NEW FOR SOIL MANAGEMENT

With SoilOptix, soil analysis goes far beyond conventional soil sampling. The goal, its developers say, is to make crop management more scientific than ever

By Ralph Pearce, CG Production Editor

In conventional soil sampling and analysis, growers have access to a fairly wide array of parameters and values. There are the standard N-P-K values from a soil test, plus organic matter, soil pH — and for an added price — nitrates, sulphur, copper and manganese. Some labs will also throw in a physical analysis, with percentages of clay or sand in the soil — again, for an added price.

But what would it be worth to your operation to know the risk for compaction in your soils?

What if you could learn more about your soil's bulk density, or its water retention capability?

What if there were 15 base parameters that were available from one in-depth soil analysis?

Welcome to the future, thanks to the SoilOptix unit. Another worthwhile addition to the lineup of innovations seen at the 20th anniversary of Canada's Outdoor Farm Show, the SoilOptix system has undergone an extensive learning and adaptation curve.

The product of more than 10 years of research in Europe, SoilOptix actually made landfall in Canada around 2009, when Paul and Barry Raymer, then of The Farm Office, based in Tavistock, Ont., began studying the unit and its many applications.

The Raymers were at the Grain Farmers of Ontario's annual meeting in London last March under their new moniker, Practical Precision, and had a video presentation for the SoilOptix system, including a brief exploration of the breadth of its potential.

Now, more than six months later, Paul Raymer has had the chance to work with the system on about 750 acres here in Ontario.

Predictably, there's been some skepticism on the part of growers, who wonder at the practicality of garnering that much information. As mentioned, there are 15 basic parameters or soil properties that can be generated from the SoilOptix sampling procedure and subsequent analysis. Another seven, including nitrates, sulphur, iron, copper, manganese, zinc and boron (the micronutrients) are obtainable at an added cost.

Raymer acknowledges there's a lot to be learned about exactly how SoilOptix can best be used, but that preliminary results from the 2013 growing season are already winning converts.

Growers lined up to check out the system at the Outdoor Farm Show, and Raymer suggests that either type of reaction — positive or reluctant — is likely a reflection of the type of farmer that's out there. Those who are most positive about its use and potential tend to be the intensive managers.

"For those managers and the ones we have done the work for, they really like it," says Raymer, adding that it's not so complex that it's making growers reluctant to adopt the technology.

"It starts with their mindset and where they are today when they grab a hold of this," Raymer says. "It's a matter of going to chase 'the more' rather than what you already have. I haven't heard anybody say that land is a bargain or that inputs or seed costs are a bargain, so it's investing more to hopefully gain more."

THE SOILOPTIX DESIGN

Visually, the SoilOptix unit appears to be a simple metal tube mounted to the front of an ATV. But according to Raymer, this European technology measures naturally emitting radiation released through the decomposition of the top foot of the soil.

It is a passive sensor — not penetrating — and it measures four nuclides or isotopes that are present in the soil, namely uranium, potassium-40, thorium and cesium.

Data is collected in swaths of up to 40 feet wide (although they're narrower in smaller fields). Using this sensing technology, in combination with soil sam-

pled "ground-truthing," is roughly equivalent to 250 to 300 core sample locations per acre.

"What this researcher in Europe has found is that there's a strong correlation to these varying nuclides to what we naturally go and chase, and what we chase is based on mathematics," explains Raymer. "But we still go and collect calibration physical soil samples to be able to correlate to what the mathematical models tell us."

The recommended frequency for the SoilOptix process is based on a nine-year cycle. Raymer uses the initial survey to benchmark the values present in the soil, confirming their values by pulling core samples, and then repeating the procedure every three years following a standard corn-wheat-soybean rotation. In that setting, he'd return to take follow-up readings and core samples at three and six years to complete the cycle.

"With the field survey, we're measuring the decomposition of the soil, and that decomposition isn't that fast," says Raymer.

At the Outdoor Farm Show, Raymer and his father Barry were showing growers how the rates for their service (less than $10 per acre per year during a nine-year cycle) will work out to be less expensive than the 1.0-acre grid sampling regimen (listed in Practical Precision's brochure as $9 to $11 per acre per year). The cost for a 2.5-acre grid sampling was listed at $4 per acre per year.

Again, soil sampling still takes place, providing a confirmation — and in some cases a contrast — to what the SoilOptix system is reading. In the past few years, there has been considerable debate around the accuracy of soil sampling. Some crop advisers and dealers have questioned the relevance of a sampling protocol they say is more than 30 or even 40 years out of date. Add to that, shifts in management practices and refined plant genetics that have changed the standards to which soil nutrient levels can or should be measured, and the overall value of soil sampling has become questionable in the eyes of many.

Far from second-guessing or questioning those values, Raymer is nevertheless curious to get at exactly what the farmer is trying to do with the information from standard soil test results.

"The only thing guys have been getting

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It looks like a simple hollow tube and a few wires, but SoilOptix analyzes soil radioactivity.

By measuring uranium, potassium-40, thorium and cesium, SoilOptix assesses soil quality.

There are still lots of skeptics, SoilOptix backers say, but they say the technology will prove itself.

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back is the nutrients," Raymer says. "Not to say those aren't important, but are they a big generator to help boost yields?"

