

**DETAILED INSTRUCTIONS FOR COMPLETING  
NUTRIENT MANAGEMENT PLANS  
MUNICIPAL WASTEWATER SLUDGE OR BIOSOLIDS**

Whenever a check box () appears, mark the appropriate box with an 'X' to indicate choice.

The plan must be signed on the certification page by the person preparing the plan, or the plan is void. Nutrient management plans may be completed by the operator or by a Professional Agrologist or Certified Crop Adviser working on behalf of the operator who has completed a nutrient management planning course.

Throughout the plan, GPS (Geographic positioning system) coordinates are requested, if available. These coordinates are not essential for registration, but help to ensure the field(s) is/are accurately identified. It is recommended that GPS coordinates be provided as an amendment if not available at the time of the initial plan submission.

If you require technical assistance, please contact your local Manitoba Agriculture GO Office or consult a Professional Agrologist or Certified Crop Adviser.

**Section A – Operation Information**

- **GPS** - Provide GPS in decimal degrees at the entrance to the site, if available.
- **Corporation File #** - This only applies to those entities that have been incorporated. The corporation file number can be obtained by contacting the Manitoba Companies Office. Telephone: (204) 945-0514 or toll free 1-866-205-1657 or by email at: onenumber@gov.mb.ca
- **Affiliate** - If the operation is affiliated with a larger corporation, list the larger corporation here.
- **Nutrient Management Plan required to comply with a Director's Order or a Water Protection Officer Order** - If Manitoba Sustainable Development ordered the operation to file a plan as a condition of the Order, insert Order Number.

**Section B – Fertilizer and Wastewater Sludge or Biosolids Storage Facilities**

- Indicate whether or not nutrients such as fertilizers or wastewater sludge or biosolids are being stored for a period beyond a single cropping season by marking the appropriate box with an 'X'.

**Section C – Volume to be Land Applied**

- Indicate the volume of municipal wastewater sludge or biosolids to be land applied. Be sure to include units.

## **Section D – Nutrient Buffer Zones**

- Mark the appropriate box with an 'X' to indicate whether or not the setbacks are being adhered to.

## **Section E – Field Information**

### **Legal Description**

- Indicate the legal location as:
  - Quarter-Section-Township-Range-Meridian (e.g. SW-30-14-03-W1) or
  - River Lot(s) and Parish (e.g. RL 110-115 Baie St. Paul).

### **GPS Coordinates**

- If available, provide GPS coordinates of the entrance to the spread field. Format should be decimal degrees, with Latitude above Longitude:  
e.g. one corner would be :

Latitude = N	<input type="text" value="49.13716"/>
Longitude = W	<input type="text" value="097.55209"/>

### **Field ID**

- In addition to the legal description of the field, you can use this area (if desired) to provide a useful note of the parcel of land you are referring to (e.g. home quarter or south pasture).

### **Field Size**

- Indicate only the field acreage on which nutrients will be applied, considering setbacks and excluding land that may not be suitable for application (e.g. low areas, brush, sink holes, etc.). Be sure to include units.

### **Agriculture Capability (Soil Class and Subclass Column)**

- This refers to the soil class as described under the heading “Soil Capability Classification for Agriculture” in *The Canada Land Inventory* Report no. 2, published in 1972 by the Government of Canada, Department of the Environment.
- Both **Class** (1-7) and **subclass** (limiting factor(s)) must be included for the plan to be registered.
- In situations with multiple agriculture capability ratings, include all agriculture capability ratings where nutrients will be applied. When calculating application rates, use the poorest agriculture capability rating.
- This information is available from published Manitoba Soil Survey reports or through electronic data in both Google Earth format (kmz) and as shapefiles (for GIS software) distributed by the Manitoba Land Initiative at: <http://mli2.gov.mb.ca>

### **Soil Nitrate Nitrogen Column/Residual Nitrogen**

- This information can be obtained from the soil analysis report.
- Ensure appropriate soil testing procedures have been followed.
- Sample depth is to be 0-60 cm (0-24")
- Ensure you attach a copy of the soil analysis report to this plan. Soil analyses must be recent and are to be provided not less than 14 days prior to nutrient application.
- Be sure to include units.

