2014 SOUTH DAKOTA STATE UNIVERSITY

SHEEP RESEARCH REPORT

South Dakota State University
College of Agriculture and Biological Sciences
Animal Science Department

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SHEEP 2014-1

Presence of *Mycoplasma sp.* in lambs with lung lesions

J. A. Daniel, J. E. Held, L. Holler

OBJECTIVES

To test the impact of NPCoat administration on the prevalence of lung lesions in lambs.

MATERIALS AND METHODS

NPCoat is a cattle product designed to combat respiratory disease (NPCoat; Camas, Inc.). NPCoat is an intranasal preparation of avian polyclonal antibodies against various respiratory disease pathogens, including *Pasteurella sp.* Lambs were assigned to 1 of 4 pens, and all lambs in one pen were treated with 0.5 ml/nostril of NPCoat or carrier. Lambs received the initial intranasal treatment at weaning and a second and third intranasal treatment 7 and 14 days later, respectively. Lambs were weighed every 2 weeks. All pens were in the same barn, and lambs were prevented from having nose to nose contact with lambs in other pens. All pens were fed the same diet, and lambs had feed available ad libitum. Lambs were weighted every 14 days. Lambs were slaughtered at a commercial packing plant, and lungs were collected and transported on ice to the South Dakota Animal Disease Research and Diagnostic Laboratory for lung lesion scoring, histological examination, and bacterial culture. A portion of the right cranial lobe of each lung was collected. Samples of lungs were cultured aerobically and for *Mycoplasma sp*. Additional samples were prepared for histological examination. Carcass data (fat thickness at 12th rib, ribeye area, and body wall thickness) were collected approximately 24 h after slaughter.

Lung lesion scoring: Lambs were determined to have severe lung lesions if over 50% of any lobe was consolidated. Lambs were considered to have moderate lung lesions if greater than 5% but less than or equal to 50% of a lobe was consolidated. Lambs were considered to have normal lungs if not more than 5% of any lobe was consolidated. Lungs were also examined for the presence of active abscesses or pleural adhesions.

Statistics: Effect of treatment on prevalence and severity of lung lesions were tested by Chi-square. Average daily gain, hot carcass weight, back fat thickness between the 12th and 13 rib, body wall thickness, ribeye area between the 12th and 13th rib, and yield grade data were tested for effect of treatment by ANOVA using JMP software (SAS, Inc. Cary, NC).

RESULTS

Treatment with NPCoat had no effect on the prevalence or severity of lung lesions ($P > 0.75$). Production traits, including average daily gain, hot carcass weight, back fat thickness between

the 12th and 13 rib, body wall thickness, ribeye area between the 12th and 13th rib, and yield grade, were not effect by NPCoat ($P > 0.30$). Histopathology indicated bronchopneumonia with mixed mononuclear cells present in lambs with lung lesions. Culture analysis confirmed the presence of *M. haemolytica* and *P. multocida* in lambs with lung lesions, and revealed the presences of *Mycoplasma sp*. Data were tested for effect of lung lesion prevalence or severity on the detection of *Mycoplasma sp*. by Chi square analysis. *Mycoplasma sp*. was present in a greater percentage of lungs with lesions than in lungs without lesions (51% vs. 15%; $P = 0.04$). However, the severity of the lung lesions did not affect the percentage of lungs which had positive cultures for *Mycoplasma sp*. (38% vs. 53% for moderate vs. severe lung lesions, $P = 0.42$). Treatment with NPCoat did not affect the presence of *Pasteurella sp*. or *Mycoplasma sp*. ($P > 0.17$). These results indicate administration of the current cattle formulation of NPCoat at the time of weaning is not effective at reducing the prevalence of lung lesions in sheep. These results also suggest strategies to reduce infection of *Mycoplasma sp*. may reduce the prevalence of lung lesions.

SHEEP 2014-2

A comparison of corn or soybean hull based diets with dried distillers grain with solubles (DDGS) as the protein source in finishing diets comparing lamb growth, feed efficiency, and carcass merit.

R.D. Zelinsky, A.E. Wertz-Lutz, J.E. Held

OBECTIVES

To evaluate growth, carcass merit and mineral status in wether lambs fed finishing diets formulated with dried distillers grain with solubles (DDGS) and soybean hulls (SH).

MATERIALS AND METHODS

Sixteen Polypay wethers were individually housed in 0.9 m x 1.5 m pens in the Animal and Range Science metabolism facility to record animal feed intake. After shearing lambs were adjusted to the indoor environment and their treatment diet during a 7-d acclimation period. Pelleted diets were formulated to have similar nutrient composition based on tabular values (15 % crude protein and 2.7 Mcal/kg ME). Dietary ingredients for the diets fed in this trial are reported in Table 1. Calcium to phosphorus ratio of the corn based diet was 1.7 to 1 and the SH based diet 3.6 to 1. Lambs were fed for 56 d with feed intake data and animal weight recorded at 14-d intervals. Lambs were harvested at a commercial packing plant, and livers were collected and transported on ice to our laboratory. Liver tissue samples were collected and frozen for subsequent mineral analyses. Carcass data (hot carcass weight, fat thickness, body wall thickness, ribeye area and USDA yield and quality grades) were collected approximately 24 hr after harvest.

Data were analyzed statistically as a completely randomized design with individual animal as the experimental unit. Differences in least squares means for growth performance, carcass characteristics, and mineral status that resulted from treatment were separated using the PDIFF option of SAS.

RESULTS

Lamb growth performance, feed efficiency and carcass data measurements are reported in Table 2. Average daily gain was similar for lambs regardless of ingredient composition of the finishing diet. However, lambs fed SH-DDGS consumed more feed ($P \leq 0.002$) to grow at a similar rate and therefore, had less efficient feed conversion ($P \leq 0.001$) compared to lambs finished on the Corn-DDGS diet. Lower feed efficiency for the SH-DDGS fed lambs could be related to a lower energy-density for this diet than expected or less efficient use of energy due to a greater rate of gastrointestinal tract passage associated with higher dry matter intake for the SH-DDGS diet.

Other lamb nutrition research has consistently shown high-voluntary intake for SH-formulated diets when used as a replacement for traditional energy feeds. The indication that dietary ingredient composition and particularly the inclusion of co-products may impact feed efficiencies and dry matter intake warrants further investigation.

Table 2 also shows the carcass data for the objective measurements hot carcass weight, fat depth, body wall thickness, loin eye area and the subjective USDA quality and yield grade estimates. Lambs finished on the treatment diets had similar carcass merit although the lambs finished on the SH-DDGS diet tended (P = 0.08) to have more subcutaneous back fat and numerically smaller loin eye area (P = 0.15) when compared to lambs finished on the Corn-DDGS diet. Body wall thickness was similar between treatment groups of carcasses. Research has shown that body wall thickness and hot carcass weight are the two most significant variables to estimate lamb carcass cutability.

Liver tissue mineral concentrations are reported in Table 3. Copper concentration was higher (P = 0.04) for lambs fed the SH-DDGS diet. Soybean hulls are known to have higher copper concentrations than traditional lamb finishing diet ingredients yet below the levels considered toxic. Most reported copper concentrations for SH range from 15 to 18 ppm. Although the liver copper concentration was significantly higher there was no evidence of copper toxicity for any lambs in the finishing trial or at harvest.

Table 1. Diet Composition (% DM Basis)

Ingredient	Corn-DDGS	SH-DDGS
Corn	37.00	----
Soybean hulls	----	84.65
DDGS	31.65	10.00
Alfalfa pellets	15.00	----
Oat hulls	11.00	----
Liquid molasses	2.50	2.50
Limestone	1.00	1.00
White salt	1.00	1.00
Ammonium chloride	0.50	0.50
TM micro mix	0.25	0.25
Decoxx	0.10	0.10
Total	100	100

Table 2. Growth performance and carcass data

	Treatment			
Trait measured	Corn-DDGS	SH-DDGS	SE	P <
Initial wt (kg)	43.40	44.10	0.92	0.58
Final wt (kg)	61.40	61.60	1.17	0.89
ADG (kg/d)	0.32	0.31	0.011	0.62
DMI (kg/d)	1.58	1.91	0.06	0.002
Feed:Gain	4.94	6.16	0.16	0.001
Gain:Feed	0.204	0.163	0.006	0.001
Hot carcass wt (kg)	33.0	32.7	0.81	0.80
Body wall thickness (cm)	3.30	3.30	0.21	0.92
Back fat (cm)	0.76	1.00	0.10	0.08
Loin eye area (cm^2)	17.6	16.50	0.53	0.15
USDA yield grade	3.50	3.30	0.18	0.33
USDA quality grade	CH	CH	----	----

Table 3. Liver tissue mineral concentrations

	Treatment			
	Corn-DDGS	SH-DDGS		
Mineral	ppm		SE	P <
Calcium	55.6	56.1	2.04	0.870
Copper	48.8	73.8	7.89	0.040
Iron	90.1	115.6	6.36	0.010
Manganese	5.3	3.4	0.17	0.001
Molybdenum	1.5	1.4	0.05	0.100
Zinc	35.9	36.7	0.90	0.550
Magnesium	186.8	172.7	1.68	0.001
Sodium	757.9	834.3	26.80	0.060
Potassium	2717	2617	20.10	0.003
Phosphorus	4357	4216	68.60	0.170

SHEEP 2014-3

Effects of increasing dietary energy density by replacing hay with soyhulls (SH) and dried distillers grains with solubles (DDGS) on nutrient digestibility and rumen physiology.

