4 NMP CALCULATORS

This chapter is essentially a series of user guides for using the **NMP Calculator** suite of spreadsheet programs to assist with developing a Nutrient Management Plan. This suite consists of three separate programs:

- Forage NMP Calculator – p. 18
- Vegetable NMP Calculator – p. 27
- Berry NMP Calculator – p. 32

Detailed instructions are contained within each spreadsheet program. This chapter provides a concise overview of how the steps within each program link with each other. It also provides help for making decisions and tips to solve common problems that are particularly useful to first-time users.

The following objectives will be met to varying degrees depending on the program used:

- determine crop nutrient recommendations
- estimate available nutrient supply from soil and manures
- determine optimum time, rate and method of manure application
- determine appropriate amount of supplemental fertilizer to be applied, if required

Various assumptions have been made to simplify the process. In reality, nutrient cycles are quite complex and predicting the availability of manure nutrients is not an exact science. Nevertheless, following a systematic process as outlined in this chapter will help to generate a reasonable plan. The results should be considered to be part of a strategic plan: the nutrient management plan is forward-looking and relatively long term. After a plan is complete, short term decisions are made that ideally will be consistent with the plan but ultimately must reflect conditions in the field as they happen. Records of these decisions are backward-looking and are meant to be used to improve assumptions for updating the nutrient management plan. Chapter 6 addresses record-keeping and monitoring.

The steps and examples used in this chapter are oriented towards nutrient management in **forage crops, field vegetables,** and **raspberries and blueberries**. A modified process would be used for determining crop nutrient requirements for other crops. At the time of printing, processes for other crops was still under development.

BEFORE YOU BEGIN

Data Collection

Collect the necessary information to enter into the programs, according to instructions in Chapter 2. With this information, you should be able to, but are not expected to, complete the summary sheet (Figure 4.2).

About the NMP Calculators

System requirements: Microsoft Excel 2003 or newer. The NMP Calculator suite of programs was developed for Microsoft Excel 2007 and is compatible with Microsoft Excel 2003.

It is assumed that users have a basic understanding of Microsoft Windows and Excel, including how to copy and rename files. Regardless of which NMP Calculator program you use, the **first thing you should do** is to make a copy of the spreadsheet program with a new filename and keep a copy of the original spreadsheet program.

All of the NMP Calculator programs share the following features:

- Users should have to **fill in only cells that are shaded light yellow**.

Table 4.1 Colour scheme in NMP Calculator programs

	yellow	user enters a value (in some cases from a drop-down list)
	purple	no change necessary, usually a title or heading
	grey	no change necessary, a calculated or blank value
	blue	no change necessary, a calculated value

- Worksheets are protected to help prevent accidental changes to formulas that should not change in most cases.
- Macros need to be enabled. Depending on the security settings in your version of Microsoft Excel, users may see a security warning like those in Figures 4.1a and 4.1b and should choose the option to **enable macros**.

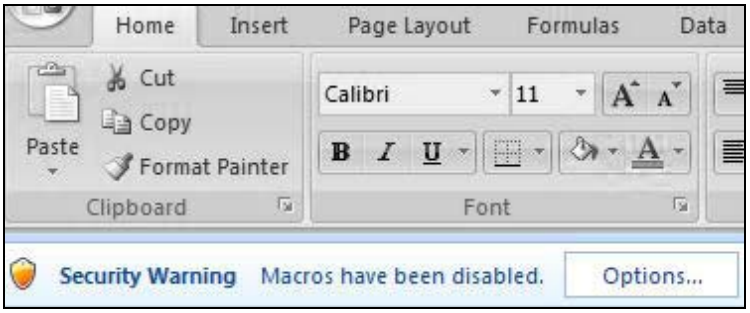

Figure 4.1a. Prompt to enable macros in Excel 2007

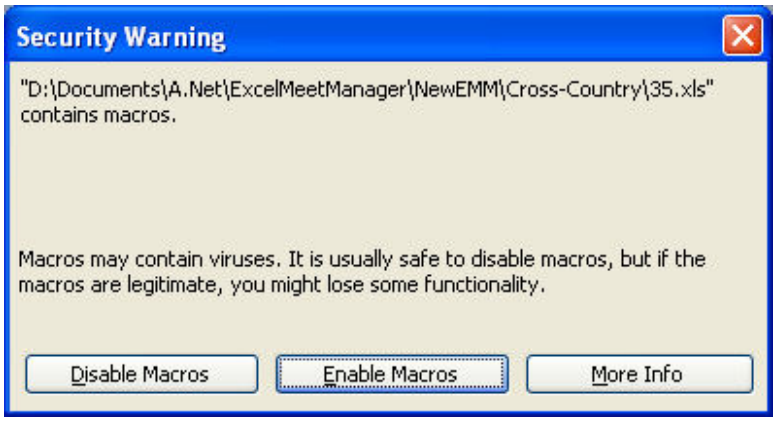

Figure 4.1b. Prompt to enable macros in Excel 2003.

Figure 4.2

SUMMARY SHEET FOR SOIL, PLANT, AND MANURE ANALYSIS INFORMATION - EXAMPLE

General Farm Information: (type of livestock, number of animals)

Soils information:

Field	History	Spring soil sampling and analyses		
		Nitrogen (as nitrate-nitrogen ppm NO_3-N)	Phosphorus[a] (ppm)	Potassium[b] (ppm)

[a] Lab method for phosphorus: [b] Lab method for potassium:

Crop information:

Field	Crop type to be fertilized	Field size (ha)	Manure and fertilizer history	Historical crop yield and analyses			
				Dry Matter yield	Protein or N (%)	Phosphorus (%)	Potassium (%)

Manure information:

Manure source	Description	Manure sampling and analyses			
		Total nitrogen (kg N/t)	Ammonium - nitrogen (kg NH_4-N/t)	Phosphorus (kg P/t)	Potassium (kg K/t)

Comments on manure management practices:

FORAGE NMP CALCULATOR

The Forage NMP Calculator will help meet the following objectives:

- determine forage crop nutrient recommendations
- estimate available nutrient supply from soil and manures
- determine appropriate amount of supplemental fertilizer to be applied, if required
- determine optimum time, rate and method of manure application

Figure 4.3 is a flowchart that gives an overview of how the worksheets of the Forage NMP Calculator link with each other. When the program is opened in Excel, the user completes the worksheets from left to right – beginning with the Quick Fill worksheet and ending with Worksheets 9a and 9b, as shown in the flowchart. Each worksheet is completed from top to bottom.

