

Livestock Farm Phosphorus Import/Export Analysis and Strategies for Phosphorus Management

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Introduction

Land application of manure in Minnesota is restricted to rates determined by nitrogen (N) needs of the crop. However, dairy and beef manure applied at N rates on an annual basis will result in buildup of excess soil test phosphorus (STP). On dairy and beef farms that apply manure at N rates and do not have sufficient land to rotate manure applications among fields, excess STP leads to elevated phosphorus (P) in surface runoff and eutrophication of streams and lakes. A good indicator of whether crop fields will trend up or down in STP is the measurement of farm gate P imports compared to exports.

This project selected 19 land-limited dairy and beef farms, determined the annual level of P imports compared to exports, and identified strategies that could reduce their import-export imbalances. The farms and strategies were developed into case studies that were presented at workshops for livestock producers and agricultural professionals.

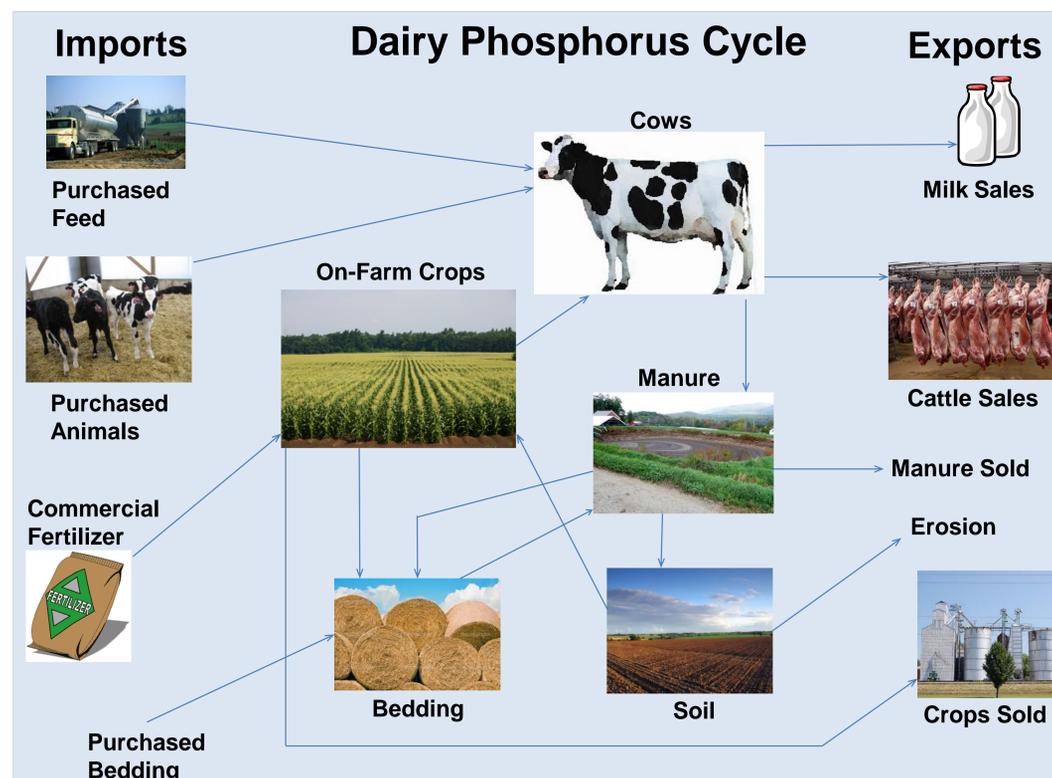
Methods

Farm P Import-Export Balance: About 70 candidate dairy and beef farms were proposed by local Extension and conservation staff. The farm operators were interviewed by phone and promised anonymity. A subset was interviewed in person, and a thorough P import-export analysis was carried out on 14 dairy and 5 beef farms. Farm gate imports included livestock, fertilizer, manure, bedding, feed, feed supplements, and forage. Exports included milk, livestock, crops, and manure. Feed P content was obtained from feed analysis provided by the farmer, feed supplier, and the farm's consulting nutritionist. Manure P content was obtained from the farmer, while P composition for imported bedding and exported crops, milk, and livestock was obtained from standard tables. The analysis was carried out using a modified "Nutrient Management Yardstick" spreadsheet developed in the Netherlands by the Centre for Agriculture and the Environment (CLM) and adapted in the U.S. by the Institute for Agriculture and Trade Policy.

Case Studies: Strategies for reducing excess P imports compared to exports were observed on several of the study farms and elsewhere. These were described or proposed in relation to seven of the farms as case studies, with more in development.

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Funding was provided by a Clean Water Act section 319 grant from the Environmental Protection Agency and Minnesota Pollution Control Agency.



Characteristics of the 19 Farms

Units	Range
Harvested Area	67 to 364 ha (166 to 900 acres)
Harvested Area/Animal Unit	0.1 to 1.1 ha/a.u. (0.2 to 2.8 acres/a.u.)
Excess P per Year	-31 to 130 kg/ha (-28 to 116 lb/ac)

Most of the 19 farms studied ranged from 0.3 to 0.8 hectares per animal unit, and 7 to 34 kg/ha/year excess P. That is the equivalent of 16 to 78 kg/ha of excess P₂O₅ applied annually.

Strategies to Reduce Excess Farm P Imports vs Exports

Feed Management

On many of the farms, the largest sources of P imports are feeds and feed supplements. Strategies to reduce these sources include:

- Reduce feed ration phosphorus. * By following the National Research Council recommended P composition in feeds, the imported P supplements and high P feed components like distillers grains can be reduced.
- Reduce feed waste.* Wasted feed enters the manure system, adding P to field applications and to feed expense by requiring additional feed purchase.

Herd Management

Measures to reduce unproductive livestock numbers and time on feed reduce the amount of imported feed and increase profit.

- Breeding all heifers to freshen at 22-24 months.
- Reduce the heifer inventory to an essential level for replacement.

* Developed in a case study.

Crop Management

Reducing unnecessary fertilizer P applications and increasing crop productivity reduce fertilizer P and feed imports.

- Eliminate P in starter fertilizer on soils already high in P. An economic response to starter P is rare in soils testing above 25 ppm Bray P-1. *
- Increase crop productivity through better water management and other measures to reduce the need for imported feeds.
- Acquire more land through purchase, lease, or contract feed production. * More land allows increased crop production and manure application. The increased crop production can either be exported or substituted for imported feed. A low-cost way to achieve this is to contract with a neighboring farm to receive manure and provide feed grains or silage.

Manure Management

Increasing manure use efficiency and exporting manure can reduce P imports and increase exports.

- Inject or incorporate manure immediately to reduce N losses and manure applied to meet crop N needs.* Manure saved can be exported or transported to more distant fields.
- Export manure.*
- Stop importing manure.* Poultry manure purchased for its N content brings in excess P. Substituting fertilizer N is necessary when STP levels are too high.
- Increase manure transport efficiency to permit cost-effective application to more distant fields.* This can include manure liquid/solids separation or improved transport equipment.

Resources

The UM Extension Manure Management and Air Quality Web Page will host the case studies: <http://manure.umn.edu>