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Effects of Diet Particle Size and Lasalocid on Growth, Carcass Traits, and N balance in Feedlot Lambs[1]

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Summary

The objective of this research was to determine the influence of diet particle size and lasalocid on growth and feed intake, carcass characteristics, and N balance in feedlot lambs. One hundred sixty crossbred (Suffolk x Rambouillet) lambs (31.2 kg ± 0.09 kg) were stratified by weight and sex in a completely random design and allotted to one of 16 pens (n = 4). Lambs were fed a basal feedlot diet consisting of 80 percent corn and 20 percent market lamb pellet *ad libitum* (AF basis). Diets were whole corn with lasalocid (**WCL**), whole corn without lasalocid (**WCNL**), ground corn with lasalocid (**GCL**), or ground corn without lasalocid (**GCNL**). Lambs were harvested following the 112 d feeding trial (69.7 kg ± 0.74 kg BW) and carcass data were collected at a commercial abattoir. Final BW, DM offered, G:F, mortality, and the majority of carcass traits were not affected by diets ($P \geq 0.06$). Lasalocid-fed lambs had an increase in HCW (P = 0.05). Additionally, there was an interaction of particle size and use of ionophores for ADG ($P = 0.05$), loin eye area ($P < 0.001$), and percentage of boneless closely trimmed retail cuts (**%BCTRC**; $P = 0.004$). Loin eye area was greatest ($P < 0.05$) for WCL and GCNL. A second study was conducted utilizing the same diets to evaluate N balance in 16 crossbred wethers (Suffolk x Rambouillet; 40 kg ± 1.7 kg BW; n = 4). Nitrogen balance was not affected by diet ($P = 0.22$). Our results indicate that HCW in lambs fed lasalocid was increased by 3 percent, while particle size had no major impact on growth, feed intake, carcass traits, or N digestibility.

Key words: Carcass, Growth, Ionophores, Lasalocid, Particle Size, Sheep

Introduction

In the Northern Great Plains, lambs are commonly fed whole corn accompanied by a market-lamb pellet through self-feeders during the growing-finishing phase. However, as evidenced in the cattle industry, when feeding high-energy and low-roughage diets acidosis can become a health problem resulting in a decrease in performance and an increase in morbidity and mortality (Elam, 1976).

Research in cattle has shown the effectiveness of ionophores for increasing feed efficiency and decreasing the incidence of acidosis in cattle fed high-grain diets (Jacques et al., 1987). Researchers have reported the ability of monensin to improve rate of gain, organic matter and crude protein digestion, and the absorption of N in sheep (Funk et al., 1986; Horton, 1980; Ricke et al., 1984). However, monensin is not currently labeled for use in sheep (FDA, 2005). The ionophore lasalocid is approved for use in sheep (FDA, 2003) and has been shown to increase total-tract, organic-matter digestibility in finishing lambs (80 percent vs. 76.4 percent; Funk et al., 1986) fed a 65 percent concentrate diet. With the exception of the previous trial, little data exist that describes the effect of lasalocid on lamb growth, feed intake, and carcass traits.

Grinding the diet, especially diets including corn (Theurer, 1986), can increase digestibility, intake, and growth rate of livestock (Kerley et al., 1985). However, the cost of grinding usually exceeds the benefits of feeding a ground diet to lambs (Stanton and LeValley, 2006). Additionally, when feeds are ground, lambs tend to select larger particles (Reynolds and Lindahl, 1960), potentially resulting in reduced DM intake and/or failure to eat a complete diet. Grinding feeds can decrease rumen retention time of feeds (Uden and Van Soest, 1982), therefore decreasing total digestibility and potentially resulting in more cases of acidosis (Kerley et al., 1985; Gressley, et al., 2011).)

We tested whether lambs fed diets containing whole corn and lasalocid would grow faster and more efficiently and improve N digestibility when compared with lambs fed diets with ground corn without lasalocid. Our specific objectives were to determine the influence of lasalocid and particle size on growth and feed intake, carcass characteristics, and N balance in lambs

Materials and Methods

All procedures were approved by the Animal Care and Use Committee of North Dakota State University (protocol # A13041). This study was conducted at the NDSU Hettinger Research Extension Center in Hettinger, N.D.