- On worksheets with field-specific data, the data for up to 16 fields is shown on the same worksheet.

More detailed explanations about how the program works and the calculations in each worksheet are in the program itself and are not repeated here. Instead, this section provides support for those steps where the Planning Advisor needs to make decisions about what data to enter. These steps are marked in the flowchart by parallelograms and diamonds and are discussed below according to the worksheet. The outputs are marked in the flowchart as rectangles.

QUICK FILL WORKSHEET FOR WORKSHEETS 1 TO 5

The Quick Fill worksheet is an optional form that allows the user to enter all laboratory data in one worksheet and then click a button to copy this information into Worksheets 1 to 5. If Quick Fill is not used, the user will enter the data directly into Worksheets 1 to 5.

Enter field information and data from soil tests, crop tests and manure tests. Having good data from the laboratory analyses is crucial to producing reliable estimates of manure and fertilizer requirements. Here are some tips and questions to ensure you are entering good laboratory data:

- Check the data as soon as you get results. If confidence in the data is low, you may be able to have the laboratory reanalyze the sample(s) before the laboratory disposes of them. Alternatively, you may decide to take another set of samples for analysis if time permits.
- Compare the laboratory values for crops and manures with book values. Although nutrient contents of these materials vary from farm to farm, they should be reasonably close to the book values provided in the program. If they are not and there is a reasonable explanation for the difference, be prepared to explain the difference.
- continued on page 20

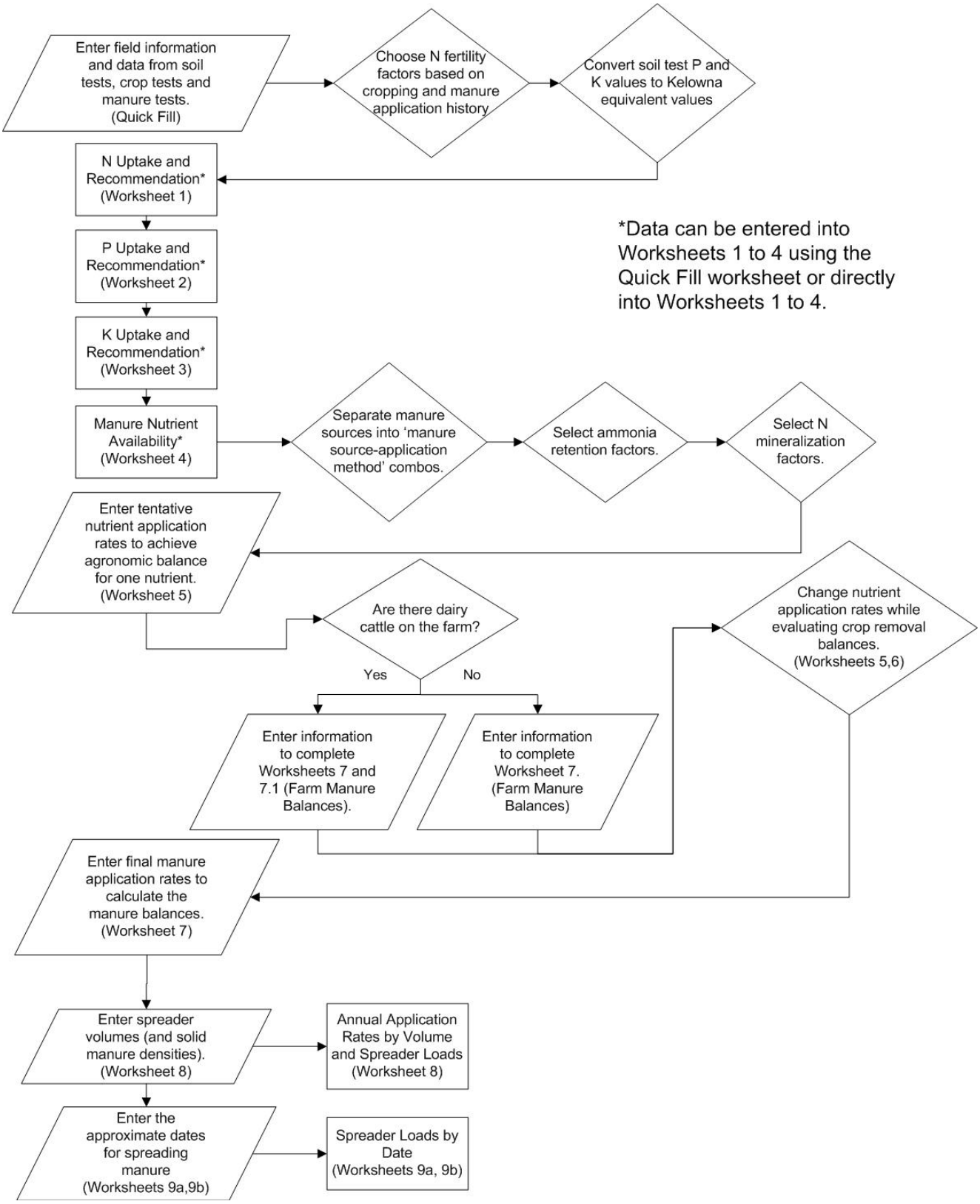

Figure 4.3. Flowchart overview of process for completing worksheets in Forage NMP Calculator

Here are some more tips and questions to ensure you are entering good laboratory data (continued from page 18):

