INTRODUCTION

All of us need nutrients to live and thrive, and we rely on crops to provide much of our daily quota. Crop production repackages plant nutrients such as nitrogen, phosphorus and potassium into forms that we and other animals can use.

Crops need nutrients too. They grow properly only if they obtain nutrients in the correct amounts, at the appropriate times. Soils can supply many of the nutrients needed by crops, but often require additional nutrients from sources such as commercial fertilizers and manures.

Nutrients, whether in fertilizer or other materials, are both an essential input and a major cost for crop production. In Ontario, commercial fertilizer and lime applied to cropland cost farmers about $483-million annually. The manure from about 2.2-million cattle, 3.6-million hogs, and 47-million chickens and turkeys is also applied to cropland.

Livestock are an important part of the nutrient cycle in Ontario.

Cropland nutrients must be managed wisely to preserve the quality of our soil, air and water.

Many of Ontario's vital natural areas rely on private landowner stewardship, of which nutrient management is but one part.

A small number of farmers apply nutrients in excess of recommended rates. This is not a best management practice if it ignores costs, profits, and the environment. For example, applying more nitrogen than the crop can use will increase the risk of nitrate-nitrogen leaching from the soil, polluting precious groundwater resources. Runoff from snowmelt or heavy rains can carry nutrients such as phosphorus to streams, drains, and rivers. Eroding cropland can pollute surface waters, with sediment and nutrients attached to soil particles.

Nor is it wise to apply too few nutrients. Yield and profits will drop.

By adopting best management practices, you can do your part to reduce environmental risks without sacrificing productivity. This book will help you to understand the:

- importance of nutrients to your crops
- behaviour of nutrients in soil
- sources that add nutrients to soil
- factors that influence the supply of nutrients available to your crops
- effects of poor nutrient management.

This book also describes best management practices for:

- determining the amount of nutrients to apply
- applying nutrients for optimum efficiency.

Growing crops with insufficient nutrients will lower yield, quality, and returns.

Successful crop production depends on good nutrient management. Regular manure applications can help maintain nutrient and organic matter levels.

USING A SYSTEMS APPROACH TO MANAGE CROP NUTRIENTS

A **systems approach** to managing crop nutrients involves taking a step back and thinking about the big picture. How you manage nutrients will depend on many other components of your whole farm operation. Use a systems approach where:

- all components of the system, from barn to application to monitoring, are included in the nutrient management program
- all nutrients are inventoried – organic, inorganic, those that a crop needs, those already in a crop, and those already in the soil

- ► all nutrients (liquid and solid forms) are managed – according to land base, production goals, proximity to water resources, farmstead layout, equipment, and odour and safety concerns
- ► site conditions are assessed to determine limitations for facilities, suitable application rates, and proper separation distances from sensitive areas.

Making an inventory of crop nutrients is well worth the effort. Nutrient management affects crop:

- **growth**
- **maturity**
- **reproduction**
- **harvestability**
- **pest tolerance**
- **disease tolerance**
- **winter survival**
- **profitability**
- **standability**
- **quality**
- **yield.**

Here are some key considerations as you get started:

- ► baseline fertility levels with regular soil tests
  - ▷ knowing soil fertility levels and crop requirements is the best way to determine application rates
- ► special needs
  - ▷ some high-value crops have unique fertility requirements for quality, e.g., boron in rutabagas and potassium in tomatoes
- ► residual nutrients from previous crops
  - ▷ some legume crops can provide nitrogen (N) for crops in subsequent years, so you should account for and estimate the amount of N contributions from these crops
- ► organic sources
  - ▷ it may not be desirable to supply all of a crop's requirements from organic sources (manures, biosolids, legumes, etc.), as some nutrients may be oversupplied
- ► application timing
  - ▷ crops need to access nutrients at specific times for optimum quality and yields
- ► nutrient use efficiency
  - ▷ sustainable practices that waste less, meet crop needs and maintain soil fertility
- ► production versus profit
  - ▷ maximum yield will usually not be your most profitable yield
- ► other farm management considerations
  - ▷ nutrient management is part of a comprehensive crop production system that includes soil and water management, crop rotation, varietal selection, planting techniques, tillage system, and pest and weed management.

SAVING ON INPUTS

A deficiency of any given nutrient can limit crop growth and quality. Shown here are soybeans with a potassium deficiency.

A well-planned nutrient management system can save money in many ways. Putting one together will help you:

- save time and money by purchasing and applying only what's needed
- make better use of on-farm nutrient sources
- identify opportunities for using lower-cost alternative sources of nutrients, e.g., manure from a neighbouring farm, sewage biosolids and other non-agricultural source materials, or other forms of commercial fertilizers
- consider more efficient fertilizer application practices
- use rotations, cover crops, residue management, and sound soil management practices to conserve the nutrients in the soil.

Have you heard of Whole Farm Nutrient Accounting?

It seeks to account for all nutrients imported to and exported from a farm. The ultimate goal of the exercise is to have them balance each other.

Farm operations that import more nutrients than they export are at greater risk of nutrients accumulating excessively over the long run. At the other extreme, productivity will decline on operations where nutrients exported in crops or livestock are not replaced.

The greatest benefit of nutrient management planning will be realized by operations with the largest imbalance between nutrient imports and exports.

We'll be referring to other Best Management Practices books, especially *Soil Management*, *Manure Management*, *Water Management*, *Nutrient Management Planning*, *Field Crop Production*, and *Horticultural Crops*. We urge you to read these companion books: they'll help you situate your nutrient program within the big picture of resource management on your farm.

The need for quality as well as yield can increase the fertilizer requirements for some crops, like these whole-pack processing tomatoes, which need large amounts of potassium to ripen evenly.