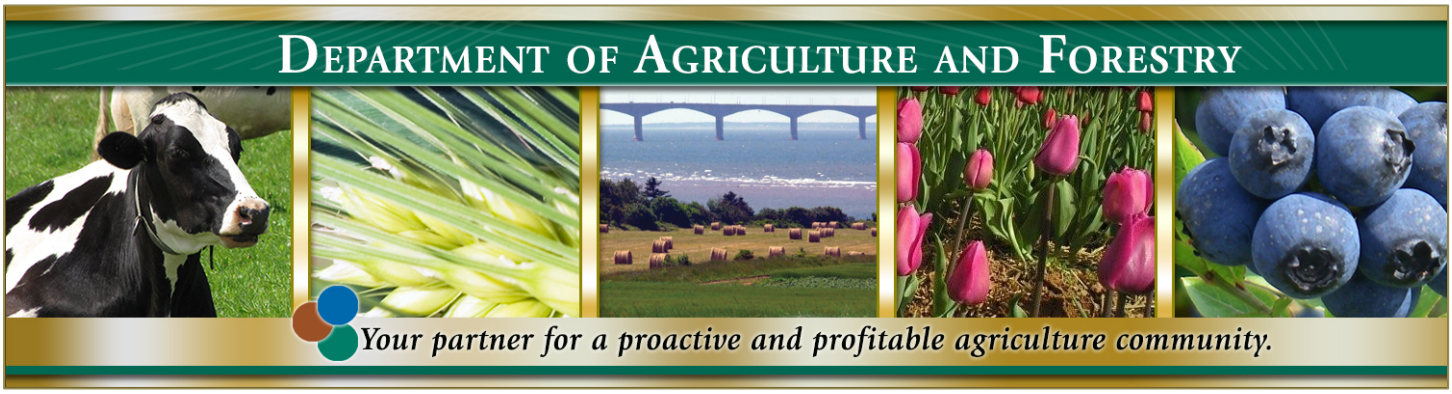


Nutrient Management Planning: How to Develop a Nutrient Management Plan

Nutrient management planning is an environmentally responsible farming practice that maximizes crop nutrient uptake by balancing sustainable use of commercial fertilizers with the use of nutrients produced on farm or sustained within the soil from previous crops.

Nutrient management planning promotes the use of the 4R Nutrient Stewardship approach (a program that is promoted by the Canadian Fertilizer Institute, and has been adopted by the Government of PEI's Department of Agriculture and Forestry, and Department of Environment, Labour and Justice). The 4R approach encourages the use of the **right** nutrient sources (fertilizers and manures), at the **right** rate, at the **right** time, and in the **right** place. By only applying the required amount of nutrients to a crop, nutrient management practices provide a more sustainable approach to nutrient usage on the farm by reducing the risk of nutrient contamination of nearby water sources.

Nutrient management can include a variety of different soil conservation and fertility practices. These strategies can include correct application, use, timing and incorporation of various organic amendments, such as manures and crop residues. By incorporating these practices, nutrient management promotes responsible nutrient usage that in effect, reduces excessive nutrient application that could potentially lead to groundwater and surface water contamination, excessive on farm greenhouse gas production, and soil degradation and erosion.

Nutrient management strategies are often more cost-effective than conventional fertilization practices since most of the organic amendments produced on farm are recycled and used as sources of fertilization, rather than disposed of as wastes. Therefore, reliance on heavy usage of commercial fertilizers may not be as prevalent. Crops produced under nutrient management practices can be also be more efficient at nutrient uptake and can still produce high yielding crops comparable to conventional farming practices.

A nutrient management plan (NMP) is a detailed record of nutrient management practices and recommendations. A NMP will take into consideration required nutrients for the current crop by accounting for available soil nutrients from previous years and from applied organic amendments or previous crop residues. A NMP carefully considers nutrient credits available from the planned crop rotation, crop management practices, and soil and manure reports. Typically, a NMP lasts the length of one full crop rotation (approximately every 3 years), however, it is common to adjust or modify recommendations from the NMP throughout the season with consultation from the NMP planner, depending on the season's growing conditions.