R.D. Zelinsky, A.E. Wertz-Lutz, J.E. Held

OBJECTIVES

To determine the effects of increasing dietary energy density in lamb diets from soybean hulls (SH) and dried distillers grain with solubles (DDGS) on nutrient digestibility and rumen physiology.

MATERIALS AND METHODS

Four ruminally cannulated wethers were used in a 4x4 Latin Square design with four 15 d trial periods. In each period a 10 d dietary treatment adaptation phase occurred with lambs fed at 90 % ad libitum for data collection. Dietary ingredients for the four diets fed in this trial are shown in Table 1. For each treatment diet all ingredients were in a pellet form except for chopped long-stemmed hay. Following adaptation, daily feed intake was recorded and a sample of each diet taken for nutrient analyses. Total fecal and urine output were collected separately for 4 d following the adaptation period. Feed, fecal, and urine samples were each pooled over the 4-d collection period, then subsampled and stored frozen for subsequent analysis of dry matter (DM), crude protein (CP), ash (ASH), ether extract (FAT), acid detergent fiber (ADF), neutral detergent fiber (NDF) and digestible energy (DE). Gross and fecal energy values were determined by bomb calorimetry and DE calculated by difference. Apparent digestibility of the nutrients also was calculated by difference. On d 15 of the sampling period, rumen fluid was collected -2, 0, 1, 4, 8, 12 h relative to feeding. Immediately following collection, rumen fluid pH was recorded and a sample was prepared and stored frozen for analysis of volatile fatty acids.

Digestibility data were analyzed statistically as a Latin square design with a model that accounted for variation that resulted from lamb, period, and their interactions. Differences in least squares means for nutrient digestibility that resulted from dietary treatment were separated using the PDIFF option of SAS. Ruminal pH data was analyzed statistically as repeated measures in time with a model that accounted for variation in that resulted from lamb, period, treatment, time, and the interaction of time and treatment. Differences in least squares means for ruminal pH that resulted from the interaction of dietary treatment by time were separated using the PDIFF option of SAS.

RESULTS

Apparent nutrient digestibility values are reported in Table 2. Dry matter digestibility was higher ($P < 0.03$) for lambs fed SH40-DDGS and SH60-DDGS than lambs offered Hay-DDGS.

Nitrogen digestibility was lower ($P < 0.02$) for the diets with SH. Digestibility of OM, ADF, NDF and FAT was not influenced by diet composition. Dry matter intake for lambs receiving Hay diets averaged 795 g and 1,277 g for SH diets. The NDF and ADF digestibility was not different although numerically higher for the treatment diets with the rapidly fermentable fiber in SH. With substantially higher dry matter intake for the lambs fed SH it is remarkable that digestibility coefficients would favor these treatments. Rumen pH decreased for all dietary treatments following feeding (Figure 1). Diets with high inclusion rates of SH had lower rumen pH subsequent to feeding than diets that included hay as the fiber source. However, only when SH was included at 60% of the diet DM was rumen pH below 5.5 the threshold for concern regarding acidosis. Physical signs of acidosis were not evident for lambs on any dietary treatment.

Table 1. Diet Ingredient Composition

	HAY-SBM	HAY-DDGS	SH40-DDGS	SH60-DDGS
Item	%DMB			
Grass hay	60.00	60.00	20.00	0.00
Soy hulls	0.00	0.00	40.00	60.00
Corn	25.62	12.75	22.78	28.06
SBM	11.64	0.00	0.00	0.00
DDGS	0.00	25.39	15.34	10.00
Urea	1.00	0.45	0.40	0.40
Dical	0.39	0.05	0.40	0.60
Limestone	0.85	0.86	0.58	0.44
TMS	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
	Nutrient Composition DMB			
CP (%)	13.85	13.85	13.85	13.85
DIP (%)	45.60	45.76	45.70	45.93
ME (mcal/kg)	2.40	2.51	2.82	2.97
Ca (%)	0.68	0.68	0.68	0.68
P (%)	0.34	0.34	0.34	0.34
NDF (%)	45.56	51.99	46.10	43.10
ADF (%)	27.60	29.49	29.54	29.53

Figure 1. Rumen pH

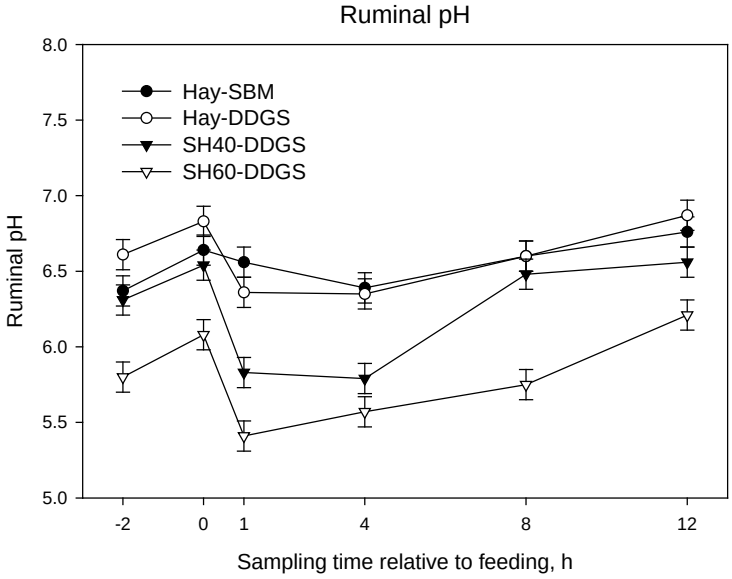

Table 2. Apparent Nutrient Digestibility

	Treatment					
Apparent Total Tract Digestibility	HAY-SBM	HAY-DDGS	SH40-DDGS	SH60-DDGS	SE	P <
DM (%)	66.92^{abc}	61.55^{c}	72.84^{ab}	74.84^{a}	2.39	0.03
OM (%)	69.17	66.34	75.65	77.43	3.07	0.12
ADF (%)	58.44	55.38	67.64	68.12	7.28	0.54
NDF (%)	55.46	56.06	65.03	67.43	5.68	0.40
N (%)	75.66^{a}	73.42^{a}	69.59^{b}	64.95^{b}	1.67	0.02
FAT (%)	69.02	70.83	80.29	77.21	4.74	0.46
DE (mcal/kg)	2.46^{c}	2.54^{bc}	2.93^{ab}	3.10^{a}	0.14	0.05

SHEEP 2014-4

Effects of increasing the energy density of a lactating ewe diet by replacing hay with soyhulls (SH) and dried distillers grains with solubles (DDGS)

R.D. Zelinsky, A.E. Wertz-Lutz, J.E. Held

OBJECTIVES

To evaluate the effects of increasing the ewe's dietary energy by replacing hay with SH and DDGS on milk production, nutrient composition, lamb growth, and changes in ewe body weight and body condition score (BCS).

MATERIALS AND METHODS

Sixteen Polypay-sired ewes rearing twin lambs were selected within a narrow post-partum period and individually housed in 1.8 m x 4.8 m pens for an 8-wk lactation period. Ewes were assigned randomly to one of four dietary treatments and fed at a rate of 3.5% (DMB) of initial post-partum body weight. The dietary treatments were 1) Hay-SBM 2) Hay-DDGS 3) SH40-DDGS and 4) SH60-DDGS. The ingredients and physical form offered in these dietary treatments were the same as described in the previously reported metabolism trial (Table 1). Lamb weigh-suckle-weigh was used each week to estimate ewe milk production. In this procedure, to quantify ewe milk production the lambs were withheld from the dam for 3 h, weighed followed by an udder zeroing period and reweighed. This process was repeated four times in a 12 h period to calculate daily production. Milk samples were collected following the weigh-suckle-weigh for subsequent nutrient analyses.

Lamb and ewe performance data were analyzed statistically as a completely randomized design. The model accounted for variation that resulted from animal and dietary treatment. Differences in least squares means for performance that resulted from dietary treatment were separated using the PDIFF option of SAS. Milk production and milk composition data were analyzed statistically as repeated measures in time with a model that accounted for variation that resulted from ewe-lamb pair, treatment, week of lactation, and the interaction of treatment and week of lactation. Differences in least squares means for milk production and milk composition that resulted from treatment and week of lactation were separated using the PDIFF option of SAS.

RESULTS AND DISCUSSION

Preliminary statistical analysis for animal performance responses to increasing dietary energy intake from co-products during lactation is summarized in Table 2. Milk production was affected ($P < 0.001$) when more energy dense co-products were substituted in lactation diets. Ewes receiving the highest energy dense diet SH60-DDGS numerically produced the greatest quantity of milk, with the lowest production in the Hay-DDGS treatment group. Milk fat, milk protein

and total milk solids also were affected ($P < 0.001$). Lamb body weight gain was affected ($P < 0.001$) by the dietary treatment offered to the dam. Lamb gain is higher ($P < 0.001$) in the SH40-DDGS and SH60-DDGS treatments, where milk production is the highest ($P < 0.001$) and ewe weight loss is numerically lower. Further statistical tests will be applied to evaluate treatment differences in this study. Using the co-products SH and DDGS in this study to increase the energy density for lactation diets appeared to have no detrimental impact on measured animal performance or observed health status.

