

## Strategies to Improve Nutrient Balance

Evaluating a livestock system’s nutrient balance from a whole farm perspective provides a more complete picture of the driving forces behind nutrient-related environmental issues. The original sources of these nutrient inputs are clearly identified, which in turn suggest management strategies for reducing excess nutrient accumulations. The following four management strategies (Figure 2-7) should reduce nutrient imbalances:

- (1) Efficient use of manure nutrients in crop production
- (2) Alternative livestock feeding programs
- (3) Marketing of manure nutrients
- (4) Manure treatment

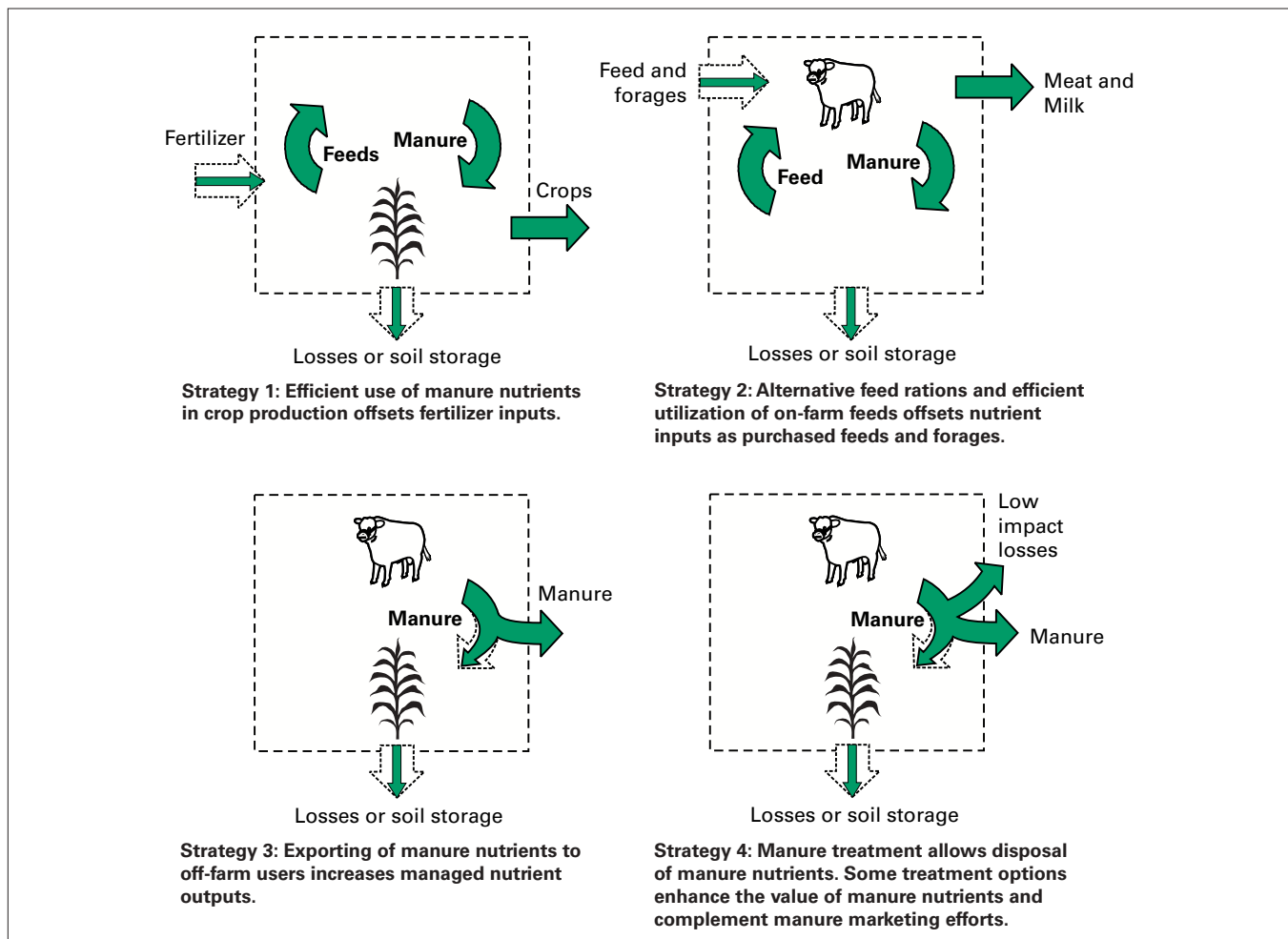


Figure 2-7. Four strategies are fundamental to addressing nutrient imbalances on modern livestock operations and achieving a sustainable nutrient balance between nutrient inputs and managed outputs.

**Efficient use of manure nutrients in crop production**

By accurately crediting manure nutrients in a cropping program, the purchases of commercial fertilizer can be reduced or eliminated and the risk to the environment reduced (Figure 2-7). This practice is especially important to livestock operations with significant crop production and substantial nutrient inputs as commercial fertilizers. It may offer greater benefit for N-related issues due to common use of commercial N fertilizers as insurance on manure applied fields. Lessons 30 through 36 will provide an in-depth discussion of the planning and management practices for efficiently using manure nutrients in crop production.