The components of a NMP include:

- general farm information including main commodities and farming practices
- field maps
- any soil or organic amendment reports
- crop rotation and yield information
- manure production information (if applicable)
- nutrient recommendations for the current crop rotation.

Nutrient management plans are produced by a certified nutrient management planner. To view a list of certified NMP planners on PEI for 2013, please visit: http://www.gov.pe.ca/photos/original/af_NMPlanners.pdf.

Attached below is a sample NMP generated to provide an outline of the various requirements and logistics of a NMP, for the sample farm "Clear View Farms".

General Information

The general information section includes the farm and producer names, as well as their contact information. The farm description is a brief overview of the farm's main commodities and general crop management practices, and can be as detailed as the planner and/or producer wishes.

Example Farm Summary Table:

Farm Summary	
Farm Name	Clear View Farms
Producer(s)	George and Rebecca O'Connor
Date NMP was created:	Feb. 5, 2013
Civic & Mailing Address	1200 Brackley Point Rd., Harrington, PE C0A 1H4
Phone Number(s)	(902) 767-6410
Fax	(902) 767-6518
Email	clearviewfarms@pei.sympatico.ca
Farm Description	Clear View Farms is a 160 acre dairy farm located at 1200 Brackley Point Rd, Harrington, PEI. It is a mixed farm with a general five year rotation of corn silage-corn silage-mixed hay-mixed hay- mixed hay rotation. As part of an additional cereal/legume rotation, every three years some fields are rented to a neighboring potato farmer, using a variety of different potato rotations. One potato rotation is a three year barley- red clover-potato rotation, another is a three year soybean-ryegrass-potato rotation, and an experimental field was also put into a three year trial rotation of wheat- mixed forage- potato. Within the barley-red clover-potato rotation, barley is under-seeded with red clover, and barley straw is baled and removed from field. Red clover is cut three times over the season and left in the field, with plow down in early spring, with no glyphosate applied. The ryegrass within the soybean-ryegrass-potato rotation is clipped three times over growing season, and left on field. The wheat within the wheat-mixed forage-potato rotation is harvested and the straw is left in field. The mixed forage is cut three times over the growing season and baled for silage. Liquid dairy manure is used as the primary source of fertilizer/soil amendment applied at a rate of 5500 gal/acre. Dairy manure is incorporated within 1 day unless otherwise noted.

Field Information and Field Maps

The field information section includes field names, acreage, and provincial field and property identification numbers. Field identification numbers can be found through the website, www.PeiLandOnline.com. Field maps including the field boundaries, with details on the slope, soil types and any buffer zones, waterways or sensitive areas of land within the farm region (if applicable) should also be included in this section.

