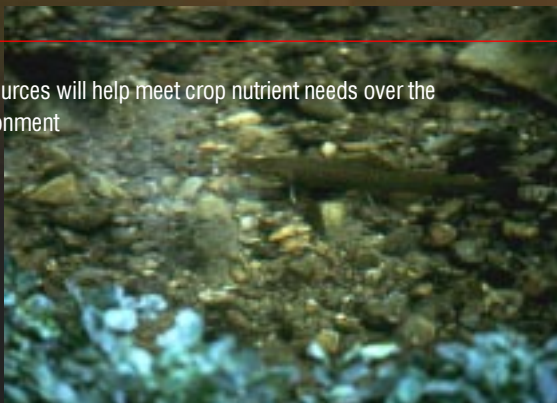


Manure

farming & healthy fish habitat

Properly managing manure resources will help meet crop nutrient needs over the long term and protect the environment

i s s u e 2



Pathways to the Stream - Pollution Prevention and Manure Management

The small streams and watercourses that drain rural Ontario are home to a wide variety of fish species. Improper manure management can cause different problems for fish and fish habitat at different times of the year.

When applying manure, proper farm management options should consider the following:

- ▶ the crop's nutrient needs in each season,
- ▶ the "pathways" manure can take to reach a stream,
- ▶ the sensitivity of fish and fish habitat to manure spills.

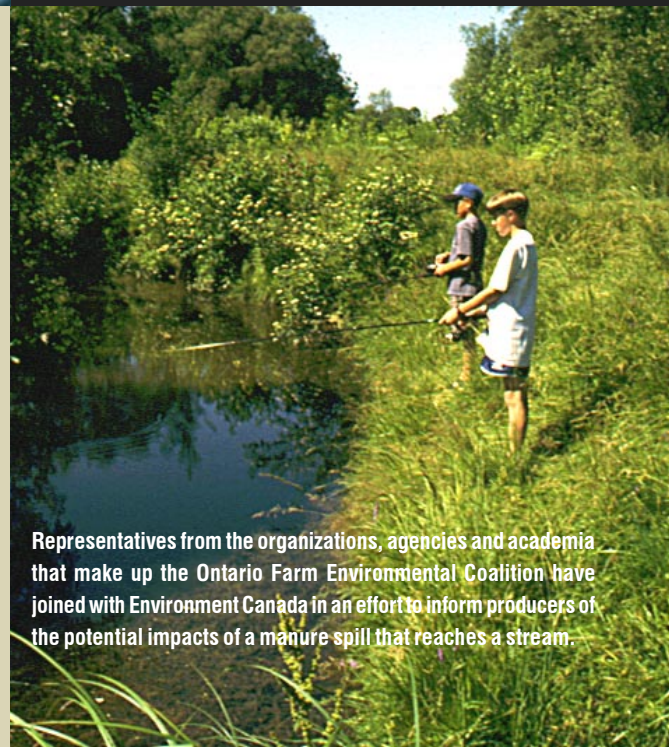
Assessing these factors is the first step to best utilizing manure nutrients while minimizing the risk to fish habitat and protecting water quality. The following pages are designed to help you make the best management decision for your farm operation.

Fish Kills in Ontario

- ▶ Between 1988 and 1996, an average of 25 manure spills per year were reported.
- ▶ In 1997, 25 manure spills were reported; seven of these resulted in fish kills.
- ▶ Half of the spills occurred when liquid manure was being applied; inadequate or poorly constructed manure storage tanks accounted for the remainder.

Lasting Effects

The effects of pollution on fish and fish habitat may be temporary or long lasting. A healthy stream can sustain a single isolated manure spill and may recover once the slug of manure has passed. However, if the same stream is subjected to a continuous influx of pollution, the healthy, diverse population will gradually be replaced by small, short lived, pollution tolerant species of aquatic insects and a lower diversity of fish species having an increased incidence of disease and parasites.



Representatives from the organizations, agencies and academia that make up the Ontario Farm Environmental Coalition have joined with Environment Canada in an effort to inform producers of the potential impacts of a manure spill that reaches a stream.



WINTER

Crops have been harvested, plant growth has slowed or stopped and the ground is typically wet or frozen.

Crop Nutrient Needs

- ▶ The crop demand for nutrients is minimal.
- ▶ Manure nitrogen will be of limited benefit to next year's crop, as much will be lost due to leaching or, if left on the soil surface, lost to the air as ammonia.



Pathways

- ▶ A substantial amount of the manure applied may run off the surface of wet or frozen ground into streams.
- ▶ Although the ground may be frozen, the tiles are normally running and the risk of contamination is high.

Effects on Fish & Fish Habitat

- ▶ Fish activity is much reduced in the winter. Fish and eggs from fall spawners are very sensitive to pollution's impacts.
- ▶ Organic matter that is deposited on gravel containing eggs can reduce the amount of oxygen getting to the eggs. Although eggs can tolerate lower levels of oxygen better than adult fish, too little oxygen can cause the eggs to suffocate or develop abnormally.

