

Using the Right Soil Sampling Method to Capture Field Variability:

A CASE STUDY



Soil sampling is important for any farm operation as it allows the grower to maintain and monitor their soil fertility. A healthy soil is paramount to good, sustainable yields. A regularly scheduled soil sampling program guarantees that your fields nutrient management goals are being met and that you are maximizing your crop input investment. A well-balanced soil makes your seed perform as anticipated, your chemical program perform as promised, and your yield levels continue to increase (Veritas, 2018). A soil sampling program will help apply crop nutrients where they are needed following a 4R nutrient stewardship program while maximizing your input investment on every acre.

Provincial regulation states that soil samples need to be taken in preparation for a new nutrient management plan. The maximum interval for soil sampling would be 5 years, unless there is a change in the operation in which a new plan needs to be created (OMAFRA, 2006). If you are not using a nutrient management plan, it is still a good agronomic practice to sample each field every 5 years to ensure you are applying the nutrients that are required. The soil acts as a bank, growers need to make sure there are enough nutrients in the bank to support the crop year over year.

When you have decided to soil sample, there are a few different methods to consider. It is important to choose one that will supply you with the most accurate resolution and the most economic rate possible for your business. This case study aims to explain each method available and its differences.

What is bulk soil sampling?

Bulk soil sampling consists of dividing a field into 1-4 areas, depending on the size of the field, and sampling those areas. The maximum area included in a single sample should be 25 ac (10 ha). The field can be divided into high zones and low zones with all high zone areas being sampled together and similarly for the low areas. The field could also be sampled simply in halves or quarters and depending on its direction, for example, north section, east, south and west. Bulk soil sampling is useful for capturing a snapshot of what the average soil characteristics of the field are. This is useful when first purchasing a new farm, or to better understand the average fertility across the farm measuring the average change over time.

Bulk soil sampling does not separate the soil based on variability, different soil textures or fertility. This method can skew soil texture results and can impact the accuracy of the soil nutrients levels, which leads to the under or over applying of fertilizer



What is grid soil sampling?

Growers can choose a 1 acre, 2.5 acre, 5 acre, or 10 acre grid. The grid is overlaid onto the field through a computer program and soil cores are taken with each grid using georeferencing. There are on average 10 to 12 cores taken within each grid, the cores are taken in areas that are most representative of the sampling grid. The cores in a grid are mixed and each grid sample is kept separate from the rest.

As shown in the variability example below, it is not until the 2.5 acre grid can you start to see some of the field variability but it is minimal. The 1 acre grid size captures most of the fields variability but is not an economically feasible way to soil sample the field.



10 acre



5 acre



2.5 acre



1 acre

Grid sampling on the larger scale can start to capture some variability and produce an overall nutrient level of a field by section but it is hard to narrow down specific nutrient levels by soil characteristic. Grid sampling can average test results across dissimilar soil types, mixing soils that should be kept separate and is also susceptible to mixing uneven fertilizer applications or a variety of other environmental factors. For instance, one grid could have a mix of sand and clay soil. The test results would average the nutrient amounts across that block and lead to a misapplication of fertilizer based on the soil type.

What is polygon soil sampling?

Polygon (zone) are areas drawn on a field based on soil type, topography, yield variability, drainage, fertilizer applications or grower knowledge of the field. The information about the variability across the fields is used to create field management maps. The best zones come from multiple layers of data that when layered on top of each other reveal to us the true variability across the field.

Polygon soil sampling is done to obtain a better understanding of the variability of the field. It also uses the information gathered to determine the specific nutrient levels per polygon area and which ones need adjustments. It is important to ensure that each sampling area is uniform and separate from areas that are obviously different.

Polygon sampling on a larger scale such as 10 acre polygons captures some of the variability and are able to start separating out the high, low and middle ground areas and keeping those samples separate.



10 acre



5 acre



2.5 acre



1 acre

The 5 acre polygon map separates out the field in more detail. It is not until you get down to the 2.5 acre and 1 acre polygons that the true variability of a field is captured. The 1 acre polygon is comparable to a CEC soil map from an optical soil sensor mapping system, which will be discussed in the next section. The 2.5 acre polygon is a more economical sampling method but it also captures the level of variability that is easier for growers to manage, making it the most common approach to sampling at this time.

A regular soil sampling program using polygons can help a grower accurately apply crop nutrients. It also helps maximize input investment on every acre, identifies the fields limiting nutrient, applies 4R nutrient stewardship and make the most of your crop input dollar. Soil Sampling using the polygon approach also allows for deeper analysis to be done on the sampling data. Because the zones match yield very closely, we are able to analyze the data with new analytics to give growers a deeper look into their fertility programs,

What are soil sampling sensors?

Soil sampling sensors are a newer method of sampling that has grown in recent years. These sensors are used to capture a variety of soil properties. These are used in real-time using GPS (Global Positioning Systems) and can be programmed to capture certain soil properties at one time, such as soil texture, nutrient, and moisture (Adamchuk, Vlacheslav I., et al, 2002). Some programs even capture soil cores throughout the field in different areas along with the scans. These cores are collected to validate and calibrate the sensor maps values.

There are a couple types of sensors being used commercially today, they are electromagnetic (EM-38 sleds or Veris) machines that use electrical conductivity in the soil to measure soil properties. The other popular method is Soil Optix, a sensing system that measures the natural radiation given off to characterize the soil. The variability that an optical sensing unit captures is demonstrated here in a CEC (Cation Exchange Capacity) map. A CEC map helps identify the soil textures of the field.



These sensors are beneficial in capturing the whole fields soil texture variability as well as the moisture and nutrient levels all in one scan. There are multiple other layers that can be applied to the soil sensors, such as topography, drainage and many more that can work together to capture the entire fields soil health. It may not be economical for some growers who are looking for nutrient levels only, in this case, a 2.5 acre polygon sample may be a better option. But for an overall soil health check-up of your field's characteristics, nutrients, and moisture, it may be the best bang for your buck.



Conclusion

Soil sampling is the most important place to start to understand your farms soil characteristics and to start capturing your soil health. Soil tests will show what the fields nutrient levels are, what areas need improvement, and how you are changing things over time. Soil sampling is the first line of defense against nutrient deficiencies and helps strengthen your crops against the threat of disease and insects during the growing season. Knowing what is in your soil bank every 3-5 years can tell you what you can take out and what/where you should put in to maintain a healthy soil. It is much easier and profitable to maintain a well testing soil than it is to build a soil up that has been depleted over the years. Soil testing is the best line of defence to not get your field into the depleted situation. It is up to the individual grower to choose which soil sampling method is right for their operation and how they are planning to apply it. But regardless if it is bulk, grid, polygon or sensing technology, the best choice is always to soil sample.



References

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