ca, Mg, and Na; and DTPA for zinc, iron, manganese and copper. Ward says these have "pretty good correlation on some of the nutrients, especially P and zinc. Manganese is the poorest correlation between the Haney H3A extract and standard DTPA."

Dwayne Beck, PhD (SDSU: Dakota Lakes Research Farm) has deep knowledge of soil testing—he did his PhD work on the topic. Of the Haney test, Beck says, "If it were calibrated, MAYBE it would be okay. But we don't know until the calibration work is done." Beck says, "It's interesting, but don't use it as your only tool to figure out what to apply without testing it extensively against your normal program in replicated strips." Beck says that much of the blame for the stampede to the Haney test lies with a certain gov't agency (which is insisting on, and sometimes paying for the testing, depending on your program), although Haney himself did plenty to promote it for use in fertilizer recs. Also note that the gov't agency involved has an agenda — they want farmers to cut back on N fertilizer for environmental reasons. While some farmers really do apply far too much N fertilizer, there are plenty of others who aren't applying enough — and this is especially true in continuous no-till, and doubly true when high-carbon cover crops are added to the rotation in dry regions such as Kansas. Cutting N rates willy-nilly based on a test with no predictive value certainly doesn't serve farmers' economic interests very well.

Beck's and Ward's comments agree with my experience — when a client has the Haney test ran, my reaction is always to ignore it for purposes of figuring out how much fertilizer to apply. And from what I hear of other strip-trials being ran (farmer made one or more strips with the Haney N rate instead of his usual), the yields can be really bad in the Haney strip because it often underestimates the N requirement — the yield losses would be financially catastrophic if implemented on a farm-wide basis.

If the gov't insists on the Haney test, then I tell the farmer that they truly need to be running the standard tests as well if they want any idea of what they should actually be doing — at the present time (and for the foreseeable future), the Haney test is completely worthless for predicting how much N your crop will need. And Ray Ward agrees that much work is needed to make the Haney test viable. John Grove, PhD (soil fertility expert, U.Ky) also agrees on this point.

A different aspect of the Haney test is the biological 'report card'— derived from the CO_2 respiration and water-soluble organic C and organic N. These portions of the test might be

beneficial to the folks trying to make their soils more resilient and sustainable, and measure how they're doing on that front — although again the respiration test is just a very crude way of demonstrating that there's X amount of microbial biomass blowing off CO2 (without any idea of which microbial groups are present, or whether they're good or bad for the crop or soil productivity); this test does measure something entirely different from stable soil OM as determined by ignition, however. And it does correlate roughly with how much vegetation the site has supported in the recent past (e.g., perennial vegetation provides higher readings than annual crops, unsurprisingly).

As for water-soluble C, this tells us how much food is readily available to the microbes. This part of the test is very sensitive to how recently something was growing, and how quickly it's decomposing. Water-soluble C is mostly from root exudates, and from the final stages of decomposition of organic material (roots mostly) & soil OM.

But the science really hasn't advanced enough for these 'report card' aspects to find much practical application. Use them for benchmarking your progress, but try to standardize the time of the year you take them, as well as where in your rotation (e.g., always 30 days after soybean harvest, or whatever).

** With tillage, most of the ammonia converts very quickly to nitrate. Many of the N recs assume tillage.*

For more eye-opening truths and candid discussions (including sorting through the propaganda on many crop inputs), join me & Dr. Grove for this year's Crop Health Workshop (Agronomy Essentials) in Wichita, KS or purchase the booklet after the event.

We'll roll up our sleeves and get to the nitty-gritty of making your farming more profitable as well as more sustainable. And have a few laughs along the way.

Manage your no-till for prosperity!