Table 1. Feed Ingredient Composition

	HAY-SBM	HAY-DDGS	SH40-DDGS	SH60-DDGS
Item	%DMB			
Grass hay	60.00	60.00	20.00	0.00
Soy hulls	0.00	0.00	40.00	60.00
Corn	25.62	12.75	22.78	28.06
SBM	11.64	0.00	0.00	0.00
DDGS	0.00	25.39	15.34	10.00
Urea	1.00	0.45	0.40	0.40
Dical	0.39	0.05	0.40	0.60
Limestone	0.85	0.86	0.58	0.44
TMS	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
	Nutrient Composition DMB			
CP (%)	13.85	13.85	13.85	13.85
DIP (%)	45.60	45.76	45.70	45.93
ME (mcals/kg)	2.40	2.51	2.82	2.97
Ca (%)	0.68	0.68	0.68	0.68
P (%)	0.34	0.34	0.34	0.34
NDF (%)	45.56	51.99	46.10	43.10
ADF (%)	27.60	29.49	29.54	29.53

Table 2. Milk production, milk composition, and ewe body condition

	Treatment					
	HAY-SBM	HAY-DDGS	SH40-DDGS	SH60-DDGS	SE	P <
Ewe body weight						
Initial wt (kg)	84.4	86.0	86.8	88.6	5.21	0.95
Final wt (kg)	72.4	77.3	79.7	80.5	6.29	0.80
BW change (kg)	-12.0	- 8.75	- 7.16	- 8.18	2.21	0.46
Ewe BCS[a]						
Initial BCS	3.1	3.1	3.2	3.1	0.23	0.98
Final BCS	2.1	2.3	2.7	2.8	0.29	0.30
BW change BCS	- 1.0	- 0.81	- 0.50	- 0.25	0.25	0.21
Milk Composition						
Milk production (kg/d)	2.07	1.95	2.57	3.27	0.07	0.001
Total milk solids (%)	16.31	18.65	16.35	15.52	0.27	0.001
Milk protein (%)	5.25	5.63	5.19	5.03	0.10	0.001
Milk fat (%)	5.66	7.28	5.45	4.58	0.33	0.001
Lamb Performance						
Initial wt (kg)	6.32	7.05	6.37	7.07	0.41	0.40
Final wt (kg)	15.98	17.37	19.13	21.05	0.65	0.001
BW gain	9.66	10.32	12.76	13.98	0.64	0.001

[a] Body Condition Score: 1 = poor condition 5 = good condition

SHEEP 2014-5

Effect of vitamin E supplementation on reproductive performance in spring mated ewes

J.E. Held, R. Zelinsky, K. Bruns, C. Wright

OBJECTIVES

To evaluate reproductive performance in commercial Polypay ewes fed supplemental vitamin E at the level recommended in the sheep NRC (1985) compared to the small ruminant NRC (2007) during spring mating.

MATERIALS AND METHODS

Mature commercial Polypay ewes (n = 81) were allocated to two treatment groups balanced by weight and supplemented with either 50 or 200 IU vitamin E for 5 weeks during the mating period (April 9 – May 14, 2008). Vitamin E was supplemented daily using a co-product based pellet fed at a rate of 1 lb per ewe. Mixed grass hay was available free-choice and the vitamin E level was 21 IU per pound. Four mature rams equipped with marking harnesses were used for each treatment group (1 ram:10 ewes). Rams selected for this study passed a breeding soundness exam including semen evaluation 2 wk prior to exposure. Breeding marks were observed daily and recorded by ewe eartag identification number. The source of ewes was from maternal lines selected for out of season reproductive success over several generations without exogenous hormones. Body weight, body condition scores, and serum vitamin E concentrations were determined prior to treatment and d 35 of the breed season. Vitamin E analyses for blood serum and feed ingredients were performed in a commercial laboratory located at a land-grant university.

Difference in least squares means for body weight, body condition scores (BCS), serum vitamin E and prolificacy that resulted from treatment were separated using the PDIFF option of SAS. Difference in least square means for reproductive performance including estrus activity and fertility data that resulted from treatment was separated by chi-square analysis.

RESULTS AND DISCUSSION

Reproductive performance data is given in Table 1. Level of vitamin E supplementation affected estrus activity (P = 0.0078) but not fertility or prolificacy. Even though estrus activity was higher for the vitamin E-50 ewes the result was a similar percent of ewes lambing and percent of lambs born and reared per ewe lambing. Out of season fertility and prolificacy data are similar to past reproductive performance results for this select line of ewes. As expected blood serum vitamin E concentration was higher (P = 0.001) for the vitamin E– 200 ewes after 5 wk, however all

treatment values were below 2 ug/ml the minimum serum vitamin E concentration suggested in the small ruminant NRC (2007) for adequacy.

The recommended vitamin E supplementation for breeding ewes using the sheep NRC (1985) is 6.8 IU per pound of dry matter, the small ruminant NRC (2007) suggests 2.4 IU vitamin E per pound of body weight for all classes of sheep. For ewes in this study the recommended daily supplemental vitamin E using sheep NRC (1985) guidelines is 34 IU and the small ruminant NRC (2007) computes to 336 IU.

Table 1. Reproductive performance of mature ewes supplemented with vitamin E at breeding

	Vit E-50	Vit E-200	SEM	*P* <
Number of ewes exposed	n = 41	n = 40		
Initial wt (lb)	137.9	137.5	2.88	0.95
(BCS)	(2.5)	(2.4)	0.04	0.78
Ending wt (lb)	146.5	145.6	2.47	0.84
(BCS)	(2.9)	(2.9)	0.04	0.89
Serum Vit. E level (μg/ml)				
Initial	0.74	0.79	0.02	0.22
Ending	0.92	1.59	0.05	0.001
Estrus Activity (%)				0.0078
None	2.5	24.4		
1st 17d period	70.7	57.5		
2nd 17d period	58.8	40.1		
1st mark	(41.6)	(62.5)		
Repeated	(58.4)	(37.5)		
1st and 2nd period	35.0	17.1		
Fertility (%)				0.95
Open	47.5	48.8		
Lambed	52.5	51.2		
Prolificacy per ewe lambing (%)				
Lamb born	138	143	0.09	0.97
Lambs reared	133	138	0.08	0.78

SHEEP 2014-6

Effect of level of soyhulls on finishing lamb growth efficiency and carcass merit

J.E. Held, R.D. Zelinsky, R. Beck, K. Bruns

OBJECTIVES

To determine the effects of soyhull (SH) based diets on finishing lamb growth performance, feed efficiency and carcass merit.

MATERIALS AND METHODS

Sixty Polypay and Hampshire sired wether lambs were allocated by weight and breed to 20 pens. Dietary treatments, SH-40, SH-60, SH-80 and SH-90 were each assigned randomly to five pens. Diets were balanced to have similar crude protein (14.5 %), metabolizable energy (1.41 Mcal/lb), and calcium:phosphorus ratio (2:1). Dietary ingredient composition for the diets offered in this trial is shown in Table 1. Diets were pelletized and offered through self-feeders for a 10 d adaptation and 56 d finishing period. Lamb growth performance, feed intake and the computed feed efficiency were based on weights recorded at initiation and termination of the 56 d finishing period. Lambs were harvested at a commercial packing plant, approximately 24 h later carcass data (hot carcass weight, fat thickness, body wall thickness, ribeye area and USDA yield and quality grades) were collected by trained lamb carcass evaluators.

Animal performance parameters and carcass data were analyzed statistically as a completely randomized design. The model accounted for variation that resulted from dietary treatment with pen as the experimental unit for animal performance parameters and individual lamb for carcass data. Difference in least squares means for these animal production and carcass parameters that resulted from treatment were separated using the PDIFF option of SAS. Linear and quadratic treatment relationships were tested on animal performance parameters.

RESULTS AND DISCUSSION

The level of SH in the dietary treatment did not affect lamb growth performance (ADG), feed intake (DMI) or feed efficiency (F:G) (Table 2). Although a quadratic relationship for level of SH was detected ($P = 0.021$) for ADG. Animal performance parameters are similar to the results in our previous lamb finishing trials with soyhull based diets. As shown in that study when a diet similar to SH-60 was offered at 90 % ad libitum to rumen fistulated wethers rumen pH dropped below 5.5 at 1 h post feeding and was greater than 5.5 at 4, 8 and 12 h post-feeding. In this same study when feeding a diet similar to SH-40 the lowest recorded rumen pH measurement was 5.7 at 1 h post feeding. Rumen pH less than 5.5 is considered the threshold for potential acidosis. Physical symptoms of acidosis or other digestive disturbances (bloat, dysentery) were absent in this finishing trial although for lambs with sub-clinical acidosis lower DMI and subsequent ADG

could have resulted. One lamb died during the trial from complications associated with urinary calculi.

Overall the DMI for the soyhull based diets was equivalent to 3.8 % of live body weight. A high level of intake has been reported in numerous lamb finishing research trials when soyhulls is the primary energy feed. The fiber fraction (NDF 60) of soyhulls ferments rapidly in the rumen and contributes to increased rate of passage compared to traditional finishing diets (corn plus protein pellet supplement). The F:G values shown in Table 2 are consistent with results from our previous lamb finishing trials with soyhull based diets and lambs of similar genotype and target finished weights. Compared to traditional lamb finishing diets the animal response to soyhull based diets has resulted in higher DMI and similar or lower ADG subsequently lower feed efficiency. Results from these past lamb finishing studies have consistently shown a F:G advantage for traditional diets equivalent to 1 lb of DM per lb of gain. Given these animal performance efficiencies a soyhull-based diet at $20 per ton less than a traditional diet would result in similar lamb finishing economics.

