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Convincing Oregon's Dairy Industry They Have a Problem with Phosphorus

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Convincing Oregon's Dairy Industry They Have a Problem with Phosphorus

Abstract
Dairy nutritionists historically balanced milk cow rations for phosphorus at .45 to .5 % DM of the total ration. New studies have shown a high producing milk cow only requires a diet at .38% DM. Thirty-seven farms were studied to determine and compare P feeding levels in Oregon. The results of the project were then incorporated into educational programs. The average farm studied was over feeding by 18%. Eighty-nine percent of producers surveyed indicated this project increased their understanding of the problem we face as an industry. Approximately 50% of producers participating reduced P feeding on their farm.

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Introduction

Historical research has shown a benefit in overall cow performance with high levels of dietary phosphorus (>.45%P). Some research has suggested increased levels of phosphorus increased dry matter intake and ultimately increased milk yield (Kincaid, Hillers, & Cronrath, 1981). Furthermore, Alderman (1963) determined that deficiencies in dietary phosphorus decreased reproductive performance in dairy cattle. For years dairy nutritionists have designed dairy rations to ensure adequate, if not excessive amounts of phosphorus.

With environmental concerns building in the country during the 1990's, the National Research Council (NRC) conducted a re-evaluation of the importance of phosphorus in dairy cattle diets. More recent studies indicated the old recommendation was too high and that something was misleading or inaccurate in the older feeding studies. With this new information, the NRC published a new dietary phosphorous recommendation of 0.38% of the diet, much lower than the previous recommendation of 0.55% of the diet made in 1988 (NRC, 2001).

Changing the diet from one that is overfeeding phosphorus to one that meets the animals nutritional needs can have significant impacts on P in the manure and total P accumulation on the farm. Lowering phosphorus levels in the diet from 0.48% to 0.38% decreased the phosphorus content in the manure by 44% (Cerosaletti, Fox, & Chase, 2004). Making this feeding change will

reduce the load of phosphorus on dairy farms and allow for a more manageable waste management program.

Effective educational programs often are ones that find ways to involve learner participation and that use statistics that students can relate with, no matter whether your audience is producers, nutritionists, or other Extension agents. Conversations with leading dairy nutritionists in 2002-03 indicated very few had made significant ration P changes. No nutritionist in Oregon admitted to reducing P levels in lactating cow diet down to .38% as recommended by the National Research Council. Essentially they had nothing to gain by reducing phosphorus to .38%. They argued a little extra was "good insurance." In the spring of 2003, a project was developed to survey producer knowledge of phosphorus and document phosphorus feeding practices.

Objectives

The objective of this study were to:

- Access the levels of phosphorus in lactating and dry cow rations on Oregon dairy farms.
- Use a written survey to help understand the current phosphorus knowledge of Oregon dairy farmers, and use as a teaching tool in follow-up visits.
- Document phosphorus feeding practices on Oregon dairies.
- Use survey information to engage producers in Extension programs and provide Oregon data as "real life" examples.
- Work in partnership with the dairy producers and their nutritionists to change current feeding practices in an effort to alter levels of phosphorus excreted while maintaining/improving the performance of the dairy cows.

Procedures

A field study consisting of 37 Oregon dairy farms was conducted. Participating farms were located in the western region of Oregon and were divided in two regions based upon geographic location of farms: valley (V) and coast (C). Valley comprised 17 farms residing in the Willamette Valley. The remaining 20 farms were located on the coast of Oregon in Coos and Tillamook counties. These two areas represent the major dairy areas in Oregon. In addition to geographic location, farms were classified as either small (S) or large (L). Farms with herd size smaller than the herd size median, for each region, were classified as S. Likewise, farms with herd size larger than herd size median, for each region, were classified as L.

Each farm was visited on three separate occasions to collect data. Each farm visit was scheduled to be 4-6 weeks a part to monitor the farm over time. Data collection included ration information and feed samples for both lactating and dry cows, as well as fecal and urine samples from the lactating and dry cows. Individual feeds, fecal matter, and urine were then analyzed for phosphorus.

