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field right away, delaying weed control until spring. However, what we don't like is the fact that between corn planting and application of the postemergence herbicide the field looks like an unmade bed, full of grasses and broadleaf weeds and leftover alfalfa. We'll continue to use postemergence herbicides, but retain the right to be grumpy about the situation. The manufacturers of these products should furnish signs (especially for corn fields on main roads) that say THIS FIELD WILL BE SPRAYED SOON. IT'S SUPPOSED TO LOOK LIKE THIS.

2. Corn is generally in fine shape, especially that which received adequate nitrogen either as fertilizer or manure. Our comments in the July *Farm Report* concerning low soil nitrate levels were echoed by an ag professional from Quebec who said that their presidedress nitrate tests were also surprisingly low. Some corn fields which don't receive much manure and which were fertilized with the by guess and by gosh method might be running out of gas. Look for yellow fired leaves; if the fired leaves reach the ear prior to maturity, it's a sign that the plant ran out of N. On the other hand, if at maturity the plant is dark green all the way to the ground, that means you used too much N.

3. It was a normal August with farmers making first, second, and third cut hay, although those making third cut hay were seldom the same ones making first. As usual, we are starting to get questions about when or if to cut alfalfa from here on out. Current Cornell recommendations are to avoid September harvest of alfalfa: this seems an especially good idea if you've shortened your harvest interval between cuttings. In spite of the alfalfa we cut a fourth time last year making it through the winter in fine shape, the jury's still out regarding a fourth cut in the North Country. If you have already taken three cuts, wait until October before taking a fourth, and only cut if you really need the feed or if you'll plow the stand anyway. Caution: the fourth cut alfalfa we made last year was so low in fiber (33% NDF) that we're still trying to figure out what to do with it. If you make fourth cut, don't feed it until after it's forage tested.

Ev Thomas

NUTRIENT MANAGEMENT ON THE FARM
Mucking About!

I remember a professor telling a classroom of students that nutritionists spend most of their time looking at the south end of a north-bound cow. These past couple of months have convinced me of that.

As part of the SARE Project we recently finished a manure study in the Miner Institute dairy barn. We wanted to know how much manure was being generated by each group in the barn, how the nutrients were distributed in the manure, and compare the output and composition with what is predicted by some farm management models.

I had looked through the literature for similar studies and found none. Not really surprising. Who looks forward to the prospect of mucking about in an entire barn of manure? I think it was Charlie, who called the study *elegant*! What's elegant about mucking around in a couple of tons of cow _____!! All that aside though, he was right.

For two days over two weeks, with the help of a lot of the crew here, we separately collected the previous day's manure from each of the four groups in the barn consisting of 41 bred heifers, 37 high group Holsteins, 12 low group Holsteins, and 27 Jerseys. Once we had the manure corralled at the push-off, we had to sample it for analysis.

Sampling was tricky stuff. It had to be random and it would work best if the pile was homogeneous. How do you get 2500 lbs of feces, urine, and straw homogeneous?? Use a skidsteer! After we got our sample the manure was loaded into the spreader and weighed. In addition to manure, we also sampled the TMR and straw bedding. These were dried and analyzed.

The intake is presented in Table 1. On a daily basis we were handling 8,754 lbs of feed for 117 animals. In that feed there were 107 lbs of nitrogen and 16 lbs of phosphorus. I have extrapolated the numbers to give you an idea of the totals for an entire year.

Output of fresh manure and some of the components are given in Table 2. Each day we had to move close to 5 tons of wet manure from the barn. The amount varied with the moisture. One morning a waterer had been stuck open, that day we moved 7 tons of wet manure.

Table 1. Intake of feed, dry matter, crude protein, and phosphorus by groups of dairy cattle at Miner Dairy Barn.

