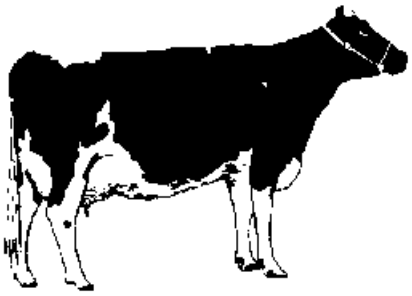

IMPACT OF NUTRITION ON MANURE NUTRIENTS

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- ***Feeding dietary phosphorus in excess of requirements is costly and unnecessary.***

  - Phosphorus has more known biological functions in animals than any other mineral.

  - Based on available research, supplying P in excess of requirements ***does not*** increase feed intake or milk yield.

- ***Naturally occurring feed phosphorus accounts for 45-80% of total phosphorus inputs, with the remainder being added as part of mineral supplementation.***

  - The major source of imported P into dairy farms is from purchased feeds.

  - Variation in actual P content within and among types of feeds is large. Wet chemistry analysis is essential for *accurate* P levels in feeds.

- ***Less than 35% of feed phosphorus is exported from the farm as animal products (meat, milk)***.

  - Typically, greater than 95% of total P excretion is in feces, thus a large quantity of P remains on the dairy in the form of manure.

  - Amount of P consumed is the largest determinant of amount of P excreted.

INTRODUCTION

There are two routes through which the nutrient cycle within a dairy can be manipulated:

- ration management
- cropping systems

Field demonstrations in Texas have shown the potential for manipulating the manure nutrient content through the ration fed to the herd. This reduction in manure P transfers through the system and influences waste application levels.

Different approaches to reducing manure P through ration management include: (1)

lowering ration P in a one-group feeding system and (2) re-defining grouping strategies to lower ration P by supplementing according to production and stage of lactation.

DIETARY PHOSPHORUS LEVEL

The National Research Council (NRC, 1989) recommends dietary phosphorus levels of .36 to .40% of dry matter for high producing dairy cows in lactation. Research from the University of Wisconsin supports these levels, reporting that dietary phosphorus levels of .37-.40% were adequate for high producing cows (Wu and Satter, 1999).

Table 1 reports the data from the 2-year study: Trial 1 had 26 cows on the low dietary P level and 27 cows on the high dietary P level; whereas, Trial 2 had 8 cows on each dietary P level. From these data, reducing P from .49 to .40% did not impair milk production or reproductive performance, but the reduction to .031% dietary P reduced milk yield in late lactation.

A survey was conducted in 1997 among nutritionists in the Mid-South (Sansinena et al., 1999). The objective of this survey was to identify the aspects of phosphorus nutrition in which available data was perceived as being inadequate. Survey respondents reported an average formulation of .52% phosphorus in the diets of lactating cows. This is approximately 30% over NRC's current recommended level. Reasons for this included:

- A belief that lactating cows require more phosphorus than NRC suggests
- Use of a safety margin
- A lack of confidence in published ingredient values

Additionally, a 3-year project is in progress on 9 commercial dairies in Texas. The objective is to evaluate the opportunity to alter manure nutrient loading (nitrogen and phosphorus) through diet Preliminary data (Jordan and Stokes, 1998) from the first year is presented in Table 2. In evaluating individual herds, the manure phosphorus content did reflect dietary phosphorus intake (the higher the dietary P intake, the higher the level of manure P concentration).

Several research groups have evaluated the impact of dietary P on manure P excretion (University of Florida, University of Wisconsin). Using prediction equations published from these studies, Table 3 illustrates the potential to lower manure phosphorus levels through diet and the economic impact. The example uses a 1000-cow dairy, with cows eating 50 pounds of feed (dry matter) and averaging 65 pounds of milk daily. As seen in this example, manure phosphorus content can be lowered as much as 16% through reducing dietary phosphorus intake from .52% to .45%. Additionally, feed cost will be reduced by $13,988. Further lowering phosphorus supplementation to .40% will decrease manure P excretion by 27% and reduce ration cost by over $23,000 per year on a 1000-cow dairy.

GROUPING STRATEGIES

Herds that are fed one total mixed ration usually supplement P at the levels needed by the fresh and high-producing groups. This feeding scheme over-supplements phosphorus to cows in later lactation. By grouping cows according to production and supplementing accordingly, there is a theoretical potential for reducing P excretion by 21% (Table 4).

SUMMARY

Recent research reports no production or reproduction advantage to over-feeding phosphorus in the dairy ration. Additionally, it can raise feed costs substantially. An added advantage to keeping ration P levels in check is the lower manure P content. This could influence the amount of acreage needed to

distribute dairy waste and result in more economical waste management costs.

Table 1. Effect of dietary phosphorus on milk production and reproduction (Wu and Satter, University of Wisconsin, 1999).

	Trial 1: Dietary P, %		Trial 2: Dietary P, %		
	.31 - .37	.44 - .47	.31	.40	.49
Milk, lb per 308 day	21,701	21,776	23,738	24,697	24,495
Milk protein, %	3.14	3.14	3.08	3.07	3.11
Milk fat, %	3.78	3.65	3.65	3.69	3.71
Days to first estrus	45	61	41	78	44
Days open	103	105	78	106	112
Pregnancy rate, %	96	86	100	89	89
Services/conception	1.6	2.1	1.4	1.6	2.3

Table 2. First year summary of ration, milk, and fecal phosphorus (Jordan and Stokes, Texas A&M University, 1998).

	Average	Range
Ration P - lbs	.26	.09 - .49
%	*.52*	*.25 - .80*
Milk P - lbs	.04	.02 - .08
%	*.08*	*.07 - .09*
Fecal P - lbs	.17	.10 - .51
%	*1.05*	*.66 - 1.79*

Table 3. Example impact on manure phosphorus excretion and ration costs due to dietary phosphorus manipulation.

	Dietary Phosphorus Level		
	.52%	.45%	.40%
Manure P excreted[1], lb per 1000 cows per year	58,970	49,392	42,863
Reduction in % manure P (from .52%)		16%	27%

Reduction in yearly feed costs (from .52%)		$13,988	$23,314

[1]Manure P excretion values based on equations from Van Horn, University of Florida, 1991.

Table 4. Example of changes in herd phosphorus excretion based on feeding

PEN	DMI, lb/d	% diet P	P intake, lb / d	Milk, lb / d	Milk P, lb / d	lbs P Excreted	Herd P Excreted
High	48	.47	.226	70	.07	.156	
Low	45	.47	.212	50	.05	.162	***31.8***
High	48	.42	.202	70	.07	.132	
Low	45	.37	.167	50	.05	.117	***24.9***

Assumptions: 200 cow herd (100 cows per pen)
Cows divided according to production and DIM
Milk P = .10%
Lbs manure P Excreted = lbs P intake - lbs milk P

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