### **Olsen Soil Test Phosphorus Column**

- This information can be obtained from the soil analysis report.
- Ensure appropriate soil testing procedures have been followed.
- Extraction to be by sodium bicarbonate (Olsen procedure)
- Sample depth is to be 0-15 cm (0-6")
- Ensure you attach a copy of the soil analysis report to this plan. Soil analyses must be recent and are to be provided not less than 14 days prior to nutrient application.
- Be sure to include units.

### **Date(s) of Anticipated Nutrient Application(s)**

- Provide estimates of anticipated nutrient application date(s). Enter date(s) as YYYY-MM-DD.

### **Irrigated**

- Indicate if the field is irrigated by entering 'Yes' or 'No'

### **Section F – Certification of Nutrient Management Plan**

- Plans must be certified by signature of the operator. If the plan is prepared for the operator, it must be certified by a Professional Agrologist or Certified Crop Adviser. If plan is not certified it is void.
- Indicate MIA# or CCA# in the submission if it has not been prepared by the operator. If exempt from registration from Manitoba Institute of Agrologists as per Section 23 of M.R. 62/2008 enter '0000'.
- Indicate the crop year referenced (year in which the nutrients applied will be taken up) as part of the nutrient management plan. This template must be completed on an annual basis.
- Incorrect/incomplete information voids this Nutrient Management Plan

## **APPENDIX – NUTRIENT BUDGET**

The Appendix – Nutrient Budget is to be completed for all fields that:

(A) nitrogen will be applied that exceeds the soil nitrate-nitrogen limits for Nutrient Management Zones referenced in Section 7 of the Nutrient Management Regulation  
OR

(B) exceed 60 ppm soil test phosphorus and you cannot meet the phosphorus application rates listed in section 8(2) of the Nutrient Management Regulation  
OR

(C) you intend to apply nutrients to Nutrient Management Zone N4 soils.

The Appendix – Nutrient Budget must be completed if you meet any of the previous three conditions. The goal of the nutrient budget is to balance nutrients over time.

Please note that the first table within the Appendix addresses nitrogen only while the second table references P<sub>2</sub>O<sub>5</sub>.

### **Legal Description**

Only one legal land description is to be referenced on a single page. Photocopy additional pages as necessary. Complete Appendix in either metric or imperial units.

### **Past Crop**

Indicate the crop grown in the preceding year.

### **Field ID**

In addition to the legal description of the field, you can use this area (if desired) to provide a useful note of the parcel of land you are referring to (e.g. home quarter or south pasture).

### **Crop Year**

- This is the year in which the nutrients will be taken up. For example, a fall application in 2009 (after August 15<sup>th</sup>) on a field used to produce a cereal crop will be used as a fertilizer in the 2010 growing season. Therefore, the crop year would be 2010.
- The nutrient budget should cover the same number of years as referenced in the certification section. Nutrient budgets can encompass up to five years with the exception of those fields receiving municipal biosolids.

### **Crop**

- Indicate the crop grown in the crop year.

**The following terms pertain to the nitrogen budget:**

**TARGET YIELD (A)**

Indicate an anticipated **target yield** for the crop year that is reasonable on that site. Contact your local Manitoba Agriculture GO office or refer to Manitoba Agricultural Services Corporation Crop Insurance data should you have difficulty in estimating this **target yield**.

**NITROGEN BALANCE CARRY FORWARD (B)**

As a starting balance for nitrogen during the first year, use your soil test results.

Carry the nitrogen balance from column G (from the previous crop year) for subsequent crop years. Note that Nutrient Management Plans for Municipal Wastewater Sludge or Biosolids can only be submitted for a period of one year.

**NITROGEN ADDITIONS (C)**

Nitrogen additions refer collectively to nitrogen fertilizer additions (C1), manure additions (C2) and wastewater sludge, biosolids or other nitrogen additions (C3). Note  $C=C1+C2+C3$ .