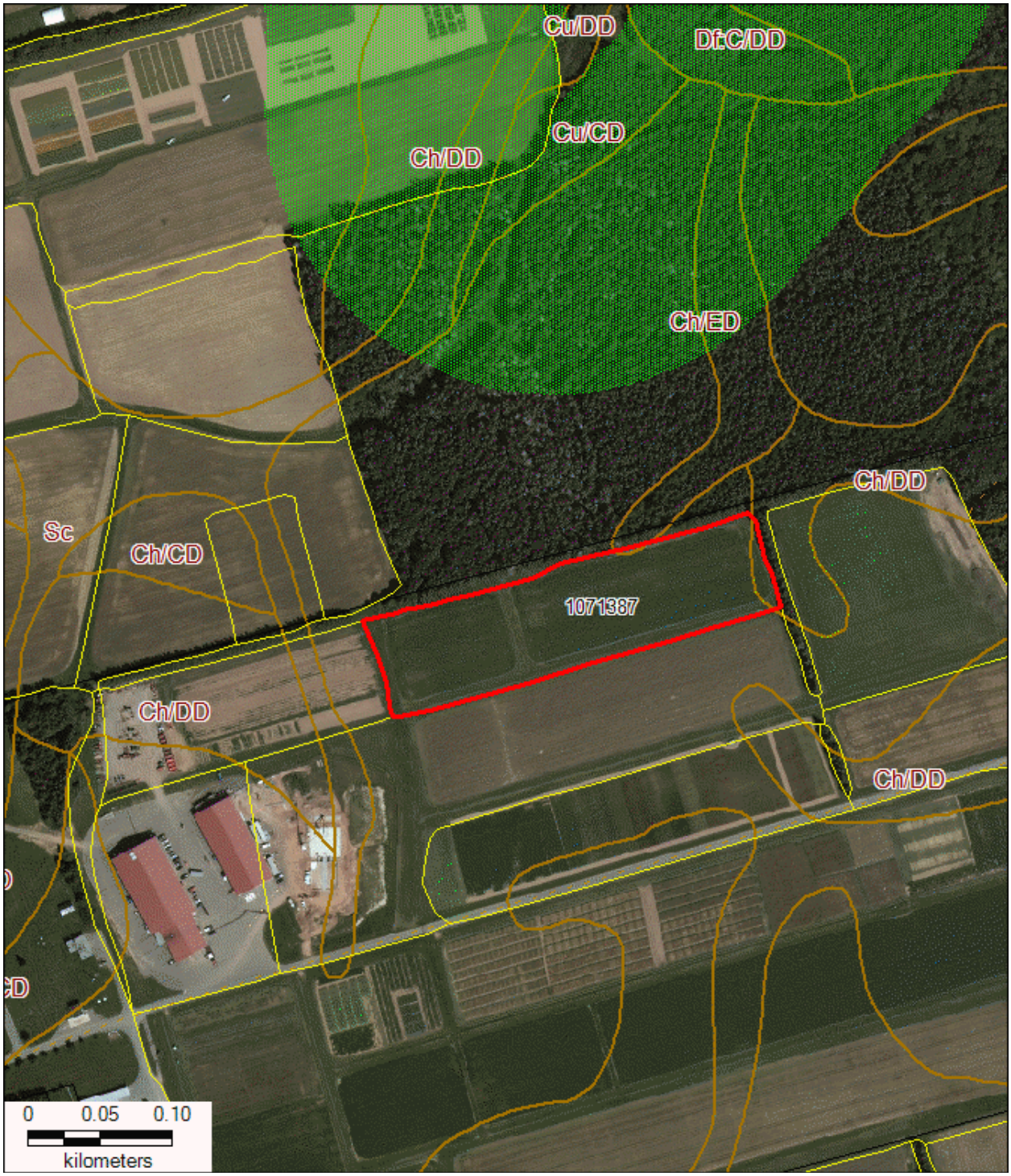
It is useful to include a record of the most recent soil and/or manure analysis accession numbers as a reference for the nutrient requirements section of the NMP. Any environmental considerations or sensitive land areas that are within property boundaries should be listed here such as the proximity of the field to local waterways, residential areas, or topographical characteristics.

Example Field Information Table:

Farmer Field ID	Acreage (ha)	Provincial Field ID(s)	Provincial Property ID(s)	Soil Analysis Reference	Manure Analysis Reference	Environmental Considerations
1	5.5	1672951	654194	# 178594	N/A	W/in Mackay's pond 200 m buffer zone.
2	4.8	1071387	654194	# 178594	N/A	N/A
3A	10.9	1089634	654194	# 178594	N/A	N/A
3B	4.2	1071386	654194	# 178594	N/A	Sloped land on Northeast side of field.
4A	1.2	1071377	654222	# 178594	# 2567	W/in Mackay's pond 200 m buffer zone.
4B	1.3	1071377	654222	# 178594	# 2567	N/A
4C	1.1	1071377	654222	# 178594	# 2567	N/A
4D	1.2	1071377	654222	# 178594	# 2567	N/A
5A	5.4	1277860	655303	# 178594	N/A	N/A
5B	3.1	1328520	655303	# 178594	N/A	W/in Mackay's pond 200 m buffer zone.
9	5.8	1148714	654193	# 178594	N/A	N/A
11	8.7	1223698	312598	# 178594	N/A	W/in 200 m of residential area.
12	3.8	1112351	655303	# 178594	N/A	N/A
13A	6.4	1298571	654222	# 178594	N/A	N/A
13B	1.9	1365204	654222	# 178594	N/A	N/A

