Soil
FACTSHEET

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NITROGEN RECOMMENDATIONS FOR RASPBERRIES

For South Coastal British Columbia

INTRODUCTION

Why Soil Test ?

Good nitrogen management in raspberries makes good agronomic and economic sense. Application of too little nitrogen can result in reduced yield, reduced crop vigour and possibly reduce the life expectancy of the crop stand. However, applying too much nitrogen means unnecessary input costs, may result in increased disease incidence and reduced crop quality. High nitrogen levels may also interfere with fruit set and dormancy.

Over application of nitrogen can also impact the environment. In most cases all the nitrogen remaining in the soil in the fall will be washed out of the root zone over the fall and winter. The over application of nitrogen from manure and inorganic fertilizer to raspberry crops, is known to be a significant contributor to the high nitrate-N concentrations in the Abbotsford Aquifer.

The amount of nitrogen which is required by raspberry crops varies widely between fields. Much of the nitrogen used by the raspberry crop is supplied by the soil through the release of nitrogen from soil organic matter. The amount of nitrogen released is generally higher for soils that have a history of manure application, a high organic matter content, have a deep topsoil and are fine to medium textured.

Manure or inorganic fertilizer nitrogen is used to supplement the nitrogen supplied by the soil in order to meet the crop nitrogen requirement. As a result of variability in the nitrogen level supplied by the soil, the amount of manure or inorganic fertilizer required is also variable. A soil test can provide an index of how much nitrogen is being provided by the soil. This allows for determination of the manure and inorganic fertilizer requirement.

Poultry manure

Poultry manure is a valuable source of nutrients and organic matter. In addition to nitrogen, manure contains phosphorus, potassium, sulphur, calcium, magnesium and several micronutrients. The organic matter in manure can help contribute to good soil structure.

Manure can be used as the sole source of nitrogen in raspberry production, but care must be taken to apply the manure uniformly. The amount of nitrogen the manure will provide is highly dependent on storage and application of the manure. Proper manure storage, particularly a cover to reduce leaching by fall and winter rains, will maximize the nitrogen content of the manure. Most of the nitrogen provided by the manure to the crop is available within a few weeks of application. If used on an ongoing basis, manure will

greatly increase the amount of nitrogen released from the soil organic matter. Manure should only be applied in spring. Almost all the nitrogen supplied by fall applied manure will be lost during the fall and winter as a result of leaching.

Cover crops

Cover crops, such as spring barley or oats, are an effective way to manage nitrogen more efficiently. If seeded after berry harvest but before September 1, a cover crop can take up a significant amount of nitrogen not used by the raspberry crop. Some of this nitrogen will be released for use by the raspberry crop in the following growing season. Late planting of the cover crop significantly reduces the amount of nitrogen that is taken up.

Besides trapping leachable nitrates, cover crops have other benefits. These are providing protection against soil erosion, increasing soil organic matter and improving soil tilth and have been found to enhance the onset of dormancy in raspberry canes. Cover crops, if left in place until late spring, can also provide excellent control of winter annual weeds.

ESTIMATING FERTILIZER NITROGEN REQUIREMENT

The fertilizer nitrogen requirement for raspberries can be estimated using the following tables. Either a **fall soil test** (Table 1) **OR** the **field characteristics** (Table 2) are used to assess the nitrogen status of the soil and estimate the crop nitrogen requirement. The crop nitrogen requirement is then modified by the cover crop (Table 3) and manure management (Table 4) to estimate the fertilizer nitrogen requirement, using the calculation given in Table 5.

The test outlined in the following tables will give an estimate of the crop fertilizer nitrogen requirement in the next growing season. However, the test is best suited to monitoring of the soil test value over time. Nitrogen management should be modified to meet a range of target test values. The target range of the test value is between 20 and 30 ppm nitrate-N from a soil sample taken to 30 cm (1 ft) depth between August 15 and September 1.

1. Late Summer Soil Test

How to sample

Soil samples should be taken from three points at each sampling site in the field. These three sampling sites are (1) half way between the rows and (2) at the centre of the fertilizer band between the plants along the crop row, and (3) at the centre of the cultivation/root mound between plants in the crop row. (see Figure 1).

