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Understanding Soil Nutrients for Cranberries

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Proper use of fertilizers is an important factor in producing a high yielding cranberry crop. Equally as important is the nutrient composition of the sand in the cranberry bed. Sand used in cranberry bogs in Prince Edward Island show a wide range of nutrient levels. Accurately testing the different nutrients and understanding what they do is the first step in developing the optimum fertilizer program for your cranberry bog.

Sand, silt or clay?

Soils are made up of sand, silt and clay. The difference between them is in the size of the soil particle (sand particles are larger than silt and silt particles are larger than clay), in their ability to hold nutrients and in their ability to hold water. Generally clay and silt hold nutrients and water better than sand. Soil can also contain organic matter, such as decomposed leaves or peat moss. Different plants prefer different soil types; cranberries generally produce best in sand (see *Selecting Sand for Cranberry Bogs* by Scott Anderson). Since sand does not hold water and nutrients very well, water and fertilizers are applied to cranberry bogs on a regular basis. It should be noted that in some areas cranberries are successfully produced on peat (organic) soils that have little or no sand, silt or clay.

Soil nutrients, what are they and what do they do?

There are a number of nutrients (also referred to as minerals or elements) that the cranberry extracts from the soil through the roots. All of the nutrients are important but some are required in greater quantities that others. For example, a good cranberry soil will contain about 100 ppm of phosphate but requires only 0.2 ppm of boron. Even though boron is only required in very small amounts, if there was no boron in the soil the cranberry plants would die. A soil can also contain toxic levels of a specific nutrient. For example, if the soil contained 100 ppm of boron then the cranberry plant would die.

Some nutrients, such as iron, are almost always present in sufficient amounts and never have to be added. Other nutrients, such as nitrogen, are almost never naturally present in high enough levels and have to be supplemented by adding the appropriate fertilizer. Table 1 shows how the different soil nutrients are used by the cranberry plant.

Table 1	What the Different Nutrients Do *

Nutrient	Effect on Cranberries
Organic Matter (OM)	Ties up pesticides. Maintains soil moisture.
pH (soil acidity)	Determines the availability to the cranberry of the different nutrients. Cranberries prefer a low pH.
Nitrogen (N)	The most common nutrient applied to cranberry bogs. Important for stem and leaf growth. This nutrient is not measured in soil samples.
Phosphorous (P) or Phosphate (P_2O_5)	Important in many aspects of growth, especially root growth.
Potassium (K) or Potash (K_2O)	Important in many aspects of growth.
Calcium (Ca)	Required to make fruit firm. Calcium will generally raise the pH.
Magnesium (Mg)	Required for general plant growth.
Boron (B)	Required for pollination. Only required in very small quantities.
Copper (Cu)	Required in very small quantities for general plant grow. Not usually added as a fertilizer.
Zinc (Zn)	Zinc has been associated with winter hardiness in some fruit crops. Only required in very small quantities.
Sulfur (S)	Required for general plant growth in small quantities. Sulfur is often used to lower the pH. Many common fertilizers contain small amounts of sulfur.
Manganese (Mn)	Required for general plant growth in small quantities. Not usually added as a fertilizer.
Iron (Fe)	Required for general plant growth in small quantities. Not usually added as a fertilizer

*** Most nutrients are involved in a number of important plant functions. Only some of the important functions have been listed above.**

Soil Acidity and pH

Another important factor is the pH. This is a measure of how acid the soil is. The lower

the pH the more acidic the soil. Generally calcium (lime) is used to raise the pH and sulfur is used to lower the pH. Gypsum, which contains sulfur and calcium, tends to keep the pH the same. Cranberries prefer low pH soils (pH 4.5 - 5.5). Most soils in PEI are acidic; however, shore sand can contain very high levels of calcium from sea shells, and consequently can have a very high pH (pH +8.0). Shore sand can also contain harmful levels of salts.

How do I measure soil nutrients?

Measuring the amount of nutrients in your soil can be done by taking a soil sample and having it analysed by a qualified soil laboratory.

Different laboratories use different methods of measuring soil nutrients. In addition, different regions sometimes use different methods of reporting the recommended nutrient levels. For example, researchers in Massachusetts measure the total phosphorous in the soil (P), while the PEI Soil & Feed Lab measures the amount of phosphorous available to the plant (phosphate or P_2O_5) . Therefore, a reading of 45 ppm (P_2O_5) from the PEI lab is the same as a reading of 20 ppm (P) from a Massachusetts lab. Care must be taken when comparing results and recommendations from different laboratories.

Soils used in Prince Edward Island for cranberry bogs can vary greatly in their nutrient levels (see Table 2). For this reason, a soil test is an important tool to use when selecting a source of sand and when planning a fertilizer program.

