STRATEGIES TO REDUCE EXCESS SOIL TEST PHOSPHORUS BUILDUP ON LIVESTOCK FARMS

Strategy: Reduce Feed Waste/Feed Shrink

CASE STUDY: DAIRY OPERATION

The purpose of this case study is to demonstrate the economic and environmental value of reducing imports of phosphorus into dairy farms by reducing feed waste, otherwise known as feed shrink.

Farm Description:

This dairy farm in Central Minnesota has 330 head of Holstein cows on 2x milking with a 20,000 lb. Rolling Herd Average giving them an average of 636 animal unit (A.U.). Most of the milking cows are housed in a freestall barn with mattresses utilizing wood shavings; some of the milk cows and all of the dry cows and replacement heifers are on conventional bedding packs. This dairy farm has 545 harvested acres, including 480 that are tilled, with mostly Sandy Loam and some Loam type soils. Center pivot irrigation is used on 225 acres. The ratio of 0.9 harvested acres to animal units forces them to purchase some of their forages and all of their corn and bedding. This farm has excess phosphorus (P) imports over exports of 22.7 lb. per acre and 19.4 lb. per animal unit, which has increased most of the farm's soil P analysis above 50-ppm Bray 1-P.

Photo: Freestall Barn

Phosphorus Import-Export Analysis:

There is no P fertilizer imported. All field manure application is based on nitrogen needs, and there is some export of liquid and pen-pack manure. Most of the farm's soil tests are greater than 50 ppm Bray 1-P. The total P in the lactation ration varies from .38% to .45%. Purchased feed includes commercial supplements, shell corn, grass hay for dry cows and heifers, dry alfalfa hay, and alfalfa baleage. Some small grain straw is purchased. The farm's P import/export balance is shown in the table below. The farm is importing 22.7 lb. more P per harvested acre than it is exporting, which indicates that the already high soil test P on the farm is increasing. The 22.7 lb. excess P per acre is equivalent to 60 lbs. per acre P_2O_5. In the next section we will consider one strategy, reduction of feed waste, for reducing excess P imports over exports.

Phosphorus Balance						
	Phosphorus (lb.)			Ratios		
P Source	Imports	Exports	Excess			
Animals	0	1317		Harvested Acres	Animal Units	Ratio
Forages	3172	0		545	636	0.86
Grains	1166	0				
Protein/Minerals	17,284	0		Excess P (lb.)	Harvested Acres	Ratio
Bedding	1659	0		12,361	545	22.7
Fertilizer	0	0				
Milk	0	4933		Excess P (lb.)	Animal Units	Ratio
Manure	0	4670		12,361	636	19.4
Total P	23,281	10,920	12,361			

Livestock Feed Shrink Background:

Feed waste and losses, commonly referred to as feed shrink, result from various practices most of which can be reduced through improved facilities, equipment, or management. Providing adequate quantity, quality, and nutritionally balanced feedstuffs is important to the profitability of any livestock farm. Purchased feed is the largest source of imported P on almost all livestock farms. Forage production and purchased feed are the largest annual expense items for most livestock farms. Almost all feed shrink, other than gaseous fermentation losses, eventually end up in fields. Therefore, anything to reduce feed loss has the potential to reduce the P imports and feed expenses. It would be impossible to have zero feed shrink on a livestock facility.

Mismanagement of forages can contribute up to 30% shrink on some farms, however, some farmers are able to manage their forage shrink to as low as 5%[1, 3]. Keeping forage shrink to less than 10% is a good goal[1, 3]. Some commercial feed mills attain a 1% grain/concentrate shrink but many livestock farms have grain/concentrate shrink of 10% or more[1, 3]. Attaining less than a 5% grain/concentrate shrink on a livestock farm would be a good goal1. Knowing the actual amount of feed shrink on a given farm is difficult without a scale system weighing everything coming in and going out, and having a detailed data management system. Following is a summary of various areas of potential feed shrink[1, 2, 3].

