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THE EFFECT OF PROCESSED SOYBEANS AND ADDED ENERGY IN CALF STARTERS ON THE GROWTH OF HOLSTEIN CALVES

P. V. Reddy and J. L. Morrill

Summary

In Trial 1, 91 Holstein calves were fed starters containing either soybean meal (SBM), extruded soybeans (ESB), roasted soybeans (RSB), SBM+soy oil (SO), or SBM+ruminant inert fat (RIF) from birth to 10 wk of age. There were no differences in overall feed consumption, except that calves fed RSB consumed more than calves fed SBM+SO. There were no significant differences in weight gains, but calves fed SBM+SO tended to gain less. In trial 2, 71 Holstein calves were fed starters containing roasted soybeans from birth to 10 wk of age. Three of the starters contained 18% protein and soybeans roasted at 210, 260, or 290 F; the fourth starter contained 15% protein and soybeans roasted at 260 F. Calves fed starter containing soybeans roasted at 290 F consumed more feed, gained more weight, and were more efficient in converting feed and energy to gain than were the other calves fed 18% protein. Feed consumption was high and gains were intermediate by calves fed starter containing 15% protein. Growth in body size correlated with weight gains.

(Key Words: Calves, Starter Diets, Soybeans.)

Introduction

Young calves require a feed high in protein and energy. Soybean meal (SBM) has been a major source of protein in calf starters for many years and is a satisfactory source, although utilization of the protein may be increased in some diets by heat treatment to make the protein less degradable in the rumen. Fat supplementation increases the concentration of energy in diets but may decrease palatability and fiber digestion in the rumen.

Raw whole soybeans are a good source of protein and fat but contain several antinutritional factors. Proper heat treatment destroys these factors and decreases the degradation (increases the "bypass") of the protein in the rumen. Several processing methods are now available that may improve soybean utilization, and the benefits of heat processing soybeans for lactating cows are well documented. Among processing methods, the energy expenditure and fixed costs are lower for roasting than for extrusion, thereby warranting further research on this type of heat treatment. Less is known about the requirements of the calf for bypass protein, the effect of adding fat to calf diets, or the optimum conditions for processing soybeans. This experiment was conducted to answer some of these questions.

Procedures

Trial 1

Ninety one Holstein calves were used from birth to 10 wk of age. They were fed colostrum for 3 d and then whole milk at 4% of birth weight twice daily and could consume calf starter ad libitum. Calves were weaned when they consumed 1.5 lb or more starter per day for 2 consecutive days. Calves were assigned randomly to one of five pelleted calf starters, which contained either soybean meal (SBM), extruded soybeans (ESB)¹, roasted soybeans (RSB)², SBM+soy oil (SO), or SBM+ruminant inert fat (RIF)³.

Starter consumption was recorded, and weekly intake was calculated. Twice daily, each calf was assigned a value for consistency of feces (1, normal to 4, watery). All calves were weighed weekly. At birth and at 10 wk of age, wither height, length, and heart girth measurements were recorded.

Trial 2

Seventy one Holstein calves were used from birth to 10 wk of age. Feeding and management were as described in trial 1. Calves were assigned randomly to each of four pelleted calf starters, which were formulated by using soybeans roasted at either 210, 260, or 290 F temperatures with a Jet Pro Roaster⁴, to provide 18% protein in three starters and soybeans roasted at 260 F temperature to provide 15% protein in the fourth starter. Calves were allowed to consume calf starter and water free choice. Body measurements and weights were recorded as in trial 1.

Results and Discussion

Trial 1

Average weekly feed consumption is shown in Figure 1. There were no differences in weekly feed consumption except at wk 3, 4, and 5. A trend was observed up to 8 wk of age for depressed feed intake in calves fed SBM+SO. Total feed consumptions for the 10 wk period were 173, 171, 177, 157, and 168 lb for calves fed SBM, ESB, RSB, SBM+SO, and SBM+RIF starters, respectively. There were no differences in overall feed consumption except that calves fed SBM+SO tended to consume less than RSB-fed calves. The soy oil-containing pellets were softer and broke apart more easily, which accounted for at least part of the reduced consumption.