- Use manure nutrient values that represent the manure that will be applied. Nutrient concentrations (on a fresh weight basis) for liquid manures increase with decreasing water contents, so using laboratory analyses from spring and summer manure samples will likely produce more reliable estimates than from a single manure sample.
- Are the data in the same units as those required in the program? Use book values and conversion factors in the program. Note whether phosphorus is given as P or P_2O_5 and whether it is K or K_2O.
- Are soil test P and K ratings consistent with the P and K ratings of the forages? Low soil values and high forage values, or vice versa, may indicate an error in the sampling or analysis.
- Are soil test P and K ratings consistent with previous results? Dramatic changes in these nutrients from one year to the next are unusual in typical cases, as are sudden departures from year-to-year trends in levels of these nutrients.
- If soil test values are reported as a range (e.g. "> 60 ppm"), ask for the soil sample to be reanalyzed and the result to be reported as an absolute value.
- If there is no confidence in using the laboratory results, consider using historical data and book values if available until samples can be retaken according to **Factsheets 2, 4 and 5** for sampling guidelines. Keep notes about sampling protocols and environmental conditions around the time of sampling that may explain discrepancies between expected values and laboratory results.

Choose N fertility factors based on cropping and manure application history. This is one of the steps in the planning process with least certainty. The actual nitrogen credits from historical practices will vary with the practices as well as the conditions (e.g. soil moisture and temperature) that are more difficult to predict. The Planning Advisor has the flexibility to change nitrogen credits according to the following principles:

- Nitrogen fertility factors can probably be increased to 150 kg N/ha (130 lb N/ac) or greater if organic matter content in the top 20 cm of soil is greater than 5% and forage crops have been fertilized with manure every year for the past five years.
- If legumes (e.g. alfalfa) will be part of the stand and their roots are nodulated (indicating they can 'fix' nitrogen from the air), increase the nitrogen fertility credit in proportion to its density in the stand up to 150 kg N/ha (130 lb N/ac). Although legumes will use nitrogen from manures and other soil amendments, most of this nitrogen is not necessary, will decrease the ability of the legumes to fix their own nitrogen and may increase competition from weeds and grasses.

Convert soil test P and K values to Kelowna equivalent values.

- If the soil test P method used is bicarbonate (i.e. Olsen method), you will most likely choose the bicarbonate-**colorimetry** method for converting the value to the Kelowna method equivalent. Most commercial laboratories use colorimetry for bicarbonate; you can

confirm with the laboratory that you use. This conversion has the least certainty of the conversions provided.

- Pick the proper method. Some laboratories analyze and report soil P values using multiple methods.

📖 **Nutrient Management Factsheet Series #1: Nutrient Testing Laboratories**

📖 **Nutrient Management Factsheet Series #3: Understanding Different Soil Test Methods**

WORKSHEET 4: MANURE NUTRIENT AVAILABILITY

Separate manure sources into manure source-application method combinations. If you used the Quick Fill worksheet, you entered manure sources (e.g. liquid dairy manure). Because of the high variability in nitrogen losses under different manure spreading conditions, it is important to try to account for the most probable situations. In this worksheet, make a separate and well-described line entry where any of the following combinations of conditions may vary:

- manure type – dairy, hog, poultry, etc. and liquid or solid
- manure application method – splash plate, injection, SSD, etc. or time between application and incorporation
- time of year – spring versus summer

Select ammonia retention factors. This is directly related to the manure application method and climatic conditions expected at the time of manure application. Use the ammonia retention factors in Tables 7a-d, or use the Ammonia Loss Calculator for liquid dairy and hog manure to vary the factors that affect ammonia loss from spreading these manures: http://www.farmwest.com/index.cfm?method=climateammonia.showgraph The percent manure that is not lost is assumed to be the percent retained.

Select N mineralization factors. See Table 6 in the worksheet for help.

WORKSHEETS 5, 6 AND 7: AGRONOMIC, CROP REMOVAL AND MANURE BALANCES

Deciding what data to enter into Worksheets 5, 6 and 7 is like juggling a need to balance nutrients according to agronomic and crop removal balances and a need to use the manures generated on (and imported to) the farm. The greater the surpluses of manure, indicated by negative manure balances, the more complicated is the juggling act. The process attempts to select nutrient application rates to achieve the following objectives:

- Maximize beneficial use of manure generated on the farm.
- Meet nutrient recommendations and avoid negative agronomic balances.
- If negative agronomic balances cannot be avoided, minimize the magnitude of negative crop removal balances and allocate manure application to fields according to the priority nutrient for each field.
- Determine how much of the farm's manure supply can be utilized by the application rates selected.

1. Enter tentative application rates for each manure source-application method and fertilizers including desired amounts of starter fertilizer (Worksheet 5).

- Choose the highest application rates of manures to achieve an agronomic balance (indicated by a value of zero) for one nutrient without creating negative balances for the other two nutrients. In most cases, you will start by achieving an agronomic balance for phosphorus or potassium.

2. Enter information to calculate manure balances (**dairy**, Worksheets7 and 7.1: manure imports and exports, livestock/animal, manure storage system, and grazing information; **non-dairy**, Worksheet 7 only: manure imports and exports, livestock/animal).

- If manure types were split in Worksheet 4 according to their application method, group them together in Column C and sum the total weight of the manure to be applied (e.g. combine "liquid dairy-spring" and "liquid dairy-summer" into "liquid dairy").

3. Change nutrient application rates while evaluating crop removal balances (Worksheets 5 and 6).

- If possible, achieve an agronomic balance for all three nutrients by increasing fertilizer rates (Worksheet 5). If the agronomic P or K balance is negative, the field in question will be oversupplied with either phosphorus or potassium for optimal crop production. It is advisable to not apply any more manure to these fields.
- If manure must be applied, select the application rates based on the priority nutrient (see Chapter 3):
    - if K is the priority nutrient, the crop removal balance for potassium should be greater than or equal to zero (i.e. the total potassium applied should not exceed the expected crop potassium removal)
    - if P is the priority nutrient, the crop removal balance for phosphorus should be greater than or equal to zero.
    - if N is the priority nutrient, the agronomic balance for nitrogen should be greater than or equal to zero.
- If you choose nutrient application rates that exceed crop K or P removal balances, the best strategy is to exceed removal only in fields with the lowest risk of high soil K to the livestock or lowest risk of soil P transport to the environment.