Example Field Map:

Field 2 (B. Smith Field)
4.8 hectares, FID #1071387, PID #654194



Crop Rotation and Yield Information

To estimate nutrient requirements based on crop and variety, the general crop rotation (crop and variety), estimated yields for each crop, and any management practices (including timing and rates of manure applications, timing of plough-down of cover crops and timing of forage harvests) are also required.

It is important to note that each field's yield potential can vary, based on its own specific topographical and soil physical characteristics, and that each field should be fertilized to its own potential. In practice, this means that excess fertility added to a low yielding field may not necessarily create a high yielding crop, nor does a high yielding field mean it has reached its greatest yield potential. Each field's fertility recommendations should be tailored to meet the expectations of that field, not the average yield desired for all of the fields cropped to that commodity.

To determine the yield potential of each individual field, it is recommended to keep good records of gross and marketable crop yields over numerous years, to provide an average yield estimate expected from that field.

Example Crop Rotation and Yield Table:

Field ID(s)	Crop to be Grown + Variety (if applicable)			General Field Rotation	Yield Estimate	General Management
	2012	2013	2014			
1	Red clover	Potato (Ranger Russet)	Barley (Island)	barley-red clover-potato	250 cwt	Final hilling of potato early July. Barley under-seeded with red clover. Barley straw is baled and removed from field. Spring plough down of red clover prior to potato crop.
2	Mixed Hay (Atlantic Dairy Mix)	Mixed Hay (Atlantic Dairy Mix)	Mixed Hay (Atlantic Dairy Mix)	corn-corn-hay-hay-hay	12 T/a	Application of liquid dairy manure in spring and fall of 2012 (not incorporated with soil).
3A	Red clover	Potato (Ranger Russet)	Barley (AC Queen)	barley-red clover-potato	250 cwt	. Final hilling of potato early July. Barley under-seeded with red clover. Barley straw is baled and removed from field. Spring plough down of red clover prior to potato crop.
3B	Red clover	Potato (Ranger Russet)	Barley (AC Queen)	barley-red clover-potato	250 cwt	Final hilling of potato early July. Barley under-seeded with red clover. Barley straw is baled and removed from field. Spring plough down of red clover prior to potato crop.
4A	Corn silage	Corn silage	Mixed Hay (Atlantic Dairy Mix)	corn-corn-hay-hay-hay	14 T/a	Application of liquid dairy manure in fall of 2012 (not incorporated with soil).
4B	Corn silage	Corn silage	Mixed Hay (Atlantic Dairy Mix)	corn-corn-hay-hay-hay	14 T/a	Application of liquid dairy manure in fall of 2012 (not incorporated with soil).
4C	Corn silage	Corn silage	Mixed Hay (Atlantic Dairy Mix)	corn-corn-hay-hay-hay	14 T/a	Application of liquid dairy manure in fall of 2012 (not incorporated with soil).