SPRING

Traditionally, most manure is applied in the spring, although cool soil conditions reduces the uptake of available nutrients.

Crop Nutrient Needs

- ▶ The cool soil and air temperatures mean slow growth and minimal nutrient uptake by crops and buffer vegetation.
- ▶ The breakdown of old crop residue and cover crops begins to release nutrients.
- ▶ There is a major risk of additional nutrients being lost to streams and groundwater, due to the high potential for soil erosion at this time of year.

Pathways

- ▶ Water and manure will drain through the soil using the path of least resistance. Cracks, worm holes and old root paths offer easy routes to tile drains. Up to 80% of the water drains through as little as 20% of the cross-sectional area of the soil.
- ▶ 75% of the soil lost annually to water erosion is taken between spring melt and the crops emerging. During this time, soil, manure and nutrients are at high risk of being carried into streams by runoff if there is no crop residue to hold them in place.
- ▶ Buffer area vegetation is dormant and will intercept or utilize very little of the nutrients in runoff.



Effects on Fish & Fish Habitat

- ▶ Many species of fish are migrating to the smaller headwater streams to spawn, concentrating their numbers in streams adjacent to land where manure may be applied. Fish species that inhabit these watercourses year round are also spawning. Spawning fish, eggs and newly hatched fry are extremely sensitive to pollution.
- ▶ In some instances the immediate effects of a spring spill may not be as apparent because of higher water levels. However, the organic loading will reduce oxygen levels and can smother eggs, prevent fry from emerging from spawning gravel and encourage excess plant and algae growth.

Field Tips to Preventing Tile Water Contamination

When tiles are flowing, manure can reach tiles in less than 20 minutes. As much as 2% of applied manure can end up in tiles. Based on a 5000 gal/ac application rate, 100 gal/acre can end up in the tiles.

- ▶ Break up macropores before manure application either by tillage before surface application or by zone-tillage of the soil ahead of the injector. Injection minimizes surface erosion, odour, and ammonia loss.



- ▶ Especially in no-till, side dress manure when soil is drier, tiles are less active, and soil has been dried by planting.

If a tile drain carries water off of your property, consider doing the following:

- ▶ Install a catch-basin to allow inspection of tile water leaving your property.
- ▶ If the drainage water in the catch-basin is discoloured, cap the basin outlet and pump the water back onto the land until the drainage water runs clear.
- ▶ If tile outlets do not drain into catch basins and the water is discoloured, a barrel can be installed to contain and pump contaminated water back onto the field. Alternatively, if the land is level the tile outlet can be temporarily plugged by inflating a sports ball surrounded by foam to expand into the pipe's corrugations.
- ▶ Consider splitting the total application rate over two passes several days apart if the tile drainage water is discoloured.

SUMMER

Manure nutrient utilization peaks when the crops are growing quickly, and drier soil means pollution pathways are less active.

Crop Nutrient Needs

- ▶ Attempts should be made to match crop requirements at this time to achieve full yield potential.

Pathways

- ▶ Drier soils have a greater ability to absorb applied liquid manure.
- ▶ Vigorous plant growth means fewer nutrients are lost to the stream or groundwater.
- ▶ Buffer vegetation is able to intercept and take up more nutrients from surface runoff.
- ▶ Crop canopy and buffer vegetation reduce soil erosion and delivery of manure nutrients overland to streams.
- ▶ Drainage from tiles contributes significantly less water to streams than during other seasons.



FALL

Harvesting corn and soybeans and planting fall cover crops offer some manure management flexibility at this time of year.

Nutrient Needs

- ▶ Nitrogen is not required by pastures and forage crops with a high legume content.
- ▶ Unless crops are growing, manure applied will not be used and may, instead, end up in streams.
- ▶ Manure can be used to build organic matter and nutrient levels.

Pathways

- ▶ Cracks that developed in the soil during a dry summer are potential pathways to tiles that applied manure can follow.
- ▶ Worm holes can develop to a significant depth, creating possible pathways for manure to reach tiles.
- ▶ Tile drains begin to run with more frequent rainfall, increasing the potential for stream contamination.



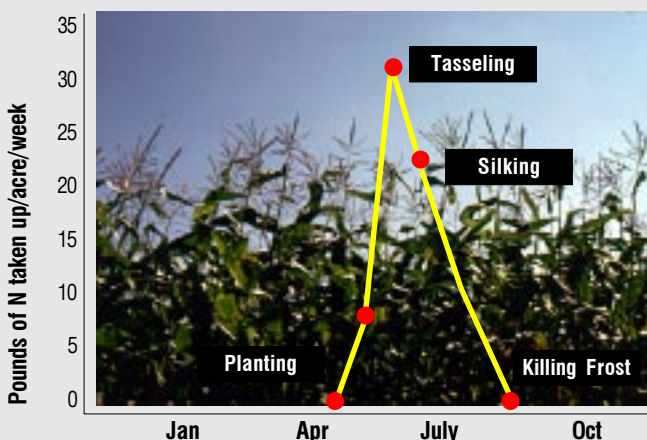
Effects on Fish & Fish Habitat

- ▶ Summer is the most stressful period in a stream due to higher temperatures and lower water and oxygen levels. Particular care must be taken to avoid spills in the summer because of these conditions.
- ▶ Fish searching for cover and food compete for sites, such as deep pools downstream of riffles, that have lower temperatures and higher oxygen levels.
- ▶ Headwater streams are vital for reproduction and rearing but their relatively small size provides no room to escape if there is a spill.