Table 3 show the carcass data including hot carcass weight, dressing percent, fat depth, body wall thickness, ribeye area, USDA quality and yield grades, and % BCTRC. Lambs finished on the treatment diets resulted in carcasses with treatment differences for dressing percent (P = 0.013), body wall thickness (P = 0.054) and % BCTRC (P = 0.076). Of the dependent variables in the regression equation to compute %BCTRC, carcass cutability, only differences were detected for body wall thickness. Dressing percent for SH-60 was higher by more than 2 % compared to the other treatment groups. It is difficult to explain biologically this treatment affect however it could be associated with differences in gut fill. Despite this advantage the SH-60 treatment has been shown in this study to promote numerically the lowest animal growth efficiency.

Table 1. Diet ingredient composition (% of DM)

Ingredient	SH-40	SH-60	SH-80	SH-90
Soybean hulls	40.0	60.0	79.0	88.5
Corn	37.0	21.8	7.0	----
DDGS	20.5	16.0	11.8	9.5
Limestone	1.0	0.8	0.8	0.5
Dical	0.5	0.5	0.5	0.5
TMS-Sheep[a]	0.5	0.5	0.5	0.5
Ammonium chloride	0.5	0.5	0.5	0.5
Decoquinate (6.6%)	0.1	0.1	0.1	0.1
Total	100	100	100	100

[a]Sodium chloride 92.6 ≤ 77.4%, zinc 0.9%, manganese 0.71%, iron 0.11%, iodine 90 ppm, cobalt 18 ppm, selenium 90 ppm, Vitamin A, D and E (2,000 IU/lb)

Table 2. Least square growth traits means for lambs offered soyhull based finishing diets

		Soyhulls (%)							
Trait	N[a]	SH-40	SH-60	SH-80	SH-90	SEM	P <	Linear	Quadratic
Initial wt (lb)	5	101.8	100.4	97.0	97.6	2.32	0.43	----	----
Final wt (lb)	5	139.0	131.6	130.0	134.0	3.36	0.29	----	----
ADG (lb/d)	5	0.67	0.52	0.60	0.65	0.042	0.27	0.89	0.021
DMI (lb/d)	5	4.32	3.94	4.57	4.69	0.25	0.12	0.073	0.18
Feed:Gain	5	6.45	7.58	7.62	7.21	0.52	0.18	0.28	0.11

[a]Five pens per treatment

Table 3. Least square carcass traits means for lambs finished on soyhull based finishing diets

		Soyhulls (%)					
Trait	N	SH-40	SH-60	SH-80	SH-90	SEM	P <
HCW (lb)	58	73.20	71.60	68.10	69.80	0.930	0.240
DP (%)	58	52.6[a]	54.40[b]	52.30[a]	51.80[a]	0.290	0.013
FD (in)	54	0.30	0.27	0.23	0.28	0.012	0.220
REA (in)	54	2.91	2.76	2.85	2.67	0.038	0.140
BW (in)	54	1.09[c]	0.99[d]	0.93[d]	1.00[cd]	0.020	0.054
USDA YG	54	3.40	3.10	2.70	3.20	0.120	0.220
USDA QG	58	3.10	3.00	3.00	3.10	0.024	0.580
BCTRC (%)	54	45.10[c]	45.50[cd]	46.20[d]	45.20[c]	0.152	0.076

[ab]Means with different superscripts differ P < 0.05.
[cd]Means with different superscripts differ P < 0.10.
HCW = Hot carcass weight.
DP = Dressing percent.
FD = Fat depth (midpoint of ribeye at 12-13th rib).
REA = Rib eye area (12-13th rib).
BW = Body wall thickness (measured 4.3 in from center of spine).
BCTRC = Boneless-closely trimmed retail cuts = 49.936 – (0.0848 x HCW) – (4.376 x BF) – (3.530 x BW) + (2.456 x REA).

SHEEP 2014-7

Effects of glycerol and sire breed on growth and carcass traits of finishing wether lambs

R. M. Beck, A. E. Wertz-Lutz, C. L. Wright, J. E. Held, R. D. Zelinsky, C. L. Delvaux

OBJECTIVES

To evaluate crude glycerin as an energy source for finishing lambs and to determine the effect of sire breed on finishing lamb growth performance and carcass characteristics. In light of previous research, the hypothesis for this experiment was that glycerol would have an energy value similar to that of corn when fed in high concentrate diets to finishing lambs.

MATERIALS AND METHODS

The trial consisted of seventy-two crossbred wether lambs of two different sire breeds, Hampshire or Southdown. Body weights, feed intake and carcass data were recorded in order to determine if substituting 0, 5, or 10% glycerol for corn had an impact on average daily gain, feed efficiency, and carcass characteristics. Experimental design was a 2 x 3 factorial arrangement of treatments to determine the effects of sire breed and replacing corn with glycerol on growth performance and carcass characteristics. Wethers were separated by sire breed and randomly assigned to 24 pens, with 3 lambs per pen, such that initial body weights were similar among pens within a breed (initial BW Hampshire 34.7 ± 0.3 kg, Southdown 32.2 ± 0.3 kg). Glycerol treatments were assigned to 4 pen replicates by sire breed. The control diet ingredients consisted mainly of soyhulls and corn, and treatment diets were similar with the exception of replacing 5 or 10% of the corn in the diet with glycerol (Table 1). All diets were pelletized to reduce sorting and offered ad libitum using self-feeders. Diets were not formulated to be isonitrogenous, as glycerol does not contain any crude protein to replace that lost by removing corn from the diet, but they met or exceeded the animals requirement (NRC, 2007). Diets were formulated to be isocaloric by assuming that glycerol has an energy value similar to corn. The formulated composition of the diets is shown in Table 2. Body weights were recorded at 21-d intervals, with initial and final weights the average of 2 consecutive-day weights. Lambs were harvested at the Iowa Lamb Corporation facility (Hawarden, IA) after 64 d on feed and carcass data was recorded after a 24-h chill.

Experimental design was a completely randomized design with a 2 x 3 factorial arrangement of treatments. Growth performance data were analyzed for the main effects of dietary treatment, breed, and the interaction between dietary treatment and breed using the GLM procedure of SAS with pen as the experimental unit. Means were separated using the LSMEANS statement with the PDIFF option in SAS. Carcass data were analyzed for the main effects of dietary treatment, breed, and the interaction between dietary treatment and breed using the GLM procedure of SAS with animal as the experimental unit. Means were separated using the LSMEANS statement with

the PDIFF option in SAS, and frequency of quality grades was separated using Chi-squared analysis. Significance was declared at $P \leq 0.05$.

RESULTS AND DISCUSSION

Sire breed did have an effect on overall growth performance of the lambs. Hampshire-sired lambs had heavier initial and final weights and a higher average daily gain (ADG) than Southdown-sired lambs (Table 3). Dietary treatment had no significant effects on growth performance of the lambs. Initial and final body weights, ADG, dry matter intake (DMI), and feed efficiency (G:F) were not different among glycerol treatments (Table 4). There was no interaction between sire breed and dietary treatment.

Sire breed also affected carcass characteristics of the lambs. Hampshire-sired lambs had heavier hot carcass weights (HCW), less subcutaneous fat, and lower yield grades than Southdown-sired lambs (Table 5). Hampshire-sired lambs also tended to have larger longissimus muscle area than Southdown-sired lambs *(P* = 0.07). Dietary treatment did not have an effect on carcass characteristics of the lambs. Hot carcass weight, subcutaneous fat thickness, body wall thickness, longissimus muscle area, and yield grade were all similar among treatments (Table 6). Again, the interaction between dietary treatment and sire breed was not significant.

As expected, sire breed did affect lamb growth performance and carcass traits. Hampshire-sired lambs exhibited heavier live weights and higher ADG than Southdown-sired lambs in the growth performance trial. However, it is important to note that feed efficiency was not significantly different between the two sire breeds, indicating that Southdown-sired lambs grew as efficiently as Hampshire-sired lambs. Measurements of carcass characteristics revealed that Hampshire-sired lambs had heavier HCW, less subcutaneous fat, lower yield grades, and a tendency to have larger longissimus muscle area than Southdown-sired lambs. Chi-squared analysis also indicated that Hampshire-sired lambs had a lower incidence of grading Prime than Southdown-sired lambs *(P* = 0.02).

Growth performance and carcass characteristics were not affected by replacing up to 10% of corn in the diet with glycerol. These results support the initial hypothesis for this experiment that glycerol has an energy value similar to that of corn when fed in high concentrate diets to finishing lambs. Utilizing glycerol in finishing lamb diets may help producers save money on feed input costs however more research in this area would provide additional insight as to the advantages and disadvantages of feeding glycerol to ruminants.

Table 1. Ingredient composition of diets (DM basis)

	Glycerol (%)		
Ingredient	0	5	10
Soybean hulls	25.0	25.0	25.0
Corn	62.4	57.4	52.4
Glycerol	0.0	5.0	10.0
Soybean meal	10.0	10.0	10.0
Supplement[a]	2.6	2.6	2.6

[a]Contains 0.5% urea, 1.0% limestone, 0.5% ammonium chloride, 0.1% decoquinate, 0.5% sheep trace mineral salt.

