

Nutrient Management Planning

Introduction

What is nutrient management planning?

Nutrient management is not an entirely new idea. Agricultural producers have used soil amendments in one form or another to provide nutrients for as long as there has been agriculture. Producers apply fertilizer, manure, compost and other nutrient sources to increase crop yields and improve crop quality. The objectives of nutrient management planning are to:

- balance the nutrient requirements of your crops,
- properly account for all organic nutrient sources, such as manure,
- maximize costs savings, and
- reduce the risk of contaminating wells or streams while protecting the environment for future generations.



Why use nutrient management planning?

In recent years, agricultural producers have become aware of the potential environmental impacts of improper or excessive use of fertilizer, manure and compost, for example:

- contamination of drinking water supplies
- pollution of aquatic habitats
- odours

Producers are now using Nutrient Management Planning to minimize the environmental impact of the nutrients used on their farms, while at the same time optimizing crop yields and reducing fertilizer costs. A complete nutrient management plan will identify the actions required to meet your crop management goals by balancing the nutrients already present in the soil with amendments from other sources, ensuring that the level of nutrients in the soil is optimal for crop growth and meeting environmental objectives.

Crop nutrients

Nitrogen, phosphorus and potassium are the nutrients required by crops in the largest amounts, followed by calcium, magnesium and sulphur. Crop plants may also require very small amounts of other “micro-nutrients” such as zinc, copper, iron, boron, manganese or molybdenum.

Nitrogen is the nutrient most commonly deficient in soils. Crop plants need nitrogen for forming protein and chlorophyll. Plants deficient in nitrogen are often stunted and yellow. **Phosphorus** is the second most commonly deficient nutrient in soils. It is used in the plant in many physiological roles, including the promotion of root growth. Phosphorus deficient plants are often stunted, dark green and delayed in maturity. **Potassium** is the third most commonly deficient nutrient in soils. Potassium deficient plants will generally have poor growth. Cereal grains deficient in potassium tend to develop weak stalks and may be more prone to root infections.

Fertilizers commonly contain nitrogen, phosphorus and potassium due to the tendency of these nutrients to be deficient in soils and because plants require large quantities of these three nutrients.

On-farm Nutrient Management Planning follows a few simple soil fertility, nutrient management and environmental principles that are outlined below.

Nutrient content and availability varies with the source of the nutrients.

Producers use both inorganic and organic sources of nutrients. Inorganic nutrient sources are things such as fertilizers and organic sources are things such as manure or compost. Commercial fertilizers are excellent sources of plant nutrients. Manure and compost are also very good sources of plant nutrients, however nutrients may be released more slowly from some organic sources than from inorganic fertilizers. The nutrient content and the slow release of nutrients from organic sources should be taken into account when doing nutrient management planning.

The nutrients in manure should be accounted for.

Manure can contain substantial amounts of nitrogen, phosphorus, potassium and other nutrients, however, the nutrient content of manure is highly variable. In order to avoid over-application of nutrients from manure, the nutrient content of your manure should be determined by laboratory analysis. Your manure application rates should be based upon that analysis. However, proper sampling of manure is required to obtain a representative analysis. An agrologist could help you to determine appropriate sampling techniques for your manure.

Manure loses nitrogen during storage, and handling and after application.

Manure will lose nitrogen during storage, handling and application, mostly through the volatilization of ammonia. With careful management you can keep more of the nitrogen in the manure, which will benefit the crop and avoid the loss of nutrients to the environment.

The best way to reduce nitrogen losses and odour from manure is to apply the manure in the spring and incorporate it into the soil as soon as possible after application. Nitrogen losses are low in the spring in the cooler temperatures and higher in the summer.



Incorporating manure immediately or injecting manure will cover the manure and thus reduce nitrogen losses and the risk of manure runoff.

The nutrients in legume plowdowns and composts should be accounted for.

Legume plowdowns may contribute a substantial amount of nitrogen to the soil, depending on the legume and the time of year that it is plowed down. The nutrients contributed from these organic sources should be taken into account when doing nutrient management planning.

Composts are a slow-release organic form of nutrients with a relatively low concentration of nutrients. However, when applied at appropriate rates, composts can supply considerable quantities of nutrients and these should be accounted for in a nutrient management plan.

Availability of nutrients is reduced in acid or alkaline soils.