4D	Corn silage	Corn silage	Mixed Hay (Atlantic Dairy Mix)	corn-corn-hay-hay-hay	14 T/a	Application of liquid dairy manure in fall of 2012 (not incorporated with soil).
5A	Potato (Ranger Russet)	Soybean (Currie R2)	Ryegrass	soybean-ryegrass-potato	0.9 T/a	Ryegrass clipped three times over growing season, and left on field. Potatoes are final hilled early July, with incorporation of potato vines into field post-harvest.
5B	Potato (Ranger Russet)	Soybean (Currie R2)	Ryegrass	soybean-ryegrass-potato	0.9 T/a	Ryegrass clipped three times over growing season, and left on field. Potatoes are final hilled early July, with incorporation of potato vines into field post-harvest.
9	Red clover	Potato (Ranger Russet)	Barley (Island)	barley-red clover-potato	250 cwt	Final hilling of potato early July. Barley under-seeded with red clover. Barley straw is baled and removed from field. Spring plough down of red clover prior to potato crop.
11	Potato (Ranger Russet)	Barley (Island)	Red clover	barley-red clover-potato	1.2 T/a	. Final hilling of potato early July. Barley straw is baled and removed from field. Spring plough down of red clover prior to potato crop.
12	Potato (Ranger Russet)	Barley (Island)	Red clover	barley-red clover-potato	1.2 T/a	Final hilling of potato early July. Barley under-seeded with red clover. Barley straw is baled and removed from field. Spring plough down of red clover prior to potato crop.
13A	Potato (Ranger Russet)	Milling Wheat	Mixed hay (30-60% legume)	wheat-red clover/timothy/fescue/alfalfa-potato	1.0 T/a	Final hilling of potato early July. Barley under-seeded with red clover. Barley straw is baled and removed from field. Spring plough down of red clover prior to potato crop.
13B	Mixed Hay (Atlantic Dairy Mix)	Mixed Hay (Atlantic Dairy Mix)	Corn	corn-corn-hay-hay-hay	12 T/a	Application of liquid dairy manure in spring and fall of 2012 (not incorporated with soil).

Manure Production Information

Proper management and use of livestock manure is essential in successful implementation of nutrient management plans. By estimating the total amount of livestock manure produced, the required manure storage facilities can be determined. This will allow for planning to optimize the timing and amount of available manure for application. As a result you can reduce the risk of manure over application due to lack of manure storage.

Total manure production can be calculated based on the size of the population, size and ages of the animals, animal housing structure, and the type of manure produced by the livestock. To get an accurate determination of storage space required, be sure to include any additional liquids, such as washline waste water and rainfall, as well as bedding in your total manure produced calculations. A general approximation of manure production rates based on animal class can be found in Table 1 of the '"Guidelines for Manure Management for Prince Edward Island" factsheet (available at: http://www.gov.pe.ca/agriculture/index.php3?number=1012103#land_testing).

Total manure applied per year should be based on the amount of manure produced and individual crop requirements, using nutrient management recommendations. If the amount of manure produced is in surplus to the total amount of manure applied, the excess manure needs to be accounted for by adjusting the current nutrient recommendations to accommodate larger manure applications, or by exporting the manure to another farm.

Example Manure Production Information Table:

Herd Class	Number of Animals	Type of Manure	Days in Barn	Manure produced per animal (L/day)	Total Manure Produced (L/day)
Dairy Calves Large Frame (100-400 lbs)	10	Liquid	365	5.4	54
Dairy Heifers Large Frame (400-1150 lbs)	35	Liquid	365	21.2	742
Dairy Milking Age Cows Large Frame (1150-1400 lbs)	50	Liquid	365	45.3	2265
Total Manure Produced Per Day on Farm (L)					3061
Total Manure Produced Per Day on Farm (m^3)					3.1
Milkhouse and Washline Wastewater Produced Per Day (m^3)					0.4
Total Manure and Wastewater Produced Per Day on Farm (m^3)					3.5
Rainfall Volume (m^3)					650
Total Manure + Wastewater + Rainfall Produced Per Year (m^3)					1928
Total Manure Applied Per Year (m^3)					1899
Total Manure Surplus/Shortage (m^3)					+29

Soil and Manure Analysis Reports

Soil reports are also included within the NMP to provide a better estimate of the current nutrient content of the soil within each field. To ensure that the nutrient management recommendations can be customized to each individual field, all cropped fields should be regularly soil sampled (approximately once throughout the crop rotation). Soil should be consistently be sampled either prior to planting and/or fertilization of the crop in early spring, or following harvest in the fall. Recommendations for each crop can vary based on the concentration of available nitrogen, phosphorus or potash available at the time of each sampling.