Table 2. Formulated dietary composition (DM basis)

	Glycerol (%)		
Formulated composition	0	5	10
DM (%)	88.10	88.60	89.10
CP (%)	13.73	13.34	12.96
DIP (%)	60.86	61.25	61.66
ME (mcal/kg)	3.04	3.04	3.04
NDF (%)	22.66	22.20	21.75
ADF (%)	13.90	13.79	13.67
Ca (%)	0.60	0.60	0.60
P (%)	0.23	0.22	0.21

Table 3. Effect of sire breed on growth performance of lambs

	Sire breed			
Item	Hampshire	Southdown	SEM	P <
Initial BW (kg)	34.70	32.20	0.27	0.001
Final BW (kg)	57.90	53.40	0.82	0.001
ADG (kg)	0.36	0.33	0.01	0.05
DMI (kg/d)	1.55	1.51	0.05	0.53
G:F (kg)	0.23	0.22	0.01	0.16

Table 4. Effect of dietary treatment on growth performance of lambs

	Glycerol (%)				
Item	0	5	10	SEM	P <
Initial BW (kg)	33.5	33.7	33.2	0.33	0.57
Final BW (kg)	56.6	54.8	55.7	1.00	0.43
ADG (kg)	0.36	0.33	0.35	0.01	0.24
DMI (kg/d)	1.58	1.47	1.53	0.06	0.40
G:F (kg)	0.23	0.23	0.23	0.01	0.90

Table 5. Effect of sire breed on carcass characteristics of lambs

	Sire breed			
Item	Hampshire	Southdown	SEM	P <
HCW (kg)	33.96	29.33	0.42	0.02
Fat (cm)	0.51	0.66	0.04	0.01
BWTH (cm)	2.82	2.90	0.07	0.44
LM area (cm^2)	19.48	18.06	0.21	0.07
YG	2.80	3.20	0.12	0.01

HCW = Hot carcass weight.
BWTH = Body wall thickness.
LM = Longissimus muscle.
YG = USDA yield grade.

Table 6. Effect of dietary treatment on carcass characteristics of lambs

	Glycerol (%)				
Item	0	5	10	SEM	P
HCW (kg)	30.50	33.12	32.66	0.51	0.53
Fat (cm)	0.56	0.53	0.64	0.04	0.33
BWTH (cm)	2.90	2.84	2.87	0.08	0.93
LM area (cm^2)	18.77	18.83	18.64	0.26	0.98
YG	3.00	2.90	3.10	0.15	0.76

HCW = Hot carcass weight.
BWTH = Body wall thickness.
LM = Longissimus muscle.
YG = USDA yield grade.

SHEEP 2014-8

Effect of EAZI-BREED CIDR on reproductive efficiency in seasonally anestrous mated ewes (Year 1)

J.E. Held, R.D. Zelinsky, K. Bruns, A. Kolthoff

BACKGROUND

Improving flock reproductive efficiency and management through eliciting estrus in seasonally anestrous ewes is a high priority in intensively managed commercial sheep operations and the industry's 2Plus initiative. The commercial progesterone intravaginal device, EAZI-BREED CIDR (controlled internal drug release device), provides a new technology to the sheep industry for induction of estrus in ewes during seasonal anestrous.

Studies have demonstrated that during the ewe's anestrous period various hormone treatment protocols can induce a synchronized estrus response. Previous work with progesterone treatment for periods of 6 to 14 days resulted in synchronized estrus activity, for most studies treatment duration was 12 -14 days. The EAZI-BREED CIDR was approved with a recommended insertion period of 5 days.

The sheep CIDR was developed in New Zealand during the late 1980's, it is simple to apply and has proven efficacy. Utilizing the sheep CIDR in reproductive management decisions for ewes during the seasonal anestrous period in Upper Midwest commercial sheep flocks has potential to improve overall flock reproductive efficiency.

OBJECTIVES

To demonstrate the use of the EAZI-BREED CIDR in ewe reproductive management, and evaluate the effect of EAZI-BREED CIDR insertion period of 6 or 12 d on reproductive efficiency in seasonally anestrous ewes in the Upper Midwest.

MATERIALS AND METHODS

A study was conducted at the South Dakota State University Sheep Unit with one-hundred sixty-two Polypay sired ewes they were randomly allocated to CIDR treatment, 6 d or 12 d, by season of birth, age, body weight and body condition score. All ewes received an intravaginal EAZI-BREED CIDR (0.3 mg progesterone) on April 28, 2010. Animals were comingled until CIDR removal for 6 d treatment ewes, they were penned separate from the 12 d treatment ewes until the conclusion of the experiment. Treatment groups were exposed to fertile yearling and mature rams at the time of CIDR removal for 4 days then removed, 15 days later rams were introduced for 6 days. No teaser or intact rams were exposed to ewes until CIDR removal, during the ram exposure periods the ewe to ram ratio was 8:1. Each ram was fitted with a breeding harness to facilitate the recording of

mating (estrus) activity with treatment ewes individually identified with duplicate permanent ear tags. Ewe fertility (lambing success or failure) and prolificacy were recorded at lambing in the fall of 2010.

Difference in CIDR retention and reproductive performance including estrus activity and ewe fertility data resulting from treatment were separated by chi-square analysis. Differences in least square means for age, ewe body weight and body condition score, and lambs born per ewe exposed were separated using the PDIFF option of SAS.

RESULTS AND DISCUSSION

CIDR retention and reproductive performance data are reported in Table 1. CIDR insertion period resulted in similar level of retention, estrus activity, ewe fertility and lambs born per ewe exposed. Overall the percentage of CIDR retention was 91%, there were no treatment differences for this parameter in the study but the retention rate was below previously reported levels at 95% or higher. Estrous activity (1st service) and ewe fertility treatment affects were similar whether or not accounting for CIDR retention. Our reported data for these variables exclude ewes that lost the CIDR. Estrus activity (ram breeding marks) in the1st service for 6 d and 12 d CIDR insertion was similar (P = 0.70), average 76.5%. These results are similar to data reported by other investigators comparing short duration (5 d) insertion with or without additional exogenous hormone treatment. In our study the percentage of ewes exhibiting estrus activity in the 2nd service was 28.9%, yet further data analysis is necessary to evaluate treatment affects during this service period and for both ram exposure periods. Ewe fertility was similar (P = 0.72) for the 6 d and 12 d CIDR insertion treatments with 71%, or 106 of 149 ewes lambing in the fall of 2010. Other studies using various progesterone protocols to induce estrus in seasonally anestrous ewes report lower or a similar level of ewe fertility. The number of lambs born per ewe exposed was also similar (P = 0.22), 1.01 $\pm$ 0.80 for 6 d and 0.86 $\pm$ 0.75 for 12 d, the prolificacy was 140 % compared to 133 % for the 6 d and 12 d treatments, respectively. Age (P = 0.59, 2.3 $\pm$ 1.3 6 d vs 2.2 $\pm$ 1.1 12 d), ewe body weight (lb) (P = 0.52, 144.8 $\pm$ 27.9 6 d vs 145.6 $\pm$ 27.8 12 d) and body condition score (P = 0.87, 2.7 $\pm$ 0.6 6 d vs 2.8 $\pm$ 0.7 12 d) were similar across treatments.

Table 1. CIDR retention and reproductive performance of seasonally anestrous ewes treated with the EAZI-BREED sheep CIDR for either 6 or 12d

Item	6-d	(%)	12-d	(%)	Overall	(%)	P <
Number of ewes	81		81		162		
Retention	76	(93.8)	73	(90.1)	149	(91.9)	0.33
Estrus Activity							
1st Service	55	(72.3)	59	(80.8)	114	(76.5)	0.70
2nd Service	19	(25.0)	24	(32.9)			
Ewe Fertility	55	(72.3)	51	(69.9)	106	(71.2)	0.72

SHEEP 2014-9

Effect of EAZI-BREED CIDR on reproductive efficiency in seasonally anestrous mated ewes (Year 2)

J.E. Held, R.D. Zelinsky, A. Kolthoff, K. Bruns

BACKGROUND

Improving flock reproductive efficiency and management through eliciting estrus in seasonally anestrous ewes is a high priority in intensively managed commercial sheep operations and for the industry's 2 Plus initiative. The commercial progesterone intravaginal device, EAZI-BREED CIDR (controlled internal drug release device), provides a new technology to the sheep industry for induction of estrus in ewes during seasonal anestrous.

Previous work conducted with seasonally anestrous ewes receiving exogenous progesterone treatment of 5 to 14 d resulted in synchronized estrus activity. Studies conducted to gain US approval for the EAZI-BREED CIDR demonstrated that a 5 d insertion period succeeded in synchronized estrus activity for seasonally anestrous ewes.

The sheep EAZI-BREED CIDR was developed in New Zealand during the late 1980's and is simple to apply and has proven efficacy. Implementing the sheep CIDR technology to intensive management systems has the potential to enhance overall flock management, and ease facility and labor requirements. The US sheep industry "2 Plus initiative" goals include improved flock efficiencies and to attract new sheep producers. This technology has the potential to positively impact these goals.

OBJECTIVES

To demonstrate the use of the EAZI-BREED CIDR in ewe reproductive management, and evaluate the effect of EAZI-BREED CIDR insertion period of 6 or 12 d on reproductive efficiency in seasonally anestrous ewes in the Upper Midwest.

