



STRATEGIES TO REDUCE EXCESS SOIL TEST PHOSPHORUS BUILDUP ON LIVESTOCK FARMS

Strategy: Acquire More Land through Lease, Purchase, or Exchange

CASE STUDY: DAIRY FARM

The purpose of this case study is to demonstrate reduction of net phosphorus imports into a dairy farm by acquiring more crop land through lease, purchase, or exchange.

Farm Description:

This dairy farm in Southern Minnesota has 120 head of Holstein cows with a DHIA Rolling Herd Average of 27,000 pounds. The milking cows, replacement heifers, and a few feedlot steers give them an average of 297 Animal Units. Housing for the lactating cows is sand bedded freestalls, the dry cows, heifers, and steers are on conventional bedding packs in the winter, and some of the dry cows and heifers are on pasture in the summer. This dairy farm has 230 tilled acres and an additional 92 acres of pasture and harvested grassland for 322 dry-land acres with mostly silt loam type soils. They purchase a small portion of their forage and corn grain, and export some of

their liquid manure. This dairy has two to three months of cement storage for sand-laden manure. The farm monthly field-applies the bedding pack manure with timely incorporation, or stockpiles for later application, depending on the time of the year.



Sand Freestalls

Phosphorus Import-Export Analysis:

The farm purchases all feed protein and mineral supplements. The minimum level of phosphorus (P) in the lactation ration is 0.36%; however, most of the rations result in a P level from 0.40 to 0.44%. There are no purchases of commercial fertilizer containing P. The farmer bases manure application on nitrogen needs. He exports 150,000 gallons of liquid manure pumped off the top of the pit. The farm's soil tests are all higher than 30 ppm Bray 1-P. Following is a table illustrating this existing farm's P balance.

Phosphorus Balance						
P Source	Phosphorus (lb.)			Ratios		
	Imports	Exports	Excess	Harvested Acres	Animal Units	Ratio
Animals		741		322	297	1.1
Forages	609					
Grains	564			Excess P (lb.)	Harvested Acres	Ratio
Protein/Minerals	6677	0		3066	322	9.5
Fertilizer		0				
Milk		3636		Excess P (lb.)	Animal Units	Ratio
Manure		407		3066	297	10.3
Total P	7850	4784	3066			

Acquiring Additional Crop Land:

One way to reduce excess P imports compared to exports on a farm is to acquire additional land by purchase or lease. This reduces the P import-export ratio by increasing on-farm crop production, which decreases feed imports, increases crop exports, or both. Assuming the number of livestock remains static, this would also result in more acres to apply the same amount of manure.

This dairy farm is presently operating 322 acres of harvested farmland with 297 animal units for a harvested land to animal unit ratio of 1:1. Corn grain yields are 187 bu. per acre and alfalfa yields 6 tons per acre. This dairy farm has an opportunity to lease 70 acres of tillable land nearby. This would increase the land-base by 30% to 392 harvested acres as displayed in the table below. We will assume that half of the additional acres will raise shelled corn and the other half will raise alfalfa at the same average yield as the original acres, all other activities remaining constant. The additional land enables the farm to supply all of its own forage and grain needs and creates a surplus of grain and hay to sell. This lowers ratio of excess P to harvested acres to 1.4 and the P to animal units ratio to 1.8.

Phosphorus Balance with Lease of 70 Acres of Cropland						
P Source	Phosphorus (lb.)			Ratios		
	Imports	Exports	Excess	Harvested Acres	Animal Units	Ratio
Animals		741		392	297	1.3
Forages		928				
Grains		429		Excess P (lb.)	Harvested Acres	Ratio
Protein/Minerals	6677			536	392	1.4
Fertilizer						
Milk		3636		Excess P (lb.)	Animal Units	Ratio
Manure		407		536	297	1.8
Total P	6677	6141	536			

The chart below illustrates the difference acquisition of the additional land has on this dairy operation's P balance. It reduces the P to harvested area ratio by 8.1 pounds per acre and the P to animal units ratio by 8.5 pounds per animal unit. Even after the acquisition of the additional 70 acres, the ratio of land to livestock is still tight at 1.3 harvested acres per animal unit. Prior to the land acquisition, this dairy farm already had discontinued use of phosphorus fertilizer including corn starter, was exporting some manure, and had decent crop yields, all which help the P balance of the farm.

