Background Information for Interpreting Soil Nutrient Test Results – FVSNS 2012

Individual Soil Analysis Results

Thank you for participating in the 2012 Fraser Valley Soil Nutrient Study. This report provides you with *preliminary* soil analysis results for the field(s) from your farm. A more comprehensive and detailed report will be mailed to you shortly, but we wanted to send out the soil analysis results as soon as possible to help with 2013 nutrient management.

Why the delay in getting results back?

When you send soil samples to a commercial laboratory, you expect results within a week or two. Why did it take so long to send the results back from this study?

There were a total of 177 fields sampled in the soil study from 97 different farms spanning from West Delta to East Chilliwack. The sampling period lasted from mid-August to mid-October; in total nearly 2000 individual soil samples were collected.

After the samples were collected, they were air-dried as quickly as possible in a greenhouse. Dried samples were then crushed and sieved through a 2 mm screen. This labour-intensive process was completed by the end of 2012. Air drying is accepted as the most suitable and convenient method to ensure that the nutrients in the soil do not change during long-term storage and it makes it easier for the laboratory analyses.

For quality control purposes, it was decided that all the laboratory analysis would be done in complete batches after all the crushing and sieving was completed. Laboratory analysis began in January 2013 and the main analysis was completed by the end of February.

Why were samples collected from three depths?

Soil scientists frequently collect samples from multiple depths to track the movement of nutrients through the soil. Different soils differ in the amounts of nutrients they contain naturally and in their ability and capacity to bind these nutrients. Certain nutrients like phosphorus are relatively immobile and are usually found at the highest concentration in the surface soil. High phosphorus concentrations at depths below 30 cm may indicate that the surface has become saturated and the nutrient is beginning to leach down the soil profile.

While some nutrients are immobile within the soil, nitrate nitrogen is highly mobile and can be leached out of the root zone with excessive irrigation or rainfall, especially in the autumn, our traditionally wet season, when crops use little or no water. By sampling to 60 cm, we attempted to take into account any leaching that might occur during the sampling period. If the nitrate concentration below 30 cm is higher than the concentration above 30 cm, it indicates that nitrate leaching has likely been occurring. Measurements of the subsoil help to evaluate the implications of these factors.

Results are presented for three depths: 0-15 cm, 15-30 cm, and 30-60 cm. If you plan on using these results for decisions about nutrient applications, the results for the 0-15 cm depth should be given highest priority.

Why were three replicate samples collected from each field?

A replica is a copy of something. Soil scientists collect replicate samples to test variability within a field or within an experiment. Variation between samples within the same field typically ranges between 15 and 30 %. Replication also allows scientists to conduct statistical calculations to determine whether there is a great probability (e.g., 19 times out of 20) those values for individual fields or groups of fields are different from each other and not just due to the variability of the fields sampled. For example, it can be used to determine if residual soil nitrate concentrations are significantly different between fields in corn production versus grass production, or between potato fields in Delta versus Abbotsford.

In your report we are presenting the results for each replicate and depth plus the mean (average) values. In interpreting the data, we encourage you to consider the mean values but take note of the variability between samples.

How do my results compare with other farms?

This report only contains your individual results. We are working on producing a summary report that will highlight the key findings of the overall study. We will mail the summary report to you separately when it is finalized. It will include average soil nutrient values for each crop type and geographic area included in the study, and how your farm ranks amongst them.

Presentation of Results

The traditional soil coring method was used to collect samples, and three replicated samples were collected at three depths from each field. The results from each replicate are reported separately. Soil analysis data includes:

Nitrate Nitrogen (NO_3-N)
Available Phosphorus (P)
Available Potassium (K)
Available Magnesium (Mg)
Available Sulfur (S)

The Mehlich III Extraction Method was used for P, K, Mg, and S, while a KCl Extraction was used for nitrate analysis.
Results represent concentrations on a soil weight basis (parts per million by weight or mg/kg). Tables 2 thorough 5 provide recommendations for nutrient additions based on soil test results for P, K, Mg and S, taking into consideration the associated crop. Ratings for P, K, Mg and S are given only for the 0-15 cm soil sampling depth.