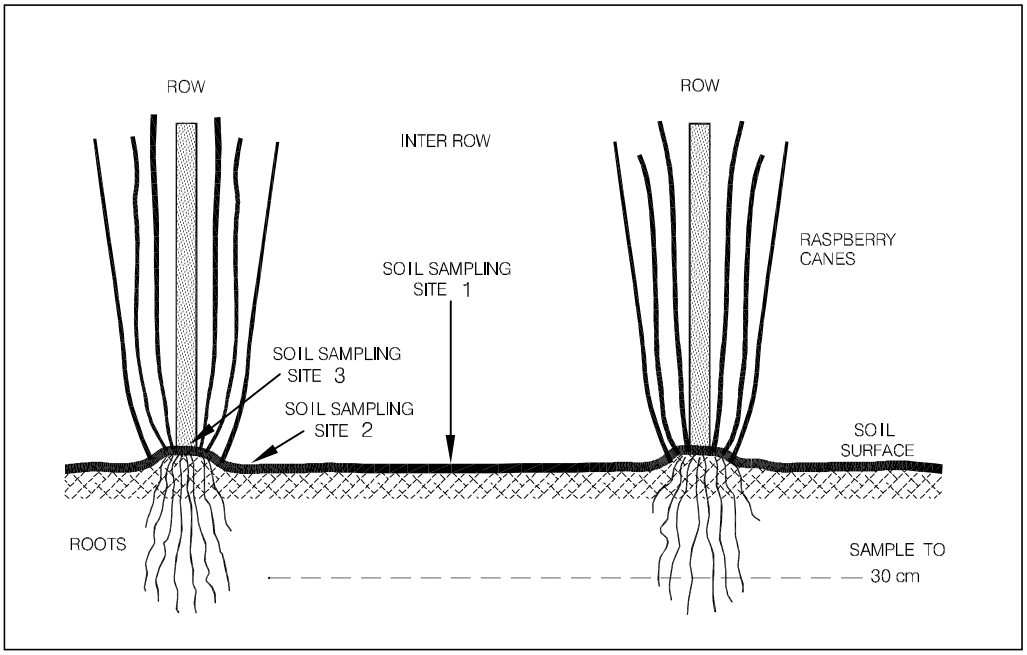
Take 10 to 20 individual samples for each 8-hectare (20-acre) field. These samples can then be bulked into one composite sample. Avoid unusual areas in the field, or if the field has different soil types, sample them separately.

When sampling for nitrate-nitrogen soil samples should be taken from the top 30 cm (1 ft) of soil. When determining the levels of other macro and micro nutrients the sampling depth should be 0–15 cm (0-6 in).

When to sample

For spring bearing canes, soil samples should be taken after crop harvest in the period between August 15th and September 1st. A spring soil test cannot be used to assess nitrogen fertility levels of a raspberry field. Spring soil sampling can be used for other nutrients and should only be taken to a depth of 15 cm.

Figure 1 Soil Sampling Location and Depth



2. Interpretation of Late Summer Soil Test

Table 1 INTERPRETATION OF FALL SOIL TEST

NITRATE LEVEL [0 - 30 cm depth (0-1 ft)] (ppm nitrate nitrogen)	INTERPRETATION	DISCUSSION AND GENERAL RECOMMENDATION
More than 40 [equivalent to greater than 120 kg/ha (110 lb/ac)of NO_3-N in top 30 cm 1 ft) of soil]	high to very high N soil	• Significant risk of nitrate leaching. Fertilizer and manure applications are well in excess of crop requirement. • Nitrogen application (all sources) 0–25 kg/ha (0-20 lb/ac).
25 to 40	low to moderate N soil	• Some risk of nitrate leaching. Fertilizer and manure applications are above crop requirement. • Nitrogen application (all sources) 25–50 kg/ha (20-45 lb/ac).
Less than 25 [equivalent to less than 75 kg/ha (65 lb/ac) of NO_3-N in top 30 cm of soil]	low to very low N soil	• Minimum risk to the environment from nitrate leaching. Nitrogen applications are recommended for the following season. • Nitrogen application (all sources) 50–100 kg/ha (45-90 lb/ac).

3. Determination Of Soil Nitrogen Fertility Status Without A Fall Soil Test

Five categories of soil nitrogen status have been developed ranging from very high to very low. Soils are divided into the five categories based on a range of factors. These factors manure management history, topsoil depth and texture, soil organic matter content and previous cropping history. Of these factors **soil depth and soil management have the greatest impact** on the nitrogen fertility level of a field.

Soils with a high organic matter or fine texture may still require nitrogen applications to meet crop requirement. In raspberries, either a high fertilizer nitrogen application or a single manure application will have limited effect in the next year in terms of soil nitrogen level. However, repeated manure applications have a major effect on soil nitrogen levels in following years. The five categories are outlined in Table 2 with a description of the soils which fall into each category, and the associated nitrogen recommendation for each category.