Says Raymer about SoilOptix: "I'm not saying this is a silver bullet, but we believe it's taking us farther than we've ever been."

Once the survey is complete, Raymer looks at the variation in radiation levels, then pulls the core samples based on those variations. He can use the isotopes and derive an average for nutrient content, with an accuracy of 60 to 85 per cent, based on different properties. For soil texture — and that, says Raymer, is the real strength of this tool — the accuracy jumps to 70 to 95 per cent. Thorium, for instance, correlates very well with clay content.

INTEREST BUILDING

Shortly after the Woodstock show, Raymer met with representatives from the Ontario Ministry of Agriculture and Food to discuss the use of the SoilOptix system. He's pleased to know that there's interest from the ministry, although he believes it was more as a tool for environmental applications. Yet he's still confident that such interest will have a positive impact going forward.

> **"It's taking us farther than we've ever been."**
> — Paul Raymer

Raymer notes that there's been considerable skepticism in the past from ministry staff regarding the use of GreenSeeker technology, which Raymer also markets. Yet provincial corn specialist Greg Stewart has reversed his previous stance, advocating the use of GreenSeeker technology at a specific point in the growing season. And Raymer sees that as a signal that times — and some time-honoured perceptions — are changing.

"The ministry is applying for some OFID (Ontario Farm Income Database) funding for a two-year project for variable-rate nitrogen utilizing optical sensing, and yet we're going to the next level of utilizing those zones," says Raymer. He notes that he can now use the SoilOptix system to enhance the prescriptions created by the GreenSeeker unit and either override its recommendations or tweak them based on the more-detailed results from the SoilOptix unit. "We can take something like nitrogen-use efficiency to the next level."

LOOKING AHEAD

Raymer says he's been very fortunate in that Practical Precision is the exclusive North American distributor and he feels it puts him at a tremendous advantage. And depending on the uptake of the technology, there may come a time when he can sell the SoilOptix units direct to growers.

Again, the key is determining what the farmer is looking to address on their particular farm.

The learning continues for Raymer as well. He notes that one Swedish researcher is studying spatial variability in cadmium as a means of improving production in wheat, which has a sensitivity to cadmium. There's also room for expansion beyond the 15 standard properties and seven micronutrients.

"It's the power of numbers, and the biggest thing is that growers can utilize this system, and a lot of them have the appetite for this type of information," says Raymer. "They already have the variable-rate equipment in their shed, but it's been underutilized."

So the learning continues.

SOIL SAMPLING ANALYSIS — GRID SAMPLING VS SOILOPTIX

	2.5 Acre grid sampling	1 Acre grid sampling	SoilOptix
Cost	$12	$35 - $45 (where offered)	$40 Initial – Retest $20
Recommended frequency	Every crop cycle (3 - 4 years).	Every crop cycle (3 - 4 years).	Every 9 - 10 years (every third crop cycle). Retest calibration sites every crop cycle.
Cost per acre per year	$4 per acre per year.	$9 - $11 per acre per year.	Approximately $8 per acre per year.
Collection	Random core samples (minimum of 12 recommended) from 2.5 acres.	Random core samples (minimum of 12 recommended) from every acre.	Data is collected from up to 40 ft. swaths. (Closer for smaller fields.) Equivalent to approximately 250 - 300 core samples per acre. Physical calibration core samples collected.
Analysis:			
Soil pH	Yes	Yes	Yes - High resolution map
Magnesium	Yes	Yes	Yes - High resolution map
Phosphorus	Yes	Yes	Yes - High resolution map
Potassium	Yes	Yes	Yes - High resolution map
Organic matter	Yes	Yes	Yes - High resolution map
Calcium	Yes	Yes	Yes - High resolution map
% Base saturation	Yes	Yes	Yes
Cation exchange capacity	Yes	Yes	Yes
Water retention	No	No	Yes - High resolution map
% Bulk density	No	No	Yes - High resolution map
Risk for compaction	No	No	Yes - High resolution map
Bulk density	No	No	Yes - High resolution map
Altitude	No	No	Yes - High resolution map
M50	No	No	Yes - High resolution map
Leakability	No	No	Yes - High resolution map
Hydraulic saturation capacity	No	No	Yes - High resolution map
% Sand	Some labs - Extra cost	Some labs - Extra cost	Yes - High resolution map
% Clay	Some labs - Extra cost	Some labs - Extra cost	Yes - High resolution map
Nitrate	Yes - Extra cost	Yes - Extra cost	Yes - Extra cost
Sulphur	Yes - Extra cost	Yes - Extra cost	Yes - Extra cost
Iron	Yes - Extra cost	Yes - Extra cost	Yes - Extra cost
Copper	Yes - Extra cost	Yes - Extra cost	Yes - Extra cost
Manganese	Yes - Extra cost	Yes - Extra cost	Yes - Extra cost
Zinc	Yes - Extra cost	Yes - Extra cost	Yes - Extra cost
Boron	Yes - Extra cost	Yes - Extra cost	Yes - Extra cost
Uses	Lime application, fertility maps	Lime application, fertility maps	High resolution maps offer ease of ability to create VRA prescriptions (lime, seeding, fertilzer, etc.)
Other optional information gathered			
Trimble WM drain			Topography data for field drainage
GreenSeeker NDVI data			Crop NDVI for vineyard, turf, cover crops