6 RECORD KEEPING AND MONITORING

The first time that a Nutrient Management Plan is done, the quality of the plan may be less than ideal because many of the calculations are based on assumptions that are not necessarily backed up with solid information. However, as the farmer begins a process of keeping thorough organized records on nutrient management practices, the plan can be adjusted each year based on these records. Over time, the quality of the plan will improve substantially.

RECORDS THAT SHOULD BE KEPT

Chapter 5 outlined a process for setting up a binder that contains the Nutrient Management Plan and all related records including manure tests, soil tests, and forage tests.

The record-keeping component of the plan is a systematic way of recording the nutrient management practices that actually occurred.

The most important data to record includes:

- Crop grown
- Date, rate and method of all manure applications
- Date, rate and method of all chemical fertilizer applications including formulations
- Harvest (and planting/seeding) date
- Yield
- Crop quality information (or vigour assessment for berries)

If using the Forage or Vegetable NMP Calculators, the worksheet, "Record Keeper" can be used to generate forms that can help the producer organize records and compare actual activities with the planned activities at the end of the year.

Additional comments that can be helpful include statements about weather conditions (before and after nutrient applications) and the performance and uniformity of manure application equipment.

MONITORING

Once a Nutrient Management Plan is developed, there are a number of tests and suggested practices that can be utilized to ensure that the plan is working well. In some cases, the tests will also indicate a need to change values in the

plan. The tests are indicated below and discussed briefly in the soil sampling factsheet.

📖 **Nutrient Management Factsheet Series #2: Soil Sampling**

Pre-Sidedress Nitrate Test

The Pre-Sidedress Nitrate Test (PSNT) has been developed primarily for corn producers who apply nitrogen fertilizer to the crop just prior to the corn going into the rapid growth stage. The test is used to evaluate if additional nitrogen is required and if so, how much.

To conduct the test, soil samples are collected mid-way between the corn rows when the corn is at about the 6 leaf stage (usually mid-June) and submitted to a laboratory for analysis.

Research has shown that if soil test nitrate values are above 30 parts per million (ppm), there will not normally be an economically viable crop response to a sidedress application of fertilizer nitrogen. Table 3, below, provides suggested application rates if the PSNT value is below 30.

Table 6.1: Fertilizer Nitrogen Recommendations Based on the Pre-Sidedress Nitrate Test

PSNT test value (ppm, 30 cm depth)	Fertilizer N recommendation (kg N ha^{-1})
PSNT > 30	0
30 ≥ PSNT > 26	25
26 ≥ PSNT > 21	50
21 ≥ PSNT > 18	75
18 ≥ PSNT > 14	100
14 ≥ PSNT	125

**based on Zebarth, B.J. etal Reducing Risk of Groundwater Contamination Through Development of a Nitrogen Test for Silage Corn in South Coastal British Columbia. Final report for Project GP#3102, Agriculture & Agri-Food Canada 1999*

Post-Harvest Soil Nitrate Test

Note this is the main nitrogen test that has been developed for Nutrient Management Planning for raspberries. Interpretations for results are provided in the Berry NMP Calculator and they depend on a combination of the soil test and visual assessment of the plant vigour in the late summer.

The post-harvest nitrate test measures the quantity of plant available nitrogen present in the nitrate form in the surface 30 cm (one foot) of soil, assuming that nitrogen has not already been mostly leached below the 30 cm depth by rainfall or irrigation.

Whereas spring soil samples are taken to help predict how much fertilizer is needed for the upcoming season, fall (or late summer) sampling gives feedback about the accuracy of the predicted nitrogen supply relative to crop

needs. If the crop yielded as expected and the soil level of nitrate is low in fall after crop growth has stopped, the amount of nitrogen applied in manure and fertilizer was appropriate for the crop grown (since the crop was able to use almost all of the applied nitrogen, leaving little to be leached). If the soil level of nitrate is high after crop growth has stopped and conditions were optimal for crop growth, the crop was not able to use all of the plant-available nitrogen released in the soil, and manure and/or fertilizer application rates should be reduced if the same crop will be grown next year.

In Coastal BC, most residual soil nitrate-nitrogen is expected to be lost from the soil through leaching over the winter and will eventually find its way to groundwater. In the Interior of BC, this is not the case: residual nitrate-nitrogen will be mostly available for crop growth next spring and should be considered when determining the nitrogen requirement for next year's crop.

Collecting samples: Fall sampling for soil nitrate level should occur after crop growth has stopped in fall (mid August to late October depending on crop) but before heavy fall rains begin. Once significant rainfall begins in late fall, nitrate will begin to move down in the soil profile beyond the sampling depth, and will move eventually to groundwater. Collect a composite sample from each field to a sampling depth of 30 cm.

If there is concern that some nitrate may have moved below this depth, sample an additional 30 cm. Make two separate composite samples – the 0 to 30 cm and the 30 to 60 cm depth samples. Keep the samples cool and send to the laboratory immediately to minimize changes in nitrate content of the soil sample. Conversely, if stones or rocks prevent samples from being taken at the ideal depth, note the actual sample depth to convert measurements to a volume (i.e. kg NO_3-N/ha) basis for comparison with the interpretations described below, using the guidelines in the soil sampling factsheet of this publication.

Interpreting the lab soil nitrate-nitrogen analysis: Lab results are usually expressed as "parts per million" nitrate-nitrogen (ppm or mg/kg NO_3-N). Convert ppm nitrate-nitrogen to kg per hectare by multiplying ppm by 3 (ppm x 3 = kg nitrate-nitrogen /ha). This assumes a soil bulk density of 1000 kg/m^3 and a sampling depth of 30 cm.

If the soil nitrate-nitrogen concentration is less than 20 ppm (60 kg NO_3-N/ha) for silage corn or less than 15 ppm (45 kg NO_3-N/ha) for perennial grasses, it is recommended to continue with present nitrogen management practices. If levels are above these thresholds, actions should be taken in the following year to reduce nitrogen excesses (i.e. reduce N application rate).

More detailed information on conducting and interpreting the post-harvest nitrate test is provided in the following publication.

- **Post-harvest Soil Nitrate Testing for Manured Cropping Systems West of the Cascades:** available on the Oregon State University extension website at http://extension.oregonstate.edu/catalog

Long-term Soil Quality Monitoring

Once every three to five years it is useful to do a complete nutrient, pH and metals scan on your soil samples as a way for you to monitor the long-term soil quality of your fields.

The Nutrient Management Planning worksheets look at only nitrogen, phosphorus and potassium levels in soil, look indirectly at soil pH and do not consider the secondary nutrients, micro nutrients, metals or other soil parameters that can change in your soil as the result of on-going manure and fertilizer applications and cropping practices. Understand that the levels and relative proportions of these 'other' nutrients affect soil fertility and crop production.

Have the additional analyses done on the same samples that you submit for nutrient management (0 to 15 cm depth). If metals will be analyzed on the samples, ensure that the sampling equipment is clean and rust-free, and that you wear rubber gloves. Request an analysis of the secondary nutrients calcium, magnesium, sodium and sulfur as well as micronutrients and metals, particularly copper and zinc.

Most agricultural laboratories have a standard nutrient and micronutrient/metals package that will give you the required background information to monitor soil quality. Lab analyses can be interpreted by a qualified agrologist or by a Ministry of Agriculture and Lands soils specialist. Reports should be kept on file, and be used to compare with on-going sampling results to pick out any significant changes in soil concentrations of metals or nutrients.