Effects on Fish & Fish Habitat

- ▶ Several species of fish will have moved upstream into headwater areas to spawn, concentrating their numbers in streams that may be adjacent to land receiving manure.
- ▶ Organic matter such as manure that settles on gravel containing eggs can impede water circulation through the gravel, reducing the amount of oxygen being delivered to developing embryos.

Weekly Nitrogen Uptake of Corn for 150 bushel per acre yield



Too little dissolved oxygen in the water can kill fish. The amount of oxygen available rises and falls daily due to the photosynthesis-respiration cycle, peaking in the late afternoon and bottoming out just before sunrise. Throughout the day, aquatic plants produce oxygen as a byproduct of photosynthesis. Levels drop after dark when the process reverses and the plants use oxygen. Excess nutrients, such as phosphorus, trigger an overgrowth of plants and algae, which has a direct impact on the dissolved oxygen levels. When the algae and plants die the decomposition process also uses oxygen, further stressing the aquatic system.



Looking for Solutions

The role of the Livestock Manure Pollution Prevention Project Working Group is to:

- ▶ enhance communication and partnerships between industry, government and academia;
- ▶ provide a forum to encourage practical ideas about manure management and promote research;
- ▶ organize pilot projects and demonstration days;
- ▶ promote booklets and other information on best management practices;
- ▶ encourage Ontario farmers to adopt best management practices and strategies to reduce manure spills and resulting fish kills.

Secretariat services are provided by the Upper Thames River Conservation Authority. Funding for the secretariat and P3 Working Group is provided by Environment Canada - Ontario Region.

Working Group Partners

Agriculture and Agri-Food Canada
Christian Farmers Federation of Ontario
County of Huron Planning & Development Department
Dairy Farmers of Ontario
Department of Fisheries and Oceans
Environment Canada
Ministry of Agriculture, Food and Rural Affairs
Ministry of Environment
Ministry of Natural Resources
National Agriculture Environment Committee
Ontario Cattlemen's Association
Ontario Federation of Agriculture
Ontario Pork
Ontario Soil and Crop Improvement Association
Ontario Farm Environmental Coalition
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Environment Canada
Ontario Region

Environnement Canada
Région de l'Ontario



Manure is a source of nutrients and organic matter for the soil. Manure provides immediate benefits as well as contributing nutrients for several years. However, when exposed to the air a significant amount of manure's nitrogen can be lost to the atmosphere as ammonia gas.

General management tips to prevent spills:

- ▶ When manure must be spread under less favourable conditions, apply to level fields with the lowest seasonal risk to fish habitat and watch for runoff and tile water contamination.
- ▶ Apply manure to higher risk fields only when soil is dry and runoff can be avoided.
- ▶ If your manure storage is full and you must spread in winter, choose level fields and stay away from watercourses, catch-basins, drop inlets and wetlands.
- ▶ Ensure equipment is maintained and operating properly to avoid spills. Be aware that because spring is a busy time, the risk of spills and accidents is higher.
- ▶ Consider expanding the time-frame during which manure is spread to include side dressing when soil is drier and corn nutrient demand increases.
- ▶ Spreading manure must be flexible to accommodate wet weather conditions. This will protect soil from compaction and streams from contamination.



Ontario Farm Environmental Coalition Activities

Environmental Farm Plan (EFP) Program

The EFP Program is a farmer led initiative to raise farmers' awareness of environmental concerns associated with agricultural production practices. To date 11,000 Ontario farmers have participated in EFP Workshops.

Nutrient Management Planning Strategy

A nutrient management strategy has been developed by the Ontario Farm Environmental Coalition (OFEC) to address the concerns expressed by many Ontario residents regarding the production, storage and use of agricultural nutrients. The purpose of the strategy is to provide a uniform approach to nutrient management across the province that can be adopted by farmers and municipalities.

Best Management Practices Booklet - Nutrient Management Planning

The Nutrient Management Planning booklet will be released this spring. The BMP series provides the reader with a practical, affordable approach to conserving a farm's soil and water resources without sacrificing productivity.



When a manure spill occurs call: Spills Action Centre

1-800-268-6060

Photo credits: Agriculture and Agri-Food Canada, Ontario Ministry of Natural Resources, The Upper Thames River Conservation Authority.



Printed April 1998