	Intake of:			
Group	Feed	DM	CP	Phos
	----- lb/d -----			
Hef	1,551	698	103	2.3
HH	3,997	1,799	314	7.4
LH	1,020	459	76	1.7
JER	2,137	983	171	4.1
	tons			lb
Totals:				
Wkly	30.6	13.8	2.3	109
Yrly	1,593	717	19.4	5,657

Of the 655 lbs of CP the animals ate, 231 lbs appeared in the manure or 35% of that offered. In addition, there was 11 lbs of phosphorus or 25 lbs of P_2O_5. That's about as much phosphorus as you would find in 8.5 tons of corn silage or 12 tons of alfalfa haylage.

Table 2. Output of manure, dry matter, crude protein, and phosphorus by groups of dairy cattle at Miner Dairy Barn.

	Output of:			
Group	Manure	DM	CP	Phos
	----- lb/d -----			
Hef	2,079	305	50	2.5
HH	4,425	504	95	4.1
LH	1,462	155	27	4.3
Jer	2,708	326	59	3.2
	tons			lb
Totals:				
Wkly	37.4	4.5	0.8	79
Yrly	1,943	235	42	4,108

These outputs may look impressive but be forwarned that there is quite a bit of variation. For instance dry matter output can vary by 17%. Because of the amount of variation, I am happy to say we've decided to repeat the study. Any volunteers out there?

- This study was supported in part by the funds of USDA Agreement 91 COOP-1-6593.

Bob Allshouse

BUDGETING BLUES:
Directing the fall of the ax

As part of our summer farm management program, we decided it would be a good exercise for students and instructor to lay out the yearly equine budget for the students and ask their opinion for where costs could be cut and income obtained. They were surprised to see the highest horse expense was farrier services. Realizing the importance of a competent, reliable farrier, we decided that figure could not be reduced.

The next highest cost was bedding (shavings & sawdust). Over the last year, we have tried to minimize this expense by switching from bagged shavings to loose sawdust. We use a lot of bedding in each stall because the milk down 6% vs. a year ago. Fortunately, forage supplies are good.

Ev Thomas

Phosphorus Soil Stratification

"Typical" as-produced dairy manure contains 7-10 lbs of phosphorus (17-22 lbs P_2O_5) per ton of dry manure. Liquid dairy manure applied at 4000 gallons per acre as is done here at Miner Institute is equivalent to 40 lbs P_2O_5 and 75-80 lbs of K_2O or the equivalent of 2 tons dry manure per acre. The liquid manure is typically 6.7 to 7.8% dry matter so 4000 gallons at 8.1 - 8.2 lbs per gallon equals approximately 2400 - 2500 lbs of dry manure as it is coming out of the pit. The nutrients going back onto the field from the manure pit are usually more than enough to supply all the phosphorus needs and most (but not all) of potassium needs of either corn, alfalfa or grass.

A good corn silage yield of 20 tons per acre at 30% DM is actually 6 tons of dry plant material that is being removed each year. Nutrients removed must either be supplied by the soil or added back as either fertilizer or manure. Corn silage contains 0.17 - 0.22% phosphorus and 0.8 - 1.0% potassium so 20-26 lbs P(45-60 lbs P_2O_5) and 96 - 120 lbs K (115 - 145 lbs K_2O) are being removed with each silage harvest.

A quick nutrient balance for phosphorus indicates that slightly more P is being added each year as fertilizer or manure than is being removed by the corn. P_2O_5 from starter fertilizer (32 lbs) and manure (40 lbs P_2O_5) totals 72 lbs. Crop removal is 45-60 lbs leaving a positive balance of 12-27 lbs per acre per year. Most of this excess P (5-12 lbs elemental P) gets adsorbed onto Calcium, Iron, and Aluminum minerals, slowly builds the soil test P levels, and is considered immobile. It usually takes 5-10 lbs P (varies by soil type and soil test level) to increase the soil test level by 1 lb so not all of this "excess" phosphorus is readily available for plant growth.