A five-page survey covering topics of soil testing and commercial fertilizer use, phosphorus knowledge, and manure management were issued to participating farmers on the initial visit. The majority of the questions were multiple choice. However, a few fill-in-the-blank questions were also included. The survey was conducted in a manner that was compliant with the regulations of the Oregon State University Institutional Review Board. This allowed producers to complete the survey on a voluntary basis, and all results were collected anonymously. The survey was used to understand the current participant understanding of phosphorus issues related to manure and soil fertility.

Results of surveys were recorded, and response percentages were tabulated for each question. A point system was devised to measure the accuracy of responses for multiple choice and true-false questions. An overall score for phosphorus questions was determined by summing the points received for each response within each question. This score was then divided by the total number of responses for that individual question.

Multiple lactating and dry cow diets existed on several of the farms visited. Many of the producers grouped cows (i.e., according to stage of lactation and/or number of lactations) to more closely meet nutrient requirements. As a result of grouping strategies on farms, each of the differing cow group diets was recorded, and subsequent manure and urine samples were collected. On average, the number of lactating and dry diets fed on farms was 2 and 1.4, respectively. In most cases, group size was recorded or obtained from DHI records. Data were analyzed as repeated measures using the mixed procedure of SAS (1996).

Results

The average herd size in the study was 339 cows and ranged from 50 to 1650, with an average of 277 acres receiving manure ranging from 65 to 1000 acres. Producers were divided into groups based on geographic region (V or C) and herd size (S or L), and characteristics of these groups are

summarized in Table 1.

Out of the 37 surveys issued, a total of 34 surveys were completed for a 92% response rate. The survey was modeled after a similar one done in the upper Midwest. This survey was issued to farmers in southeastern Minnesota and west central Wisconsin. Similarities in questions between the original and present survey allowed for comparisons between soil testing and commercial fertilizer use, P information, manure management, and farm characteristics between the Midwest and Oregon. The results of the survey and the comparison between the Midwest and Oregon were used mainly as a talking point to engage producers in Extension activities.

Table 1.
Characteristics of Participant Farms

	Coast		**Valley**	
	Small	**Large**	**Small**	**Large**
Number of farms	10	10	8	9
Herd size, cows	101	278	198	800
Milk Yield, lbs/d	56.5	64.9	77.7	78.3
Grazing (months)	7.8	6.7	4.8	2.4
Total acres receiving manure	171	292	209	428
Owned	117	181	92	335
Rented	55	111	117	93
Acres/Cow	1.69	1.05	1.06	0.54

Based upon the responses received by the participating Oregon dairy producers, it appears that respondents were more knowledgeable about P information when compared to the Midwest producers. When asked about the P levels in manure and grass crops, 60% of the Oregon respondents answered correctly, compared to a 40% correct response rate from the participating Midwest producers. Oregon respondents also had more knowledge of the rate at which P moves through the soil. However, when asked about the effect of excessive soil P on the environment, only 12% of Oregon respondents answered correctly. Overall, this survey was an excellent educational tool to engage producers in conversations about phosphorus.

Table 2 illustrates the levels of phosphorus feeding as well as fecal and urine phosphorus levels. Participating Oregon dairy producers were feeding 0.40% P (DM basis) to lactating dairy cattle. Based upon milk production records, a typical farm should feed 0.34% P (NRC, 2001). Phosphorus levels in diets studied were 18% higher than currently recommended. In comparison to a Virginia field study, Oregon producers are feeding less P. This study reported dietary P content of lactating cow rations was 0.49% (Sink, Knowlton, & Herbein, 2000).