Average weekly gains are shown in Figure 2. There were no differences in gains except at wk 3 and 10; calves fed SBM at wk 3 and SBM or SBM+RIF at wk 10 gained more weight than calves fed SBM+SO. Total gains for the 10 wk period were 85, 83, 85, 78, and 83 lb for calves fed SBM, ESB, RSB, SBM+SO, and SBM+RIF containing starters, respectively. None of these were significantly different.

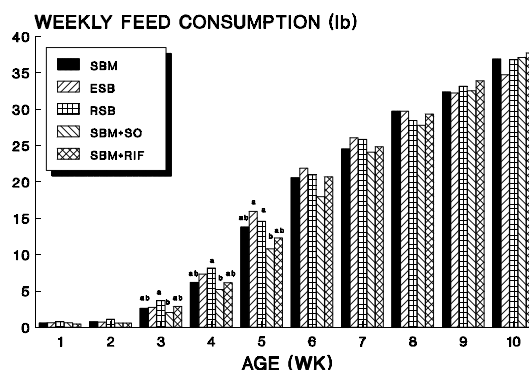


Figure 1. Mean Weekly Feed Consumption (lb) of Calves Fed Processed Soybeans or Added Energy in Their Diets. Means within a Week with Different Superscripts Differ ($P < .05$).

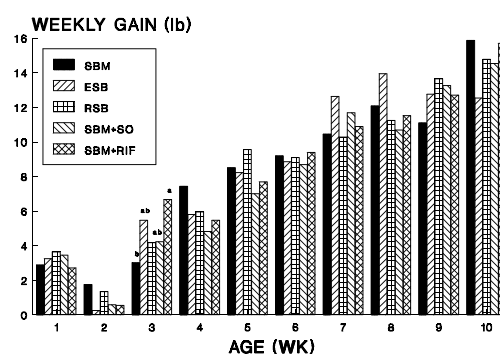


Figure 2. Mean Weekly Gains (lb) of Calves Fed Different Starters. Means within a Week with Different Superscripts Differ ($P < .05$).

Body measurement increases and fecal scores are shown in Table 1. Measurement increases reflected weight gains. There were no significant differences in increase in wither height and length from birth to 10 wk, but calves fed SBM had greater ($P < .05$) increases in heart girth measurements than SBM+SO-fed calves. The average fecal scores were not different, except that calves fed SBM had lower scores than ESB- or RSB-fed calves.

In conclusion, calves fed SBM+SO consumed less than RSB-fed calves. Weight gains

were not significantly different; however, there was a trend for calves fed SBM+SO to gain less. Lower body measurement increases were observed in calves fed SBM+SO. Calves fed starter containing SBM had lower fecal scores than RSB-or ESB-fed calves.

Trial 2

The overall feed consumption for the 10-wk period is shown in Figure 3. As the roasting temperature increased from 210 to 290 F, greater feed consumption by calves was observed.

Total gains for the 10-wk period are shown in Figure 4. Weight gains were reflective of feed consumption. Calves fed either RSB-290 or RSB-260 (15%) containing starters had higher gains than calves fed RSB-210.

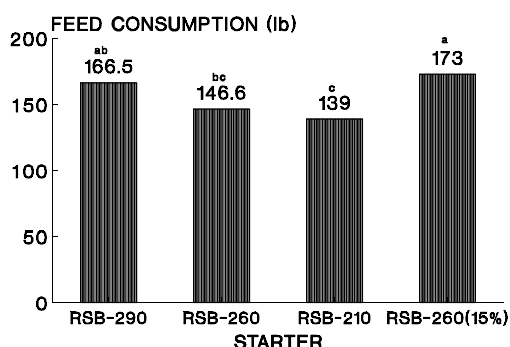


Figure 3. Overall Feed Consumption of Calves Fed Soybeans Processed at Different Temperatures. Means with Different Superscripts Differ (P<.05).