**Nitrogen Fertilizer Additions (C1)**

Calculate the commercial fertilizer application for nitrogen from all applications during the crop year. Use one of the examples for dry or liquid fertilizer below, to help with the calculations.

**Example 1. – Dry Fertilizer**

Dry fertilizer with a blend of 11-52-0 is applied at 100 lb/ac. This fertilizer contains 11% N, 52% P<sub>2</sub>O<sub>5</sub> and 0% K<sub>2</sub>O.

$$\begin{array}{rclcl} \text{N} & 100 \text{ lb/ac} \times 11\% & = & & 11 \text{ lb/ac} \\ \text{P}_2\text{O}_5 & 100 \text{ lb/ac} \times 52\% & = & & 52 \text{ lb/ac} \end{array}$$

**Example 2. – Liquid Fertilizer**

Liquid fertilizer with a blend of 10-34-0 and a density of 11.68 lb/gallon is applied at 10 gallons/ac.

The fertilizer contains 10% N, 34% P<sub>2</sub>O<sub>5</sub> and 0% K<sub>2</sub>O.

The application rate is 10 gallons/ac x 11.68 lb/gallon = 116.8 lb/ac.

$$\begin{array}{rclcl} \text{N} & 116.8 \text{ lb/ac} \times 10\% & = & & 11.7 \text{ lb/ac} \\ \text{P}_2\text{O}_5 & 116.8 \text{ lb/ac} \times 34\% & = & & 39.7 \text{ lb/ac} \end{array}$$

**Manure Nitrogen Additions (C2)**

If the manure results are expressed on a dry-weight basis, they must be converted to wet-weight in order to calculate a manure application rate. To convert back to a wet-weight or as-received value, the moisture content (%) must be known. This is usually provided in the manure test report. The conversion from a dry-weight value to a wet-weight value is as follows:

$$\text{Wet-weight value} = \text{dry-weight value} \times (1 - (\% \text{ moisture}/100))$$

For example (using total N):

- 1.7% total N (on a dry-weight basis)
- 69.5% moisture content

**To convert the total N value to a wet-weight basis:**

Wet-weight value = dry-weight value x (1 – (% moisture/100))

Wet-weight value = 1.7 x (1 – (69.5/100))

Wet-weight value = 1.7 x (1 – 0.695)

Wet-weight value = 1.7 X 0.305

Wet-weight value = 0.52% total N

The manure test report should include results for total N and ammonium N.

**Available Ammonium N:** The amount of ammonium N available to the crop will depend on the spreading method, season and weather conditions. Ammonium can be readily lost to the atmosphere as ammonia through volatilization. The amount of ammonium N lost will depend on how long the manure is exposed to the air. To maximize the economic benefit of the manure N, an application method that minimizes volatilization should be chosen.

The following table provides estimated % loss of ammonium under varying weather conditions when the manure is surface broadcast (with and without incorporation) or injected. In general, injection and incorporation immediately after application will significantly reduce volatilization losses. Research on N loss from ammonia volatilization shows that losses are highly variable. Volatilization estimates associated with different application methods and weather conditions are contained in the Table 1.

**Available Ammonium N = Ammonium N x [100 – Volatilization Loss (%)]**

**Table 1. Volatilization losses (%) associated with different application methods and weather conditions.**

<b>Application Methods</b>	<b>Cool Wet</b>	<b>Cool Dry</b>	<b>Warm Wet</b>	<b>Warm Dry</b>	<b>Average Losses</b>
Injected	0	0	0	0	0
Incorporated within 1 day	10	15	25	50	25
Incorporated within 2 days	13	19	31	57	30
Incorporated within 3 days	15	22	38	65	35
Incorporated within 4 days	17	26	44	72	40
Incorporated within 5 days	20	30	50	80	45
Not incorporated	40	50	75	90	64
Irrigated	Above factors + 10%	Above factors + 10%	Above factors + 10%	Above factors + 10%	Above factors + 10%
Applied to cover crop	25	25	40	50	35

For further information regarding livestock manure application and use, please consult the Tri-Provincial Manure Application and Use Guidelines available from Manitoba Agriculture.