Results represent concentrations on a soil weight basis. Laboratories sometimes conduct these measurements on a volume of soil (parts per million by volume or µg/ml) rather than on a weight of soil. In most cases, especially for mineral soils, the results are sufficiently similar to interpret them on an equivalent basis. This is consistent with the way most commercial laboratories present results. Tables 2 through 5 provide recommendations for nutrient additions based on soil test results for P, K, Mg and S, taking into consideration the associated crop. Table 6 provides suggestions for interpreting the nitrate results. Ratings for P, K, Mg and S are given only for the 0-15 cm soil sampling depth. Ratings for NO_3-N are based on a weighted average of all three soil sampling depths and replicates.

Keep in mind the sampling was conducted in the late summer and fall of 2012 and the results represent what was in the soil at the end of the growing season. The nitrate results are equivalent to a Post-Harvest Nitrate Test or Residual Soil Nitrate Test. Under South Coastal BC conditions, other research has demonstrated that most of this residual nitrogen will not be available the following spring. Instead, the nitrogen will be taken up by growing crops (e.g. winter cover crops), leached out of the soil into groundwater or surface water, or denitrified and lost to the atmosphere.

How do I interpret my results?

The following are a few tips to consider in reviewing your data.

If values are "low":

Consider the soil test results in light of how your crop has been performing. If yields are high and there is little disease trouble or symptoms of nutrient deficiencies, you are likely fertilizing your crop in an optimal manner. If yields are inadequate, and the crop is showing symptoms of nutrient deficiency, you may benefit from increasing nutrient application rates from current practices.

If values are "medium":

Again, consider the soil test results in light of how your crop has been performing. If yields are high and there is little disease trouble or symptoms of nutrient deficiencies, you are likely fertilizing your crop in an optimal manner. Continue with current practices and monitor soil test levels every few years. If soil test levels rise over time, you may need to cut back on your nutrient application rates.

If values are "high":

Nutrients are likely not a limiting factor to attaining high yields. The environmental risk of nutrient escape into the environment increases with increasing soil nutrient concentrations. If you have not already done so, initiate a soil testing program to monitor soil nutrient levels over time. A Nutrient Management Plan is recommended as a method to ensure nutrient applications are matched with crop nutrient requirements.

If values are “very high”:

At very high soil nutrient concentrations there is an elevated risk of nutrient escape into the environment, causing pollution by impacting water and air quality. There may also be toxicity effects on some crops.

A soil testing program to monitor nutrient levels over time is highly recommended. A Nutrient Management Plan is also recommended as a method to ensure nutrient applications do not exceed crop requirements. The plan should include a long term strategy to bring nutrient levels back into the high or medium categories.

Why do my results differ from the soil test results I received from a commercial laboratory?

Determining soil nutrient concentrations involves mixing the soil in an extraction solution, filtering it, and then running the filtrate solution through an analytical instrument. Different laboratories use different chemical extract solutions and different analytical instruments. These can influence the results. The ultimate goal is to extract the amount of the specific nutrient that best reflects the availability of that nutrient in the soil. In this study phosphorus extraction was done using both the Kelowna Method and the Mehlich-III Method. Although the results from each method were highly correlated, the Mehlich-III Method extracted 30% more phosphorus. When comparing results from different laboratory methods, it is important to know which techniques the laboratories used. (Note: the Kelowna and Mehlich-III Extraction Methods are common analytical methods used by labs across North America.)

Table 2: Recommended Phosphorus (P_2O_5) Applications based on Soil Test Phosphorus (P) Values (using the Kelowna Extractant) for the Lower Fraser Valley

Soil Test P (μg/ml 0-15cm)	Rating[1]	Crop Group 3	Crop Group 4	Crop Group 5
		Grasses, Grass-Legume mix (10-50%)	Peas, Beans (bush & pole), Lettuce, Spinach, Corn, Cucumbers, Grass-legume mix (>50%)	Cole Crops, Beets, Carrots, Parsnips, Radishes, Turnips, Asparagus, Bulbs, Celery, Sweet Corn, Onions, Garlic, Peppers, Grapes, Berries, Potatoes
		P_2O_5 Recommended (Kg/ha)		
< 20	Low	80 - 140	100 - 170	100 - 200
20 - 49	Medium	30 - 60	40 - 80	50 - 80
50 - 99	High	20	30	40
≥ 100	Very High	0	0	0

[1]Phosphorus Soil Test Rating:

Low	Moderate to large economical response to fertilizer nutrient
Medium	Small economical response
High	No immediate response – suggested rate of fertilization is intended to maintain soil potassium fertility
Very High	No response