Phosphorus is immobile and does not usually move into the soil through leaching. Downward movement of phosphorus into the soil is usually dependent upon degree of tillage. Phosphorus movement from agricultural fields occurs during surface runoff events in sediment following soil erosion. The excess P in sediment, when applied over several years, can become a significant contributor to phosphorus loads in streams, rivers, and lakes. An unanswered question is whether phosphorus moves downward at high rates of manure application. Preferential flow of the soil solution through soil cracks, worm holes, and tile drainage may accelerate movement of anions like phosphate and nitrate. Work just completed here, however, indicated that both phosphate and nitrate were extremely low in tile outlet flow following manure application. Similar results have also just been reported from Massachusetts indicating that tile drainage may not contribute to enhanced phosphate and nitrate movement. In fact, plant nutrient uptake may be enhanced by tile drainage thereby reducing potential surface runoff of nutrients in soil sediment! Moderation is the key. Overloading of manure or fertilizer will cause problems that may be accentuated by tile drainage.

The question is how much is too much? Each soil will vary in terms of texture (clay, silt, sand) and landscape slope (topography) and these properties will determine how much manure a particular site can handle. Four fields at Miner with differing manure histories (0 to 175 tons liquid manure per acre over the past

14 years) were sampled down to 24 inches and tested for phosphorus. The objective was to determine if phosphorus was moving into the soil at various rates of manure application.

Soil was sampled at 0-1", 1-2", 2-4", 4-8", 8.16", and 16-24" at six sites within each field. At each site, several cores (6-8) were taken and composited. We are currently setting up to run phosphorus in the lab at Miner using several extractants. The amount of phosphorus extracted from a given soil varies considerably dependent upon the chemical extractant used and represents only a small fraction of the total phosphorus in soil. The phosphorus tightly bound to soil minerals is not easily dissolved even in strong chemical extractants and so it is easy to understand why phosphorus would not easily leach in the soil water solution.

Preliminary results were obtained by compositing soil from each site at each depth from each field and sending half of the sample to the Vermont soil testing lab. Results presented in Table 1 represent the extractable phosphorus that is considered available for plant growth.

Each field varied tremendously in its available P and there didn't appear to be any relationship between manure application rate and available P level. Field R-38, which received the highest manure rate (175 tons/Ac since 1981), had an available P level 5-6 times lower than R5-NT which received only 40 tons manure since 1981. Obviously, plant uptake and varying soil characteristics account for each field's available P levels. R-38 appears to be a soil that could handle high rates of manure application.

Movement of phosphorus downward in the soil was facilitated by tillage. Fields R-20 and R-38 had relatively equal P levels down to 8". These fields were conventionally tilled with a moldboard plow. Mixing of the soil incorporated P and other nutrients thereby reducing their concentration at the soil surface. R-5NT (no-till field that has only been minimally disked) on the other hand, showed a sharp accumulation of P at the surface (0-1"). This accumulation of P at the soil surface is subject to runoff if soil erosion or seasonal flooding is a problem. Fortunately, R-5NT is not highly erodible nor is it subject to flooding so surface movement of P is not a problem on this field. More significantly, downward movement of P was not evidenced on R5-NT or on any of the fields sampled. Available P was greatly reduced to generally very low levels at 16-24". These results are preliminary and work will continue to determine if phosphorus movement is, in fact, not a problem as indicated thus far. This study was supported in part by the funds of USDA Agreement 91 COOP-1-6593.

David Lang and Ev Thomas

Table 1. Soil Phosphorus Stratification at Miner Institute

	Field			
Soil Depth	M-12	R5-NT	R-20	R-38
inches	ppm P[1]			
0-1	1.5	37.3	11.9	5.8
1-2	1.1	25.3	13.2	5.8
2-4	1.4	20.5	14.9	6.4
4-8	1.8	11.7	12.9	5.2
8-16	1.5	5.9	8.6	1.7
16-24	0.6	1.4	3.4	0.8

Manure and Tillage History:

M-12: No Manure Since 1981; Conventional Tillage
R5-NT: 40 Tons Manure/Ac Since 1981; Minimum Tillage
R-20: 110 Tons Manure/Ac Since 1981; Conventional Tillage
R-38: 175 Tons Manure/Ac Since 1981; Conventional Tillage

[1] Vermont Soil Test Available Phosphorus