**Other Nitrogen Additions (C3)**

Include nitrogen contributions from compost, municipal wastewater sludge or biosolids as well as other materials containing nitrogen.

**NITROGEN CREDITS (D)**

Nitrogen credits refer collectively to credits from past legume crops (D1), past applications of manure, sludge or biosolid applications (D2) and soil organic matter mineralization (D3). Note  $D=D1+D2+D3$ .

**Nitrogen Credits from Past Legume Crops (D1)**

It is recognized that nitrogen requirements for crops may be reduced following past legume crops. Table 2 provides nitrogen contributions from alfalfa based on date of termination.

**Table 2. Nitrogen Contributions from Alfalfa based on Date of Termination.**

Termination Time	N Contribution to following crop	
	(lb N/ac)	(kg N/ha)
Before July	90	100
July – August	70	78.5
Fall	45	50.4
Spring	30	33.6

For further information refer to the Manitoba Soil Fertility Guide available from Manitoba Agriculture or <http://www.umanitoba.ca/outreach/naturalagriculture/articles/nbenefit.html>.

### Soybeans, Dry Beans and Field Peas

Nitrogen (N) credits are small (10 lb N/ac (11 kg/ha) or less) for soybeans and dry beans. Field peas provided the most consistent N benefit of some 25 lb N/ac (28 kg N/ha).

### Green Manure Crops

Nitrogen contributions are greater when forage or grain legume crops are grown as a green manure crop. For legume or pulse crops, every 1000 lb of vegetative material contains approximately 30 lb (33.6 kg) of nitrogen. Half of this plant nitrogen is available to the following crop, with some 15% being available in year 2. Typical amounts of nitrogen produced in Manitoba studies are shown in Table 3.

**Table 3. Typical Nitrogen Contributions from Green Manure Crops in Manitoba.**

Green manure crop	Amount of available nitrogen					
	Year 1		Year 2		Year 3	
	lb/ac	kg/ha	lb/ac	kg/ha	lb/ac	kg/ha
<b>Full season growth</b>						
Alfalfa (4 year stand)	70	78.5	25	28.0	7	7.9
Sweet clover	55	61.6	20	22.4		
Chickling vetch	75	84.1	5	5.6		
Indian Head lentil	70	78.5	10	11.2		
<b>Relay seeded with winter cereals</b>						
Annual alfalfa	45-55	50.4-61.6	5	5.6		
Red clover (spring terminated)	20-25	22.4-28.0	5	5.6		
<b>Double cropped after winter cereals</b>						
Chickling vetch	25-40	28.0-44.8				
Indian Head lentil	20-35	22.4-39.2				
Summerfallow	55	61.6	-4	-4.5		



### **Nitrogen Credits from past manure applications (D2)**

Organic N is not measured in the laboratory. Organic N is calculated as follows:

$$\text{Organic N} = \text{Total N} - \text{Ammonium N}$$

The amount of organic N that will be available to the crop is estimated to be 25% to 30% in the first year after application.

$$\text{Available Organic N} = \text{Organic N} \times 0.25 \text{ Year 1}$$

Organic N will be continued to be released in the years following application. The amount of N that is available at the beginning of the second and third cropping years following manure application will be determined by the soil nitrate test. If a soil nitrate test is not available, the amount of organic N available in the second and third years following application can be roughly estimated. As a “rule of thumb”, about 12% will be available two years later and 6% will be available three years later. Annual manure application, particularly in the case of solid manure, can result in a significant organic N pool, which can provide a considerable amount of available N.

### **Nitrogen Credits from soil organic matter mineralization (D3)**

Mineralization is the microbial breakdown of organic compounds that release the mineral forms of nitrogen. The nitrogen is released initially as ammonium, which is rapidly converted to nitrate by nitrifying bacteria. Mineralization and immobilization occur at the same time and the balance between the two is affected by the carbon-to-nitrogen ratio of the organic materials in the soil.