Alternatively, if there are no negative agronomic balances, crop removal balances may still be negative. This indicates the planned application rate presents minimal risk in the short term and a build up of soil K or P (indicated by negative crop removal balances) that is not sustainable in the long term, after the soil test K or P reaches high or excess levels.

📖 **for detailed phosphorus and potassium management information, see Nutrient Management Factsheet Series #6: Phosphorus Management *and* #7: Potassium Management**

4. Recalculate the manure balances using the final manure application rates selected (Worksheet 7).

WORKSHEETS 8 AND 9: MANURE APPLICATION RATES AND TIMING FOR FIELD USE

After annual manure application rates are determined (as tankers or loads per hectare or acre, Worksheet 8), the next step is to determine the amount to be applied for each application during the growing season (Worksheets 9a, 9b).

Individual Application Amount

Crops follow a relatively predictable growth curve as illustrated for corn in **Figure 1** and grass in **Figure 2**. Crops should be fertilized with an amount of nutrient which is proportional to the amount of annual growth expected prior to the next harvest. Figures 1 and 2 show the percent of annual manure application that should occur at the various manure spreading opportunities.

Consider the following guidelines:

- a single manure application should not exceed 50 m^3/ha (5300 gallons/ac) for slurry or 50 tonnes/ha (22 tons/ac) of solid manure
- for liquid manures on annual crops, if crop nutrient requirements suggest a higher rate than 50 m^3/ha (5300 gallons/ac), consider a split application and incorporate the first application prior to the second application
- leave at least three weeks between applications - this reduces sealing of the soil surface and allows for the soil to recover

Application Timing

Figures 4.4 and 4.5 show the times of the year when manure applications as a fertilizer should be considered. The optimal times to apply manure are before the crop needs the nutrients and when crop growth will not restrict manure application.

The South Coastal Region

- **February and March***:* If the soil is not saturated and not subject to flooding or runoff during this time period, manure can be applied on perennial grassland or well-established cover crops. Use T-Sum 200 or T Sum 300 as a guide to determine timing of first fertilizer application.
- **April to August***:* Avoid spreading on wet soils which could compact or cause crop damage.
- **September and October***:* In general, manure application is suitable only on grasslands that are well drained and not subject to flooding or runoff. Winter cover crops must be well established before any manure application is contemplated on annually cropped land.
- **November to January***:* Application of manure is not recommended.

The Interior Region:

- **March to May***:* Manure fertilizer application should only be considered within fields with no history of runoff or flooding during this time period, and on soils that are not snow covered or frozen.
- **June to August***:* Avoid spreading on wet soils which could compact or cause crop damage.
- **September and October***:* Manure application to thawed ground only.
- **November to February***:* Application of fertilizer (particularly manures) is not recommended. If spreading is to occur, then spread only on fields with no history of runoff or flooding, and with soils that are not snow covered or frozen.

📖 **for more detailed guidelines on timing of manure application, EFP Reference Guide, Chapter 6**

In addition to crop and seasonal climate conditions, the farmer and manure applicator will also consider time of day and weather conditions that affect drift and odour (i.e. ideal to spread when it is cool and early morning, little wind, etc.)

There are times when manure application is not acceptable due to the risk of impacting the environment or little potential for nutrient utilization by the crop.

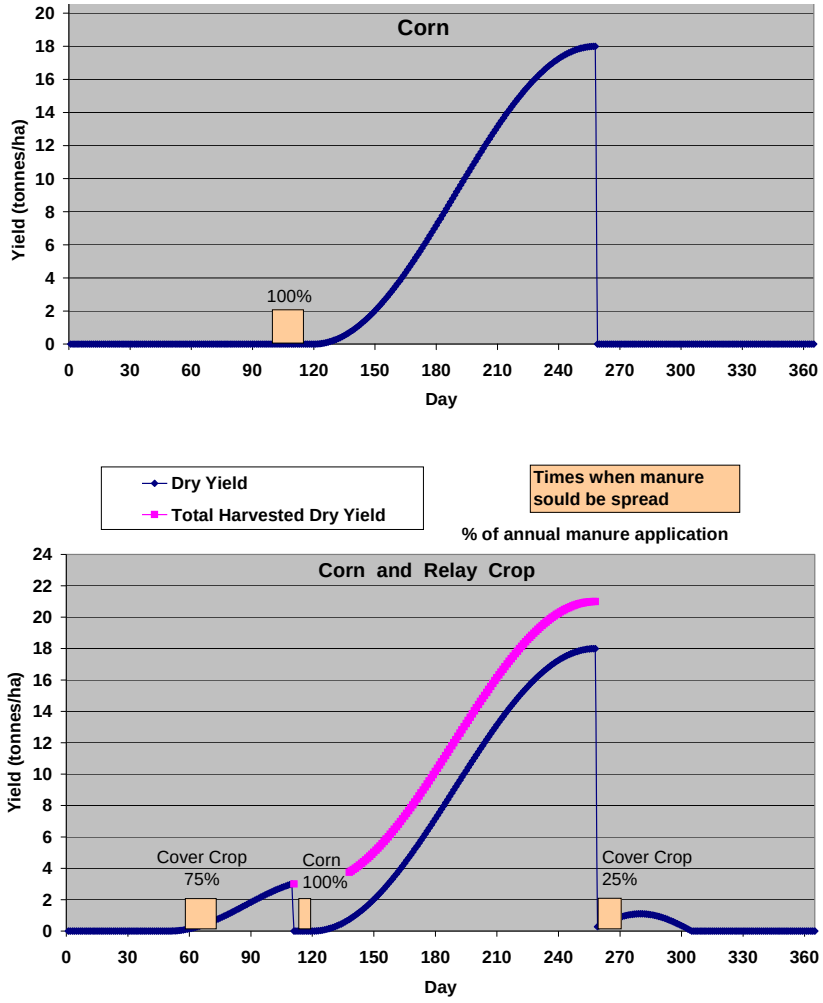

Figure 4.4: Typical Corn Growth Curves and Manure Spreading Opportunities with Approximate Percent of Annual Manure Application for:

a. corn typical for South Coastal and Okanagan/Thompson areas

b. corn planted with a relay crop typical for South Coastal areas

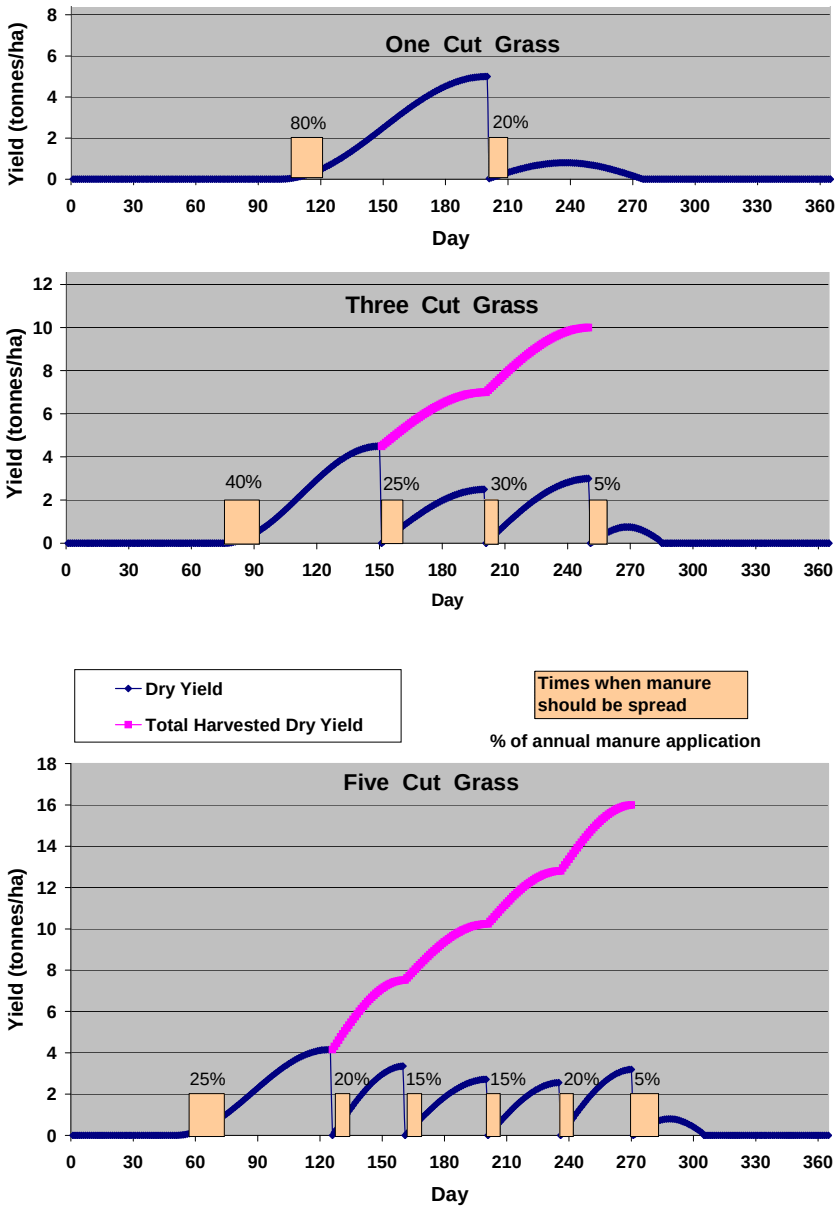

Figure 4.5: Typical Grass Growth Curves and Manure Spreading Opportunities with Approximate Percent of Annual Manure Application for:

a. One cut grass typical for dryland Interior areas
b. Three cut grass typical for dryland South Coastal areas
c. Five cut grass typical for South Coastal and irrigated Okanagan/Thompson areas

RECORD KEEPER

This is a worksheet for printing out field record sheets to record actual practices and compare them with planned practices (optional).

VEGETABLE NMP CALCULATOR

The Vegetable NMP Calculator will help meet the following objectives:

- determine crop nutrient recommendations
- estimate available nutrient supply from soil and manures
- determine appropriate amount of supplemental fertilizer to be applied, if required

The worksheet flowchart (Figure 4.6) gives an overview of how the worksheets of the Vegetable NMP Calculator link with each other. When the program is opened in Excel, the user completes the worksheets from left to right – beginning with the Soil Tests worksheet and ending with the Farm Summary worksheet as shown in the flowchart. Each worksheet is completed from top to bottom.

- Data specific to a field are shown on the same worksheet and fields are separated by different worksheets.

More detailed explanations about how the program works and the calculations in each worksheet are in the program itself and are not repeated here. Instead, this section provides support for those steps where the Planning Advisor needs to make decisions about what data to enter. These steps are marked in the flowchart by parallelograms and diamonds and are discussed below according to the worksheet. The outputs are marked in the flowchart as rectangles.

Note: The assumptions used in the tables in the Vegetable NMP Calculator are based on the same assumptions as in the Forage NMP Calculator.