4. Cover Crops Effects On Nitrogen Fertility Levels

Cover crops can be an effective soil management tool for berry growers. In order to determine the level of nitrogen credits, some assumptions must be made. The following assumptions are for the use of cover crops in raspberries:

- Barley or oats (Canada #1)
- Planted either by broadcast plus harrow OR grain drill
- Seeding rate of 100 kg/ha (80–150 kg/ha)
- Cover crop should be planted on all bare ground between rows and on headlands
- Seeded prior to September 1st
- Approximately one third of all the nitrogen taken up by the cover crop is available in the following season

Table 2 COVER CROP NITROGEN CREDITS

CREDIT LEVEL	DESCRIPTION OF COVER CROP
20–25	Excellent quality stand, thick vigorous growth, over 30 cm (1 ft) high prior to frost or heavy fall rains and seeded between August 15th and September 1st. A cover crop planted in this period could potentially produce 6.5 tonnes dry matter/ha (3.0 t/ac) biomass prior to November 15th and takes up greater than 60 kg/ha (55 lb/ac) of nitrogen.
10–15	Good quality stand, less vigorous growth, about 30 cm (1 ft) tall before frost or fall rains and seeded prior to September 15th. A cover crop planted between September 1st and September 15th could produce up to 3.5 t/ha (1.5 t/ac) dry weight biomass prior to November 15th and take up less than 40 kg/ha (35 lb/ac) of nitrogen.
0–5	Poor quality stand, spotty growth, less than 30 cm (1 ft) high and seeded after September 15th.

Credit level **refers to the plant available nitrogen (kg N/ha) released from the cover crop residue in the following crop year.**

Table 3 INTERPRETATION OF SOIL NITROGEN STATUS WITHOUT A FALL SOIL TEST		
SOIL NITROGEN LEVEL	**SOIL/SITE CHARACTERISTICS OF EACH LEVEL**	**NITROGEN RECOMMENDATIONS**
Very High	Soils with **very high** fertility levels have the following: • >30 cm (>1 ft) soil over sand or gravel, repeated annual heavy use of manure and fertilizer, are cover cropped annually and recent cropping to raspberries. May also have: • > 8% organic matter and a moderately fine to fine (silty clay to clay loam) soil texture.	No nitrogen fertilizer should be applied from any source (manure or fertilizer)
High	Soils with **high** fertility levels have the following: • >30 cm (>1 ft) soil over sand or gravel, repeated use of manure and fertilizer however may not be annual or heavy, normally cover cropped and recently cropped to raspberries. May also have: • 6–8% organic matter and a moderately fine (silty clay loam to loam) soil texture.	Nitrogen fertilizer application rate should be between 0–25 kg/ha (0-20 lb/ac)
Moderate	Soils with **moderate** fertility levels have the following: • about 30 cm (1 ft) soil over sand or gravel, use of manure and fertilizer near crop requirement, annually cover cropped. May also have: • 4–6% organic matter and a medium to moderately fine (loam to silt) soil texture.	Nitrogen fertilizer application rate should be between 25–50 kg/ha (20-45 lb/ac)
Low	Soils with low fertility levels have the following: • <30 cm (<1 ft) soil over sand or gravel, limited manure use and low or below crop requirement use of fertilizer. No cover cropping is practised. May also have: • <4% organic matter and a moderately coarse to medium (Silty loam to sandy clay loam) soil texture.	Nitrogen fertilizer application rate should be between 50–75 kg/ha (45-65 lb/ac)
Very Low	Soils with **very low** fertility levels have the following: • <30 cm (<1 ft) soil over sand or gravel, low organic matter, no manure use, and a coarse (sandy loam to sand) soil texture.	Maximum acceptable nitrogen application from all sources is 100 kg/ha (90 lb/ac)

5. Poultry Manure Utilization

Table 4 NITROGEN CREDITS FOR SPRING APPLIED POULTRY MANURE	
N Credit - Kilograms nitrogen per cubic yard of manure ***(kg/yd^3)*** *(moisture on AS-IS basis)*	
Incorporated within 12 hours of application	*Not incorporated*
4.5 (10 lbs/yd^3)	*3 (7 lbs/yd^3)*

Table 4 Assumptions

Manure stored in a proper storage facility shortly after leaving the barn and is in either a solid or semi-solid form. Nitrogen and moisture content of poultry manure varies depending on the type of poultry operation the manure came from.

The numbers in the above table are calculated on a weight per volume basis which takes moisture content and density variations into account. The numbers given in Table 4 refer to all types of poultry (layer, broiler and turkey) manures. Nitrogen credits shown in Table 4 assume 50% nitrogen availability for incorporated and 33% nitrogen availability for non incorporated manures.

6. Calculation of Nitrogen Requirement

Example Calculation:

Nitrogen Requirement (kg/ha) from Table 1 or Table 3 ➔			❶			**100 kg/ha①**
Nitrogen Credits						
Cover Crop (Table 2)		❷			**15 ②**	
Manure (Table 4)🡻						
	credit per cubic yard ❸			**3 ③**		***example***
	cubic yards per ha ❹			**4 ④**		
	credit: (❸ x ❹)	❺			**30 ⑤**	
	Total Credits: (❷+❺)		❻			**45 ⑥**
Nitrogen Fertilizer Requirement (kg/ha): (❶ - ❻)			❼			**55 ⑦**

Note: The soil test recommendation system outlined in this factsheet, is based on results from research conducted from 1994 to 1997 on operating raspberry farms in the Abbotsford Area. The trials were completed with funding from the Canada-British Columbia Green Plan for Agriculture (Project GP 3116).

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