

# Milk Production and Reproductive Performance of Dairy Cows Fed Low or Normal Phosphorus Diets: Year Two

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## Introduction

Last year we reported that cows receiving no supplemental phosphorus (P) produced as much milk during a complete lactation and had similar reproductive performance as cows supplemented with phosphorus. The experiment has been continued for another lactation, with the objective being to determine response of lactating cows to reduced dietary P over a minimum of two lactations.

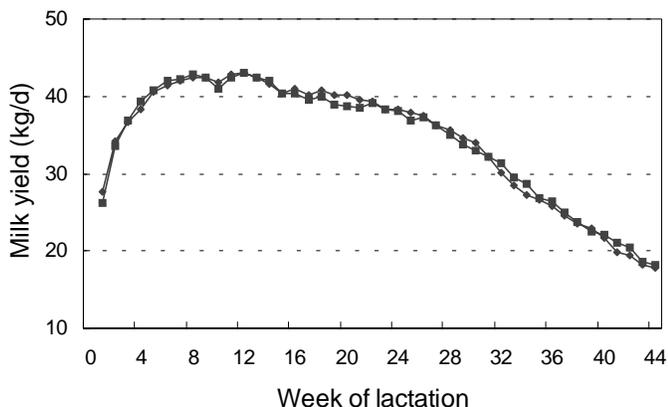


Figure 1. The lactation curve of cows fed diets containing low (0.37%,  $\blacklozenge$ ) or high (0.47%  $\blacksquare$ ) P.

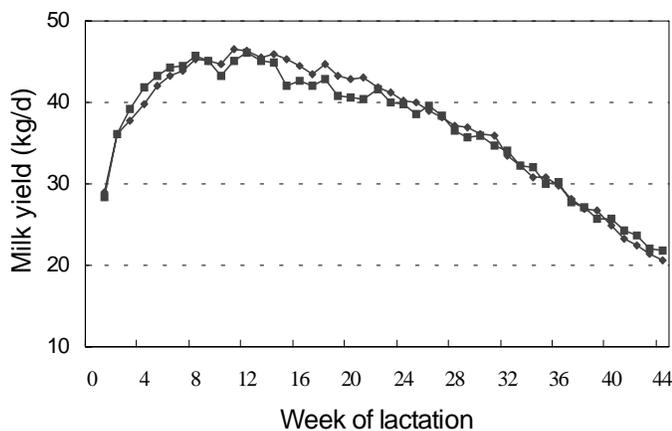


Figure 2. The lactation curve of cows fed diets containing low (0.37%,  $\blacklozenge$ ) or high (0.47%  $\blacksquare$ ) P for a second year of lactation.

## Materials and Methods

Fifty-three cows were used in this second year trial. The lactation period included confinement feeding for approximately the first 2/3 of lactation, and grazing for the last 1/3 of lactation. Thirteen of the 53 cows were in confinement for the entire lactation. A supplemental grain mix was fed during grazing. Twenty-six cows received no supplemental P (dietary P was  $\sim$  .37% of dry matter during confinement and  $\sim$  .31% during grazing) and 27 cows received  $\text{NaH}_2\text{PO}_4$  and  $\text{CaHPO}_4$  to increase dietary P to  $\sim$  .47% during confinement and  $\sim$  .44% during grazing. Thirty of the cows were in their second year of experiment.

## Results and Discussion

Milk yields for the entire lactation were not different between treatments. This was true when all 53 cows were used to obtain treatment averages, and also when just the 30 cows in their second year of the experiment were evaluated (Table 1). At no time during lactation did milk yield for the two groups appear different (Fig. 1 and 2)

The lack of difference in lactation performance due to dietary P level is consistent with results of several other long (Brintrup et al. 1993; Steevens et al. 1971) or short term (Dhiman et al. 1995) studies. The dietary P concentrations compared in these studies were .33 vs. .37%, .4 vs. .6%, and .39 vs. .65%, respectively. In another study we conducted, milk yield was similar for cows given either .40 or .49% P in their diet dry matter (11,226 vs. 11,134 kg/308 d), but was reduced (10,790 kg/308 d) when only .31% P was fed, resulting from lower production during the late part of lactation. These studies indicate that feeding .32% P may not harm milk production of low producing cows (7,500 kg per lactation), but .37 to .40% P is recommended for high producing cows (> 10,000 kg per lactation).