Feedlot Study

Animals and Diets. At 2 wk of age, tails were docked, males were castrated, and all lambs were vaccinated against *Clostridium perfringens* types C and D and tetanus (CD-T; Bar Vac CD/T; Boehringer Ingelheim, Ridgefield, Conn.). Lambs were weaned and vaccinated against CD-T again at approximately 60 d of age and d -1 (~4 mo) of the trial. Lambs were allowed free choice access to a commercial lamb-creep pellet (16 percent CP) from birth to weaning. Lambs were adapted to a basal diet of 80 percent corn/20 percent commercial market-lamb pellet (DM basis; Table 1) following weaning. One hundred and sixty crossbred (Suffolk x Rambouillet) wether and ewe lambs (31.2 kg ± 0.09 kg BW; approximate 90 d of age) were stratified by BW and sex (80 wethers and 80 ewes; 5 ewes and 5 wethers/pen) and randomly assigned to one of 16 outdoor pens (10 lambs/pen). Pens were assigned randomly to one of 4 diets, with pen serving as the experimental unit (n = 4 pens/diet). Diets were: whole corn with lasalocid (**WCL**), whole corn without lasalocid (**WCNL**), ground corn with lasalocid (**GCL**), or ground corn without lasalocid (**GCNL**; Table 1). Lambs fed the lasalocid (20 g/ton of market lamb pellet, Bovatec, Alpharma Inc., Bridgewater, N.J.) diets were given the basal feedlot ration with lasalocid included in the market lamb pellet starting on d 0.

Ground diets were ground through a 1.27 cm screen (Gehl Mix-All, Model 170, Gehl, West Bend, Wis.). Diets were mixed and provided by the same mixer-grinder and offered ad libitum via bunk feeders (48.6-cm bunk space/lamb). Lambs had continuous access to clean, fresh water and shade. Diets were balanced to be equal to or greater than CP and energy (NE) requirements (NRC, 2007). The diets were formulated with a minimum Ca:P ratio of 2:1. Feeders were checked daily, cleaned of contaminated feed when needed, and the feed removed

Table 1. Ingredient and analytical composition of diets with differing particle sizes of corn and market lamb pellet with or without lasalocid (DM basis)

	Diets[1]			
Item	WCNL	WCL	GCNL	GCL
Ingredient, %				
Corn	80	80	80	80
Market lamb pellet[2]	20	20	20	20
Composition, %				
DM	96.4	96.3	96.0	96.7
CP	19.6	18.7	17.7	17.2
NDF	16.4	15.4	14.4	15.7
ADF	5.3	4.8	4.5	5.3

[1] Diets: WCNL= whole corn and market lamb pellet without lasalocid (Bovatec, Alpharma Inc., Bridgewater, NJ); WCL= whole corn and market lamb pellet with lasalocid; GCNL= ground corn and market lamb pellet without lasalocid; GCL= ground corn and market lamb pellet with lasalocid.

[2] Market lamb pellet contained 38% CP, 4.25% Ca, 0.6% P, 3.5% salt, 1.2 mg/kg Se, 52,920 IU/kg vitamin A, 5,292 IU/kg vitamin D, and 209 IU/kg vitamin E with lasalocid diets containing 20 g/ton of lasalocid (90% DM basis).

was weighed and subtracted from the feed offered. Lambs were observed daily to monitor health and treated when necessary.

Data Collection Procedures. The study was divided into four periods. Lambs were weighed on two consecutive d at the initiation (d -1 and d 0) and end (d 111 and d 112) of the trial; single-day weights were taken on d 33, d 57, and d 85. Diet- and feed-ingredient grab-samples (approximately 0.2 kg) from the bunk feeders were collected at the beginning of each period and dried at 55°C for 48 h to determine DM and dietary composition. Dried samples were ground using a Wiley mill (Arthur H. Thomas Co., Philadelphia, Penn.) to pass a 2-mm screen. Samples were analyzed for DM, ash (method 942.05; AOAC Int., 2010), N (method 2001.11; AOAC Int., 2010) using a Kjeltec Auto 1030 Analyzer (Tecato AB, Höganäs, Sweden), NDF (Van Soest et al., 1991) as modified by Ankom Technology (Fairport, N.Y.) using an Ankom 200 Fiber Analyzer without sodium sulfite, with amylase, and without ash corrections as sequentials, and ADF (Goering and Van Soest, 1970). Dry sieving of the whole diet was performed using sieves with openings ranging from 250 µ to 4750 µ (250 µ, 500 µ, 1000 µ, 2000 µ, and 4750 µ). Dry sieving of the ground diet was performed using sieves with openings ranging from 53 µ to 2000 µ (53 µ, 106 µ, 212 µ, 250 µ, 500 µ, 1000 µ, 2000 µ). Each sample (250 g) was manually shaken for 10 minutes to determine the weighted average particle size. Average-particle size for the whole and ground diets were 4177 µ and 427 µ, respectively.