### **NITROGEN CONTENT/UNIT (E)**

Use Tables 4 (Imperial units) and 5 (Metric units) to determine the nitrogen removal value(s) for current year crop. Scale-up or scale-down your nitrogen removal values on a prorated basis.

### **NITROGEN REMOVAL (F)**

Use the average nitrogen removal rate column (E) and multiply by the target yield (A). Note:  $F=A \times E$ .

### **NITROGEN BALANCE (G)**

Calculate the nitrogen balance by adding nitrogen balance carry forward (B), nitrogen additions (C) and nitrogen credits (D) and then subtracting nitrogen removal (F) to yield the overall nitrogen balance (G). See Appendix – Nutrient Budget for an example. Note:  $G=B+C+D-F$ .

In order to double check your math within the nitrogen balance table, you can add the nitrogen carry forward (B) from the initial year referenced to the sum of all nitrogen additions (C) and nitrogen credits (D) to achieve a subtotal. The sum of the nitrogen removal column (F) is subtracted from the previous subtotal and should equal the nitrogen balance (G) during the last year referenced in the nutrient budget table.

**The following terms pertain to the phosphorus budget:**

**AVERAGE YIELD (H)**

Indicate your **average yield** over the past number of years under similar management practices. Contact your local Manitoba Agriculture GO office or refer to Manitoba Agricultural Services Corporation Crop Insurance data should you have difficulty in estimating this **average yield**. Note that **average yield** may be less than **target yield**.

**P<sub>2</sub>O<sub>5</sub> BALANCE CARRY FORWARD (I)**

As a starting balance for P<sub>2</sub>O<sub>5</sub> during the first year, use your soil test results. To convert soil test P (0-15 cm or 0-6”) in ppm to lb/ac multiply by 2. To convert from P to P<sub>2</sub>O<sub>5</sub> multiply the value for P by a factor of 2.3.

Carry the P<sub>2</sub>O<sub>5</sub> balance from the column M (from the previous crop year) for subsequent crop years.

**P<sub>2</sub>O<sub>5</sub> ADDITIONS (J)**

P<sub>2</sub>O<sub>5</sub> additions refer collectively to P<sub>2</sub>O<sub>5</sub> fertilizer additions (J1), manure additions (J2) and wastewater sludge, biosolids or other P<sub>2</sub>O<sub>5</sub> additions (J3). Note J=J1+J2+J3.

**P<sub>2</sub>O<sub>5</sub> Fertilizer Additions (J1)**

Calculate the commercial fertilizer application of P<sub>2</sub>O<sub>5</sub> from all applications during the crop year. Use one of the examples for dry or liquid fertilizer below, to help with the calculations.

**Example 1. – Dry Fertilizer**

Dry fertilizer with a blend of 11-52-0 is applied at 100 lb/ac. This fertilizer contains 11% N, 52% P<sub>2</sub>O<sub>5</sub> and 0% K<sub>2</sub>O.

$$\begin{array}{rcl} \text{N} & 100 \text{ lb/ac} \times 11\% & = & 11 \text{ lb/ac} \\ \text{P}_2\text{O}_5 & 100 \text{ lb/ac} \times 52\% & = & 52 \text{ lb/ac} \end{array}$$

**Example 2. – Liquid Fertilizer**

Liquid fertilizer with a blend of 10-34-0 and a density of 11.68 lb/gallon is applied at 10 gallons/ac.

The fertilizer contains 10% N, 34% P<sub>2</sub>O<sub>5</sub> and 0% K<sub>2</sub>O.

The application rate is 10 gallons/ac x 11.68 lb/gallon = 116.8 lb/ac.

$$\begin{array}{rcl} \text{N} & 116.8 \text{ lb/ac} \times 10\% & = & 11.7 \text{ lb/ac} \\ \text{P}_2\text{O}_5 & 116.8 \text{ lb/ac} \times 34\% & = & 39.7 \text{ lb/ac} \end{array}$$

**Manure P Additions (J2)**

The manure test report will generally provide a total P analysis. Manure P can be in both inorganic and organic forms, but the organic P must be mineralized before it can be used. Inorganic P is considered to be available to the crop. Approximately 50% of the total P is considered to be available to the crop in the year of application.