Feeding low P showed no adverse effect on reproductive performance of cows (Table 2). This is consistent with eight other studies reviewed. Data summarized from these experiments involving 730 cows indicate no influence of dietary P level on reproductive efficiency. Impaired production appears unlikely unless P levels are extremely low (< .25%). This rarely occurs with lactating dairy cows because their diets usually include protein supplements, which are high in P.

## Conclusions

Consistent with the results in year one, reducing dietary P from .47 to .37% did not affect milk

production or reproductive performance. Cows receiving the low P diet for a second year performed normally. Phosphorus at .37-.40% is adequate for high producing cows.

## References

- Brintrup, R.T., T. Mooren, U. Meyer, H. Spiekens and E. Pfeffer. 1993. Effects of two levels of phosphorus intake on performance and fecal phosphorus excretion of dairy cows. *J. Anim. Physiol. Anim. Nutr.* 69:29-36.
- Dhiman, T.R., L.D. Satter and R.D. Shaver. 1995. Milk production and blood phosphorus concentrations of cows fed low and high dietary phosphorus. *Research Summaries, U.S. Dairy Forage Research Center, Madison, WI.* p. 105.
- Steevens, B.J., L.L. Bush, J.D. Stout and E.I. Williams. 1971. Effects of varying amounts of calcium and phosphorus in rations for dairy cows. *J. Dairy Sci.* 54:655-661.

Table 1. Lactation performance of cows fed diets containing low or high phosphorus.

Item	All cows				Second year cows			
	Low P (n = 26) <sup>1</sup>	High P (n = 27) <sup>1</sup>	SEM	P	Low P (n = 14)	High P (n = 16)	SEM	P
Milk, kg/308 d	9,864	9,898	340	0.94	11,457	11,358	404	0.86
Milk fat								
%	3.78	3.65	0.10	0.38	3.66	3.63	1.20	0.85
kg/d	1.23	1.20	0.04	0.68	1.39	1.34	0.04	0.47
Milk protein								
%	3.14	3.14	0.04	0.96	3.06	3.15	0.05	0.23
kg/d	1.01	1.03	0.03	0.73	1.16	1.17	0.03	0.88
Milk lactose, %	4.81	4.87	0.05	0.44	4.79	0.05	0.74	
Milk SNF, %	8.72	8.77	0.07	0.65	8.60	8.71	0.08	0.31
Milk SCC, 10 <sup>3</sup> /ml	230	407	82	0.14	259	373	102	0.44

<sup>1</sup>Includes 6 primiparous cows in each group.

Table 2. Reproductive measures of lactating cows fed diets containing low or high phosphorus.

Measure	All cows				Second year cows			
	Low P (n = 26)	High P (n = 27)	SEM	P	Low P (n = 14)	High P (n = 16)	SEM	P
Days to first estrus	47.8	60.7	8.4	0.28	48.7	73.6	10.0	0.09
Days to first AI	65.6	72.2	5.7	0.42	67.2	80.7	7.4	0.21
Days open <sup>1</sup>	103.3	104.7	12.6	0.94	104.8	109.8	17.1	0.83
Conception rate at first AI, %	42.3	28.0	--	--	42.9	12.5	--	--
Pregnancy rate								
Before 120 DIM, %	61.5	50.0	--	--	64.3	43.8	--	--
End of lactation, %	96.4	86.4	--	--	85.7	56.3	--	--
Services/conception <sup>1</sup>	1.6	2.1	0.2	0.13	1.5	2.0	0.2	0.13

<sup>1</sup>Includes only the cows that ultimately became pregnant.