One hundred and sixty lambs weighing a minimum of 61 kg (69.7 kg ± 0.74 kg BW) were transported (888 km) to Superior Farms, Inc. in Denver, Colo. on d 113 and harvested on d 114. Trained personnel collected carcass data after a 24-h chill (temperature < 2°C and humidity near 100 percent). Carcass data included HCW, leg score, conformation score, fat depth and body wall thickness (measured at the 12th rib), loin eye area, flank streaking, quality grade, and yield grade (0.4 + [10 x fat depth]), and percentage of boneless closely trimmed retail cuts (%**BCTRC**) was predicted from the equation of Savell and Smith (2000). Leg score, conformation score, and quality grade were scored on a scale of 1 to 15 (1 = cull; 15 = prime). Flank streaking was assigned, with scores of 100 to 199 = Practically Devoid, 200 to 299 = Traces, 300 to 399 = Slight, 400 to 499 = Small, and 500 to 599 = Modest.

Statistical Analyses. Growth, feed intake, and carcass data were analyzed as a completely randomized design with a 2 × 2 factorial arrangement of treatments with pen serving as the experimental unit using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC). The model included effects of inclusion or exclusion of ionophores and the diet particle size (ground or whole), and the interaction of both the ionophores and diet processing with *P*-value ≤ 0.05 considered significant.

Nitrogen Balance Study

Animals and Diets. Sixteen crossbred (Suffolk x Rambouillet) wethers (40 kg ± 1.7 kg BW; approximate age = 90 d) were used in a completely random design. Wethers were weighed on d 0 and d 1, stratified by weight, and allotted randomly to diets (n = 4 wethers/diet) as described in the feedlot trial. Lambs were assigned randomly to individual metabolism crates on d 1. Wethers were housed in an enclosed room with lighting from approximately 0730 h to 2000 h. Lambs were adapted to diets (Table 1) and processed as outlined in the previous study, but also were given an injection of vitamins A, D and E on d 1 of the trial. Rations were provided daily at 0830 h at 130 percent of the average-daily intake for the previous 5 d. Feed refusals from the previous day were determined before feeding. Water troughs were cleaned and refilled daily after feeding.

Data Collection Procedures. The experimental period was 21 days. Dry matter intake was determined on d 14 to d 20. Additionally, samples of corn, pellets, and ration were collected on d 14 to d 20 and dried at 55°C for 48 hours to determine DM. Orts (weigh backs) were collected on d 15 to d 21 and dried at 55°C for 48 hours. Wethers were fitted with fecal collection bags on d 11. Total fecal and urine outputs were collected on d 15 to d 21. A subsample of each daily fecal sample (7.5 percent of total, wet basis) was dried at 55°C for 96 hours for calculation of fecal DM. Urine was collected via stainless steel funnel beneath the lamb, with total urine output collected. Sufficient 6 *N* HCL (100 mL) was added daily to urinals to maintain urine pH < 3. Total daily urine output was recorded, and urine was composited daily by wether (10 percent of total; wet basis) and stored at 4°C. Approximately 288 g of urine were collected from each urine subsample and stored at 4°C. On d 15 to d 21, 10 mL of blood were collected via jugular venipuncture 4 hours after feeding using vaccutainers (VWR International). Blood was cooled at 4°C for 2 hours and centrifuged (3,640 × g, 15°C, 20 min), and serum was harvested and stored (-20°C).