The manure test results may be expressed as total elemental P or as P<sub>2</sub>O<sub>5</sub>. To convert from P to P<sub>2</sub>O<sub>5</sub> multiply the value for P by a factor of 2.3.

### **Other P<sub>2</sub>O<sub>5</sub> Additions (J3)**

Include P<sub>2</sub>O<sub>5</sub> additions from compost, municipal wastewater sludge or biosolids as well as other materials containing phosphorus.

### **P<sub>2</sub>O<sub>5</sub> CONTENT/UNIT (K)**

Use Tables 4 (Imperial units) and 5 (Metric units) to determine the P<sub>2</sub>O<sub>5</sub> removal value for current year crop. Scale-up or scale-down your P<sub>2</sub>O<sub>5</sub> removal values on a prorated basis.

### **P<sub>2</sub>O<sub>5</sub> REMOVAL (L)**

Use the average P<sub>2</sub>O<sub>5</sub> removal rate column (K) and multiply by the average yield (H). Note:  $L=H*K$ .

### **P<sub>2</sub>O<sub>5</sub> BALANCE (M)**

Calculate the P<sub>2</sub>O<sub>5</sub> balance by adding P<sub>2</sub>O<sub>5</sub> balance carry forward (I), P<sub>2</sub>O<sub>5</sub> additions (J) and then subtracting P<sub>2</sub>O<sub>5</sub> removal (L) to yield the overall P<sub>2</sub>O<sub>5</sub> balance (M). See Appendix – Nutrient Budget for an example. Note:  $M=I+J-L$ .

In order to double check your math within the P<sub>2</sub>O<sub>5</sub> balance table, you can add the P<sub>2</sub>O<sub>5</sub> carry forward (I) from the initial year referenced to the sum of all P<sub>2</sub>O<sub>5</sub> additions (J) to achieve a subtotal. The sum of the P<sub>2</sub>O<sub>5</sub> removal column (L) is subtracted from the previous subtotal and should equal the P<sub>2</sub>O<sub>5</sub> balance (M) during the last year referenced in the nutrient budget table.

### **NOTE:**

State reason(s) why soil test results exceed soil nitrate-nitrogen limits in Section 7 or why you cannot meet the phosphorus application rates listed in Section 8(2) of the Nutrient Management Regulation (e.g. previous manure applications, drought, frost, weeds, insects or disease) and how results will be brought into compliance over time. Legume crops include peas, soybeans, dry beans, chickpeas, lupins, clover, vetch, alfalfa, birdsfoot trefoil, sainfoin and lentils.

**Table 4. Crop Removal Rates for N and P<sub>2</sub>O<sub>5</sub><sup>1</sup> (Imperial Units).**

Crop <sup>2</sup>	Example Target Yield <sup>3</sup>	Average Nutrient Uptake Rate <sup>4</sup>		Average Nutrient Removal Rate <sup>5</sup>	
		N	P <sub>2</sub> O <sub>5</sub>	N	P <sub>2</sub> O <sub>5</sub>
	bu/ac	lb/bu	lb/bu	lb/bu	lb/bu
Spring Wheat	40	2.11	0.8	1.5	0.59
Winter Wheat	50	1.35	0.61	1.04	0.51
Barley	80	1.39	0.56	0.97	0.42
Oats	100	1.07	0.41	0.62	0.26
Rye	55	1.67	0.84	1.06	0.45
Grain Corn	100	1.53	0.63	0.97	0.44
Canola	35	3.19	1.47	1.93	1.04
Flax	24	2.88	0.83	2.13	0.65
Sunflowers	50	1.49	0.51	1.07	0.32
	t/ac	t/ac	t/ac	lb/t	lb/t
Alfalfa	5	N/A <sup>6</sup>	N/A	58.0	13.8
Grass	3	N/A	N/A	34.2	10.0
Corn Silage	5	N/A	N/A	31.2	12.7
Barley Silage	4.5	N/A	N/A	34.4	11.8

