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Evaluation of raw and processed full-fat soybeans for high-producing dairy cows

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EVALUATION OF RAW AND PROCESSED FULL-FAT SOYBEANS FOR HIGH-PRODUCING DAIRY COWS¹

G. M. Ward, J. L. Morrill, M. B. Morrill,
and A. D. Dayton

Summary

Rations containing either soybean meal, raw full-fat soybeans, or processed soybeans were compared using 36 high-producing dairy cows in early lactation. The processed soybeans were heated in a California Pellet Mill Jet-Sploder for sufficient time (about 1 min) to produce beans with exit temperature of 340°F. The raw soybeans and heated soybeans were rolled before being mixed into the concentrate mixture. Alfalfa hay and concentrate were consumed ad libitum in a ratio of 35% hay and 65% concentrate.

Milk production and percent protein in milk were significantly greater when cows were fed soybean meal or Jet-Sploded beans than when fed raw soybeans. Percent milkfat and total milk solids were not affected by treatment.

Introduction

Soybeans are a good source of protein and energy; however, raw soybeans contain some anti-nutritional factors. Proper heat treatment will destroy those factors and may also increase the value of the soybean protein² by altering the amount of protein that is degraded in the rumen. In another study³, a Jet-Sploder³ was used to process full-fat soybeans for young calves. Processing was beneficial, with one set of conditions being superior as determined by several criteria. In this experiment, we evaluated soybeans processed by those conditions in rations for high-producing dairy cows.

Experimental Procedure

Each of 36 cows having 305-2X-ME records of at least 16,000 pounds milk was assigned to one of three rations on the day after calving. The three treatments differed only in the composition of the concentrate (Table 1), which contained either soybean meal, raw soybeans, or jet-sploded soybeans. The jet-sploded beans were processed in a California Pellet Mill Jet-Sploder[®] adjusted to produce beans with an exit temperature of 340°F. This temperature required a processing time of approximately 1 min. The beans were rolled before being mixed with other concentrate ingredients. The raw soybeans were from the same

¹ The assistance of Simonsen Feeds, Quimby, IA in processing some of the soybeans is appreciated.

² Abdelgadir et al (see p 16).

³ California Pellet Mill, San Francisco, CA.

source and also were rolled before being mixed into the concentrate mixture. Each cow was subjected to each treatment for 28 days in a randomized, balanced changeover design. The cows were fed all they would consume of alfalfa hay and concentrate in a ratio of 35% hay, 65% concentrate.

The amount of feed consumed by each treatment group and milk produced per cow was recorded daily. The cows were weighed and composition of the milk was determined weekly.

Results and Discussion

Data on milk production and composition are shown in Table 2. Milk production and percent protein in milk was significantly greater when cows were fed soybean meal or Jet-Sploded full-fat soybeans than when fed raw soybeans. Percent milkfat and total milk solids were not affected by treatment. Cows consumed less concentrate and lost more weight when fed raw soybeans than when fed the other rations (Table 3).

Dry matter consumption was nearly the same for the soybean-meal and Jet-Sploded soybean rations but the Jet-Sploded soybeans were full-fat and thus provided more energy with only slightly less (5%) protein in the ration. Less of the raw soybean ration was consumed, resulting in less protein and energy than from either of the other rations.

Lower consumption of the raw soybean ration compared to either of the other rations appears to be the only reason for the response obtained, since each ration furnished protein in excess of requirements^{5,6} and weight change was most negative for the cows on the raw soybean ration. Energy probably was the critical nutrient.

⁵National Research Council.

⁶Ward and Dayton JDS 61:1579(1978).

Table 1. Composition of concentrate mixtures

Ingredient	Ration		
	1	2	3
	%		
Rolled corn	85.275	82.025	82.025
Soybean meal (90% DM)	11.5	----	----
Cracked soybeans (90% DM)	----	14.75	----
Jet-sploded soybeans (90% DM)	----	----	14.7
Cophos	1	1	1
Sodium bicarbonate	1.5	1.5	1.5
Potassium chloride	.5	.5	.5
Z-10 trace mineral	.025	.025	.025
Vit A & D suppl*	.2	.2	.2
	100	100	100

*1,000,000 IU vitamin A and 500,000 IU vitamin D per pound dispersed in ground corn.

Table 2. Daily milk production and percent milkfat, milk protein, and milk solids by rations.

Ration	Milk (lb.)	Milkfat (%)	Milk protein (%)	Milk solids (%)
1	73.9 ^A	3.51	3.18 ^A	12.3
2	69.7 ^B	3.57	3.09 ^B	12.4
3	73.3 ^A	3.57	3.15 ^A	12.4

A,B Treatment effect ($P < .05$).

Table 3. Hay and concentrate dry matter intake and weight change of cows, by rations

Ration	Hay intake lb/day	Concentrate intake lb/day	Weight change lb/week
1	19.6	38.4	-2.0
2	19.8	34.6	-4.9
3	20.6	37.8	-2.5