Table 2 PEI Cranberry Soils Compared to Recommended Ranges

	Recommended Range* (Mass.)	Results (PEI cranberry bogs)**
Organic Matter (%)	0 - 100	0.2 - 2.4
pH (soil acidity)	4.5 - 5.5	4.6 - 8.8
Phosphate P_20_5 (ppm)	45 - 185	11 - 296
Potash K_20 (ppm)	35 - 60	29 - 117
Calcium Ca (ppm)	20 - 80	133 - 10,000
Magnesium Mg (ppm)	10 - 25	29 - 125
Boron B (ppm)	?	0.1 - 0.3
Copper Cu (ppm)	?	0.1 - 0.6
Zinc Zn (ppm)	?	0.6 - 1.6
Sulfur S (ppm)	?	7 - 104

Manganese Mn (ppm)	**?**	**4 - 187**
Iron Fe (ppm)	**?**	**94 - 450**

*** Information from University of Massachusetts Cranberry Chart Book and adjusted for PEI soil testing methods.**

**** Data compiled from PEI Department of Agriculture and Forestry Soil & Feed Testing Lab (1993-1998). Note: The numbers show the range of results found in PEI. These are not necessarily the recommended ranges.**

How do I take a soil sample?

The results you get from soil testing is only as good as the sample you send in. By following the basic steps below, you will ensure that you get a good soil sample.

- **A soil sample can be taken anytime of year. Early fall is recommended as this allows you ample time to plan your fertilizer program for the next year.**
- **Take about ten random samples from a bog, preferably with a soil probe; mix in a bucket. After mixing, separate about 250 ml (1 cup) of soil for analysis. Soil probes and sample bags are available from the PEI Soil & Feed Lab and the District Offices.**
- **The samples should be taken from the top 15 cm (6 inches). If your sand layer is less than 15 cm, then you should submit the sand layer and the under layer as separate samples.**
- **Keep good records. Make a map of your bogs and assign the different bogs a permanent identification number. Use the same bog number to identify all the samples that you take from that area. One of the benefits of soil sampling is to be able to track changes in nutrient levels over time (eg: changes in pH before and after an application of Sulfur). This can only be done if you keep accurate records.**

What is the cost of soil testing?

Soil testing laboratories will often offer a standard soil testing package and for an additional cost a more detailed analysis. The PEI Soil & Feed Lab has a standard soil test (pH, OM, P_2O_5, K_2O, Ca and Mg) for $5 for farmers and $10 for non-farmers. The standard + micros soil test also includes Cu, Zn, Fe, Mn, S and B for an additional $1 (farmers) or $2 (non farmers). These additional nutrients tested are referred to as micro nutrients.

When selecting a source of sand or if you have added or plan to add micro nutrients, then you should select the standard +micros soil analysis. For monitoring the nutrient levels in an existing bog, the standard field soil testing package is usually sufficient.

How do I take a leaf sample?

Cranberry leaves testing may also be used as a tool to determine the appropriate fertilizer program for your cranberry bog. The advantage of leaf tissue testing is that it shows how much nutrients are actually being taken-up by the plant. The disadvantage to this type of testing is that other factors such as disease will affect the results.

To take a leaf sample for analysis:

- **Collect about 250 ml (1 cup) of uprights (~200 stems with leaves) per sample from 10 locations in each bed.**
- **Do not include berries.**
- **Samples are usually collected in late summer.**
- **If the sample is to be tested at the PEI Soil & Feed Lab, air drying and vented plastic bags are not required. If the sample is to be tested outside the province, then special care must be taken to ensure that the sample arrives at the laboratory in good condition. In either case, you should submit the sample for testing as soon as possible.**

What is the cost of tissue testing?

The cost of a standard tissue testing package at the PEI Soil & Feed Lab is $12 (farmers) or $24 (non-farmers). Other testing laboratories may have a different fee structure. The standard leaf tissue testing package includes N, P, K, Ca, Mg, Cu, Zn and B.

What do the results mean?

Historical information on the normal leaf nutrient levels are not yet available for Prince Edward Island. Information on deficient, normal and excess levels in Maine are presented below.

Table 3 Leaf Tissue Testing Ranges*

Nutrient	Deficient below	Normal	Excessive above
Nitrogen %N	0.90	0.95 - 1.05	1.20
Phosphorous %P	0.09	0.11 - 0.14	0.18
Potassium %K	0.30	0.40 - 0.65	0.80
Magnesium %Mg	0.20	0.20 - 0.25	0.26
Calcium %Ca	0.50	0.60 - 0.80	0.90
Boron ppm B	15	15 - 60	70
Iron ppm Fe	20	>20	-
Manganese ppm Mn	100	150 - 250	400
Zinc ppm Zn	15	15 - 30	35
Copper ppm Cu	4	4 - 7	10

*** Adapted from *Cranberry Agriculture in Maine Grower's Guide***

For more information on cranberry production and soil analysis in Prince Edward Island

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