**Table 5. Crop Removal Rates for N and P<sub>2</sub>O<sub>5</sub><sup>1</sup> (Metric Units).**

Crop <sup>2</sup>	Example Target Yield <sup>3</sup>	Average Nutrient Uptake Rate <sup>4</sup>		Average Nutrient Removal Rate <sup>5</sup>	
		N	P <sub>2</sub> O <sub>5</sub>	N	P <sub>2</sub> O <sub>5</sub>
	t/ha	kg/t	kg/t	kg/t	kg/t
Spring Wheat	2.69	35.2	13.4	25.1	9.8
Winter Wheat	3.36	22.5	10.2	17.4	8.5
Barley	4.30	29.0	11.7	20.3	8.8
Oats	3.81	31.5	12.1	18.3	7.7
Rye	3.45	29.9	15.0	19.0	8.1
Grain Corn	6.27	27.4	11.3	17.4	7.9
Canola	1.96	63.9	29.5	38.7	20.8
Flax	1.50	52.0	14.8	38.1	11.6
Sunflowers	1.68	49.8	17.0	35.7	10.7
Alfalfa	11.2	NA <sup>6</sup>	N/A	29.0	6.9
Grass	6.7	NA	N/A	17.1	5.0
Corn Silage	11.2	NA	N/A	15.6	6.4
Barley Silage	10.1	NA	N/A	17.2	5.9

<sup>1</sup>Adapted from Nutrient Uptake and Removal by Field Crops, Western Canada, 2001. Compiled by the Canadian Fertilizer Institute.

<sup>2</sup>As bushel weights can vary considerably among some crop varieties, values other than those presented here may need to be chosen to better reflect a given cropping scenario.

<sup>3</sup>Example target yields for Manitoba. Site specific and actual yields for any parcel of land will depend on the agriculture capability of the land.

<sup>4</sup>Total nutrient taken up by the crop.

<sup>5</sup>Nutrient removed in the harvested portion of the crop.

<sup>6</sup>Not applicable.

## **Soil Sampling for Agricultural Operations or where Municipal Wastewater Sludge or Biosolids are applied to Agricultural Land**

Soil testing is one of the best ways to determine the available nutrient status of a field and receive specific fertilizer recommendations. Sound fertilizer recommendations are based on soil fertility analysis and fertilizer response. An effective on-farm soil testing program is one in which every field is properly sampled and tested every year.

### **Soil Sampling**

For further information on soil sampling strategies on soil sampling strategies, refer to Manitoba Agriculture publications:

- Manitoba Soil Fertility Guide
- Tri-Provincial Manure Application and Use Guidelines – Manitoba Version
- Soil Sampling Strategies for Site Specific Management factsheet

### **Soil Analysis Techniques**

**Nitrogen** - Water soluble nitrate-nitrogen is to be measured to a depth of 60 cm (24”).

**Phosphorus** - The ‘Olsen’ (sodium bicarbonate) technique is to be employed to measure extractable P in the top 15 cm (6”) depth of the soil profile.

### **Duration of Nutrient Management Plans**

Nutrient Management Plans can be registered for a period not to exceed five years for the following types of plans:

- Synthetic fertilizer
- Spreading livestock manure or livestock operations < 300 A.U.

Nutrient Management Plans are to be registered on an annual basis for the following types of plans:

- Municipal wastewater sludge or biosolids

Soil test results are required in order for a Nutrient Management Plan to be registered.

### **Acceptable Laboratories**

As of January 1, 2009, the following laboratories (listed in alphabetical order) are approved for use in analyzing soil nitrate nitrogen or soil test phosphorus using the sodium bicarbonate (Olsen) extraction method:

- A & L Laboratories Inc.
- Agri-Food Laboratories
- AgSource Harris Laboratories
- Agvise Laboratories
- ALS Laboratory Group
- Brookside Laboratories, Inc.
- Cantest Ltd.
- Central Testing Laboratories Ltd.
- Exova (formerly Accutest Laboratories and Bodycote Testing Group)
- Farmers Edge Laboratories
- Logan Labs LLC
- Soil and Nutrient Laboratory
- Stratford Agri Analysis

The above list is subject to change. Nutrient management planners are advised to check with Manitoba Sustainable Development. for current listings.

