Mapping Management Zones with Soil Conductivity

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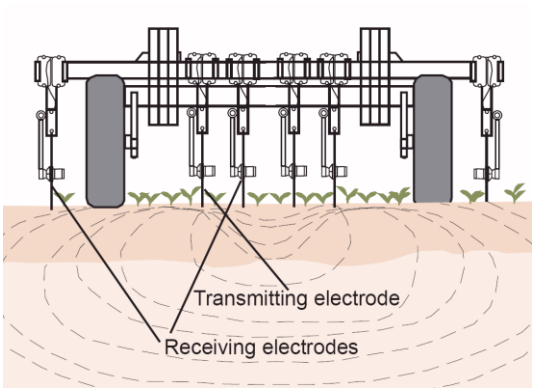
By measuring differences in conductivity across the field in combination with GPS data, management zones can be identified for variable rate management. Currently the NY Corn and Soybean Growers Association is in the early stages of conducting on-farm research across the state of New York using the Veris system in conjunction with variable seeding rates and fertilizer rates in corn and soybeans across many soil types. Additionally mapping soil conductivity can enable variable herbicide rates corresponding different in organic matter levels and soil types. Many consulting companies and individual farms are also exploring soil conductivity in northwestern NY.

What is Soil Conductivity?

It is a measurement of how well the soil conducts electricity. Two types of technology are available for measuring electrical conductivity in the soil. The sensors are either contact (Veris) or non-contact (Geonics Limited and Geophex). Both types measure the ability of the soil to conduct an electrical current. The output is usually recorded as units of milliSiemens per meter (mS/m) or deciSiemens per meter (dS/m) (1 dS/m = 100 mS/m). Contact sensors have at least one coulter sending electrical current into the soil (transmitting electrode) and at least one other coulter (receiving electrode) which measures the voltage drop between the electrodes. Veris units operate with this technology, are the mostly widely used, and a schematic is pictured in *Figure 1*. Often multiple sets of sensors will run at multiple depths to better examine the variation in soil composition across a field.

Figure 1: Contact Soil Conductivity Unit



Source: Veris Technologies

Non-contact sensors use electromagnetic induction and do not come into contact with the soil relying on a transmitter and receiver coil mounted on a non-metallic frame. A metal frame would interfere with the electromagnetic induction readings. The EM38 (Geonics Limited) and

GEM-2 (Geophex) sensors utilize this technology. Often these non-contact sensors are used in smaller scale research plots, but some commercial scale equipment is available.

Incorporating Soil Conductivity Data on Your Farm

Soil electrical conductivity will vary with soil moisture, temperature, soil type, organic matter, manure application, & salinity. Soil conductivity decreases in dry soils compared to wet soil and as the soil temperature falls. While the actual soil conductivity numbers change with varying moisture and temperature conditions, the management zones that are calculated from the relative differences often are the same. Unless a field has a patch of pure sand, the soil electrical conductivity usually only varies by 5 to 10% across soil types.

Data can be gathered under many field conditions for these units. For more operational information on measuring soil conductivity, soil OM, and soil pH mapping equipment, check out the Precision Ag section on www.nwny.org.

Variation of conductivity across soil types is the one of the main advantages of using this technology. While the maps are often very similar to the NRCS soil maps, soil conductivity maps have a finer resolution. They can also correct the border areas between soil types that are not accurately depicted in a soil survey. Soil conductivity increases with increasing organic matter, and will make a more detailed map than grid soil sampling alone. Targeted soil samples should still be taken on a regular basis within management zones. Soil samples will still require wet chemistry analysis as in-field measurements of minerals are still in the early stages of development.

Care must be used when mapping fields after manure applications. Manure contains relatively high levels of salts compared to soils. Soil conductivity measurements will increase as the amount of manure applied increases. It is best to measure fields prior to manure application. Soils from the Great Plains often contain high salt levels and mapping salinity values for management zone creation is valuable on the high plains, but not in NY.

The information layer from soil conductivity should be used in combination with the NRCS soil layer, traditional soil test data, and multiple years of yield map data to form management zones on farms. Any one of these pieces of information in isolation is not as valuable as combining them together to plan for variable rate management of seeds, fertilizers, lime, and herbicides.