Results from the 2012 Fraser Valley Soil Nutrient Study – Raspberry

Nutrient Management Factsheet

January 2014 – Order Reference No. 631.500-11

Revised December 2015

Introduction

As a follow-up to the 2005 Fraser Valley Soil Nutrient Study[1] (FVSNS), soil samples were collected from 177 agricultural fields in the fall of 2012 to measure residual nitrogen (N), phosphorus (P), and potassium (K). The 2012 FVSNS was designed to monitor post-harvest soil nutrient status in comparison to 2005 results, which brought attention to accumulations of soil N, P and K. Sampling occurred in six study regions from West Delta to East Chilliwack, and from six different crop groups. This factsheet provides selected results from the raspberry fields sampled in 2012, with comparison to the 2005 raspberry findings.

Context – Weather during the study years

Weather conditions affect the amount, timing and release of plant-available forms of N and P in to the soil, which can be subsequently detected with soil testing. This is especially true for soil N, as mineralization rates are very responsive to weather conditions. Warmer weather and optimal soil moisture favour higher residual soil NO_3-N and soil test P levels. Excessive moisture received can lead to nutrient leaching from the soil profile, and subsequent underestimation of residual nutrient levels. As a result of this, it is important to note weather conditions when interpreting results for the 2005 and 2012 study years. Most notably, weather during the raspberry sampling period was cooler in 2005 than in 2012 (Table 1).

Table 1. Weather conditions in the Lower Fraser Valley relative to the long-term average (Environment Canada) and during the sampling periods in 2005 and 2012.

Year	Pre-season	Growing season	Sampling period	Sampling period weather
2005	Wet winter	Warm spring Typical summer	Sep 30 – Oct 5	10.8°C avg. air temp no precipitation[1]
2012	Typical	Cool and wet spring/early summer Hot and dry late summer	Aug 20 – Sep 19	16.7°C avg. air temp 8 mm precipitation

[1] 72.6 mm of rain received on Sep 29, 2005.

How did raspberries compare to other commodities?

Overall, raspberry fields had the highest soil P values, but were mid-range for soil N (NO_3-N & NH_4-N) and K (Table 2). Sampling of the 177 fields in the Soil Study was not evenly distributed amongst the six regions and crop groups, and therefore results must be interpreted with caution. There were 19 raspberry fields sampled in South Abbotsford for the study. Five forage grass fields and 14 blueberry fields were also sampled in South Abbotsford. Soil NO_3-N values were similar between raspberries and forage grass, and significantly lower than in blueberry fields (Figure 1). Raspberries tended to have higher soil test P values than the other two crops sampled in South Abbotsford (Figure 2).

Growing Forward 2
A federal-provincial-territorial initiative
BRITISH COLUMBIA
Canada

Table 2. Mean residual soil nitrate (NO_3-N), ammonium (NH_4-N), soil test phosphorus (P) and soil test potassium (K) 0-30 cm values by crop for the 2012 Fraser Valley Soil Nutrient Study. The number of fields sampled per crop is represented by 'n'.

Crop	n	NO_3-N (kg/ha to 30 cm)	NH_4-N (kg/ha to 30 cm)	Kelowna[1] – P (kg/ha to 30 cm)	Kelowna – K (kg/ha to 30 cm)
Forage grass	45	66	17	415	551
Forage corn	31	90	11	540	833
Vegetables	30	109	14	642	553
Blueberries[2]	30	140	20	482	470
Raspberries[2]	19	78	14	1025	589
Nursery	22	71	16	381	565

[1] 'Kelowna' refers to the soil extraction method used to determine soil P and K concentrations. For more information on soil test methods:

[2] Blueberry and raspberry fields were only sampled within the cane/bush rows and dripline, which may have introduced a bias towards higher results on a kg/ha basis than other crops.

