Supplemental Niacin and Heat-Treated Whole Soybeans for Jersey Cows During Early Lactation

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ABSTRACT

Fifty-six multiparous Jersey cows were used in a replicated trial to investigate the effect of supplemental niacin and heat-treated whole soybeans on milk production and composition. Dietary treatments included 0 or 6 g/d of supplemental niacin beginning 21 d prior to expected parturition and raw or heat-treated whole soybeans fed at 10% of the dietary DM beginning immediately after parturition. Data were collected for 18 wk following a 2-wk postpartum period during which cows were adjusted to experimental diets and allowed to recover from parturition. Based on index values for protein dispersibility, heat-treated soybeans were marginally heated in yr 1 (12.1) and underheated in yr 2 (17.9). Intake of DM from corn silage plus concentrate, alfalfa hay, or soybeans averaged 15.5, 1.5, and 1.7 kg/d, respectively, and was not different because of niacin supplementation or form of soybean. Percentage of milk fat was highest when raw soybeans plus niacin were fed and lowest for heat-treated soybeans plus niacin. No difference was observed in milk production, milk percentage, or milk protein, lactose, and SNF. No advantage was observed from less than optimally heated whole soybeans or supplemental niacin in diets for Jersey cows during early lactation.
(**Key words**: soybeans, niacin, milk production, milk composition)

Abbreviation key: **ACAC** = acetoacetate, **HTSB** = heat-treated whole soybeans, **PDI** = protein dispersibility index, **SB** = raw whole soybeans, **SN** = supplemental niacin.

INTRODUCTION

Supplemental fat is commonly added to dairy rations to increase the caloric density of diets fed to high producing dairy cows. This practice provides additional energy in support of milk production and allows higher percentages of dietary fiber to be maintained in the diet than would otherwise be possible. Total milk production and persistency of lactation were higher for cows fed fat during early lactation (25). Whole oilseeds, such as soybeans, have frequently been used to provide both supplemental fat and protein. Soybeans (**SB**) may be fed without any additional processing or heat-treated (**HTSB**) to increase the proportion of protein escaping ruminal degradation (24). The benefits of HTSB in diets based on corn silage have not been consistent; however, HTSB improved milk production when included in diets based on

Received August 22, 1994.
Accepted March 10, 1995.

alfalfa haylage (24). This result suggests that the additional RUP may not be the most limiting factor for improved milk production when corn silage is the primary forage.

A negative aspect of dietary oilseeds is the reduction in the percentage of milk protein, especially for milk markets that include percentage of milk protein in pricing formulas (5, 17). Supplemental niacin (SN) prevented this reduction in percentage of milk protein when incorporated into diets containing whole cottonseeds (11) or HTSB (7). Although ruminal bacteria synthesize niacin, milk production and percentage of milk protein increased when SN was fed to high producing cows during early lactation (13, 18, 20). Heat treatment of soybean protein may reduce niacin availability because of the reduction in the availability of tryptophan for bacterial synthesis of niacin (4, 6). Thus, SN may be limiting when HTSB are included in diets based on corn silage and may account for the lack of response that was reported in previous trials. This trial was conducted to determine whether SN would enhance milk production or alter milk composition when SB or HTSB were included in diets based on corn silage and fed to Jersey cows during early lactation.

MATERIALS AND METHODS

Cows and Diets

Twenty multiparous Jersey cows in yr 1 and 36 in yr 2 were used in the replicated trial with a randomized block design. Cows were blocked by previous 305-d mature equivalent milk production and lactation number and assigned randomly to one of four treatments. Treatments were arranged as a 2 × 2 factorial with or without 6 g/d per cow of SN and SB or HTSB. Cows were trained to use Calan gates (American Calan Inc., Northwood, NH) beginning 21 d prior to anticipated parturition and were fed a dry cow supplement, corn silage, and alfalfa hay according to normal station practices. The SN (nicotinic acid; Lonza, Inc., Fair Lawn, NJ) was weighed prior to feeding and individually fed beginning 21 d prior to expected parturition. Cows were moved to a maternity area at parturition. After the calf was removed (within 24 h of calving), each cow was returned to the feeding area and fed the appropriate experimental diet.

TABLE 1. Composition of concentrate.

Ingredient	(% of DM)
Soybean meal, 49% CP	11.90
Corn, ground	24.93
Wheat middlings	44.19
Soybean hulls	14.73
Limestone	1.98
Dicalcium phosphate	.85
Magnesium oxide	.28
Premix[1]	.06
Salt	1.08

[1]Premix contained 1.5% Fe, 1.5% Mn, 2.7% Zn, 4000 ppm of Cu, 115 ppm of Co, 300 ppm of I, 265 ppm of Se, 4,409,245 IU/kg of vitamin A, 1,984,160 IU/kg of vitamin D_3, and 2205 IU/kg of vitamin E.

Experimental diets were formulated to contain 29.5% corn silage, 24.1% alfalfa hay, 10.2% soybeans, and 36.2% concentrate (Table 1) on a DM basis. Alfalfa hay was fed twice daily prior to feeding of the remaining portion of the diet. Corn silage, concentrate, and SB were mixed prior to feeding. The SB were procured from the same source both years. Additional SB were procured from a second source in yr 2 because the original supplier could not provide the total quantity needed for both treatments. The SB were roasted using a continuous roaster by a commercial vendor and steeped for 1 h prior to cooling. Day 1 of each experimental week was Thursday. Cows must have been lactating at least 5 d before they were considered eligible for starting the experiment.

Data and Sample Collection

All cows were allowed 2 wk for adjustment to experimental diets. Samples and data were collected for the following 18 wk. Amounts of feeds offered were recorded at each feeding, and orts were recorded once daily. Samples of ingredients were taken daily and dried at 60°C for 48 h. Milk production was recorded at each of two milkings daily. Every 2 wk, 25 ml of milk were collected from four consecutive milkings and composited by cow; duplicate samples were shipped to the Virginia DHIA laboratory for infrared analysis of percentages of milk fat, protein, lactose, and SNF. Every 4 wk, whole blood was collected via jugular puncture 2 h after milking. Immediately after