MATERIALS AND METHODS

A study was conducted at the South Dakota State University Sheep Unit with one-hundred fifty-three Polypay or Hampshire sired ewes that were randomly allocated to CIDR treatment by age and body weight. Treatments were control (no CIDR), 6 d and 12 d with or without ram exposure during CIDR insertion period. All ewes received an intravaginal EAZI-BREED CIDR (0.3 mg progesterone) on May 4, 2011. Animals were held in separate treatment group pens until CIDR removal; control ewes were commingled with the 6 d ewes at the time of CIDR removal. Both 12 d treatment groups were joined with the control and 6 d ewes at CIDR removal. Treatment groups were exposed to fertile yearling and mature rams, Polypay and Hampshire,

according to study protocol using a ewe to ram ratio of 8:1 for 30 d. Each ram was fitted with a breeding harness to facilitate the recording of mating (estrus) activity with treatment ewes individually identified with duplicate permanent ear tags. Ewe fertility (lambing success or failure) and prolificacy were recorded at lambing in the fall of 2011.

Difference in CIDR retention and reproductive performance including estrus activity and ewe fertility and performance data resulting from treatment were separated by chi-square analysis.

RESULTS AND DISCUSSION

Data found in Table 1 represents CIDR retention, estrous activity and reproductive performance data for mature ewe response to treatment (n = 112). There were 2010 fall born ewe (n = 41) lambs distributed across treatments however none demonstrated estrus activity subsequently they were removed from further analysis and discussion. CIDR insertion period resulted in similar level of retention, estrous activity, ewe fertility and lambs born per ewe lambing. Overall the percentage of CIDR retention was 85%. There were no treatment differences for this parameter in the study but the retention rate was below our previously reported level at 91%. Ewes that failed to retain CIDR were removed from the analysis of estrous activity and reproductive performance.

Estrous activity (1st service) was different ($P < 0.01$) when comparing all treatments and for CIDR treatments only ($P = 0.05$). For the 1st service period, CIDR treatment resulted in estrous activity in 94% of the ewes compared to 50% for control ewes. Comparing within CIDR treatment groups there was an exceptional rate of response with nearly all ewes in the 6 d and 12 d CIDR groups exhibiting estrous activity however the lowest response (84.6%) was observed with the 12 d CIDR w/ram.

Also in Table 1 the observed estrous activity is also reported by service period: 1st or 2nd only, both (1st and 2nd) and neither (no marks). In the 1st service period only there was a difference ($P < 0.01$) in estrous activity. The overall response rate was 81.7% with the control ewes at 27.8%, a tendency was shown ($P < 0.07$) for CIDR treatment. In the 2nd service period the CIDR treatment groups had just 1 ewe, or 1.2%, recorded for estrous activity compared to control with 3 ewes, or 16.7% ($P = 0.02$). Estrous activity to CIDR treatment in both service periods was 12% (n = 10) with only 1 ewe observed with the 6 d treatment ($P = 0.18$). Less than 5% of the CIDR treatment ewes failed to demonstrate estrous activity in neither period during the study ($P = 0.14$). The control group had the highest proportion of neither (non-marked ewes) at 33% (n = 6). Based on data collected in this study CIDR treatment resulted in a high proportion of ewes demonstrating estrous activity in the 1st service opportunity with a relatively low number of ewes repeating an estrous cycle in the 2nd service period. The number of ewes marked in both service periods was lower than an SDSU study reported in 2011 and in studies reported by other investigators with 2nd service observations at approximately 25%.

Ewe fertility was similar ($P = 0.52$) for all treatments although the control ewes at 50% were numerically lower than for CIDR treatment at 68.3%. CIDR treatment did not affect ewe fertility ($P = 0.97$). The results with CIDR treatment are similar to a previous SDSU study with 6 d and 12 d CIDR insertion resulting in ewe fertility at 71%. Other studies using various progesterone

based protocols to induce estrus in seasonally anestrous ewes report lower or a similar level of ewe fertility. In the current study the lambing rate per lambing resulting from CIDR treatment was similar (P = 0.90), 1.55 for 6 d, 1.55 for 12 d and 1.44 for 12 d w/ram, respectively. Although no differences (P = 0.36) in lambing rate was found comparing all treatments the control group lambing rate was 200%. Mature ewe age and body weight were similar across treatments.

Table 1. CIDR retention and reproductive performance of seasonally anestrous ewes treated with the EAZI-BREED sheep CIDR for 6 d, 12 d and 12 d w/ram

	Control	6-d	12-d	12 d w/ram	CIDR Trts	Chi-sq All Trt	Chi-sq CIDR Trt
Number of ewes	18	33	32	32	97		
CIDR lost	NA	7	2	6	15 (15.5%)	NA	
Retention		26 (78.8%)	30 (93.8%)	26 (81.3)	82 (84.5%)	NA	P = 0.20
Estrous activity							
1st service	9 (50%)	26 (100%)	29 (96.7%)	22 (84.6%)	77 (93.9%)	P < 0.01	P = 0.05
1st only	5 (27.8%)	25 (96.1%)	23 (76.7%)	19 (73.1%)	67 (81.7%)	P < 0.01	P = 0.07
2nd only	3 (16.7%)	0 (0%)	0 (0%)	1 (3.9%)	1 (1.2%)	P = 0.02	P = 0.33
Both	4 (22.2%)	1 (3.9%)	6 (20.7%)	3 (11.5%)	10 (12.2%)	P = 0.23	P = 0.18
Neither	6 (33%)	0 (0%)	1 (3.3%)	3 (11.5%)	4 (4.8%)	P = 0.02	P = 0.14
Ewe fertility	9 (50%)	18 (69.2)	20 (66.7%)	18 (69.2%)	65 (68.3%)	P = 0.52	P = 0.97
Prolificacy	200%	155%	155%	144%	158%	P = 0.36	P = 0.90

SHEEP 2014-10

Effect of EAZI-BREED CIDR on reproductive efficiency in seasonally anestrous mated ewes (Year 3)

J.E. Held, A. Kolthoff, K. Bruns

BACKGROUND

Improving flock reproductive efficiency and management through eliciting estrus in seasonally anestrous ewes is a high priority in intensively managed commercial sheep operations and for the industry's 2 Plus initiative. The commercial progesterone intravaginal device, EAZI-BREED CIDR (controlled internal drug release device), provides a new technology to the sheep industry for induction of estrus in ewes during seasonal anestrous.

Previous work conducted with seasonally anestrous ewes receiving exogenous progesterone treatment of 5 to 14 d resulted in synchronized estrus activity. Studies conducted to gain US approval for the EAZI-BREED CIDR demonstrated that a 5 d insertion period succeeded in synchronized estrus activity for seasonally anestrous ewes.

The sheep EAZI-BREED CIDR was developed in New Zealand during the late 1980's and is simple to apply and has proven efficacy. Implementing the sheep CIDR technology to intensive management systems has the potential to enhance overall flock management, and ease facility and labor requirements. The US sheep industry "2 Plus initiative" goals include improved flock efficiencies and to attract new sheep producers. This technology has the potential to positively impact these goals.

OBJECTIVES

To demonstrate the use of the EAZI-BREED CIDR in ewe reproductive management 6 d, 9 d, or 12 d insertion of the EAZI-BREED CIDR on seasonally anestrous ewes in the Upper Midwest.

MATERIALS AND METHODS

A study conducted at the South Dakota State University Sheep Unit consisting of 60 mature Polypay or Hampshire sired ewes were randomly allocated to one of four treatments by age and genotype. Treatments for the study were control (no CIDR), 6 d, 9 d, and 12 d insertion periods. Ewes designated to CIDR insertion received an intravaginal EAZI-BREED CIDR (0.3 mg progesterone) on April 27, 2012. Ewes were housed in a single drylot pen with shelter during the ram exposure portion of the trial; exposure began on May 3 following CIDR withdrawal from the 6 d treatment group and remained joined with the flock for 30 days. Four fertile yearling and mature rams, Polypay and Hampshire, joined the flock providing a ewe to ram ratio of 7.5:1. The ratio is based on 30 ewes, control (n = 15) and a CIDR treatment (n = 15) group, the maximum

number expected to demonstrate estrus activity during any period of the trial. Rams were fitted with a breeding harness to facilitate the recording of mating (estrus) activity with ewes individually identified with duplicate permanent ear tags. Ewe fertility (lambing success or failure) and prolificacy were recorded at time of parturition in the fall of 2012.

Difference in CIDR retention and reproductive performance including estrus activity, ewe fertility and prolificacy data resulting from treatment were separated by chi-square analysis.

RESULTS AND DISCUSSION

Results reported in Table 1 include the CIDR retention, estrus activity, and prolificacy (lambs born per ewe lambing) data for ewe response to treatment. CIDR retention was 93% with no difference detected for days of CIDR insertion. In our previous CIDR studies retention levels were even lower, 85 to 91%, yet there too no differences were found due to treatment. Other investigators that have studied CIDR use in ewe reproductive management report 95% retention success. In the current study ewes (n = 3) that failed to retain the CIDR were removed from the analysis of estrus activity and reproductive performance.

Estrus activity (1^{st} service) was different ($P < 0.01$) when compared across all treatments. The observed control group estrus activity was 40% compared to 95% for CIDR treatment groups over the 1^{st} 15 days of the trial. No difference in estrus activity was found for CIDR treatment. For the ewes that retained the CIDR during the trial (n = 42) only 2 ewes did not mark to a ram.

