

INTRODUCTION

Manure has been spread as fertilizer for almost as long as animals have been raised for food. Over the past decade in Ontario, some important features of manure and how it's handled have come into sharp focus.

The first is a **keener appreciation of manure as a valuable resource, containing key nutrients for crop growth and soil conditioning**. By taking a full account of the nutrients in manure and what their crops and soils need, farmers can fine-tune what they apply on their fields, often reducing input and labour costs.

There is **greater societal concern, shared by the farming sector, for protecting rural water sources**. For livestock producers, this means greater attention to (and possibly investment in) storage facilities and capacity, application calibration and timing, separation distances from wells and water bodies, and in-field practices to minimize soil erosion and runoff.

Livestock and poultry operations are increasing in size, and concurrently the non-farming population is quickly outnumbering farmers in rural areas. Odour complaints top the list of neighbour conflicts. Farmers must handle greater volumes of manure in ways that minimize odour.

As we better understand the value of manure and the importance of safe storage, handling and application, we are entering an era of nutrient management planning. Farmers adopting this “systems approach” benefit everyone – agriculture, soil and water, rural communities and society at large.



Livestock agriculture is fundamentally important to Ontario's agricultural economy, generating at least 50% – or \$4 billion – of annual farm cash receipts.

Taking a comprehensive “systems approach” to manure management will sharpen your understanding of the interplay among different components of your operation. In so doing, you'll be better able to foresee how a planned change to one component, e.g., bedding, could affect others, e.g., manure handling. We'll look at this concept more closely in the next chapter.

WHAT'S IN THIS BOOK

If you're a livestock producer, you're already living with the reality of accountability regarding nutrient management. This book will help you adapt and fine-tune your operation to get the most from your efforts.

THEMES

This book's intention is to help you select and implement the right best management practices for managing manure and other nutrient materials in your operation. You'll see some recurring themes, including:

the value of nutrient management planning

- accounting for all nutrients and thereby reducing input costs

the concept of a systems approach

- always considering the entire system, from animal to field, through planning and implementation

the importance of managing all liquids

- managing all liquids around facilities, storage areas, and handling equipment, and during application – regardless of whether you're set up for solid manure, liquid manure, and/or other organic materials

the need for due diligence

- as a producer, you'll be expected to match storage and handling systems to your needs, sample and test for all nutrients, calibrate application equipment, apply at calculated rates, keep separation distances, monitor storage sites, monitor application operations, develop contingency plans for spills, and keep accurate records.

Please note that this book generally complements the **Nutrient Management Act and Regulation 267/03**. The precise requirements for the Nutrient Management Act can be found on the Ontario Ministry of Agriculture, Food and Rural Affairs website: <http://www.omafra.gov.on.ca/english/agops/index.html>

OUTLINE

We'll begin by putting manure management in an Ontario context, then look at some facts and issues concerning manure, biosolids and agricultural washwaters.

In the next chapter, we'll cover the basics. These are the scientific principles related to the environmental and practical qualities of manure and other materials. An understanding of these will help you make informed choices among best management practices.

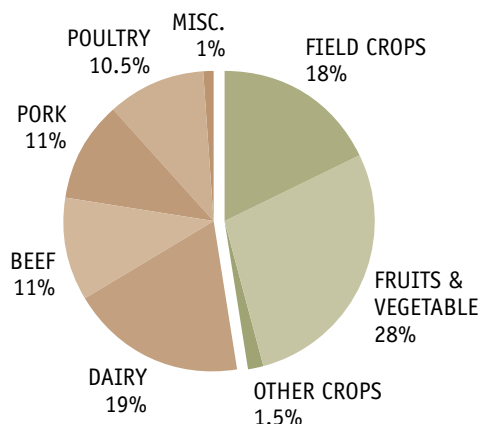
The balance of the book is devoted to describing best management practices in a systems approach context. This will cover: farmstead concerns – siting, odour and storage; field issues – planning, timing and application; and monitoring – storages, runoff and tile effluent.