Consultants or other laboratories may subcontract to these laboratories. For example, Western Ag. Laboratories and Midwest Laboratories subcontract soil nitrate analysis to one of the above laboratories, they are considered acceptable so long as reporting requirements meet the expectations of Manitoba Sustainable Development. .

## **Traditional Composite Soil Sampling Procedure**

Other acceptable soil sampling procedures include the "Benchmark" soil sampling procedure, the "Grid" soil sampling procedure and the "Landscape Directed" soil sampling procedure. Additional information on these procedures can be obtained from your local Manitoba Agriculture office.

Reliable results can only be made if the samples are fully representative of the field or area from which they are taken. In addition, proper sampling and sample handling procedures must be followed.

The Soil Fertility Guide produced by Manitoba Agriculture should be consulted for fertility recommendations.

## **Selecting Areas to Sample**

Soil sampling is normally done on an individual field basis with a single composite sample representing the whole field. Individual fields that are not uniform should be divided into smaller sampling units with a single composite sample representing each unit. The soil in each of these sampling units should have the same colour, texture, cropping history and fertilizer or manure treatments. Look for differences in slope, erosion, crop growth and yield. Any area that is different in these features and which is large enough to have manure applied at a different rate should be sampled separately. Problem areas such as saline spots, poorly drained potholes, and eroded knolls should not be sampled unless they represent a significant portion of the field. If they do, obtain separate samples. All abnormal areas such as old manure piles, burn piles, haystacks, corrals, fence rows or farmstead sites should also be avoided as well as locations of past chemical or fertilizer spills. Samples should not be taken along headlands, within 15 metres (50 ft) of field borders or shelterbelts or within 45 metres (150 ft) of built up roads. If the field has been cultivated, take the sample from the compacted soil in the wheel track.

Sample one location per 2 hectares (5 acres) to a depth of 60 cm (2 feet). In all cases, however, a minimum of 15 sample locations per individual field or sampling unit should be taken. A single composite sample is then formed from 15 or more samples.

## **Equipment and Supplies**

Special augers or probes designed for soil sampling must be used. These may be hand or hydraulic powered and are often available from fertilizer dealers. Independent firms may also be available to custom sample fields. Use two clean, labeled plastic pails for collecting samples. Information sheets, sample containers and shipping boxes are available from the lab conducting the analysis. Note that all mechanical and hydraulic samplers may yield poor samples on very dry or very wet soils. In all cases avoid getting the topsoil in the subsoil samples, or subsoil in the topsoil samples. For example, in very dry soils, be careful not to let topsoil spill into the hole before taking deeper samples.

## Handling Samples

Take care to keep samples clean and uncontaminated. Clean the probe, take a few samples from the new field and discard them before proceeding with actual sampling. Send samples to the laboratory immediately. If this is not possible or if a delay of more than 48 hours is anticipated, freeze or dry the samples. Follow these steps to dry samples:

- mix the soil in each container thoroughly, breaking lumps to less than 12 mm (0.5 inch);
- remove about 0.5 litre (1 pint) of soil and spread on a piece of clean paper;
- completely dry at a temperature of not more than 30°C (**do not dry in an oven at a high temperature since this can change the phosphorus, potassium, and sulphur levels**);
- care should be taken to avoid contamination of the samples with foreign materials such as commercial fertilizer, manure, salt, baking soda, water, dust, etc. (e.g. samples should not be dried on old fertilizer or feed bags or in areas where fertilizers have been handled);
- a fan may be used to ensure constant air flow over samples and enhance drying.

Once the sample is thoroughly dry, fill the soil sample cartons. Label each carton with the correct field number and sample depth. Complete an information sheet for each field.