Forages
Harvesting – proper moisture and cut length enabling proper fermentation.
Storage structure – cracks and uneven floors can cause spoilage and losses.
Piling or filling process – done quickly with adequate packing.
Covering pile – done properly and quickly.
Face management – adequate daily face removal and maintaining a flat face.
Wild animal control – deer, raccoon, rodents, birds – direct losses and spoilage.

Feed center and TMR
Wind – Blowing away feed stored in piles and/or when dumping feed into TMR.
Rodent and bird control – direct losses and spoilage.
Water damage – leaky roofs and bins, improper drainage.
Feed moisture and spoilage loss – any feed spoilage, especially wet concentrates.
Spillage and tires– depositing feed around farmyard by spillage or sticking to tires.

Barn
Cattle tossing feed – post and rail feed lines have higher loss than headlock systems.
Feed refusals – keep to less than 3-5%, offer refusals to other livestock.
Feed bunk heating and spoilage – affects intake, nutrition, and increases waste.
Type and management of baled hay feeders – losses range from 3.5% to over 14%.

Photo: Silage Pile with smooth face and clean floor

P Balance Difference by Reducing Feed Shrink 5%:

Based on the referenced research it is logical to assume that many livestock farms have an opportunity to reduce feed shrink and a 5% improvement in feed shrink would be an attainable goal for many. Let us assume that we could reduce feed shrink on this dairy farm by 5%. We calculate a 5% reduction of purchased grain, concentrates, and forages. We also calculate the additional feed we would have available when not losing 5% of our homegrown forages which further reduces purchasing of forages. The P density of the concentrates is variable and is more than double that in the forages. The table below illustrates the results of reducing all feeds by 5%.

Phosphorus Balance						
	Phosphorus (lb.)			Ratios		
P Source	Imports	Exports	Excess			
Animals	0	1317		**Harvested Acres**	**Animal Units**	**Ratio**
Forages	2869	0		545	636	0.86
Grains	712	0				
Protein/Minerals	16,242	0		**Excess P (lb.)**	**Harvested Acres**	**Ratio**
Bedding	1659	0		10,562	545	19.4
Fertilizer	0	0				
Milk	0	4933		**Excess P (lb.)**	**Animal Units**	**Ratio**
Manure	0	4670		12,361	636	19.4
Total P	21,482	10,920	10,562	10,562	636	16.6

In comparing the two tables above, we see that with the reduction in feed shrink by 5%, we reduced the excess P per harvested acre by 3.3 lb. and the excess P per animal unit by 2.8 lb. Because this farm is far out of P import/export balance, it will take multiple strategies to bring it into balance and stabilize the soil test values. Reduction in feed waste can contribute to that rebalancing.

Economic Analysis:

Reducing the shrink of all the feeds by 5% has a significant impact on farm profitability. Economic values obviously vary with market prices; the values used here are a reflection of prices mid-2015.

Annual Economic Returns from Reducing Shrink by 5%			
	Total savings this farm	Savings/ Animal Unit	Savings for a 100-cow dairy
Forages	$8,300	$13	$2,500
Grain and Concentrate	$27,000	$43	$8,200
Total	**$35,300**	**$56**	**$10,700**

Conclusions:

1. Some feed shrink on livestock facilities is inevitable.
2. Some producers have more feed shrink than others.
3. Most feed shrink will end-up in the manure system and then on the fields, increasing soil P test values.
4. Reducing feed shrink can reduce P imports into a livestock farm system, reducing costs.
5. Improvements to minimize feed shrink may require facility or equipment improvements, or may require more attention to daily details.

References:

1. Brouk, B. 2009. "Don't let Shrink Kill You with High Feed Prices". Western Dairy News, August 2009.
2. Clark, J. Holmes, B, Muck, R. 2008. "Feedout Losses from Forage Storage Systems". University of Wisconsin Focus on Forage.
3. Greene, D. 2014. "Shrink Management: Reducing Storage Losses". Diamond V Dairy Advisor, May 2014.

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