Other findings reported on estrus activity found in Table 1 include data analyzed by service period 1^{st} or 2^{nd} only, both (1^{st} and 2^{nd}) , or neither (no marks). CIDR treatment did affect ($P = 0.03$) the proportion of ewes that mated following CIDR withdrawal, 1^{st} only, and a tendency ($P = 0.06$) for ewes marked by rams in both service opportunities in this trial. Over 90% of the ewes in the 9 d group marked on the 1^{st} service where for the 6 d and 12 d treatment ewes approximately 50% marked on the 1^{st} only and at least 33% marked in both service opportunities. Despite these observations on estrus activity there were no differences ($P = 0.35$) on ewe fertility. For the ewes in CIDR treatment groups only 3 of 42 ewes, or 7.1%, failed to lamb in the fall of 2012. The observations for estrus activity of the control ewes, ram exposure without exogenous hormone treatment, are consistent with expectations from the “ram effect”. The percentage of control ewes lambing (46%) were similar to past reproductive performance with the same genotype and exposure protocol. Despite the variability in ewe prolificacy, ranging from 1.3 to 1.6 lambs born per ewe lambing, there were no difference when compared across all treatments ($P = 0.72$) or CIDR treatment ($P = 0.58$).

Table 1. CIDR retention and reproductive performance of seasonally anestrous ewes treated with the EAZI-BREED sheep CIDR for 6 d, 9 d and 12 d

	Control	6-d	9-d	12 d	CIDR Trts	Chi- sq All Trt	Chi-sq CIDR Trt
Number of Ewes	15	15	15	15	45		
CIDR Lost	NA	0	2	1	3		
Retention		15 (100%)	13 (86.7%)	14 (93.3%)	42 (93.3%)	NA	P = 0.34
Estrous Activity	n = 15	n = 15	n = 13	n = 14	n = 42	n = 57	
1st Service	6 (40.0)%	14 (93.3%)	13 (100%)	13 (92.9%)	40 (95.2%)	P < 0.01	P = 0.62
1st Only	1 (6.7%)	9 (60.0%)	12 (92.3%)	6 (42.9%)	27 (64.3 %)	P < 0.01	P = 0.03
2nd Only	5 (33.3%)	0 (0%)	0 (0%)	1 (7.1%)	1 (2.4%)	P < 0.01	P = 0.36
Both	5 (33.3%)	5 (33.3%)	1 (7.7%)	7 (50.0%)	13 (31.0%)	P = 0.13	P = 0.06
Neither	4 (26.7%)	1 (6.7%)	0 (0%)	0 (0%)	1 (2.4%)	P = 0.04	P = 0.40
Ewe Fertility	7 (46.7%)	14 (93.3%)	13 (100%)	12 (85.7%)	39 (92.9%)	P < 0.01	P = 0.35
Prolificacy (%)	128.6	128.5	161.5	141.7	143.1	P = 0.72	P = 0.58

SHEEP 2014-11

Effect of sorting and feeding management practices on finished lamb shrink loss

K. Manthei, J.E. Held, A. Kolthoff, K. Bruns

BACKGROUND

In the Upper Midwest public auction sale barns and direct marketing (packer buying stations) are the primary methods to sell sheep and lambs. They are generally sold on a live weight basis (lbs) with prices reported in dollars per hundred weight ($/cwt). Therefore the economic return to the producer is based on the live weight at the point of sale. Typically sheep are transported to a location and weighed immediately before being sold, referred to as the pay weight, or final weight. For public auction barns there is typically a time lag between delivery and weighing, which ranges from an overnight stand to a few hours after arrival at the sale facility. With packer buying stations the animals are off-loaded then moved directly to a weigh scale. Using either marketing option is expected to result in a fair market value of the animal, "price discovery". Yet another common denominator between these marketing options is a natural phenomenon called shrink loss. Further defined, shrink loss is the difference measured between the initial body weight at the farm and the pay weight. Since pay weight is used to compute the value of the animal, minimizing loss is imperative to maximize animal market value. The sources of shrink loss include excrement, body fluids and tissue dehydration.

Industry experts estimate shrink loss for market ready lambs (120-150 lbs) at approximately 4%, but a wide array of factors results in a range of 1 to 6 percent. Studies focused on livestock shrink loss have determined that distance traveled is a significant factor, with most shrink loss expected to occur in the initial 25 to 50 miles of transport. Yet little information is published evaluating the impact of common pre-marketing sorting, comingling and feed management practices on shrink loss for finished weight lambs. Thus, a study was designed to measure the effect of common pre-marketing management practices on shrink loss in finished weight lambs before and after transport.

OBJECTIVES

To determine the effect of common pre-marketing sorting and feeding management practices on finished lamb shrink loss.

MATERIALS AND METHODS

A study was conducted at the South Dakota State University sheep unit on March 14-15, 2013 to evaluate shrink loss with finished weight, fall born Hampshire sired and Polypay lambs (n = 44). All lambs were offered a finishing lamb diet ad libitum and comingled for more than 60 days before the pre-trial weight was recorded and lambs designated to treatment. On March 14 at

5:00PM (CST) lambs were weighed, pre-trial weight, then were randomly allocated by weight and sex of animal (wether and ewe) to treatment: control (C; n = 14), sorted on feed (SF; n = 15) and sorted on hay (SH; n = 15). These treatments correspond to common sheep industry finished lamb marketing management practices. The control lambs were housed in the original pen they had occupied for more than 60 days with ad libitum access to a finishing lamb diet and water, SF lambs were weighed then moved to a different pen and had ad libitum access to the lamb finishing diet and water, the SH lambs were also moved to a different pen with ad libitum access to hay and water. On March 15 at 8:00AM (CST) all lambs were weighed to record a post-sort weight then loaded onto a livestock trailer (8' x 24') and hauled for 50 miles. Following the transportation process lambs were off-loaded and weighed to determine a final weight.

Differences in shrink loss resulting from sorting, comingling and feed management treatments were analyzed by the GLM (general linear model) procedure of SAS. Differences in least square means for shrink loss were separated using the PDIFF option of SAS.

RESULTS AND DISCUSSION

Results for shrink loss associated with sorting and comingling are reported in Table 1. Total shrink loss and shrink due to sorting were greater ($P < 0.01$) for the lambs in the sorted on feed (SF) treatment compared to control lambs. The lambs in the control group (C) had less than 1% body weight change during the trial. In contrast, the lambs in the SF group had 3.5% total shrink loss. The SF treatment resulted in a 7 fold increase in total shrink loss, the majority of body weight loss (> 75% of total shrink loss) occurred in the 15 h period before transport. It is a common management practice for producers to sort market ready finished lambs into a different pen overnight prior to transport to direct marketing or public auction sale barn marketing options. Based on our data the ideal management practice to minimize shrink loss and subsequently improve economic return is to sort finished weight lambs from the feeding pen immediately before transport.

Results for shrink loss due to changes in sorting and feed management are shown in Table 2. No difference ($P = 0.73$) was shown for total shrink loss in lambs that were sorted to different pens then given access to the lamb finishing diet ad libitum (SF) compared to those with ad libitum access to hay (SH). The total shrink loss was 3.5% vs. 3.7% for SF and SH lambs, respectively. Since the SF lamb finishing diet was identical to that offered for the past 60 d with proven nutritional qualities and high palatability characteristics compared to the modest quality hay offered to SH lambs, it was surprising to find no difference due to feed management treatment.

A summary of the economic relevance of the total shrink loss can be illustrated by computing the effect on lamb return ($/head). Using current live finished lamb prices at $106/cwt the SF and SH lambs would return $4 to $5 less per head, respectively, than C lambs due to differences in shrink loss. Another method to express the economic impact of shrink loss is to determine the finished lamb prices for SF ($113/cwt) and SH ($117/cwt) lambs that equals the return when C lambs are priced at $106/cwt.

Based on data from this study, the management practice that results in the least lamb shrink loss is sorting and loading immediately prior to transportation to a marketing destination. Conversely,

when lambs are sorted into a different pen overnight expect substantially higher shrink loss independent of feed management decisions. Although transport is an important source of shrink loss we have shown that on-farm management decisions can have the greatest impact.

Table 1. Effect of sorting and comingling on shrink loss

Item	Control n = 14	Sorted on feed n = 15	P <
Pre-trial wt (lb)	136.8	137.4	0.88
Post sort wt (lb)	136.5	133.7	0.49
Shrink from sorting (%)[a]	0.2	2.7	< 0.01
Wt. after hauling (lb)	135.9	132.6	0.42
Total shrink (%)[b]	0.6	3.5	< 0.01

[a]Shrink from sorting = (1 - (Post sort wt / Pre-trial wt)) * 100

[b]Shrink from sorting and hauling = (1 - (After hauling wt / Pre-trial wt)) * 100

Table 2. Effect of sorting and feed management on shrink loss

Item	Sorted on feed n = 15	Sorted on hay n = 15	P <
Pre-trial wt (lb)	137.4	135.7	0.71
Wt. after hauling (lb)	132.6	130.7	0.67
Total shrink (%)[a]	3.5	3.7	0.73

[a]Shrink from sorting and hauling = (1- (After hauling wt / Pre-trial wt)) * 100

SHEEP 2014-12

Dry matter intake, feed efficiency and animal growth response to treated corn stover inclusion in lamb finishing diets

P.L. Redding, A. Kolthoff, J.E. Held and K. Bruns

BACKGROUND

The struggle to maintain the balance between concentrate and roughage concentration in finishing diets while optimizing animal performance and preventing digestive disorders continues to be a subject of concern in modern livestock feeding operations. High concentrate diets increase propionate production, the only gluconeogenic VFA and the most efficient at converting feed energy to energy useable by ruminants. However, in order to maintain rumen function and keep dry matter intakes up, a minimum amount of fiber/roughage must be present in the diet. Due to the rising cost of standard livestock feeds over the past decade, there has been an increased interest in using nontraditional feeds sources to offset rising costs of traditional feeds. Corn stover (harvest residue consisting of cobs, stalks, husks, and leaves) is a source of crude fiber comparable to that of traditional hays (NRC, 2007). Already used in the Great Plains as a source of winter grazing for livestock, corn stover's functionality as a fiber source in growing-finishing diets has not been greatly explored.