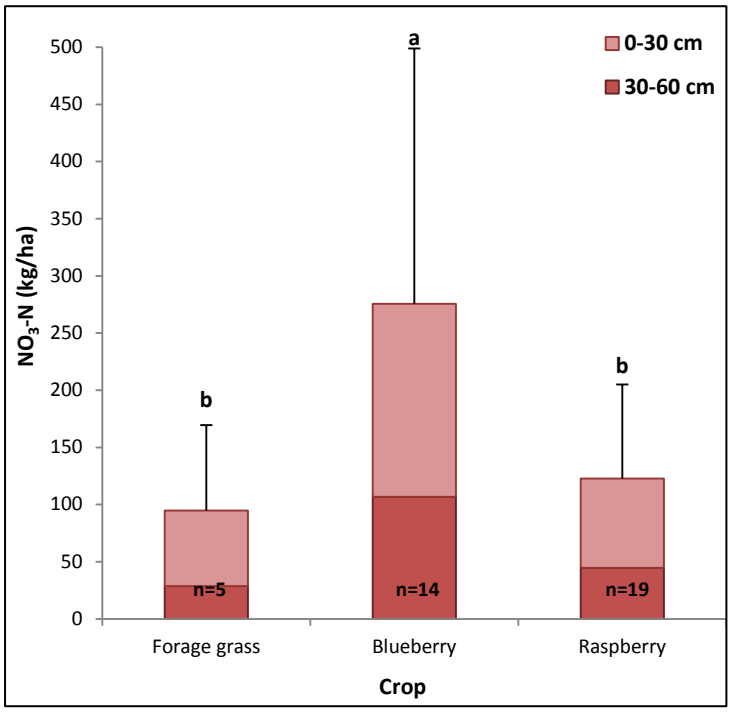

Figure 1. Mean residual soil nitrate (NO_3-N) values in South Abbotsford by crop type in 2012. Crops with the same letters are not significantly different at the 5% level for 0-60 cm. Black bars indicate standard deviation. The number of fields sampled is represented by 'n'.

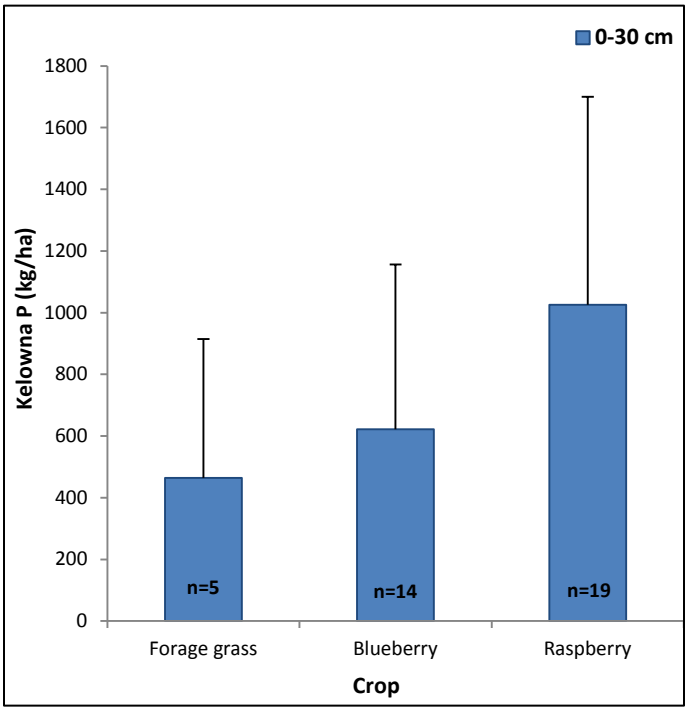

Figure 2. Mean soil test P (Kelowna equivalent) values in South Abbotsford by crop type in 2012. Black bars indicate standard deviation. The number of fields sampled is represented by 'n'. There were no significant differences among crops.

How did raspberry results compare with 2005 FVSNS?

