Tests soil like a root

New plant root simulator probe captures information on soil nutrient re-

The thick rich topsoil of the Great Plains is an important source of plant nutrients. When the soil was first plowed, this release of plant nutrients would sustain a 30 to 40bu/ac wheat crop with no added fertilizers. Over many years of intensive cultivation we have seen the soil supply diminish, first on the hilltops then in the mid-slope and depressions. However, with the increased use of peas and other legume crops the soil supply of nutrients can be enhanced. Although the changes in soil nutrient release and productivity have been evident to producers, they are often difficult to track using conventional soil testing.

Measuring the release of soil nutrients is now possible using a patented plant root simulating (PRS) soil probe commercialized by Western Ag Innovations of Saskatoon, Saskatchewan. The PRS probe uses a specially charged plastic surface to adsorb nutrients directly from the soil in a similar way to how a plant root takes up nutrients. A pair of PRS probes are placed into moist soil and left for one day or longer to adsorb nutrients. Nutrients having a negative charge (anions) like N, P and S are adsorbed by an orange coloured probe. A second purple coloured probe is used to adsorb positively charged (cation) nutrients like K, Ca and Mg. Micronutrients like copper, zinc and manganese can also be measured using a special pretreated orange PRS probe.

Capturing the release of nutrients under field conditions can be very helpful in predicting how much nutrient will be released to the next crop grown on that field. This was well illustrated by a co-operative study conducted by soil scientist Dr. Jeff Schoenau at the University of Saskatchewan and Lewis Reeve of Saskatchewan Agriculture and Food at Wynyard. PRS probes were placed in both pea stubble and wheat stubble fields for two weeks prior to seeding. The release of N on the pea stubble was three to 10 times higher than that found on the wheat stubble. PRS probes from top, mid and low slope positions show a typical pattern for N release. The lower slope soils, having more organic matter, were able to supply more N than mid or top slope positions.

Soil release of phosphorus to the PRS probes was found to be very low over the two weeks. The generally cool spring temperatures in 1997 reduced the level of P supply to the plant root simulator. Cool soil temperatures are well known to slow down P release and increase the need for seed-placed P. The PRS probes measured significant differences in P between slope positions and residue types. These differences are likely a result of slower soil warming under the wheat as compared to the pea stubble.

The nutrient supply rates measured with PRS Probes must run through the PRS Nutrient Forecaster to estimate the level of soil nutrient supply to a given crop for a given season. This computer software uses the raw PRS probe information along with the type of crop to be grown and the likely climate conditions. The forecast of soil supply and fertilizer need are integrated with climate conditions. For example, in a wet year the crop yield potential will increase and so will the soil supply of nutrients as more moisture will promote more soil turnover of nutrients.

The PRS probe nutrient forecast is not easily compared to the 'available' levels found using conventional soil testing. The PRS probe integrates the in-field conditions, crop type and climate to arrive at a more dynamic estimate of nutrient supply.

The PRS probes are currently available for use in scientific research. A full commercial release of this technology is planned for western Canada in the spring of 1998. Probes are placed in the soil with a planter apparatus. After probes have been in the soil for a given length of time, they are removed, washed off with de-ionized water, their location recorded, then sent in a zip-lock bag for analysis. The probes can be reused.

Further trials are underway to see if the probes can be used to check residue levels of certain herbicides.

Probes capture nutrients released by the soil.

Figure 1. PRS probe nutrient forecast for wheat under normal climate.

Site	P (lb/ac)	N (lb/ac)
Wheat stubble		
Top slope	2.5	3.6
Mid-slope	2.0	11
Low slope	4.2	29
Pea stubble		
Top slope	6.6	31
Mid-slope	4.2	35
Low slope	2.9	85

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