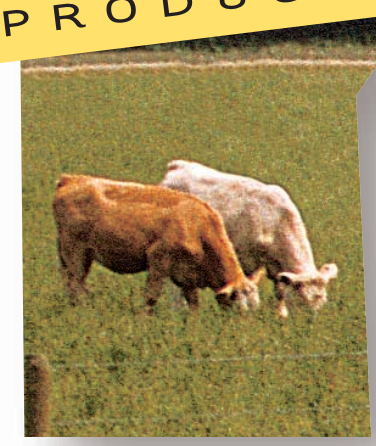
Living WITH Livestock PRODUCTION



Phosphorus in Soil and Water

SPRING 2004 FACT SHEET #14

Introduction

Phosphorus is an essential plant and animal nutrient that can impair surface water quality when present in excess. Phosphorus occurs naturally and is commonly found in fertilizers, manure, detergents, municipal and domestic sewage, and industrial waste. Phosphorus must be carefully managed to minimize the impact on surface water quality.

The Issue: Too Much Phosphorus in Surface Water

A small amount of phosphorus in water is essential for aquatic life. However, phosphorus can quickly become a problem when present at excessive levels. Such an increase in phosphorus and other nutrients in surface water is called ***eutrophication***. As eutrophication occurs, both plant and algae growth can increase to a harmful level for aquatic life. When these plants and algae die, their decomposition uses a great deal of the water's oxygen which may result in fish kills. As well, blooms of some blue-green algae may release toxins into surface water that can harm wildlife, livestock and humans if they drink the water.

Algae blooms can also cause other problems including:

- creation of harmful by-products in chlorinated drinking water
- objectionable odour, taste and appearance of water for drinking or recreation
- clogging of plumbing

Phosphorus Facts

Phosphorus is the 11th most abundant mineral in the earth's crust. It is also present in many foods, fertilizer, pesticides, detergents, matches and even toothpaste.

Phosphorus is an essential nutrient for plants, animals and humans. It is found in all living cells and is involved in many biochemical reactions. About 85% of the body's phosphorus is stored in bones and teeth.

Algae growth on a Manitoba lake.

Prepared by Manitoba Agriculture, Food and Rural Initiatives,
Manitoba Conservation, Manitoba Health and Manitoba Water Stewardship.

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How does Phosphorus get into Surface Water?

Phosphorus can enter surface water from both ***point sources*** and ***non-point sources***.

Examples of Point Sources:

- municipal wastewater systems
- industrial discharges
- feedlots and manure piles
- residential septic systems

Controllable point source discharge from a municipal lagoon.

Examples of Non-Point Sources:

- erosion of soil from agricultural land, natural habitat and streambanks
- runoff water from agricultural land, natural habitat and golf courses
- wildlife access to surface water
- allowing livestock to graze along lakes and streams

The practice of allowing livestock uncontrolled access to surface water should be avoided.

In general, non-point sources of phosphorus can be very difficult to control. Point sources may be more easily identified; however, control measures can be costly.

While phosphorus may enter surface water from a variety of sources, the remainder of this fact sheet will focus on agricultural sources.

How can the Movement of Phosphorus from Agricultural Sources to Surface Water be Minimized?

Managing runoff from manure piles and feedlots

Feedlots and manure piles are concentrated sources of phosphorus. Siting them away from surface water can reduce the movement of phosphorus from feedlots and manure piles. Manitoba's Livestock Manure and Mortalities Management Regulation requires that feedlots and manure piles be located at least 100 metres from watercourses. Any runoff from feedlots or manure piles should be collected or diverted away from watercourses.

Managing livestock access to surface water

A few animals may have little impact when drinking from a stream. When a large number of livestock have uncontrolled access to a watercourse for drinking, they may damage the shoreline and leave manure behind. This will increase the amount of phosphorus in the water. The access of livestock to surface water can be managed through the use of fencing, alternate water supplies and restricted cattle-crossings.

Off-shore watering.

Controlling soil erosion

Agricultural soils are often fertilized with phosphorus for crop production. If soil erosion occurs, natural and fertilizer phosphorus may be carried to surface water with the soil particles. Erosion can be reduced by using conservation practices which decrease the amount of time that the soil is left bare. These practices include reduced tillage, leaving crop residue on the soil and establishing cover crops. Steep slopes are susceptible to severe erosion and should not be tilled. They should be kept in permanent plant cover such as grass, shrubs or trees. Properly managed grass strips and grassed waterways can also be used to trap eroded soil particles.

Grassed waterways should be managed and vegetation should be harvested.

Managing phosphorus applications

Putting too much phosphorus on agricultural land will increase the amount of phosphorus in soil, which, in turn, can greatly increase the amount of phosphorus in runoff. Too much soil phosphorus can come from heavy or repeated application of fertilizer or manure.

Commercial fertilizer can be formulated to meet the crop's requirements for nitrogen and phosphorus. However, the nutrients in manure are often not balanced to meet the crop's needs. Manure application rates are usually based on the nitrogen needs of the crop. This can result in the application of more phosphorus than the crop can use and will result in a build-up of phosphorus in soil. This build-up can be managed using soil testing to determine how much phosphorus needs to be applied to grow a particular crop.

Where soils already have excessive levels of phosphorus, further build-up can be managed in several ways. For example, manure can be applied based on how much phosphorus the crop can remove from the land. Nitrogen fertilizer can then be added as needed. Another alternative is to separate the solids from liquid manure because most of the phosphorus is found in the solids. The solids can then be applied to low-phosphorus soils. A third approach is to reduce the amount of phosphorus excreted by livestock.

Reducing phosphorus in manure

Since livestock do not digest all of the phosphorus in their feed, any surplus is excreted in the manure. Formulating diets more closely to the animals' requirements can reduce this surplus. For pigs and poultry, a second method is to include an enzyme in the diet that will increase the digestion of the phosphorus. Improving the digestibility of plant phosphorus allows a livestock producer to reduce the amount of phosphorus added to feed without compromising the amount of meat, milk or eggs produced. The development of plant varieties that contain more digestible forms of phosphorus has shown some promise. This would further reduce the amount of phosphorus in both feed and, ultimately in manure.

Managing phosphorus from all sources will help to maintain or enhance water quality.

Summary

Although phosphorus is essential for all living things, excess in surface water can degrade water quality and cause a variety of problems. Both agricultural and non-agricultural sources contribute phosphorus to lakes, rivers and streams. All sources must be managed to maintain water quality, however, more than one approach is necessary.

Further Information

For further information about livestock production, refer to other titles in the series: "Living with Livestock Production," available from Manitoba Agriculture, Food and Rural Initiatives offices. More detailed information can be found on the Internet at www.gov.mb.ca/agriculture/livestock and from Agriculture Publications 8th floor, 401 York Avenue, Winnipeg MB R3C 0P8 (FAX: 204-945-2498).

Other titles available include:

- Health Issues and Livestock Production
- Livestock Odours – Sources, Concerns and Solutions
- Surface Water Issues
- Nitrates in Soil and Water
- Land Application of Manure
- Siting Livestock Production Operations
- Understanding Anti-microbial Resistance
- Food Safety on the Farm
- Livestock Operations and Groundwater Quality
- Livestock Pathogens – A Natural Occurrence
- Managing Livestock Mortalities
- Livestock Manure Storage
- Confinement of Livestock