A Summary of Western Ag's Fall 2009 Field Soil Testing Results.

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Abstract

The reporting of regional or provincial soil test summaries has varying degrees of value depending on the individual using the data. The monitoring of yearly data will give indications of "average" soil nutrient supply changes over time. As well, year to year differences can provide the fertilizer industry signals of anticipated demand. The relevance to an individual field is quite limited. The data presented here is a summary of fall 2009, and a three year comparison of N, P, K, and S soil supply rates as measured by PRS™ (Plant Root Simulator™) Probe Technology at Western Ag Labs Ltd.

Introduction

The PRS Probe is a soil analysis technology (Fig. 1) utilizing ion exchange membranes that measure, not the concentration of soil nutrients, rather their plant available supply rate. The PRS Probes utilize both anion and cation exchange membranes encapsulated in either an orange or purple plastic probe. The probes are chemically pre-treated enabling the membranes to exhibit surface characteristics and nutrient sorption phenomena that resemble a plant root surface.

The probes were patented in 1991 for the University of Saskatchewan by Dr. Jeff Schoenau, Professor and Researcher at the College of Agriculture and Bioresources. For brevity, the evolution of the PRS™ Technology can be reviewed in Greer et.al. (2003). An explanation of the laboratory analysis methodology and the Quality Assurance/Control procedures can be found in Hangs et.al. (2002).

Method

In research applications, the PRS Probes are often used *in situ* as shown in Fig. 1. In the analysis of agricultural fields for crop planning, composite soil samples are collected and sent to the lab where the PRS Probes are used under standardized conditions of soil moisture, temperature and time (Fig.2). The soil sampling protocol has a special focus. "Slices" of soil are collected in duplicate from 4 to 6 areas of the field. Sampling is approximately 10 cm deep while avoiding where the B horizon begins. The focus on shallow depth considers where the greatest concentration of organic matter exists, where the early crop nutrient uptake activity occurs, and avoids the more calcareous B & C horizons. Consideration is given to avoid "unusual" areas of the field that do not represent the "average" of soil conditions and characteristics. The data summarized in this paper was generated using this protocol.

The raw data can then be used within the PRS Nutrient Forecaster™ (Fig. 3). The Forecaster models economic crop yield potentials based on nutrient supply rates to different crops, varying weather scenarios and fertilizer economics. Crop plans are tailored to the farmer's own level of risk tolerance.

Figure 1. PRS™ Probes inserted directly into a moist field soil.

Figure 2. PRS™ Probes inserted into a composite field sample.