"SOIL TESTS" WORKSHEET

Enter data from soil tests. Having good data from the laboratory analyses is crucial to producing reliable estimates of nutrient recommendations. Here are tips and questions to ensure you are entering good laboratory data:

- Check the data as soon as you get results. If confidence in the data is low, you may be able to have the laboratory reanalyze the sample(s) before the laboratory disposes of them. Alternatively, you may decide to take another set of samples for analysis if time permits.
- Are the data in the same units as those required in the program? Use book values and conversion factors in the program. Note whether phosphorus is given as P or P_2O_5 and whether it is K or K_2O.
- Do soil test P and K ratings make sense compared with previous results? Dramatic changes in these nutrients from one year to the next are unusual in typical cases, as are sudden departures from year-to-year trends in levels of these nutrients.
- If soil test values are reported as a range (e.g. "> 60 ppm"), ask for the soil sample to be reanalyzed and the result to be reported as an absolute value.

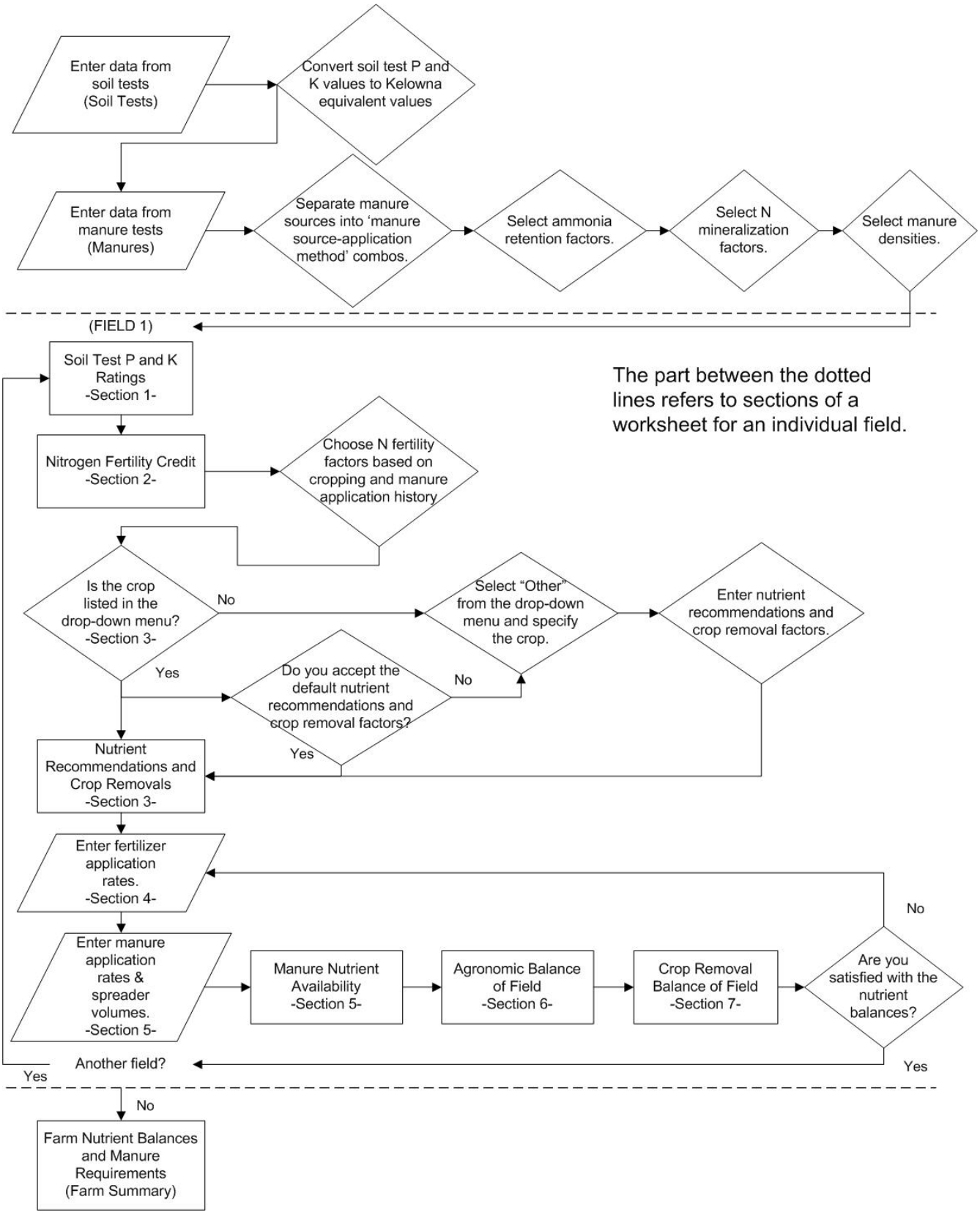

Figure 4.6 Flowchart overview of process for completing worksheets in Vegetable NMP Calculator

Convert soil test P and K values to Kelowna equivalent values.

- If the soil test P method used is bicarbonate (i.e. Olsen method), you will most likely choose the bicarbonate-**colorimetry** method for converting the value to the Kelowna method equivalent. This conversion has the least certainty of the conversions provided.
- Pick the proper method. Some laboratories are known to report soil P values using multiple methods.
- If there is no confidence in using the soil test results, consider using historical data if they are available and recent (i.e. collected in the previous three years) until samples can be retaken according to **Factsheet 2** for sampling guidelines. Keep notes about sampling protocols and environmental conditions around the time of sampling that may explain discrepancies between expected values and laboratory results.

"MANURES" WORKSHEET

Enter data from manure tests. As with soil tests, ensure you are entering reliable data to produce reliable results in the NMP Calculator.

- Ideally, the values are from samples taken just before the manure is applied in the spring. However, if the nutrient management plan is being done in the fall, a fall sample can be used until there are reliable values for spring samples.
- Compare the laboratory values for manures with book values. Although nutrient contents of these materials vary from farm to farm, they should be reasonably close to the book values provided in the program. If they are not and you have a reasonable explanation for the difference, be prepared to explain the difference.
- Are the data in the same units as those required in the program? Use book values and conversion factors in the program. Note whether phosphorus is given as P or P_2O_5 and whether it is K or K_2O.
- If there is no confidence in using the laboratory results, consider using historical data and book values if available until samples can be retaken according to **Factsheet 5** for sampling guidelines. Keep notes about sampling protocols and environmental conditions around the time of sampling that may explain discrepancies between expected values and laboratory results.

