Penn State Dairy Nutrition Workshop
October 26-27, 2004
Grantville, PA

FINDING THE BALANCE: PAST AND FUTURE NUTRIENT FLOWS IN PENNSYLVANIA

We have just seen some examples of trends in phosphorus flows for Pennsylvania cropland. Now we are going to interact with cropland phosphorus budgets at both the farm and county level.

Part I: Farm-level balances

Open the farm worksheet to begin. This worksheet calculates the phosphorus (P) balance for an example dairy farm in Pennsylvania. The orange box includes animal information and the yellow box includes crop information. We will be changing the values of variables in the orange and yellow boxes and examining the impact of those changes on the values in the results box (green). To start with, use the default values for animal and crop information.

1. In the table below, record the P balance and P balance per acre (results box) for the default number of cows (100). Change the number of cows on this example dairy farm to 125 and the number of young stock to 250. How does this impact the P balance and P balance per acre? How does the P balance change if the number of cows is changed to 75 and the number of young stock is changed to 150? Record your results below.

Number of cows	Number of young stock	P balance (tons)	P balance (lbs/ac)
100	200		
125	250		
75	150		

2. Change the number of cows back to 100 and the number of young stock back to 200. In the table below, record the P balance and P balance per acre for 100 acres of alfalfa haylage and 85 acres of corn silage. Change the numbers of acres of acres of alfalfa haylage and corn silage to the values in the table below and record your results.

Alfalfa haylage acres	Corn silage acres	P balance (tons)	P balance (lbs/ac)
100	85		
150	100		
75	50		

3. Change the number of alfalfa haylage acres back to 100 and corn silage acres back to 85. In the table below, record the P balance and P balance per acre for the default ration P percentage (0.41). Change the ration P % to 0.5% and then 0.36%. Record the resulting P balances in the table below.

Ration P %	P balance (tons)	P balance (lbs/ac)
0.41		
0.5		
0.36		

4. Change the ration P % back to 0.41. Suppose this dairy farm expanded to 125 dairy cows and 250 young stock. After changing the number of cows and young stock, find a combination of alfalfa haylage and corn silage acres that would balance the P produced by 125 cows and 250 young stock.

5. Change the number of cows back to 100 and the number of young stock back to 200. Next change the alfalfa haylage acres back to 100 and the corn silage acres back to 85. Then change the ration P % to 0.36. Finally, increase the number of cows until the P balance is approximately zero. If this farm reduced its ration P% to 0.36, how many more cows could the farm acquire in order to stay in balance for phosphorus?

6. Change the number of cows back to 100, but leave the ration P% at 0.36. Decrease the number of acres of alfalfa haylage until the P balance is approximately zero. If the farm reduced its ration P % to 0.36 (from 0.41), how many fewer acres of alfalfa haylage would be needed to keep the farm in balance for phosphorus?

7. Now you can choose your own animal and crop inputs. Select values that represent a dairy farm that you are familiar with or create an imaginary dairy farm. Record the animal and crop inputs you entered and the resulting P balance in the table below.

Animal inputs		
Number of cows		
Milk production (lbs/animal/day)		
Milk protein %		
Dry matter intake (lbs/animal/day)		
Ration P %		
Number of young stock		
Crop inputs	**Acres**	**Yield per acre**
Alfalfa hay		
Other hay		
Alfalfa haylage		
Other haylage		
Corn silage		
Corn grain		
Barley		
Oats		
Wheat		
Soybeans		
Results		
P balance (tons)		
P balance (lbs/ac)		

Now imagine some changes that might occur on this farm in the future.

8. Estimate how the number of cows on this farm might change in the future. If everything else remains constant, how would the farm's P balance be affected by this change?

9. What changes could occur in the daily milk production, milk protein %, dry matter intake or ration P %? How would these changes affect this farm's P balance?

10. What changes might occur in the number of acres grown of different types of crops? How would these changes affect this farm's P balance?

11. How do yields per acre vary for different years on this farm? Compare the impact of good yields, average yields or below-average yields on the farm's P balance.

Part II: County-level balances

Move to the county worksheet. This worksheet calculates the P balance for a whole county based on animal numbers and crop yields reported in the 2002 U.S. Census of Agriculture. For this exercise, we will assume that all farms in the county have the default values for the following animal variables: milk production per day, milk protein %, dry matter intake, and ration P percentage. Select a county in Pennsylvania that is of interest to you, using the menu at the top of the county worksheet.

County:_____

12. Suppose that all dairy producers in this county change their ration P percentage. How would this change impact the county's P balance? Change the value of ration P percentage and record the results in the table below.

Ration P %	P balance (tons)	P balance (lbs/ac)
0.41		
0.5		
0.36		

13. Change the ration P for dairy back to 0.41%. Look in the results box to see how the dairy manure P produced in the county compares to the manure P produced by other animals. Try changing the manure produced by other animals by 10%. Record your results below.

Other animal manure P	P balance (tons)	P balance (lbs/ac)
2002 Census		
+10%		
-10%		

14. In this county, which provides a greater change in P balance- varying ration P% between 0.36 and 0.5 or varying manure produced by other animals by 10%? How much of an impact do either of these changes have on the total P balance in this county?

Answer one of the questions below, depending on whether your county has a positive or negative P balance.

15. **For counties with a positive P balance:** Is it possible to balance manure P and crop P in this county by reducing manure production by other animals (non-dairy)? If so, how much of a reduction would be needed? If not, what would the P balance be if all other manure were eliminated?

16. **For counties with a negative P balance:** If the number of acres of each crop type did not change, what percentage increase in the number of dairy cows could the county support before the P balance would be zero?