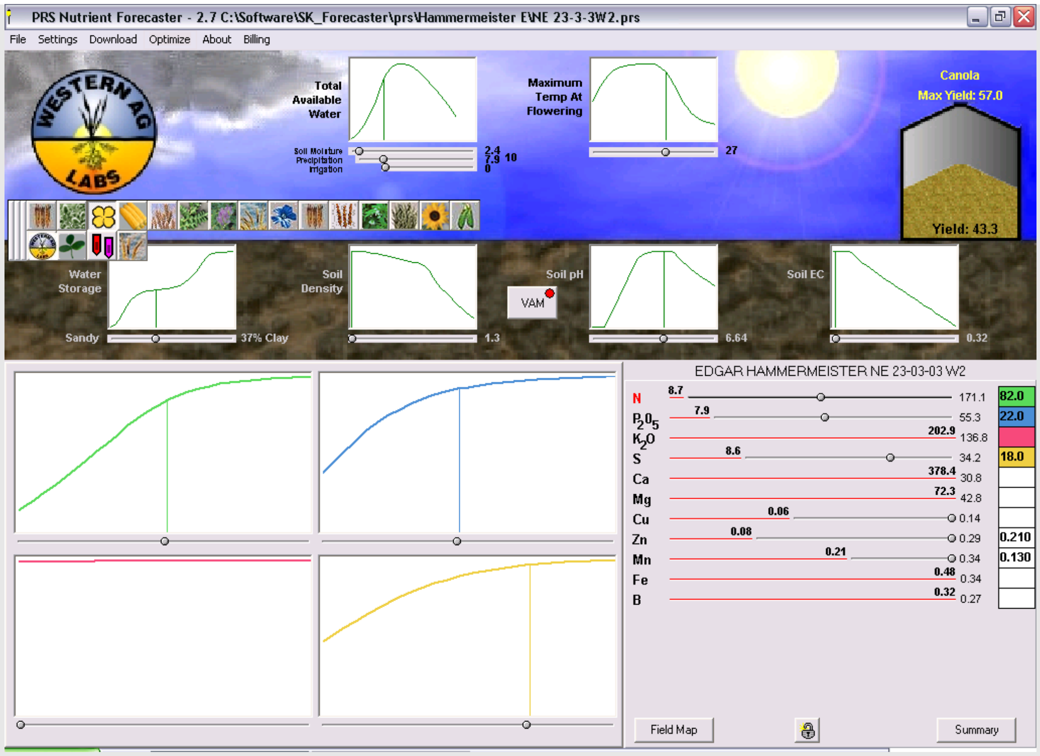

Figure 3. The PRS^{TM} Nutrient Forecaster.

Results

Prior to discussing the 2009 fall results, it would be valuable to set some context to the data presented. The 2009 growing season was in many ways similar to the 2008 season. The beginning of the growing season was marked by cool and dry soils and late spring frosts. In the West Central region, a spring drought limited early crop establishment to the point that the crop was thought to be lost in some areas. Early summer rains broke the drought and rescued the crop from certain failure. As the season progressed, the growing crops were free from many common stresses of moisture, leaf disease and pests. Of particular note was that the summer seemed quite mild with no extended periods of high temperatures. Crops were considered to be “late” in most areas. “Normal” August temperatures arrived in September just in time to help the crops mature and facilitated some harvest. That, combined with an extended frost free fall, allowed provincial crop yields to reach significant levels in many areas. October was marked by inclement harvest weather with combines at a stand still for days, or even weeks, on end. November was forgiving with warm dry weather conditions that allowed much of the harvest to be completed before winter set in.

Many harvested crops yielded significantly higher than what was fertilized for. The long cool growing season explains this to a significant degree. Wheat yields were often very good but protein levels were low. The crop started off with lower available supply rates (from the big 2008 crop) and fertilization rates were more restrained because of record high fertilizer costs.

The bigger yield with the same or lower fertility package would result in lower protein. The canola crop generally received a greater focus on fertility.

It can be anticipated then that with heavy crop yields, that nutrient uptake and export in seed was significant as well. Shown in Figures 4-7 are a comparison of provincial nutrient supply rates from 2007 through 2009. The measured data is presented as a nutrient flux per unit surface area per time (i.e. µg/10 cm^2/24 h). The supply rates circled on the x-axis represent approximate levels to which fertilizer recommendations begin to be considered within the Forecaster model.

Nitrogen (N) supply rates are in 2009 are quite similar to rates seen in 2008 (Fig. 4). The large, late crop again caused a draw down in soil N supply power.

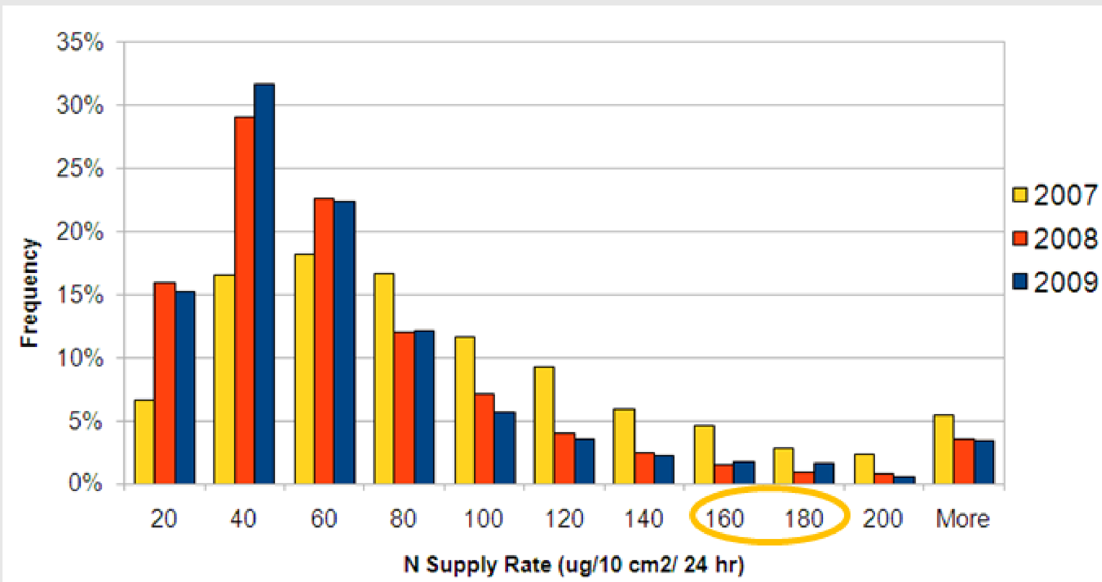

Figure 4. N Supply Rates Comparing 2007-2009.