Separate manure sources into manure source-application method combinations. Because of the high variability in nitrogen losses under different manure spreading conditions, it is important to try and account for the most probable situations. In this worksheet, make a separate and well-described line entry where any of the following combinations of conditions may vary:

- ♦ manure type – poultry, beef, etc. (and liquid or solid)
- ♦ manure application method – time between application and incorporation if manure is incorporated into the soil

Select ammonia retention factors. This is directly related to the time between manure application and incorporation.

If liquid manure is used, see the "Select ammonia retention factors" section for the Forage NMP Calculator (p. 21) to customize the value you enter.

Select N mineralization factors. See Table 6 in the worksheet for help.

WORKSHEETS FOR INDIVIDUAL FIELDS

Section 2. Choose N fertility factors based on cropping and manure application history. This is one of the steps in the planning process with least certainty. The actual nitrogen credits from historical practices will vary with the practices as well as the conditions (e.g. soil moisture and temperature) that are more difficult to predict. The Planning Advisor has the flexibility to change nitrogen credits according to the following principles:

- If legumes (e.g. clover, vetch) are planted as part or all of a cover crop that is ploughed down before a vegetable crop, the N fertility credit can be increased up to 150 kg N/ha (130 lb N/ac).
- Non-leguminous cover crops that were ploughed down were given N fertility credit in the previous version of the NMP Calculator. Although these crops are useful in taking up residual nitrogen after a growing season, no N fertility credit is recommended for the following vegetable crop in the Veg NMP Calculator.
- The N released (mineralized) from organic nitrogen amendments in previous years depends on various factors including the source and rates. As a rule of thumb, the Planning Advisor can adjust the N fertility credit due to past poultry manure applications by assuming that 15% of the total N applied one year ago and 7% of the total N applied two years ago will become available in the current year – this assumes that the past rates are known or can be estimated.

Section 3. Select a crop from the drop-down list or specify your own crop. Depending on the soil test P and K levels for the specific field and the crop, this selection affects the P_2O_5 and K_2O recommendations as well as the values that determine crop N, P and K removal.

- If you think you need to override the default values provided for a listed crop, you can specify "Other" crop and type in the P_2O_5 and K_2O recommendations and factors yourself with a justification for these values in the written portion of the nutrient management plan.

Sections 4 to 7 include the following:

- Section 4. Enter fertilizer application rates.
- Section 5. Enter manure application rates and spreader volumes.
- Section 6. Agronomic balances of the field.
- Section 7. Crop removal balances of the field.

Deciding what data to enter into sections 4 to 7 is an iterative process that begins with entering tentative fertilizer and manure application rates. Then the Planning Advisor should revise these rates according to the following guidelines:

- Ideally, rates are selected that result in agronomic balances equal to zero for all three nutrients.

- If phosphorus is the priority nutrient for a field,

1. Try to avoid a negative agronomic P_2O_5 balance (indicating more available phosphorus is supplied than recommended for an optimal crop). As an interim guideline, the program warns the user when an agronomic balance is less than an insurance amount of -15 kg P_2O_5/ha. An orange-highlighted value indicates this warning.
2. If negative agronomic P balances cannot be avoided, try to avoid negative crop P removal balances (i.e. less than -70 kg P_2O_5/ha, crop removal balance). As an interim guideline, the program warns the user when a crop removal balance is less than an insurance amount of -70 kg P_2O_5/ha. An orange-highlighted value indicates this warning. Negative crop P removal balances indicate situations of phosphorus loading or accumulation, which is acceptable only at low to medium soil P levels.
3. If both the agronomic and crop removal balances for P_2O_5 are highlighted, decrease the planned nutrient application rates.

- If nitrogen is the priority nutrient for a field, then limit agronomic nitrogen balances to positive values or do not recommend any nitrogen applications in any form.

This process for individual fields is repeated for other fields (up to 16).

FARM SUMMARY

Among other things, this worksheet estimates the amount of manure required according to the planned manure application rates for each field and field sizes.

RECORD KEEPER

This is a worksheet for printing out field record sheets to record actual practices and compare them with planned practices (optional).

BERRY NMP CALCULATOR

The Berry NMP Calculator will help meet the following objectives:

- estimate available nutrient supply from soil and manures.
- show how plant vigour and post-harvest nitrate values are related for raspberries, using a mix of numbers and subjective rankings.
- suggest a reasonable range for crop nutrient recommendations for raspberries and blueberries.

Disclaimer: At the time of writing, the Berry NMP Calculator was meant to be primarily an educational tool that a trained Environmental Farm Plan Planning Advisor can work through with a berry farmer. It is not meant to replace the expertise of professionals in berry production or the experience of a berry farmer. Although the Berry NMP Calculator provides ranges for nutrient recommendations, it does not currently integrate factors that might influence actual crop requirements – factors such as soil pH, soil type, soil organic matter, tissue tests and crop variety.

USING THE WORKSHEETS

There are three worksheets to work through for raspberries and blueberries.

1. Manure Nitrogen.

Key learning outcome: understand the nitrogen value of current and previous manure applications.

i. Whether manure will be used or not, begin by entering the year for which nutrients will be applied.

ii. If manure will be used, or has been used in the past two years, enter the nitrogen data from the manure tests or use the suggested book values for the poultry manure type in the drop-down menu.

- Currently, the manure type must be chosen from one of three poultry manure types that does not include composted manure or other amendments. Until these are added to future revisions of the NMP Calculator, use one of the three manure types for educational purposes if your manure/amendment is not shown.

iii. Enter the (approximate) manure application rates for each year manure was applied.