Feed and energy efficiencies during 6-10 wk of age are shown in Table 2. Calves fed RSB-260 (15%) required more feed than calves fed RSB-290 or RSB-260 to gain 1 lb of body weight. Calves fed starters containing either RSB-260 (15%) or RSB-210 consumed more energy to gain body weight than RSB-290 fed calves.

Body measurement increases and fecal scores are shown in Table 3. Calves fed RSB-210 were smaller in body size than others. The average fecal scores were not different among calves fed different starters.

In conclusion, as processing temperature increased from 210 to 290 F, calves consumed more feed, gained more weight, and were more efficient in converting feed and energy to gain weight. Calves fed starter containing 15% protein had higher feed consumption and moderate body weight gains. Body measurement increases were reflective of weight gains.

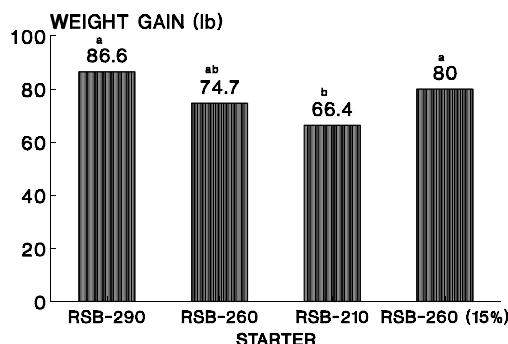


Figure 4. Overall Weight Gains of Calves Fed Soybeans Roasted at Three Different Temperatures. Means with Different Superscripts Differ (P<.05).

¹Extruded at 290 F with an Insta Pro Dry Extruder Model 2000. Triple F Products, Des Moines, IA 50322.

²Roasted at 260 F for 2 minutes with Rickel-Aire Roaster. Rickel Inc, Kansas city, MO 64112.

³Energy Booster 100, Milk Specialties Co., Dundee, IL 60118.

⁴Sweet Jet-Processing Co., Springfield, OH 45505.

Table 1. Body Measurement Increase and Fecal Score of Calves Fed Processed Soybeans and Added Energy in Their Diets

Item	SBM	ESB	RSB	SBM+SO	SBM+RIF
Height, in	4.9	4.6	4.4	4.1	4.6
Length, in	6.2	6.2	5.6	5.1	6.0
Heart girth, in	12.7 ^a	11.3 ^{ab}	11.5 ^{ab}	10.2 ^b	11.2 ^{ab}
Fecal score	1.15 ^b	1.27 ^a	1.28 ^a	1.25 ^{ab}	1.24 ^{ab}

^{a,b}Means in same row with different superscripts differ significantly (P<.05).

Table 2. Effect of Roasting Temperatures and Protein Concentration on Feed and Energy Efficiencies during 6-10 Wk of Age

Starter	ADG	g gain/ lb feed	ME (Mcal/lb)	Mcal ME/ lb gain
RSB-290	1.52 ^a	172 ^a	1.55	4.21 ^b
RSB-260	1.34 ^a	168 ^a	1.55	4.32 ^{ab}
RSB-210	1.21 ^b	159 ^{ab}	1.55	4.55 ^a
RSB-260 (15%CP)	1.39 ^a	145 ^b	1.51	4.75 ^a

^{a,b}Means within a column with different superscripts differ (P<.05).

Table 3. Body Measurement Increases and Fecal Scores of Calves Fed Soybeans Roasted at Different Temperatures

Item	Starter			
	RSB-290	RSB-260	RSB-210	RSB-260 (15%)
Height, in	4.6 ^a	4.0 ^a	3.5 ^b	4.4 ^a
Length, in	6.1 ^a	5.2 ^a	4.6 ^b	5.9 ^a
Heart girth, in	13.1 ^a	11.9 ^a	10.6 ^b	12.40 ^a
Fecal score	1.16	1.15	1.20	1.16

^{a,b}Means within a row without common superscripts differ (P<.05).