Hard hoses and pipes carrying manure to fields should be monitored for leaks.

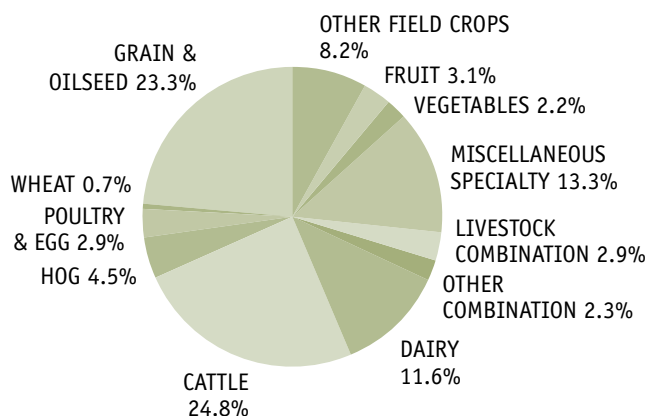
ONTARIO'S LIVESTOCK SECTOR

FARM RECEIPTS BY TYPE OF OPERATION



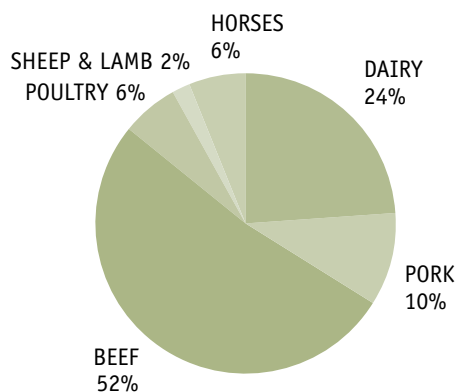
With over half of Canada's Class 1 agricultural land, Ontario boasts a diverse farming sector. The province's farms generate over \$8.3 billion annually in farm cash receipts – about half of which comes from livestock and poultry operations.

FARMS BY COMMODITY TYPES

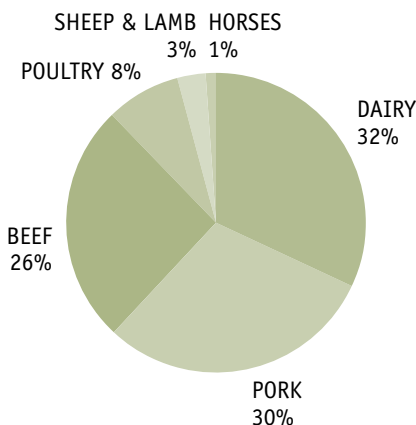


Ontario's crop and livestock sectors are interdependent. Approximately 3.9 million hectares (9.6 million ac) are in crops, a significant portion of which is used to feed livestock and poultry. In turn, most of livestock manure is recycled on cropland as nutrients to promote plant growth and soil quality.

LIVESTOCK NUTRIENT UNITS IN ONTARIO



NUMBER OF LIVESTOCK FARMS BY COMMODITY



A head count of animals on Ontario farms reveals, in descending order, approximately 41.5 million chickens, 3.3 million hogs, 3.5 million turkeys, 1.2 million beef cattle, 800,000 dairy cattle, 230,000 sheep and goats, and 75,000 horses.

MANURE PRODUCTION AND DISTRIBUTION IN ONTARIO

Animal agriculture in Ontario generates a considerable volume of manure and other by-products. These animals generate approximately 16 million cubic metres* (3.5 billion gal) of liquid manure and 22 tonnes (24.4 million tons) of solid manure.

If this manure were spread evenly over all the available cropland in Ontario, approximately 4375 litres (or 962 Imp gal) could be spread on each cropland acre – in other words, a very light application.