Dried fecal samples were ground through a Wiley mill (2 mm screen) and composited by lamb. Daily samples of corn, pellets and diet were composited for the collection period, and orts were composited by lamb on an equal weight basis (20 percent; as-fed basis). Feed, orts, and fecal samples were analyzed for DM, ash, NDF, and ADF as described previously for the feedlot trial. Feed, orts, fecal, and urine samples were analyzed for N as described previously for the feedlot trial. Concentration of N in feed, orts, fecal, and urine samples was used to calculate daily N intake and excretion from feed, ort, feces, and urine weights. Nitrogen excretion (fecal N + urinary N) was subtracted from N intake (feed N – ort N) to calculate N balance (g N/kg BW basis). Serum samples were analyzed for urea-N using the Sigma Diagnostics Procedure 640 (Sigma Chemical Co., St. Louis, Mo.) and an ultraviolet-visible spectroscopy spectrophotometer (DU 800 Spectrophotometer, Beckman Coulter, Brea, Calif.).

Statistical Analyses. Lamb N-balance data were analyzed as a randomized design using the MIXED procedure of SAS with animal serving as experimental unit. Repeated measures were used to analyze day effect for serum urea-N. The model included diet, lamb (diet), day, diet × day interaction, and residual error. The covariance structure used was Autoregressive (1). Other structures were tested but Autoregressive (1) was the best fit. Significance was observed at *P* ≤ 0.05.

Results and Discussion

Feedlot Study

Feedlot Performance. Results for growth, DM intake, and mortality are reported in Table 2. There were no interactions among diets for final BW, feed offered, G:F, or mortality ($P \geq 0.06$). However, there was an interaction between particle size and ionophores for ADG ($P = 0.05$). There were no diet effects ($P \geq 0.14$) for final BW, feed offered, G:F, and mortality. Numerically the WCL-fed lambs had the highest ADG, and this difference in BW gain could be relevant from a producer standpoint, with a difference of 2.4 kg over the 120-d finishing period, when comparing WCL vs. WCNL or GCL. Lending further evidence to the benefit of whole-corn diets including lasalocid, we observed a tendency for an interaction ($P = 0.06$) between particle size and ionophores for final BW; lambs fed WCL tended to be heavier than the other lambs by up to 0.15 kg. Erickson et al. (1988 and 1989) conducted two trials in lambs evaluating particle size in finishing diets. Erickson et al. (1989) reported that reducing particle size (whole vs. ground in corn-based diets) had no effect on ADG or G:F in feedlot lambs. However, Erickson et al. (1988) reported a tendency for lambs fed whole grain diets to have heavier final BW, which is similar to the tendencies we observed for final BW. Petit (2000) reported similar observations with whole vs. rolled corn, showing no effects on ADG or G:F.

In lambs fed finishing diets for a 56-d feeding trial, ADG was increased ($P < 0.10$) by lasalocid (0.23 kg/d vs 0.26 kg/d; Funk et al., 1986). Based on our research, it appears that lasalocid may have minimal effects on lamb growth and mortality in the finishing phase, when included in ground diets. However, in a previous trial at this experiment station, lambs fed coarse rolled corn with lasalocid had higher dressing percentage when compared to lambs not receiving lasalocid, but lasalocid did not affect growth rate or feed intake (Ruprecht et al., 1992). We observed a nonsignificant 3.9 percent increase in final weight in lambs fed a whole-grain diet,

Table 2. Effects of lasalocid and particle size on lamb growth and feed intake, carcass characteristics, and mortality.

	Diets[1]					P-value[3]		
Item	WCNL	WCL	GCNL	GCL	SEM[2]	PS	ION	PS*ION
Growth								
Initial BW, kg	31.2	31.3	30.8	31.3	0.1	—	—	—
Final BW, kg	68.7	71.4	69.6	69.1	0.7	0.34	0.17	0.06
ADG, kg/d	0.26	0.28	0.27	0.26	0.01	0.76	0.73	0.05
DM offered/d, kg	2.52	2.67	2.60	2.67	0.067	0.58	0.14	0.57
G:F	0.10	0.10	0.11	0.10	0.004	0.59	0.47	0.23
Mortality, %	0	5	2.5	5	2.39	0.61	0.14	0.61
Carcass characteristics								
HCW, kg	33.7	35.4	34.0	34.3	0.48	0.37	0.05	0.16
Leg score[4]	11.5	11.7	11.5	11.6	0.13	0.06	0.14	0.94
Conformation score[4]	11.7	11.9	11.8	11.8	0.10	0.85	0.24	0.51
Fat depth, cm[5]	0.73	0.61	0.66	0.74	0.06	0.60	0.72	0.11
Body wall thickness, cm	2.53	2.55	2.51	2.63	0.08	0.73	0.42	0.54
Loin eye area, cm^2	19.6	21.1	22.0	20.7	0.31	0.008	0.79	<0.001
Flank streaking[6]	375	389	366	376	9	0.27	0.22	0.89
Quality grade[4]	11.7	11.8	11.6	11.6	0.09	0.10	0.43	0.88
Yield grade[7]	3.28	2.81	3.01	3.30	0.22	0.61	0.70	0.11
BCTRC, %[8]	46.3	47.7	47.3	46.5	0.18	0.06	0.24	0.004
Dressing, %	49	50	49	50	0.39	0.80	0.10	0.85