Additional organic soil amendments, such as manures and/or shellfish wastes, should also be analyzed and included within the NMP. Farms analyzing their farm for the first time should do so once a year for the first 2-3 years. If there is no significant change within the average nutrient content of the manure, it is recommended that manure analysis occur only once every 5 years following initial manure analysis, unless there has been a significant change to the manure management on the farm.

Although testing of soil amendments and manures does not guarantee the exact amount of nutrients applied, these reports can provide a good estimate of the nutrients within the amendment. The appropriate amount of nutrient credits can then be applied to the nutrient budget if the timing and method of incorporation for all amendment applications are accounted for.

If a recent manure analysis is not available, or if there has been a change to the manure management since the manure analysis, general nutrient composition of various types of animal manures can be found within the NMP planner's course material book from the most recent nutrient management planner certification course. For in-depth information on how to calculate the amount of manure and/or amendment nutrients available based on the nutrient content of the report, please refer to:

- "The Guidelines for Manure Management for PEI" Factsheet (Section 5.4): http://www.gov.pe.ca/agriculture/index.php3?number=1012103#land_testing

- "Understanding Soil and Manure test reports" Factsheet: http://www.gov.pe.ca/photos/original/af_NM_manconv.pdf.

All soil and manure analyses can be tested at the PEI Analytical laboratories (PEI Department of Agriculture and Forestry). For more information on the testing packages, rates and turnaround times for individual samples, please refer to the PEI Analytical Laboratories website at: http://www.gov.pe.ca/agriculture/labservices, or call (902) 368-5671.

Example Soil Analysis Report:

5/28/2013

PEI Analytical Laboratories
PEI Department of Agriculture and Forestry
23 Innovation Way
PO Box 2000, Charlottetown, PEI, C1A7N8

Fax: (902) 368-6299
Telephone: (902)620-3300

CLEAR VIEW FARMS
C/O GEORGE AND REBECCA O'CONNOR
1200 BRACKLEY POINT RD
HARRINGTON, PE
C0A 1H4

Client: 123456
Accession: 178594
Samples Reported: 5/28/2013
Samples Received: 5/24/2013

Sample Information		Soil Test Values and Ratings								
Lab Sample #	Field Number	Organic Matter (%)	pH	Phosphate P_2O_5 (ppm)	Potash K_2O (ppm)	Calcium Ca (ppm)	Magnesium Mg (ppm)	Boron B (ppm)	Copper Cu (ppm)	Salt mS/cm
1	1 AWHALEN	2.5	5.8	209 M	127 M+	583 L	71 M	.3 M+	.4 L	
2	2 BSMITH	2.8	5.9	494 H+	141 H	705 M+	156 H+	.4 L	3.0 H	
3	3A NORMCROSS	3.6	5.5	354 H	119 M	602 L	47 M	.2 M	1.1 M+	
4	3B NORMCROSS	2.4	5.6	458 H+	110 M	798 L	29 L	.2 M	1.1 M+	

Lab Sample #	Field Number	Zinc Zn (ppm)	Sulfur S (ppm)	Manganese Mn (ppm)	Iron Fe (ppm)	Sodium Na (ppm)	Aluminum Al (ppm)	Lime Index	Nitrogen N (%)	Nitrate-N NO3-N (ppm)
1	1 AWHALEN	.9 M	13 M+	51 H+	120 H	12	1938	6.8		
2	2 BSMITH	1.6 L	32 H+	34 M+	162 H+	19	1715	6.5		
3	3A NORMCROSS	2.0 M+	23 H	26 M	150 +	10	1880	6.6		
4	3B NORMCROSS	.8 M	13 M+	38 M+	152 H+	20	1953	6.7		