With the exception of a few localized imbalances in the distribution of manure, Ontario has a net deficit of manure nutrients, i.e., more cropland needing nutrients than available manure can supply. The imbalances in manure distribution can be attributed to:

farm size

- operations are becoming fewer in number but larger in size, and the average size (and manure volume/operation) continues to increase with time

uneven distribution across Ontario

- 60% of Ontario's livestock and poultry operations are found in southwestern Ontario

shift in the rural landscape from agricultural to residential and other land uses

- less locally available, suitable land on which to spread manure and other organic wastes (e.g., biosolids, farm-generated wastewaters).

Several states in the eastern U.S. have manure surpluses, i.e., more manure than cropland on which to spread it.



Rural land use continues to change from farm to other applications. Growth in the number of rural non-farm residents increases the potential for conflicts about odour and other perceived environmental problems.



A small minority of livestock producers consider manure a waste, not a resource.

*1000 litres = 1 cubic metre

MANURE AS A RESOURCE

Manure has value both as a source of nutrients and as a soil conditioner – two good reasons for managing it as a resource.

Regular applications of manure help build soil's organic matter.



NUTRIENT VALUE OF DIFFERENT TYPES OF MANURE*

MANURE	NITROGEN	PHOSPHATE	POTASH	APPROXIMATE TOTAL VALUE
	kg/m ³ (lb/1000 gal)			
DAIRY, LIQUID	1.4 (14)	0.7 (7)	3.0 (30)	\$23.00/1000 gal
SWINE, LIQUID	2.4 (24)	1.1 (11)	2.0 (20)	\$28.00/1000 gal
POULTRY, LIQUID	5.1 (51)	2.5 (25)	3.4 (34)	\$60.00/1000 gal
	kg/tonne (lb/ton)			
DAIRY, SOLID	1.5 (3)	1.5 (3)	5.5 (11)	\$8.00/ton
POULTRY, SOLID	9.5 (19)	10 (20)	12.5 (25)	\$36.00/ton

* Values in this chart are based on the following assumptions:

- incorporated within 24 hours, spring application
 - all nutrients are required by this year's or subsequent crops for long-term value
 - nitrogen is \$0.48/lb; phosphorus is \$0.41/lb; potash is \$0.26/lb
- 1m³ = 1000 litres

To make the most of its potential, manure has to be stored, handled and applied in ways that retain its value, suit your operation, reduce the risk of environmental contamination and aren't cost-prohibitive.

With proper distribution of manure, most natural or intensive grazing systems don't require additional fertilizers.



OTHER ORGANIC MATERIALS

Manure is not the only organic nutrient material generated on farms or brought to farms that needs to be managed.

Examples of **on-farm source materials** include: milking centre washwaters, manure and yard runoff, silage leachate, and greenhouse wastewaters.

Examples of **off-farm source materials** include: municipal sewage biosolids, paper biosolids, food processing byproducts and abattoir wastewaters.

Like manure, these materials add plant nutrients and soil-conditioning organic matter. Likewise, these materials must be managed as a resource. Using these materials may require approval, e.g., Certificate of Approval from Ontario Ministry of the Environment.

MANURE ISSUES

Nutrient management of livestock and poultry manure and other organic materials is one of the most challenging issues facing agriculture in Ontario. It's complex, with dimensions ranging from environmental concerns at a societal level to nuisance concerns from neighbours, to health concerns for your family and farm animals. It's all about managing risk while conducting your farm business.

MANURE-RELATED ISSUE	CONCERNS	MANAGEMENT GOALS
ECONOMIC	<ul style="list-style-type: none"> • is generally a net cost to livestock operations 	<ul style="list-style-type: none"> • improve soil quality and fertility • reduce dependency on off-farm inputs
ENVIRONMENTAL	<ul style="list-style-type: none"> • can lead to ground and surface water contamination 	<ul style="list-style-type: none"> • increase soil water-holding capacity • increase soil biological diversity
NUISANCE	<ul style="list-style-type: none"> • produces offensive odours • can be a source of flies 	<ul style="list-style-type: none"> • minimize odour, flies, and prevent neighbour complaints
HUMAN HEALTH	<ul style="list-style-type: none"> • contains pathogenic organisms 	<ul style="list-style-type: none"> • minimize risks to human health