**Alternative livestock feeding programs**

Opportunities are available for reducing both N and P inputs by alternative livestock feeding programs (Figure 2-7). Specific management practices for reducing nutrient inputs as feeds will be discussed for ruminant (Lessons 12 and 13) and nonruminant (Lessons 10 and 11) animals.

The Nebraska study observed a greater P imbalance when high P rations were used in feedlot feeding programs. Ethanol and corn processing byproducts, attractive feed alternatives for some cattlemen, are typically high in P concentrations, resulting in finished cattle rations with excess P levels. Participating operations that were users of these byproducts experienced substantially greater P imbalance as compared to those operations not utilizing these byproducts (Table 2-2). Both groups had very similar N balance. Feeding program choices are likely to impact whole farm nutrient balance, especially for farms purchasing significant quantities of feed from off-farm sources.

In addition to changes in feed rations, some additional options that may reduce purchased feed nutrient inputs include (1) alternative crops or crop rotations that result in a greater on-farm production of livestock protein and P requirements and (2) harvesting and storage practices that improve the quality of animal feed and reduce losses.

**Marketing of manure nutrients**

Marketing of manure creates an additional managed output, similar to the sale of crops or livestock products. For two Nebraska feedlots summarized in Table 2-3, marketing of manure moved sufficient P to off-farm uses to eliminate a P imbalance (-1% and +6% imbalance on Farms #1 and #2, respectively). Farm #2’s nutrient balance was illustrated earlier (Figure 2-3) without crediting marketed manure nutrients. By actively marketing manure, this feedlot has achieved a relative level of nutrient sustainability that should prevent future buildup of soil P. Farm #3 also exhibits significant improvements in P balance due to the exporting of manure.

**Table 2-2. Nutrient imbalance for cattle operations as influenced by their use of byproducts of ethanol production and corn processing.\***

	Input:Output Ratio	
	N	P
Feedlots using byproducts (7 operations)	2.6:1	2.0:1
Feedlots not using byproducts (9 cattle operations)	2.5:1	1.1:1

\*The high P content of these feed supplements increased the P imbalance.

Improved whole farm nutrient balance can be achieved by

- (1) Efficient use of manure nutrients in crop production.
- (2) Alternative feeding programs.
- (3) Marketing manure nutrients to off-farm users.

Improved whole farm nutrient balance can be achieved by  
 (4) Manure treatment technologies.

**Table 2-3. Phosphorus imbalance for three feedlots actively marketing manure to off-farm users.**

Is Manure Marketed to Off-Farm Customers?	Farm #1 4,300 animal units		Farm #2 11,500 animal units		Farm #3 20,600 animal units	
	No <sup>1</sup>	Yes <sup>2</sup>	No <sup>1</sup>	Yes <sup>2</sup>	No <sup>1</sup>	Yes <sup>2</sup>
Phosphorus Imbalance	51 ton/yr 4.2:1	-1 ton/yr 1.0:1	123 ton/yr 2.0:1	13 ton/yr 1.1:1	280 ton/yr 2.6:1	156 ton/yr 1.5:1

<sup>1</sup>Phosphorus imbalance if manure was not marketed to off-farm sources.

<sup>2</sup>Current P imbalance including manure marketed to off-farm sources.

### Manure treatment

In some situations, it may be necessary for animal production systems to consider manure treatment technologies similar to municipal and industrial waste treatment systems. Some manure treatment systems focus on disposal of nutrients with modest environmental impact. For example, treatment systems commonly dispose of wastewater N as N gas (no environmental impact) or ammonia (some environmental impact). This is a preferable alternative to N losses to surface or groundwater. Other treatment systems enhance the value of manure (e.g., solids separation or composting) to allow alternative uses of the nutrients. Complementary manure treatment and manure marketing strategies can contribute to improved nutrient balance. For example, some producers are successfully combining composting (for odor control and volume reduction) with marketing of manure to crop farms and urban clients. Lesson 25, Manure Treatment Options, introduces the principles of manure treatment.

A single strategy will probably not fit all situations. For systems with sufficient land base for utilization of manure nutrients, a strategy that utilizes manure nutrients effectively may be most appropriate. This strategy should focus on preventing manure nutrient losses and reducing commercial fertilizer inputs as a means of achieving a nutrient balance and gaining the greatest benefit from manure. Little incentive exists for animal production facilities with sufficient land to reduce nutrient excretion by changing diets or marketing manure to off-farm customers. Alternative feeding programs to reduce P in manure may better match the ratio of manure N to P with crop needs.

When the land base becomes insufficient for utilizing the nutrients in manure, livestock dietary options for reducing manure nutrients may be an important strategy for attaining a nutrient balance. If neighboring crop farms or other nutrient users are in the vicinity of concentrated livestock operations, manure treatment and marketing of manure nutrients to off-farm customers may also be an important alternative. If nutrient uses do not exist, manure treatment options that benignly dispose of nutrients may be an important option. These alternatives will be discussed in greater detail in later lessons.