

Milk Production and Blood Phosphorus Concentrations of Cows Fed Low and High Dietary Phosphorus

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Introduction

The National Research Council recommended dietary allowance of phosphorus (P) for a cow weighing 650 kg and producing 40 kg milk/day with 3.5% fat is .41 to .48% of dietary DM. However, many nutritionists recommend dietary levels of .5 to .6% P. Feeding excessive P not only increases feed cost but also creates problems with nutrient management on the farm.

The objective of the present experiment was to measure cow response to low and high dietary P (.39% and .65% dietary P-dry matter basis).

Materials and Methods

Forty-six mid to late lactation Holstein dairy cows were fed a pretrial diet for 10 days. At the end of the pretrial period, cows were blocked according to milk yield. Cows within blocks were assigned randomly to low P and high P treatments. Ingredient composition of the diets is in Table 1. Experimental diets were fed for 84 days. Cows were housed in a free stall barn and were fed as a group. The diets were fed as a TMR once daily and feed consumption and milk production were recorded. Monthly composite samples of silage and other feed ingredients were analyzed for phosphorus and calcium. Chemical composition of the TMR was calculated from chemical analysis of the individual feed ingredients. Blood samples were collected from the coccygeal vein or artery on three

consecutive days from each cow at the end of the pretrial period, at wk 7 and wk 12 of the experiment. Inorganic phosphorus analysis was performed on blood serum samples.

Results and Discussion

Cows fed diets containing low and high P content had no effect on DM intake, milk yield, and milk composition in the present experiment (Table 2). Blood serum P concentrations of cows fed the low P diet were significantly lower compared with cows fed the high P diet at wk 7 and 12 of the experiment. As shown in Figure 1, concentrations of blood serum P in cows fed the low P diet were lower ($P = .06$) at wk 12 compared with P concentrations at wk 7 of the experiment. No change in serum P concentration was observed between wk 7 and 12 of the experiment in cows fed the high P diet (Fig. 1).

Summary

Cow performance was not affected by feeding slightly lower amounts of P than recommended by NRC. However, concentration of blood serum P decreased slightly throughout the 84 day experiment. It is not known how much further, if any, blood serum P might decrease had the trial been longer. Longer term studies are being planned.

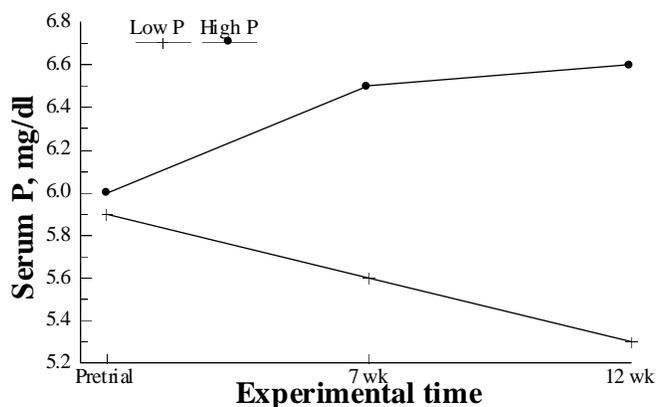


Figure 1. Blood serum phosphorus concentrations of cows fed low and high phosphorus diets. (Each point represents an average of three samples taken from 23 cows during 3 days). SD was .62, .60, and .63 during pretrial, 7 wk, and 12 wk, respectively.

Table 1. Ingredient composition of diets.

Ingredient	Treatment		
	Pretrial diet	Low P	High P
Alfalfasilage	45.0	45.0	45.0
Corn silage	10.0	10.0	10.0
High moisture ear corn	18.70	19.0	18.15
Barley	12.0	12.0	12.0
Soybean meal	3.0	3.0	3.0
Roasted soybean	10.0	10.0	10.0
Dicalcium phosphate	0.15	0.15	0.15
Sodium mono-phosphate	0.30	0.0	0.85
Calcium carbonate	0.30	0.30	0.30
Trace-mineralized salt	0.50	0.50	0.50
Magnesium oxide	0.05	0.05	0.05
Vitamin ADE ¹	trace	trace	trace
Calcium, % DM	.59	.59	.59
Phosphorus, % DM	.48	.39	.65

¹Vitamin supplement was added to supply vitamin A, 146,785; vitamin D, 48,928; and vitamin E, 489 IU/day per cow.

Table 2. Feed intake, milk yield, milk composition, and concentrations of blood serum P of cows fed diets containing low and high P content¹.

Measurement	Treatment		SEM	P
	Low P	High P		
DM intake ² , kg/d	22.0	22.1	-	-
Milk yield, kg/d	23.9	24.4	.5	.9
3.5% FCM, kg/d	24.9	25.2	.6	.3
Milk fat, %	3.88	3.97	.08	.4
Milk protein, %	3.48	3.60	.05	.3
Lactose, %	4.73	4.71	.04	.07
Blood serum P, mg/dl				
Pretrial	5.90	6.02	.13	.5
At wk 7 of expt.	5.64	6.52	.12	.01
At wk 12 of expt.	5.29	6.54	.12	.01

¹Covariate adjusted LS Means.

²Cows were fed as a group; therefore no statistical comparison was made.