Comparison of Phosphorus Balance Ratios before and after Land Addition						
Ratios before Land Addition			Ratios after Land Addition			Difference
Harvested Acres	Animal Units	Ratio	Harvested Acres	Animal Units	Ratio	
322	297	1.1	392	297	1.3	0.2
Excess P (lb.)	Harvested Acres	Ratio	Excess P (lb.)	Harvested Acres	Ratio	
3066	322	9.5	536	392	1.4	8.1
Excess P (lb.)	Animal Units	Ratio	Excess P (lb.)	Animal Units	Ratio	
3066	297	10.3	536	297	1.8	8.5

Economic and Logistic Considerations:

Farmers acquire additional land by purchase or lease. Short-term economic analysis will frequently tell us to lease and not purchase land. However, there is risk in building most farm forage and manure systems around leased land when those leases could be terminated. The need for a livestock enterprise to have a reliable land base is evident; however, there are considerations.

- Is additional land available at an affordable price or within close proximity to the farm's livestock site? If the only available land is some distance away, there can be a challenge of transporting equipment, harvested crops, and manure.
- Does the farm enterprise have the capital and equity necessary to purchase additional land?

- Does the farm have the equipment and/or the labor force necessary to handle the extra acres during planting and harvest?

The economics of acquiring extra land through lease or purchase is different for every farm depending on the price to purchase or lease and the distance the new land is from the livestock site. As commodity market prices fluctuate, the economics of purchasing forages and grain versus acquiring land by purchase or lease to raise those feedstuffs also fluctuates. A link to numerous analyses of lease options is provided¹.

We assume that all the additional 70 acres will be 50/50 corn and alfalfa production. Assume this dairy farm has a 4-year rotation with corn and alfalfa. Like many dairy farms, we would not apply manure to standing alfalfa. We would not need to apply manure the year coming out of alfalfa due to alfalfa nitrogen credits. We would not apply manure the year going into alfalfa because alfalfa does not need the nitrogen. This system would leave us an average of 17.5 additional corn acres each year to apply manure on. The total NPK fertilizer value of the manure would be \$182.57/acre or \$3195 for the 17.5 acres. Subtract the cost of application and the net value of the manure becomes \$82.57/acre or \$1445 for the 17.5 acres². If the dairy farmer in this case study were to acquire additional land beyond the proposed 70 acres, he would be able to cease exporting manure, apply all of his manure on his crop production area, and be in P balance.

An Alternative to Purchase or Lease:

Some livestock farmers have entered into an agreement with neighboring crop farmers where the crop farmers agree to raise some or all of the crops for the livestock farmer. The livestock farmer usually then applies some or all of his manure on the crop farmers land. Usually, they establish the price for corn silage compared to harvesting corn grain, less harvesting and drying expenses, then sold at harvest or some later pre-determined points in time. Fertilizer value of the manure should also factor into the price. The livestock farmer is free from the hassles of planting and



managing the crop, has a source of forage, and has a place to apply manure. The crop farmer receives the equivalent of market price for corn and benefits from the organic matter and soil health benefits of manure. This system may economically favor the crop farmer or the livestock farmer depending on current market conditions and the details of the contract.

Summary:

Acquiring additional land affects the P situation of a farm by allowing increased crop production, which should either decrease the need for feed imports, or permit an increase in crop sales or P exports. When a livestock farm has more phosphorus imports than exports and high soil test P, the goal could be to add enough acres to attain the manure management plan's requirements based on phosphorus needs. One option is adding land the livestock farmer controls through ownership or lease. Another option would be an arrangement with a neighboring crop farmer to apply manure from the livestock farm and produce forages or grain for the livestock farm.

Conclusions:

1. Acquiring additional land through lease or purchase on a livestock farm with more imports than exports will bring the farm closer to being in P balance.
2. The number of acres it takes to get a farm back into P balance varies depending on yield potential of the newly acquired acres and management of those acres.
3. Acquiring additional land through purchase or lease can present a number of challenges.
4. Another option is applying manure to neighboring crop farmer's fields. In exchange, the crop farmer raises forages and grain for the livestock farm.

References:

1. Website, land economics: <http://www.extension.umn.edu/agriculture/business/land-economics/>
2. Website, value of manure: <http://www.extension.umn.edu/agriculture/manure-management-and-air-quality/manure-application/>