L-: Low L: Low M: Medium M+: Above Medium H: High H+: Very High

To convert HECTARES into ACRES multply by 2.47

To convert T/HECTARE into T/ACRE multiply by 0.45

To convert Kg/Ha into lbs/ACRE; multiply by 0.9

Sample Information				Limestone application (T/Ha) to achieve			Required Applications (Kg/Ha)		
Lab Sample #	Field Number	Field Size (Ha)	Crop to be grown	pH 5.5	pH 6.0	pH 6.5	Nitrogen N	Phosphate P_2O_5	Potash K_2O
1	1 AWHALEN	5.5	Potato			2	135	135	135
2	2 BSMITH	4.9	30-60% Legume			3	50	0	40
3	3A NORMCROSS	10.9	Potato		2	3	155	200	135
4	3B NORMCROSS	4.2	Potato		2	2	135	135	135

Lab Sample #	Field Number	Man	Sod	CEC (Meq/100g)	Base Saturation % K	% Mg	% Ca	% H	% Na	Total % Base Saturation
1	1 AWHALEN	0	2	6	4.4	9.5	46.8	38.5	.8	60.7
2	2 BSMITH	0	0	11	2.7	11.6	31.4	53.5	.7	45.7
3	3A NORMCROSS	0	0	8	3.0	4.6	35.4	56.5	.5	43.0
4	3B NORMCROSS	0	2	8	2.9	3.0	48.9	44.2	1.1	54.8

Comments: All fertilizer recommendations are based on a pH of 6.0.
To convert P2O5 to P, divide by 2.29. To convert K20 to K, divide by 1.2.
* Accredited Methods

Methods: SFL_22M - pH*
SFL_23M - Organic Matter*
SFL_24M - Soil Nutrients *

Example Manure Analysis Report:

PEI Analytical Laboratories
PEI Department of Agriculture and Forestry
23 Innovation Wav
PO Box 2000, Charlottetown, PEI,
CJA7N8

Fax: (902) 368-6299
Telephone: (902) 620-3300

Special Products Test Report
6/7/2013

CLEAR VIEW FARMS
C/O GEORGE AND REBECCA
O'CONNOR
1200 BRACKLEY POINT RD.
HARRINGTON, PE
C0A 1H4

Client: 123456
Accession: 2567
Samples Reported: 6/ 7/2013
Samples Received: 5/31/2013

Analysis Performed	Lab #: 3980-1 Sample Type: Liq. Dairy Manure Sample Id: Manure	Sample Type: Sample Id:	Sample Type: Sample Id: J	Sample Type: Sample Id:
Dry Matter %	6.50			
Carbon %	2.53			
C:N Ratio	11.96			
Nitrogen %	.21			
Phosphorus %	.04			
Potassium %	.14			
Calcium %	.10			
Magnesium %	.04			
Copper ppm	28.39			
Zinc ppm	8.22			
Ammonium %	.19			

Organic nitrogen can be calculated by subtracting the amount of ammonium-nitrogen from the amount of total nitrogen within the sample.

Samples are reported on an "as received" basis using the dry ash method for analysis.

Nutrient Recommendations

Nutrient recommendations are made specific for each field by taking into consideration the current season's crop requirements, with nutrients supplied by credits from previous crops, manure, and fertilizer applications.

Nutrient recommendations should be filled on a need versus supplied basis using the 4R approach to nutrient management. This means that only required nutrients should be applied, and fertilizer and manure applications should be made to enable supplying nutrients at peak times of crop nutrient uptake to avoid loss of nutrients.

The following table is divided into numerous columns:

- "Crop Nutrient Requirements" is calculated based on the specific crop and variety, and the nutrient levels within the soil at the beginning of the season of that field.

- The "OM Credit" column is a credit given for the amount of N that will be mineralized through the cropping season based on the organic matter content. A credit of 15 lbs/acre of nitrogen (N) is credited to the crop if soil organic matter levels within the soil report are 3.5% or greater.

