Sustainable Agriculture Research And Education Program Farmer/Grower Grant

FINAL REPORT

FNE01-376: Maximizing Nitrogen & Phosphorus Efficiency in a Managed Intensive Grazing Dairy

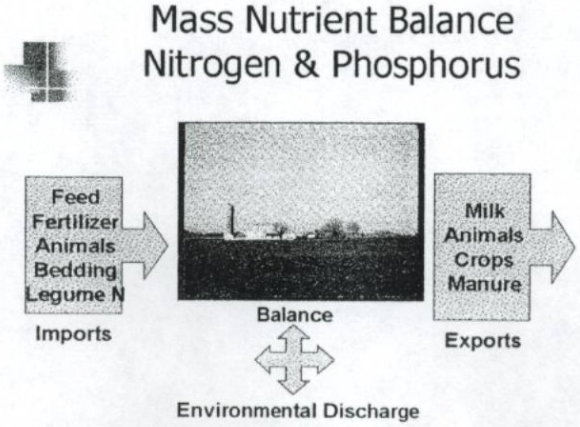
As dairy farms continue to make the transition to Managed Intensive Grazing (MIG), sustainable agricultural practices are often assumed to be a natural fit. However, in MIG operations where grass is often the only crop produced, the inflow of nutrients onto the farm from grains and fertilizer is greater than those exported in the form of milk. Excess nitrogen and phosphorus eventually accumulate in this system of farming. On St. Brigid's Farm, we conducted an On-Farm Demonstration that establishes how graziers can practice MIG responsibly and avoid accumulating excessive nitrogen and phosphorus.

St. Brigid's Farm is a managed intensive grazing dairy at the headwaters of Morgan Creek in the Chesapeake Bay watershed. The farm is owned and operated by Judy Gifford and Robert C. Fry, DVM. Currently, one hundred forty three Jerseys (86 adults, 34 yearlings and 23 calves) are raised pastured on 54 tillable acres. In 2001, we seeded 21 acres of land previously used to raise corn silage with perennial rye grass. Now our entire farm is planted in permanent pasture.

To accomplish the On-Farm Demonstration, Keith Dixon, certified nutrient management planner, University of Maryland Cooperative Extension, took soil and manure samples and created the farm's compressive nutrient management plan. Dr. Richard Kohn, professor, University of Maryland, College Park, designed a spreadsheet to calculate the mass nutrient balance and usage efficiency of nitrogen and phosphorus imports and exports.

Robert C. Fry, DVM balanced the herd's ration using a nutrition-programming model (CPM Dairy) that balances nitrogen and amino acid requirements in accordance with specific needs for maintenance, growth, and milk production. Fertilizer for the pasture was applied in accordance with soil test results. Manure was stored and exported via a contract hauler to neighboring farms in the spring and fall of 2001. There was no phosphorus fertilizer purchased and feed fortification of phosphorus was at or below the current National Research Council suggestion of .38 -.40% of the diet.

Dr. Fry tracked the tonnage and analysis of all feed and fertilizer imported, and also the tonnage and analysis of milk, animals sold and manure exported. This data was entered into the Maryland Nutrient Balancer spreadsheet to help determine the amount of nitrogen and phosphorus accumulating on the farm. The ultimate goal was to decrease the mass nutrient accumulation on St. Brigid's Farm, minimize environmental nutrient loading into the Chesapeake Bay watershed, and still operate a profitable dairy farm. Graphically the project design is depicted below.



This system of nutrient management creates a dilemma in that manure exports are very effective for removing excess phosphorus from the farm but also takes with it nitrogen that is needed for maximum grass production. The solution is costly to the exporting farmer as nitrogen rich commercial fertilizer must be re-purchased and applied to growing crops at very specific rates and times in accordance with a nutrient management plan.

Two objectives were evaluated. Could a managed intensive grazing operation minimize nutrient accumulation, especially phosphorus and what would be the cost to the producer to export the manure and import the necessary nitrogen.

Accumulation of Nitrogen and Phosphorus are shown in the tables below. The accumulated balance of nitrogen seems high at 316-lbs/ acre although the total nitrogen available to the crop was only 217-lbs/ acre. Phosphorus on the other hand only had a positive balance of 19.5-lbs/ acre. Because phosphorus loading is often the limiting factor in nutrient management planning the accumulating balance of 19.5 lbs seemed to be a very manageable level. It is noteworthy to emphasize that this low accumulation of phosphorus was only possible by exporting all manure, not importing any phosphorus fertilizer, and minimal dietary phosphorus fortification.

Nitrogen Balance

	Total for farm Tons N /yr	Total per ac Lbs N per ac
Nitrogen Inputs	**14.5**	**525.5**
Imported Feed	9.2	334.6
Imported Bedding	0.2	6.7
Imported Animals	0.0	0.0
Imported Fertilizer	3.8	137.2
Legume Fixation	1.3	47.0
Nitrogen Outputs	**5.7**	**209.1**
Animal Products	3.4	125.4
Cash Crops	0.0	0.0
Manure/Compost	2.3	83.7
Balance (Potential Loss)	**8.7**	**316.4**
Other N Flows		
Manure N Produced (animal intake - prod)	13.9	503.9
Manure N after Storage (measured)	4.8	176.4
Manure N Applied (Stored + Import - Export)	2.5	92.7
Manure N Avail to Crop (Applied -Field loss)	0.9	32.4
Total N Avail to Crop	6.0	216.7
Total Crop N	7.9	288.0
Non-Legume crop N	5.9	216.0
Total Feed N Consumed	17.1	622.6

Phosphorus (P not P_2O_5) Balance

	Total for farm Tons P /yr	Total per ac Lbs P per ac
Phosphorus Inputs	**1.6**	**58.2**
Imported Feed	1.6	56.8
Imported Bedding	0.0	1.4
Imported Animals	0.0	0.0
Imported Fertilizer	0.0	**0.0**
Phosphorus Outputs	**1.1**	**38.8**
Animal Products	0.6	23.0
Cash Crops	0.0	0.0
Manure/Compost	0.4	15.8
Balance (Potential Loss)	**0.5**	**19.5**
Other P Flows		
Manure P Produced (animal intake - prod)	1.8	64.1
Manure P Measured (using manure analysis)	1.8	64.1
Manure P Applied (Stored - Export +Import)	1.3	48.3
Manure P Avail to Crop (Applied -Field loss)	1.3	45.8
Total P Eventually Avail to Crop (manure & fertilizer)	1.3	45.8
Crop P	0.8	28.8
Total Feed P	2.4	85.6

The economics of maintaining a low phosphorus accumulation by exporting manure and importing the nitrogen lost in the exported manure are significant. In this project the cost to have commercial haulers export all manure from a herd milking 60 cows was $2, 841 and the cost of imported nitrogen was $3,338. If manure produced on the farm had been utilized on the farm to provide needs much of these costs would have been eliminated.

Future plans, in accordance with our comprehensive nutrient management plan, and the results of this On-Farm Demonstration are to continue to export 100 % of the store manure from St. Brigid's Farm. Also in future years plan will be to lower nitrogen accumulation that will minimize potential runoff issues and volatization of nitrogen as ammonia into the atmosphere.

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