

DIETARY PROTEIN AND REPRODUCTIVE EFFICIENCY OF DAIRY CATTLE
2nd Year of a Two Year Study

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Story in Brief

During the second year of a 2-year study, 62 dairy cows were fed either 15 or 20% crude protein diets from 10 ± 4 to 145 days postpartum. Milk production was increased slightly by feeding the higher crude protein diet. Nutritional stress as indicated by body weight and condition score and feed intake were not affected by diet. However, nitrogen metabolism was enhanced as evidenced by a 10 mg/100 ml increase in plasma urea when cows consumed the high protein diet. Reproductive performance as indicated by services per conception, intervals to first estrus and to conception was not influenced by diet. There does not appear to be antagonism between dietary protein requirements for lactation and reproduction.

(Key Words: Dietary Protein, Fertility, Days Open)

Introduction

The feeding program for high producing dairy cows is designed to provide adequate dietary constituents for efficient milk production. During the first 2 to 3 months of lactation, high producing dairy cows cannot consume enough feed to meet the demands of lactation. To provide the additional metabolites needed for the rapid increase in milk production that occurs at this time, cows mobilize adipose tissue and body protein. Feeding high protein rations is one way to increase the supply of dietary constituents cows can devote to milk production. The current dietary protein recommendation for cows producing 66 to 110 lbs of milk/day range from 14 to 22% of the ration on a dry matter basis (NRC, 1978).

Recently, some limited evidence indicated that reproductive efficiency was reduced when rations of 16% or more crude protein were fed (Folman et al., 1981; Jordan and Swanson, 1979). As services per conception were increased by 0.8 to 1 unit, it appeared that high dietary protein had interfered with fertilization and/or caused early embryonic mortality. These effects might be explained by changes in the uterine environment that are induced by high dietary protein (Jordan et al., 1983). Such a possible conflict between the dietary requirements for reproduction and lactation is of real concern to dairymen. A two-year experiment was conducted to determine whether or not high dietary protein is detrimental to the reproductive performance of lactating dairy cows when compared to moderate protein. In the first year of this study, high dietary protein did not appear to interfere with reproduction (Howard et al., 1985). This report covers the second year of this study.

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Materials and Methods

Fourteen Ayrshire and 49 Holstein cows of second and greater lactation were fed either a moderate (15%) or high (20%) crude protein diet. Diets were fed from 10 ± 4 days postpartum through the first 145 days of lactation. The complete mixed ration consisted of 45% sorghum silage and 55% grain concentrate on a dry matter basis. Calculated values of net energy for lactation were 0.66 and 0.67 Mcal/lb for the 15 and 20% crude protein diets, respectively. The percentages of wheat middlings and soybean meal in the concentrate mixture were varied to generate the desired levels of protein (Table 1). Cows were fed three times daily to the limit of consumption. Daily feed intake and feed refusals were recorded and weekly average dry matter and protein intake were determined. Body condition was evaluated by the system of Aalseth et al. (1983) whereby cows were scored on a scale of 1 to 9 (1 = extremely thin; 9 = over conditioned). Along with body weight, body condition was determined every two weeks as a measure of nutritional stress. Weekly plasma urea levels were measured to evaluate the effects of the diets on nitrogen metabolism. Weekly average milk production was calculated from daily milk production. Milk fat and protein were measured from samples of four consecutive milkings each week.

To evaluate reproductive performance, cows were palpated weekly to monitor uterine involution, ovarian function and pregnancy. Cows were observed twice daily for behavioral estrus and artificially inseminated with the same freeze lot of semen (within breed) at each estrus occurring 55 or more days postpartum by predominately one inseminator.

Table 1. Percentage (as fed) of grain/soybean meal concentrate.

Ingredients	% Crude Protein	
	15	20
Soybean Meal	23.5	53.0
Wheat Middlings	29.5	----
Corn, Ground	27.0	27.0
Oats, Crimped	5.0	5.0
Cottonseed Hulls	5.0	5.0
Molasses, Liquid	5.0	5.0
Limestone	1.5	1.5
Dicalcium Phosphate	1.3	1.3
Sodium Bicarbonate	1.0	1.0
Salt	0.7	0.7
Magnesium Oxide	0.5	0.5

Results and Discussion

These data represent the second year of a two-year study. Production and nutritional data were averaged for both breeds over the experimental period (Table 2). Both 4% fat corrected and actual milk production were increased 2-3 lbs by feeding the high protein diet. However, neither milk fat or milk protein percent were altered by diet. Actual percent crude protein in the diet averaged 14.2 and 19.1% on a dry basis in the moderate and high protein diets, respectively. Dry

Table 2. Effect of dietary protein level on production and nutrition performance parameters.

	% Crude Protein	
	15	20
Cows per treatment	32	31
Dietary crude protein (% dry matter)	14.2±.1 ^a	19.1±.1
Dry matter intake (lb/day)	52.4±1.1	51.7±1.0
Actual milk (lb/day)	64.4±1.9	67.2±2.0
4% fat corrected milk (lb/day)	63.8±1.9	65.7±1.7
Milk fat %	3.97±.07	3.84±.05
Milk protein %	3.08±.05	3.10±.06
Body weight (lb)	1425±9	1399±8
Body condition score (1-9 scale)	5.1±.1	5.0±.1
Plasma urea (mg/100ml)	13.9±.3	22.6±.5

^a ± S.E.M.

matter intake was comparable between the two diets. As average body weight and condition score were similar between diets and changed little throughout the experiment, nutritional stress was the same and negligible for all cows. Plasma urea was elevated about 10 mg/100 ml in cows consuming the high protein diet indicating that nitrogen metabolism had been shifted to excrete the additional ammonia produced.

Reproductive performance as affected by diet consumed is shown in Table 3. Diet did not affect ovarian function as indicated by interval to first estrus (Table 3). Similarity in services per conception in all cows as well as cows conceiving during the experiment demonstrated that fertilization rate and early embryonic mortality were not detrimentally affected by feeding high dietary protein. Good reproductive performance was further demonstrated in the short interval from calving to conception observed in cows fed both diets. Services per conception on cows conceiving during the 90-day breeding period of the experiment is perhaps a better indication of fertility as cows not conceiving are eliminated. Such cows probably had fertility problems independent of possible dietary effects. Reproductive performance was similar to that observed during the previous year of this experiment (Howard et al., 1985), and was uninfluenced by protein level in the diet.

Table 3. Reproductive performance of dairy cattle fed moderate and high levels of crude protein.

	% Crude Protein	
	15	20
Cows per treatment	32	31
Interval to first estrus (days) ^b	41.1±4.3 ^a	46.6±4.5
Interval calving to conception ^b	81.6±4.4	79.6±4.4
% pregnant on experiment ^c	97	89.6
Services/conception (cows conceiving)	1.50±.14	1.62±.18
Services/conception (all cows) ^c	1.53±.14	1.74±.17

^a ±S.E.M.

^b Cows treated for cyst or retained corpora lutea were eliminated.

^c Cows with disorders precluding conception and pregnancy diagnosis were eliminated.

In summary, after completing the second year of this experiment involving a total of 145 cows (both years), there does not appear to be any antagonism between the dietary protein requirements for lactation and those of reproduction.

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