P_20_5 X 0.436 = P or P X 2.29 = P_20_5

Table 3: Recommended Potassium (K_2O) Applications based on Soil Test Potassium (K) Values (using the Kelowna Extractant) for the Lower Fraser Valley

Soil Test K (μg/ml 0-15cm)	Rating[1]	Crop Group 3	Crop Group 4	Crop Group 5
		Grasses	Peas, Beans (bush & pole), Lettuce, Spinach, Corn, Grass-legume	Cole Crops, Beets, Carrots, Parsnips, Radishes, Turnips, Asparagus, Bulbs, Celery, Onions, Cucumbers, Sweet Corn, Garlic, Peppers, Grapes, Berries, Potatoes
		K_2O Recommended (Kg/ha)		
< 80	Low	60 – 200	100 - 200	150 - 250
80 – 174	Medium	40 - 60	60 - 100	60 - 150
175 - 249	High	20	40	40
≥ 250	Very High	0	0	0

[1]Potassium Soil Test Rating:

Low	Moderate to large economical response to fertilizer nutrient
Medium	Small economical response
High	No immediate response – suggested rate of fertilization is intended to maintain soil potassium fertility
Very High	No response

K_20 X 0.83 = K or K X 1.20 = K_20

Table 4: Recommended Magnesium (Mg) Applications based on Magnesium Soil Test Values (using the Kelowna Extractant)

Soil Test Mg (μg/ml 0-15cm)	Crop Group A[1]		Crop Group B[2]	
	Rating[3]	Recommended Mg (Kg/ha)	Rating	Recommended Mg (Kg/ha)
< 25	VL	40	VL	40
25 - 49	L	25	M	25
50 - 99	M	25	H	0
100-149	H	0		
> 150	VH	0		

[1]Crops having similar Mg requirements: Asparagus, Beans, Bulbs, Celery, Corn (Sweet), Cucumbers, Lettuce, Onions, Peas, Peppers, Pumpkins, Rhubarb, Spinach, Squash, Blueberry, Cranberry, Raspberry, Strawberry, Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Beets, Carrots, Parsnips, Radishes, Turnips, Tomatoes, Legumes, Mustard

[2]Crops having similar Mg requirements: Grass, Potatoes

[3]Soil Test Rating:

- VL Large economical response to fertilizer nutrient
- L Moderate economical response
- M Small economical response
- H No immediate response
- VH No response

Table 5: Recommended Sulphur (S) Applications for All Crops and Areas based on Soil Sulphur (S) Levels (using the Kelowna Extractant)

Soil Test S (μg/ml 0-15cm)	Rating[1]	Recommended S (Kg/ha)
< 10	VL	30
10 - 19	L	20
20 - 24	M	10
25 - 34	H	0
> 34	VH	0

[1]Soil Test Rating:

- VL Large economical response to fertilizer nutrient
- L Moderate economical response
- M Small economical response
- H No immediate response
- VH No response

Note: Tables 2 to 5 are simplified versions of interpretative tables in the BCMAL publication “Soil and Plant Tissue Testing Methods and Interpretations of their Results for British Columbia Agricultural Soils” (1996). Neville Gough, ed.

Table 6: Soil Test Nitrate-N Concentrations and Current Interpretation for Specified Crops[1]

Rating	Grass[2]	Corn[2]	Raspberries[3]
	Soil Test Nitrate-N (μg/g - average for 0-60cm)		
Low	< 15	< 20	< 35
Medium	15 – 30	20 - 45	35 – 55
High	> 30	> 45	> 55

[1]Note that suggested interpretations have not yet been developed for all crops grown in the Lower Fraser Valley. If you grow a crop not included in this table, the most suitable interpretation should be based on the crop type most similar to the crop you grow. For example, annual crops like potatoes and most vegetables should be interpreted using the corn ratings. Blueberries would most likely be best interpreted using the raspberry ratings.

[2]Rating based on: Sullivan, D & Cogger, C. (2003). Post-harvest Soil Nitrate Testing for Manured Cropping Systems West of the Cascades. EM8832. Oregon State University. Retrieved July 17, 2006 from http://extension.oregonstate.edu/catalog/pdf/em/em8832-e.pdf

[3]Rating based on: BC Ministry of Agriculture and Lands. (2005). Berry Production Guide for Commercial Growers: 2005-2006 Edition. Published by: Lower Mainland Horticulture Improvement Association