Phosphate (P) supply rates between years continue to look similar (Fig. 5). In reality, this should not be surprising as the nutrient dynamics are quite different for P. Though a significant amount of P is exported in the crop seed each year, and significant amounts of P fertilizer are typically applied, the majority of seed P comes from the soil. In essence, the soil is like a rolling bank account and therefore large fluctuations in soil supply P are not as prevalent between years.

The soil supply rate of Potassium (K) (Fig. 6) also shows a similarity between years. The significance here is that the majority of K taken up by crops is returned to the soil in the straw produced. Because of this, K supply rates also would vary less between years. Approximately 26% of the fields would respond to K_20 application. Response level varies between crops.

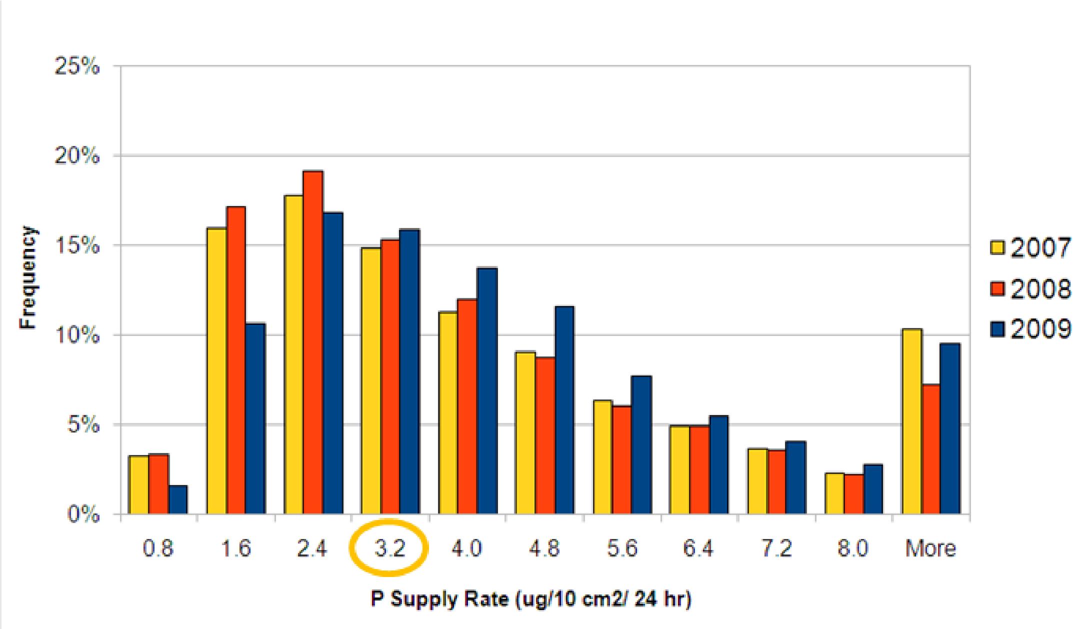

Figure 5. P Supply Rates Comparing 2007-2009.