When comparing **all fields** sampled in 2005 (12 fields) and 2012 (19 fields), soil NO_3-N and K tended to be higher in 2005 and soil P tended to be higher in 2012 (**Table 3**). Although the difference in soil N between study years was not significant at the surface depth, NO_3-N at depth decreased significantly from 2005 to 2012 (**Figure 3**). Proportionately more of the fields sampled in 2005 received manure in the three years prior to sampling than the fields sampled in 2012, which may have influenced the nitrate values. Lower residual NO_3-N may also be the result of improved raspberry N management in the last seven years.

However, a trend towards higher P values in 2012 suggests continued nutrient overloading. This may be the result of increased renovation frequency due to disease pressure, and the reliance on poultry manure at renovation.

The trends were similar when comparing **the same** 11 fields sampled in 2005 and 2012: NO_3-N and K were higher in 2005 and P tended to be higher in 2012.

Sampling weather during the study years appears not to have affected the results.

Table 3. Mean, median and maximum soil nitrate (NO_3-N), phosphorus (P) and potassium (K) values of raspberry fields from the 2005 and 2012 Fraser Valley Soil Nutrient Study. There were 16 fields sampled in 2005 and 30 fields sampled in 2012.

	NO_3-N (kg/ha to 30 cm)		Kelowna – P (kg/ha to 30 cm)		Kelowna – K (kg/ha to 30 cm)	
Year	2005	2012	2005	2012	2005	2012
Mean	148 a[1]	78 a	817 a	1025 a	737 a	589 a
Median	88	68	756	910	646	586
Maximum	516	226	1731	2571	1200	1041

[1] Means with the same letters for each nutrient are not significantly different at the 5% level.

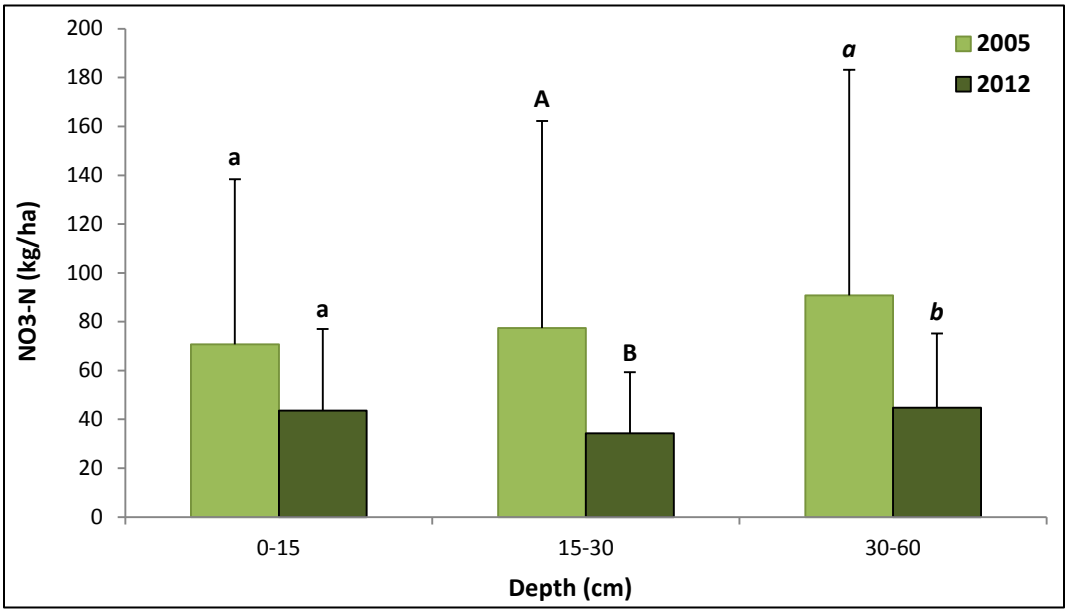

Figure 1. Mean residual soil nitrate (NO_3-N) values in raspberries by sample depth and year. Years with the same letters for each sample depth are not significantly different at the 5% level. Black bars indicate standard deviation. There were 12 fields sampled in 2005 and 19 fields sampled in 2012.