OBJECTIVES

To evaluate the effect of varying levels of treated corn stover on the dry matter intake and growth performance of growing lambs.

MATERIALS AND METHODS

This trial was conducted at the South Dakota State University Sheep Unit with forty-eight crossbred lambs (initial BW 89.33 ± 9.26 lb). Lambs were blocked by weight into a light block and a heavy block. Within each block, lambs were assigned to one of eight pens resulting in three lambs per pen and sixteen total pens. Pens were assigned one of four dietary treatments resulting in 4 pens per treatment or 2 pens per treatment by block. Lambs were housed in outdoor, dirt lot research pens (3.66 X 4.88 m).

Dietary treatments (Table 1) were increasing amounts (0, 10, 20, and 40% CST DM basis) of treated corn stover blend that was pelleted and balanced to be isonitrogenous and have similar metabolizable energy values. All diets were formulated to meet or exceed NRC nutritional requirements. The CST stock product was prepared by Iowa Biofibers (IABF Harlan, IA), and shipped to SDSU in pellet form. The CST was reconstituted and pelletized with the ingredients listed in the formulations shown in Table 1. All treatment diets were offered as completely pelletized.

Table 1. Dietary Treatments

	% of Diet, DM basis			
Item	Control	10%CST	20%CST	40%CST
Alfalfa Pellets	27.05	0.00	0.00	0.00
Soy Hulls	50.00	66.80	56.52	38.15
CST[a]	0.00	12.80	25.48	50.95
SBM	0.00	0.00	0.00	0.00
DDGS	20.00	17.30	15.50	9.05
Micro Mix	0.25	0.25	0.25	0.25
Biuret	0.20	0.35	0.25	0.10
Dical	0.40	0.40	0.40	0.40
Limestone	1.00	1.00	0.50	0.00
White Salt	0.50	0.50	0.50	0.50
Deccox	0.10	0.10	0.10	0.10
NH_4CL	0.50	0.50	0.50	0.50
	Analyzed Nutrient Composition (AS-is Basis)			
%DM	90.5	89.3	88.9	87.9
	Analyzed Nutrient Composition (DM Basis)			
%CP	18.7	19.0	19.9	18.9
%ASH	7.1	6.7	7.6	8.9
%Ca	1.2	1.1	1.1	1.1
%P	0.4	0.4	0.4	0.4
%NDF	53.6	52.9	52.0	53.0
%ADF	41.3	40.5	38.5	38.1
	Calculated Nutrient Composition (DM Basis)			
%DIP	61.4	62.5	64.5	70.4
ME (Mcal/lb)	1.2	1.2	1.2	1.2

[a]Iowa Biofibers product IABF Harlan, IA. Product containing treated corn stover and other corn by-products.

Lambs were allowed ad libitum access to feed via self-feeders, and feed was added in 50 lb increments at intervals so that feeders were never empty. Weights of feed going into the feeders, and feed remaining at the end of the trial were recorded in order to determine feed intake. Lambs had ad libitum access to water throughout the study.

Lambs were weighed at 0800 h at two week intervals over the course of a 27 day feeding period. Feed and water were not withheld before weights were recorded. Weights and feed intake data were used to determine average daily gain (ADG) and feed:gain ratios (F:G). Feed samples were taken from random spots in the feeders at two week intervals and stored for analysis. Statistical analysis of data was completed using GLM procedure of SAS.

RESULTS AND DISCUSSION

Raw lamb performance data are reported in Table 2, and treatment means are reported in Table 3. Dietary treatment had no effect on ADG, feed intake or total gain ($P = 0.2, 0.3, 0.2$ respectively). Dry matter intake across treatments exceeded the investigators expectations despite the level of CST in the diet. Average DMI tended to be decreased ($P = 0.09$) for the 40%CST treatment group compared with the 20%CST treatment group, however average DMI did not differ among other treatment groups. Feed: Gain was worse for lambs consuming the 40%CST diet when compared with those consuming the control, 10%CST, or 20%CST diets ($P < 0.05$) (Table 3). There was no treatment by block interaction on ADG, intake, or total gain ($P = 0.6$). However, there was a treatment by block interaction on F:G. Lambs in the heavy block consuming the 40%CST treatment had greater F:G ratios than lambs in light block ($P < 0.05$) (Table 4). The F:G for lambs assigned to the control diet, which contained no treated stover, also differed between weight blocks ($P < 0.05$). For lambs fed 10%CST and 20%CST, F:G did not differ significantly ($P > 0.20$) between the heavy and light blocks, however a similar numeric trend for poorer F:G was observed for the heavy block compared with the light block in each case. This observation suggests that high-roughage growing diets, regardless of roughage source, result in differences in F:G depending on the weight (stage of growth) of the animal. Higher stover inclusion likely will result in less difference in growth and feed intake in younger growing lambs when compared with older finishing lambs.

Table 2. Individual pen observations

PEN	TRT[a]	BLK	DMI, %BW	Total DMI, lb	PEN AVG GAIN, lb/hd/d	ADG, lb/hd/d	F:G	ADMI, lb/hd/d
1	C	H	3.96	126.09	20.33	0.75	6.20	4.67
2	10	H	3.78	116.55	19.33	0.72	6.03	4.32
3	20	H	3.94	124.71	21.00	0.78	5.94	4.62
4	40	H	3.69	112.34	14.00	0.52	8.02	4.16
5	C	L	3.98	118.27	26.00	0.96	4.55	4.38
6	10	L	3.99	112.90	21.00	0.78	5.38	4.18
7	20	L	4.18	119.24	23.34	0.86	5.11	4.42
8	40	L	3.80	108.36	20.67	0.77	5.24	4.01
9	C	H	3.77	109.80	16.00	0.59	6.86	4.07
10	10	H	3.45	107.84	18.67	0.69	5.78	3.99
11	20	H	3.36	103.45	17.33	0.64	5.97	3.83
12	40	H	3.63	108.77	15.00	0.56	7.25	4.03
13	C	L	4.17	112.59	20.00	0.74	5.63	4.17
14	10	L	4.26	117.80	21.00	0.78	5.61	4.36
15	20	L	4.24	122.06	21.00	0.78	5.81	4.52
16	40	L	3.74	98.72	19.67	0.73	5.02	3.66

[a] All CST inclusions were on a DM basis.

Table 3.Growth performance of lambs fed increasing amounts of treated corn stover product

	Dietary Treatment[1]				
Item	Control	10%CST	20%CST	40%CST	SEM
Pens	4	4	4	4	---
Trial length , d	27	27	27	27	---
ADG, lb/d	0.76	0.74	0.77	0.65	0.04
ADMI, lb/d	4.32^{xy}	4.21^{xy}	4.35^{x}	3.96^{y}	0.14
F:G	5.81^{ab}	5.70^{a}	5.71^{a}	6.38^{b}	0.21
GAIN, lb	20.58	20.00	20.67	17.34	1.09
DMI, lb	116.69	113.77	117.37	107.05	3.88

[1] All CST inclusions were on a DM basis.
[ab] Means having different superscripts within a row differ (P < 0.05) as a result of CST inclusion.
[xy] Means having different superscripts within a row tend to differ (P = 0.09) as a result of CST inclusion.

Table 4. Interactions of increasing treated corn stover product and body weight block

	Dietary Treatment[1]								
	Control		10%CST		20%CST		40%CST		
BLK	H	L	H	L	H	L	H	L	SEM
Pens	2	2	2	2	2	2	2	2	---
Trial length, d	27	27	27	27	27	27	27	27	---
Initial Wt, lbs	94.8	82.0	96.0	82.5	96.5	84.0	97.4	81.5	1.99
Final Wt, lbs	113.0	105.0	115.0	103.5	115.7	106.2	111.9	101.7	2.99
ADG, lb/d	0.67	0.85	0.71	0.78	0.71	0.82	0.54	0.75	0.06
F:G	6.5^{a}	5.1^{b}	5.9^{ab}	5.5^{b}	6.0^{ab}	5.5^{b}	7.6^{c}	5.1^{b}	0.30
ADMI, lb/d	4.37^{x}	4.27^{xy}	4.15^{xy}	4.27^{xy}	4.23^{xy}	4.47^{x}	4.10^{xy}	3.83^{y}	0.20
GAIN, lb	18.15	23.0	19.0	21.0	19.2	22.2	14.5	20.2	1.54
DMI, lb	118.0	115.4	112.2	115.3	114.1	120.6	110.6	103.5	5.49

[1] All CST inclusions were on a DM basis.
[abc] Means having different superscripts within a row differ (P < 0.05) as a result of CST inclusion.
[xy] Means having different superscripts within a row tend to differ (P = 0.09) as a result of CST inclusion.

ACKNOWLEDGEMENTS

SDSU investigators acknowledge the support and cooperation from Iowa BioFibers- Harlan, IA and ADM Alliance Nutrition- Quincy, IL for this study.