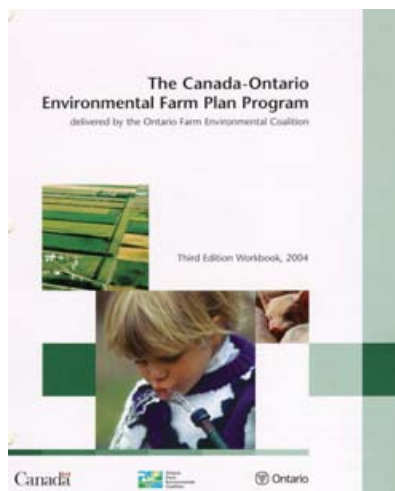
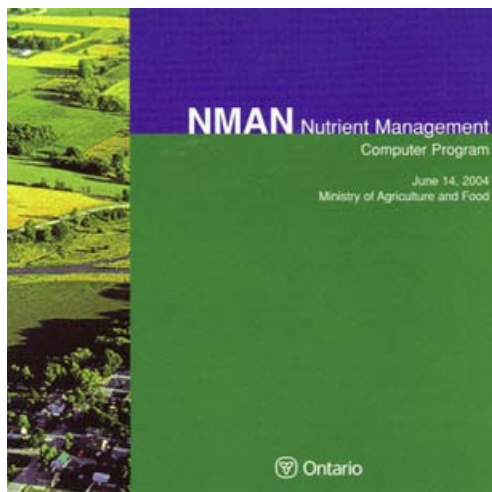
The proportion of large livestock farms is increasing in Ontario. Most intensive (or large) livestock operations are well-managed, as are their manure management systems.

AGRICULTURE'S RESPONSE

Over the past decade, manure-related issues have been addressed head-on by many, often diverse, groups involved in Ontario agriculture. Farm organizations, government agencies, municipalities, environmental non-governmental organizations and other partners are continuing to work aggressively and collaboratively.

Here are some snapshots of recent successes.

In Ontario, we have the software to develop reliable, science-based nutrient management plans. This approach helps plan storages, calculate safe application rates for suitable acreage, identify optimal timing, and schedule monitoring.



The Environmental Farm Plan program focuses on soil, water, nutrient and pesticide issues. Each participating producer develops a semi-detailed site assessment by rating components of their farm's environmental management system and completing an action plan.



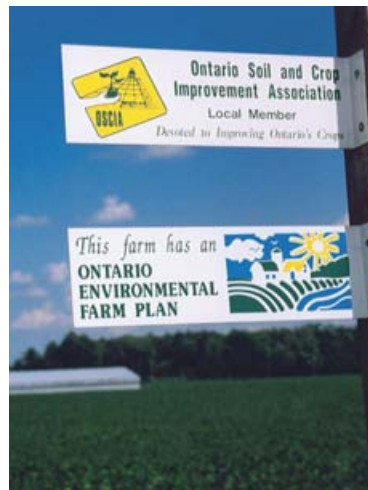
Sampling and testing manure for nutrient levels qualifies as a best management practice. Like all BMPs, it integrates production targets with environmental goals.



Ontario Ministry of Agriculture, Food and Rural Affairs engineers and commodity specialists have long advocated the systems approach to manure management. This involves comprehensive management of all liquid and solid byproducts from barn to seedbed.

Research and advisory staff are working with producers to reduce manure-nutrient levels through improved livestock nutrition and feed.

Many of farmers' questions have been answered with on-farm applied research and demonstration projects.



Improvements in manure-treatment technology may reduce the volume of material to be managed and help to provide on-farm energy.

The costs of some on-farm improvements to nutrient management practices and systems can be burdensome for individual farmers. In some cases, they can get assistance from local water quality programs (e.g., Remedial Action Plans, local Conservation Authority efforts, and municipal-based initiatives) that cost-share with government and industry partners.