Environmental risk

Although total profile soil NO_3-N (0-60 cm) was reduced by half from 2005 to 2012, more than 50% of the 2012 raspberry fields exceeded the threshold value for high to very high environmental risk of water contamination by N (> 100 kg NO_3-N/ha at 0-60 cm) . The percentage of fields in the very high risk class for NO_3-N decreased from 2005, and more fields shifted into the high and medium risk classes in 2012 (Figure 4). All of the fields sampled in 2012 were in the high to very high risk classes for soil P (> 50 mg P/kg at 0-15 cm), and the percentage of fields in the 'Very High' risk class increased from 2005 to 2012 (Figure 4).

Although this study did not assess the impact on receiving waters, any residual soil NO_3-N is assumed to be lost from leaching and denitrification over the winter[1]. The proposed risk classes are not specific to crop, region or soil type.

Raspberry nutrient management

Of the 19 raspberry fields sampled in 2012, four fields received poultry manure every year, and two fields received manure once since 2009 (at renovation). The three highest soil test P values were from fields that had used poultry manure at least once since 2009; however, the other three manured fields were in the low- to mid-range of P values.

More than 50% of the raspberry growers in the study did not apply fertilizer P in 2012. For those who used fertilizer, the average application rate was 33 kg P/ha. None of the growers who applied manure in 2012 applied fertilizer P.

Nearly all of the growers applied fertilizer N and K, which averaged 76 kg N/ha and 55 kg K/ha.