Table 2.
Levels of P for Diet, Feces, and Urine for Lactating and Dry Cows

	Region		**Herdsize**		**SE**	***P***	
Stage of Lactation	**C[1]**	**V[2]**	**S[3]**	**L[4]**		**Region**	**Herdsize**
Lactating							
Diet P (% DM)	0.41	0.39	0.40	0.40	0.01	0.12	0.76
Fecal P (% DM)	0.87	0.97	0.89	0.95	0.04	0.08	0.27
Urine P (mg/dl)	2.22	2.94	2.13	3.04	0.66	0.41	0.30
Dry							
Diet P (% DM)	0.30	0.32	0.30	0.32	0.01	0.42	0.46
Fecal P (% DM)	0.77	1.02	0.88	0.91	0.07	0.01	0.71
Urine P (mg/dl)	1.40	2.05	1.52	1.94	0.26	0.08	0.25

[1]C = Coast.
[2]V = Valley.
[3]S = Small.
[4]L = Large.

Dietary P levels of lactating diets between region ($P = 0.12$) or herd size ($P = 0.76$) did not differ. A difference between feeding levels of dietary P within herd size was expected because L herds are more apt to use professional services, such as nutritionist, compared to S herds. In addition, V

herds were expected to have lower dietary P due to more consistent rations since C herds graze more often.

Average fecal P from all lactating cow samples was 0.92% (DM basis). The overall mean for urinary P was 2.58 mg/dl. These data were similar in P concentration of both manure and urinary P as reported in a previous study (Wu, Satter, Blohowiak, Stauffacher, & Wilson, 2001). Interestingly, although P intake is similar for region and herd size, the fecal P output was greater ($P = 0.08$) for V herds, resulting in a lower apparent digestibility.

Our project showed on average we were over feeding P by 18%. Some on the study were overfeeding by as much as 100%. At 18%, the average farm in our study needs an additional 100 acres to apply manure in an agronomic fashion. Some farmers have easily made reductions, while others are finding some of the feedstuffs they are using are inherently high in P, making the reduction more difficult.

The fact that they are looking at P in their feedstuffs and attempting to reduce imports is really a major success. In a survey of producers who were part of this project, 100% that responded said this project helped them understand the challenges of over feeding P on their farm, and 89% indicated this project improved their understanding of the problem we face with phosphorus as an industry. Approximately 50% made changes in the feeding program to reduce P levels in their ration.

The results of this project have been used in many fashions to educate the rest of Oregon's dairy industry of this issue. A survey of nutritionists at one workshop indicated 72% planned on reducing P feeding levels on dairies they work with.

Summary

Before this project, dairymen were placing their trust in their nutritionists to balance their rations for them. Dairy nutritionists had no incentive to reduce phosphorus overfeeding, and many did not appreciate the magnitude of the problem they were helping to create. Data from this project have been shared with both the dairy operators and nutritionists and has changed the way both view the problem.

Often it is difficult to stimulate changes in behavior through traditional workshop and newsletter teaching methods. This project is an example of how data gathered from dairies throughout the state could be used as the basis of an effective Extension education program. We have known for years that data generated locally is very powerful when working with local audiences, but the credibility and influence it can have in an educational program like this one continues to support this idea.

References

Alderman, G. (1963). Mineral nutrition and reproduction in cattle. *Vet. Record*. 75:1015-1018.

Cerosaletti, P. E., Fox, D. G., & Chase, L. E. (2004). Phosphorus reduction through precision feeding of dairy cattle. *J Dairy Sci*. 87:2314-2323.

Kincaid, R. L., Hillers, J. K., & Cronrath, J. D. (1981). Calcium and phosphorus supplementation of rations for lactating cows. *J. Dairy Sci*. 64:754-758.

National Research Council. (2001). Nutrient Requirement of Dairy Cattle (7th Rev. Ed.) Natl. Acad. Sci., Washington D.C.

SAS User's Guide: Statistics, Version 8 Ed. 1999. SAS Inst., Inc., Cary, NC.

Sink, S. E., Knowlton, K. F., & Herbein, J. H. (2000). Economic and environmental implications of overfeeding phosphorus on Virginia dairy farms. *J. Anim. Sci*. 78 (Suppl. 2): 4.

Wu, Z., Satter, L. D., Blohowiak, A. J., Stauffacher, R. H., & Wilson, J. H. (2001). Milk production, estimated phosphorus excretion, and bone characteristics of dairy cows fed different amounts of phosphorus for two or three years. *J. Dairy Sci*. 84:1738-1748.