Example: If 7 spreader loads were used per hectare (i.e. just under 3 loads per acre), and each load had 2.5 yd^3 of manure, then the application rate would be 17.5 yd^3/ha (or 7 yd^3/ac).

Alternatively, estimate the manure application rate based on the appearance of 100 kg N/ha (total N) as broiler and layer manure in Figures 4.7 and 4.8. Because of the high nutrient concentration of poultry manure, this application rate results in a very thin layer of manure being applied, equivalent to less than 10 yd^3/ha (4 yd^3/ac) of broiler manure or 12 yd^3/ha (5 yd^3/ac) of layer manure.

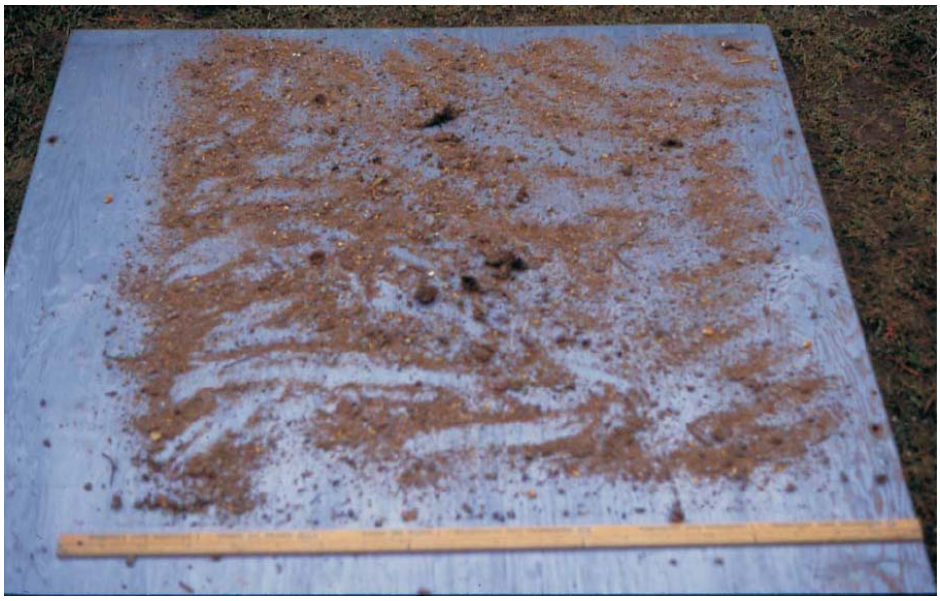

Figure 4.7. Broiler manure laid out on a 1 x 1 m board at a rate of 100 kg N/ha (90 lb N/acre). Photo courtesy of Dr. Bernie Zebarth (Agriculture and Agri-Food Canada).

Figure 4.8. Layer manure laid out on a 1 x 1 m board at a rate of 100 kg N/ha (90 lb N/acre). Photo courtesy of Dr. Bernie Zebarth (Agriculture and Agri-Food Canada).

2a. Fertilizer Nitrogen Recommendations (for Raspberries only).

Key learning outcomes:

- Understand that poor vigour in the primocanes during the fall indicates a low potential for the plant to take up nitrogen in the following year. Nitrogen application rates can be decreased; they should not be increased.
- Post-harvest nitrate values from late summer soil samples (0-30 cm) provide useful feedback that can be used to adjust future nitrogen application rates.

i. Select the plant vigour from the drop-down menu: weak, normal or excessive. The Planning Advisor and farmer should begin with the assessment that they believe to the most accurate description of the vigour of the primocanes. Later, they can change the value to understand what different 'vigour-PHNT' combinations might indicate.
ii. Enter the post-harvest nitrate test (PHNT) value. If no PHNT was taken, try entering different numbers to see how the program interprets various vigour-PHNT combinations.
iii. Enter your crop nitrogen (uptake) requirement. This represents the potential maximum nitrogen that the plant can take up from all nutrient sources. Do not exceed 70 kg N/ha.
iv. Select the cover crop vigour from the drop-down menu.
v. Enter the cover crop N credit, selecting a value in the recommended range of N credits.
vi. Enter the fertilizer N rate according to the instructions in the worksheet.

2b. Fertilizer Nitrogen Recommendations (for Blueberries only).

At this time, the Berry NMP Calculator simply summarizes the nitrogen recommendations from the 2009/10 Berry Production Guide. The recommendations do not depend on soil N testing.

3. Manure Phosphorus and Potassium.

Key learning outcomes:

- Understand the P and K value of manure.
- Understand the recommended amounts of P and K for berry crops according to soil test values.

i. Worksheet 3A: If manure will be used, or has been used in the past two years, enter the phosphorus and potassium data from the manure tests or use the suggested book values for the poultry manure type in the drop-down menu.
- Currently, the manure type must be chosen from one of three poultry manure types that does not include composted manure or other amendments. Until these are added to future revisions of the NMP Calculator, use one of the three manure types for educational purposes if your manure/amendment is not shown.

ii. Worksheet 3B. Enter the soil test phosphorus data from the laboratory report, specifying the laboratory method.
iii. Worksheet 3B. Enter the P recommendation, selecting a number in the suggested range.
iv. Worksheet 3B. Note the P fertilizer recommendation. A negative value indicates that available P from the manure and fertilizer exceeds the recommended amount according to the soil test value.
v. Worksheet 3C. Repeat steps ii to iv, replacing P with K.

Manure P availablity is assumed to be 50%. This is likely an underestimate: more than 50% of the total manure P is probably available in the year of application at high soil test P levels.

Other fields
Optionally, restart the process at the **Manures** worksheet for other fields (recommended if other fields are managed differently).

REFERENCES

Assumptions underlying the NMP Calculators are based on the sources cited below. In cases where confidence in the information was high (i.e. assumed to be reliable, relevant and recent), assumptions follow directly from results and recommendations in these sources. In other cases, the assumptions were based on a mix of best information, assumptions in the previous NMP Calculator from 2005 and the judgment of the developers of the NMP Calculators.

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