Feeding Heat Treated Cottonseed to Lactating Dairy Cows

T.R. Dhiman and L.D. Satter

Introduction

Protein supplements with high energy content that are resistant to microbial protein degradation in the rumen, yet available for absorption in the small intestine, may help supply the extra energy and protein needed for high milk production during early lactation. Linted-cottonseed on a dry basis contains approximately 20% fat and 20% crude protein and can be used effectively as a fat, protein and fiber supplement. Heat treatment has been used as a safe and economical method to reduce protein degradation by rumen microbes. Chemical, in vitro and in situ evaluation of linted-cottonseed exposed to different heat treatments indicates that heat treatment of cottonseed should increase the supply of protein to the small intestine.

The objective of this experiment was to compare optimally heat treated linted-cottonseed with solvent extracted soybean meal and unheated linted-cottonseed as a protein supplement for lactating dairy cows.

Materials and Methods

Linted-cottonseeds were brought to 146°C in a Jet Pro roaster and steeped for 30 min prior to cooling. Fifty-one multiparous cows were blocked according to milk yield in the previous lactation. Cows within each block were randomly assigned to one of three treatments according to expected calving date. The three treatments were soybean meal (SBM), linted-cottonseed (LCS), and heat treated linted-cottonseed (HLCS). Treatment diets were fed through wk 28 of lactation. Diets were fed as total mixed rations once daily. Ingredient composition of the diets is in Table 1. Daily feed offered and refused was recorded. Milk weights were recorded twice daily. Weekly milk samples were analyzed for composition. Cows were weighed weekly and scored once a month for body condition. Cows in all treatments received biweekly injection of rBST starting at week 9 of lactation.

Results

Results are summarized in Table 2. Cows in the SBM, LCS, or HLCS treatments had similar feed intake. Cows fed HLCS produced 1.9 kg more 3.5% FCM compared with cows in the SBM or LCS treatments ($P = .3$). Similar feed intake and a slight increase in milk yield increased the feed efficiency of cows fed HLCS ($P = .1$). Milk fat percent was the same across treatments. Milk protein content was decreased in cows fed cottonseed compared with soybean meal. Cows in the HLCS treatment started the experiment with lower milk protein content. During the previous lactation, milk protein content of cows in the SBM, LCS, and HLCS treatments was 3.31, 3.31, and 3.22, respectively, suggesting the two cottonseed treatments probably did not differ in milk protein content. Cows fed cottonseed (heated or unheated) had slightly higher body weight gain and body condition score.

Summary

Results suggest that feeding heat treated linted cottonseed improved dairy cow performance.

Table 1. Ingredient and chemical composition of diets.

	Diet		
Ingredients, % DM	Soybean meal	Linted cottonseed	Heated linted cottonseed
Alfalfa silage	33.3	33.3	33.3
Corn silage	16.7	16.7	16.7
High moisture ear corn	36.0	26.1	26.1
Soybean meal	12.0	6.8	6.8
Linted-cottonseed	...	15.0	...
Heated linted-cottonseed[1]	...	...	15.0
Minerals and vitamins	2.0	2.1	2.1
DM, %	50.2	51.1	51.3
NEL, Mcal/kg DM	1.64	1.68	1.68
Crude protein, % DM	16.2	15.6	15.9

[1]Linted-cottonseeds were brought to 146°C in a Jet Pro roaster and steeped for 30 min prior to cooling.

Table 2. Lactation performance.

	Treatment				
Measurement	Soybean meal	Linted cottonseed	Heated linted cottonseed	SEM	
P =					
DMI, kg/d	24.0	23.6	23.7	.5	.7
Milk, kg/d	38.1	38.3	40.3	1.0	.2
3.5% FCM, kg/d	37.6	37.6	39.5	.9	.3
Milk fat, %	3.45	3.41	3.42	.09	.9
Milk protein, %	3.24[a]	3.10[b]	3.00[b]	.04	.001
Fat yield, kg/d	1.30	1.30	1.36	.04	.5
Protein yield, kg/d	1.23	1.18	1.20	.03	.4
Weight gain[1], kg	36	51	49		
Gain in body condition score[2]	.2	.3	.4		

[1]Average weight at wk 27 and 28 minus average weight at wk 1 and 2 of the experiment.
[2]Body condition score at the end of the experiment minus beginning score. Range from 1 to 5, where 5 is the highest condition.