- The "Previous Crop Credit" column outlines any N credits that would be given to the crop based on quality of previous forage crops and the timing of forage crop plough downs.

- The "Organic Amendment Credits" column shows the total amount of nutrients supplied through the spreading of manure or soil amendments within the last three years.

- The "Nutrient Balance" column is the total amount of nutrients required to fill the crop nutrient requirements after the available nutrients from all other columns are subtracted from the total crop requirements.

- The final column "Recommended Fertilizer Blends and Timing of Applications" includes the recommendation for each individual field based on the remaining nutrients required and applied using the 4R approach.

Example Nutrient Recommendations Table:

Field	Crop	Crop Nutrient Requirements (lbs/acre)			OM Credit (lbs/acre)	Prev. Crop Credit (lbs/acre)	Organic Amendment Credits (lbs/acre)			Nutrient Balance (lbs/acre)			Recommended Fertilizer Blends + Timing of Application(s)
		N	P	K	N	N	N	P	K	N	P	K	
1	Potato (Ranger Russet)	185	200	135	0	40	0	0	0	145	200	135	Apply 12-18-12 at 1200 lbs/acre banded with planter.
2	Mixed Hay (Atlantic Dairy Mix)	50	0	40	0	0	4	15	1	46	0	36	Apply 20-0-10 at 300 lbs/acre in the spring.
3A	Potato (Ranger Russet)	185	135	135	15	40	0	0	0	130	135	135	Apply 17-17-17 at 800 lbs/acre banded with planter.
3B	Potato (Ranger Russet)	185	135	135	0	40	0	0	0	145	135	135	Apply 17-17-17 at 800 lbs/acre banded with planter.
4A	Corn silage	120	90	75	0	0	3	10	1	117	80	74	Apply spring application of liq. manure at 5500 gallons/acre (inc. w/in 1day), plus additional 12-24-0 at 250 lbs/acre at planting.
4B	Corn silage	120	90	100	0	0	3	10	1	117	80	74	Apply spring application of liq. manure at 5500 gallons/acre (inc. w/in 1day), plus additional 12-24-0 at 250 lbs/acre at planting.
4C	Corn silage	120	90	100	0	0	3	10	1	117	80	74	Apply spring application of liq. manure at 5500 gallons/acre (inc. w/in 1day), plus additional 12-24-0 at 250 lbs/acre at planting.

4D	Corn silage	120	90	100	0	0	3	10	1	117	80	74	Apply spring application of liq. manure at 5500 gallons/acre (inc. w/in 1day), plus additional 12-24-0 at 250 lbs/acre at planting.
5A	Soybean (Currie R2)	20	40	0	0	0	0	0	0	20	40	0	Apply 12-18-0 at 200 lbs/acre broadcast before planting.
5B	Soybean (Currie R2)	20	60	25	0	0	0	0	0	20	60	25	Apply 10-30-10 at 200 lbs/acre broadcast before planting.
9	Potato (Ranger Russet)	185	200	135	0	40	0	0	0	145	200	135	Apply 12-18-12 at 1200 lbs/acre banded with planter.
11	Barley (Island)	50	25	25	0	0	0	0	0	50	25	25	Apply 20-10-10 at 250 lbs/acre banded with planter.
12	Barley (Island)	50	25	0	0	0	0	0	0	50	25	0	Apply 20-10-0 at 250 lbs/acre banded with planter.
13A	Milling Wheat	60	30	30	0	0	0	0	0	60	30	30	Apply 20-10-10 at 300 lbs/acre banded with planter.
13B	Mixed Hay (Atlantic Dairy Mix)	50	40	0	0	0	4	15	1	46	25	74	Apply spring application of dairy manure at 5500 gallons/acre, and additional 100 lbs/acre of 20-10-0 if necessary after first cut.

For more information on nutrient management planning, please contact representatives from the Sustainable Agriculture Resource Section at the PEI Department of Agriculture and Forestry:

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Growing Forward 2

Prince Edward Island CANADA

Canada