Plant uptake of nutrients from acid or alkaline soil may be limited. Soil that is acid (pH below 6.5) or alkaline (pH above 7.0) may

transform nutrients into chemical forms that plants can not use. Most crops take up nutrients best around a pH of 6.5 to 7.0. Consequently, liming acid soils will often improve plant uptake of nutrients from the soil. Lime can also be a source of the plant nutrients calcium or magnesium. Some crops, such as potatoes and blueberries require a more acid soil for optimal growth.

Nutrient application rates and crop removal of nutrients may not always be the same.

Even at recommended nutrient application rates, the amount of nutrients applied may sometimes be greater than the amount of nutrients removed by the crop.

In part, this intentionally allows for some build-up of available nutrients in soils with low fertility and adjusts for nutrient fixation in the soil. However, application of nutrients over a long period of time at rates that exceed crop removal may eventually lead to nutrient runoff or leaching problems.

To reduce over-fertilization of crops, application of fertilizers should be based on soil tests. The fertilizer should be applied at rates that are just sufficient to balance the crop's requirements for nutrients and achieve good yields. If manure is to be applied, then fertilizer application rates should be reduced proportionally to account for the nutrients in the manure.

Over-fertilization of crops can lead to contamination of streams or groundwater.

Nutrients in the soil may be transferred from the field in the form of runoff or leachate resulting in contamination of surface and/or groundwater.

- Excessive application of nitrogen will increase the risk of contaminating

groundwater with nitrates. Elevated levels of nitrate in wellwater is known to be associated with the disease Methaemoglobinaemia (Blue Baby Syndrome).

- Phosphorus or nitrogen may contribute to the formation of algal blooms and eutrophication in streams, lakes or estuaries, making the waters unfit for fish or recreational use.



A new and more recent challenge is that some New Brunswick soils are starting to become saturated with phosphorus. Phosphorus from these saturated soils may be carried with runoff or through tile drains into surface waters.

Bacteria from manure may contaminate streams or wells that are used to supply drinking water.

Runoff from stored or spread manure may carry bacteria or other microbial pathogens and contaminate streams or wells that provide drinking water. Manure storage and application should be managed as carefully as possible to protect our sources of drinking water.

Manure should only be stored or applied at safe setback distances from watercourses or wells.

Where do you start – develop a nutrient management plan for your farm.

The first step in nutrient management planning is to develop a nutrient management plan for your farm. A plan can be easily developed based upon basic soil fertility principles and good record keeping. The lowest risk category in the Environmental Farm Plan recommends that you implement a nutrient management plan that has been completed and certified by a professional agronomist, and that the plan should be updated each year.



Keeping good records of all the nutrients applied on your farm will aid in planning the management of those nutrients. There are several computer programs available (ex: NMAN) for those who wish to use them to do record keeping on a computer. Adequate paper records are acceptable, however.

Regulatory requirements

A nutrient management plan is *recommended* as a beneficial management practice for all farms. Some farms may be *required* to have a nutrient management plan.

The Livestock Operations Act (LOA) and General Regulation 99-32 require some livestock operations in New Brunswick to be licensed. As part of the licensing process a manure **nutrient management plan** is required for: (a) new livestock operations with 20 or more livestock or 200 or more poultry, (b) existing livestock operations undergoing an

expansion of 10-fold or more, (c) existing livestock operations that construct a new livestock facility greater than 1 kilometre from their existing facilities, and (d) livestock operations that cease or suspend operations for a period greater than two years. For more information regarding whether or not your operation requires a licence under the LOA and thus a manure nutrient management plan, contact the nearest office of the New Brunswick Department of Agriculture and Aquaculture.

If your farm, or part of your farm, is within a *watershed or wellfield protected area* designated under the Watershed or Wellfield Protected Area Designation Orders (Clean Water Act), then the application of nutrients or storage of nutrients is subject to additional regulatory requirements to protect drinking water sources. *Producers should consult a Regional Water Planning Officer at the New Brunswick Department of Environment for more information.*

Cost savings from Nutrient Management Planning

A nutrient management plan can assist you to precisely balance the nutrient requirements of your crops. If we minimize nutrient losses from all sources on-farm, we may be minimizing environmental impacts, but we are also maximizing the economic value of those nutrients. By maximizing the efficiency of use of all sources of nutrients on your farm, you may be able to reduce fertilizer, or fuel costs. A Nutrient Management Plan can increase the overall economic profitability of your farm, while at the same time protecting drinking water sources and the environment.

This factsheet was produced by the Eastern Canada Soil and Water Conservation Centre under contract for the New Brunswick Department of Agriculture and Aquaculture as a project within the Canada-New Brunswick Agreement on the Agricultural Policy Framework. We thank all reviewers for their input.