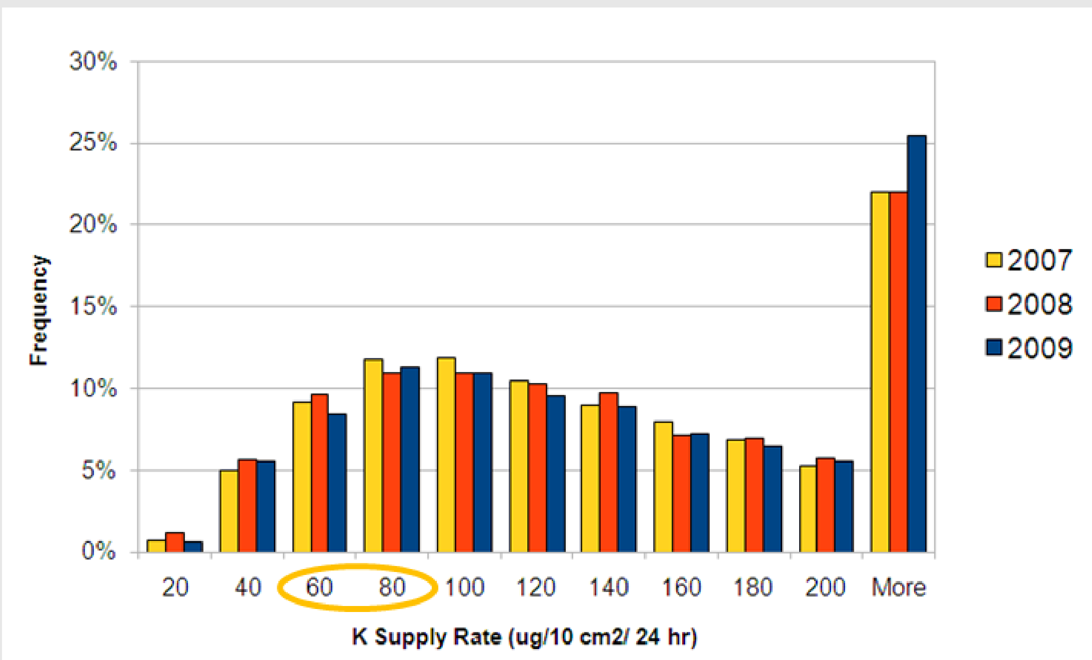

Figure 6. K Supply Rates Comparing 2007-2009.

Sulfur supply rates (Fig. 7) showed a slight improvement relative to 2008. Sulfate S levels are extremely variable across a field due to changes in parent material, organic matter and salinity and it is not unusual to sample "hot spots" from time to time. Extra consideration is given to S fertilization when these circumstances arise.

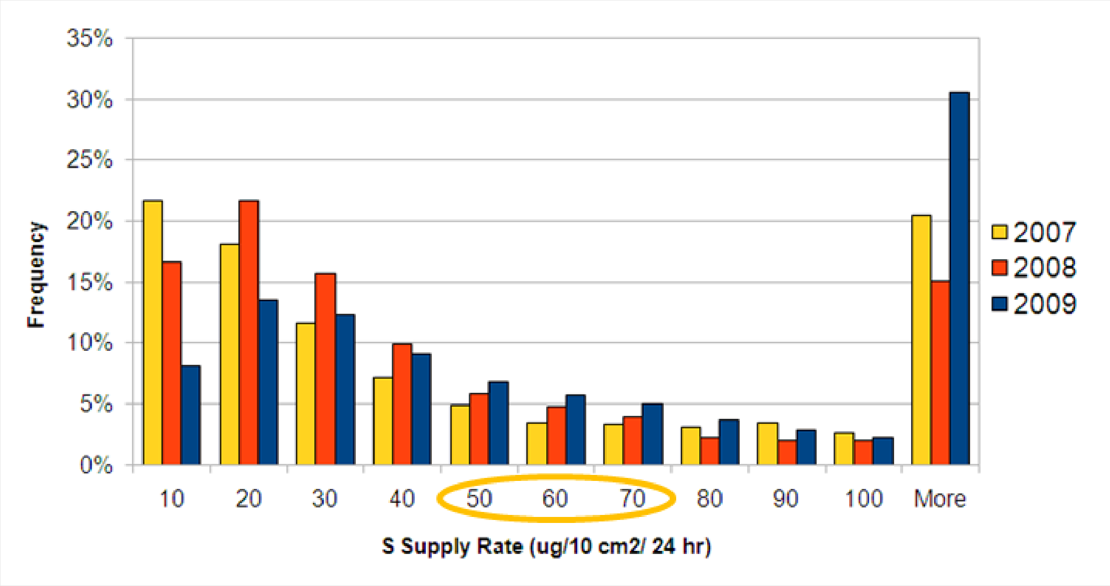

Figure 7. S Supply Rates comparing 2007-2009.

Conclusions

Though the data presented is not useful to develop individual field crop nutrition plans, monitoring yearly data over time will give indications of "average" soil nutrient supply changes over time. Year to year differences can also provide the fertilizer industry signals of anticipated demand.

The PRS^{TM} Technology has proven over twelve years of grower experience to be a useful decision support tool that optimizes economic crop yield while catering to the individual farmers risk tolerance.

References

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