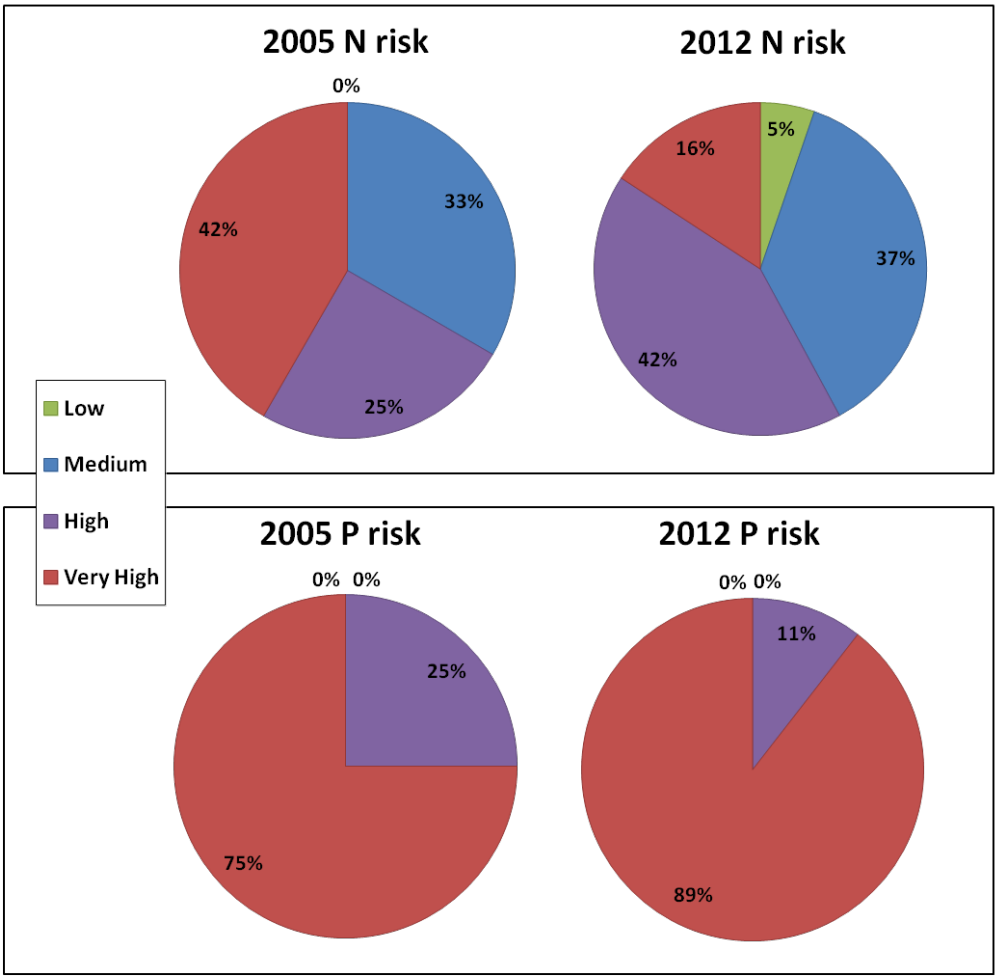

Figure 5. Distribution of raspberry fields in the environmental risk classes based on soil NO_3-N and P results in 2005 and 2012. Refer to 2005 FVSNS Report for tables of environmental risk categories.

Summary and Implications

Comparison of soil NO_3-N across the study years shows a marked improvement in raspberry N management, as values have decreased from 2005 to 2012. Although not statistically significant at the surface depth (0-30 cm), the reduction in residual NO_3-N was significant across the whole soil profile (0-60 cm) and resulted in a decreased risk of environmental contamination. Raspberries were in the mid-range of the six crops studied for soil NO_3-N results, in comparison to being the crop with the highest residual soil lNO_3-N in 2005.

Unfortunately the study results are not as positive for soil P management: raspberry fields had substantially higher soil P results than other crops, and P levels increased from 2005. The records of fertilizer rates and manure application do not provide a direct correlation with soil test P, indicating a history of soil P accumulation. Even with the six manured fields removed from the raspberry dataset, mean soil test P in raspberries was still extremely high (850 kg P/ha at 0-30 cm). The presence of P in such high quantities indicates some soils may be saturated with P. There exists a long history of over-application of P in berry crops both with manure and fertilizer, and P is not very mobile in the soil and therefore builds the soil P reserve. The amount of soil P removed in a raspberry systems is very minimal, considering the fruit removes only 3-5 kg P/ha and the prunings are returned to the soil.

In addition to an environmental risk, excessive residual soil P represents an economic inefficiency for growers. With an abundant supply of P built up in the soil, plants are supplied adequately and growers are unlikely to see economic gain from the added P amendments they are paying to apply. As the emphasis has been on improved raspberry N management over the years, growers would also benefit from increased attention to P management.

Resources for Producers

The Ministry of Agriculture continues to work with growers to enhance and promote environmental farm planning and appropriate nutrient management practices. Through Growing Forward 2 funding, the provincial and federal governments continue to provide outreach and materials to B.C. farmers.

Environmental Farm Planning resources are available online.

Nutrient Management resources are available online:

References

[1] Kowalenko, C.G., Schmidt, O. and Hughes-Games, G.A. 2007. Fraser Valley soil nutrient study 2005. A survey of the nitrogen, phosphorus and potassium contents of the Lower Fraser Valley agricultural soils in relation to environmental and agronomic concerns.

[2] Sullivan, C. 2014. 2012 Fraser Valley Soil Nutrient Study – Sampling Methodology.

Mean is the average of data in a population or group. It is calculated by adding up all of the data points from a group and dividing by the number of data points in that group.

for example – 6, 9, 11, 13, 14, 16, 20 ⟶ Mean = 89/7 = 12.7

Median is the middle point in a population or group, where half of the numbers are above and half of the numbers are below.

for example – 6, 9, 11, 13, 14, 16, 20 ⟶ Median = 13

INNOVATION AND ADAPTATION SERVICES BRANCH
BC Ministry of Agriculture
1767 Angus Campbell Road
Abbotsford, BC V3G 2M3 Canada

FOR MORE INFORMATION
Phone: (604) 556-3001
Toll-free 1.888.221.7141