1 Diets: WCNL= whole corn and market lamb pellet without lasalocid (Bovatec, Alpharma Inc., Bridgewater, NJ); WCL= whole corn and market lamb pellet with lasalocid; GCNL= ground corn and market lamb pellet without lasalocid; GCL= ground corn and market lamb pellet with lasalocid.
2 $n = 4$.
3 PS= particle size of diet and ION= ionophores.
4 Leg score, conformation score and quality grade: 1= cull to 15= high prime.
5 Fat depth and yield grades.
6 Flank streaking: 100 to 199= practically devoid; 200 to 299= traces; 300 to 399= slight; 400 to 499= small; 500 to 599= modest.
7 Yield grade= 0.4 + (10 × fat depth).
8 BCTRC= boneless closely trimmed retail cuts, % = [49.936- (0.0848 × 2.205 × HCW, kg) – (4.376 × 0.3937 × fat depth, cm) – (3.53 × 0.3937 × body wall thickness, cm) + (2.456 × 0.155 × loin eye area, cm^2)] (Savell and Smith, 2000).

which is consistent with previous research.

Carcass Characteristics. There were no interactions among diets for HCW, leg score, conformation score, fat depth, body wall thickness, flank streaking, quality or yield grade, and dressing percentage ($P \geq 0.06$). Petit (2000) observed similar results for carcass weight, when feeding whole or rolled corn. However, there was an interaction between particle size and ionophores for loin eye area ($P < 0.001$) and % BCTRC ($P = 0.004$). Loin eye area was greatest ($P < 0.05$) for WCL and GCNL, with GCL intermediate. However, GCNL had the greatest ($P < 0.05$) %BCTRC. Additionally, lambs fed diets with lasalocid had heavier HCW (3%; $P = 0.05$) compared to those fed diets without lasalocid. No additional effects of particle size or ionophore were observed for other carcass measurements ($P \geq 0.06$). The research that has been conducted evaluating particle size in grain-based, finishing diets for lambs supports our findings that reducing particle size has minimal effects on carcass traits. Erickson et al. (1988) reported that lambs fed whole vs. ground corn had no difference in HCW and leg score, however lambs had higher-yield grades and thicker-fat depths when fed whole grains. Reynolds and Lindahl (1960) reported that lambs tend to not consume finely ground feeds and sort through feed to select larger particles, although this research was conducted on hay-based diets. Additionally in a previous trial at this experiment station, similar to our research, lambs fed coarse, rolled corn with lasalocid had higher-dressing percentage, when compared to lambs not receiving lasalocid; however, lasalocid did not affect any other carcass characteristics (Rupprecht et al., 1992).

While growth, feed intake, and carcass data evaluating particle size and ionophores are limited, research is available addressing the biological effects of ionophores. Ionophores appear to alter the movement of certain ions across biologic membranes, which in the rumen, results in an alteration of microflora (NRC, 2007). Feeding lasalocid or monensin may also exert a possible N-sparing effect by inhibition of ruminal amino acid deamination (Schelling et al., 1978; Poos et al., 1979). In vitro production of amino-N decreased linearly with increasing levels of monensin in research reported by Whetstone et al. (1981), which indicates a decrease in rate of proteolysis. In a study by Paterson et al. (1983), rumen propionate was increased and the acetate to propionate ratio was decreased when lasalocid was fed to lambs. The addition of lasalocid to a low ruminal N degradable feed resulted in more rapid weight gain than without lasalocid; however, when lambs were fed soybean meal with or without lasalocid, lasalocid actually slowed the rate of gain (Paterson et al., 1983). These results indicate that lasalocid can effectively increase propionate production in the rumen, which explains the tendency for the faster growth of the lambs fed WCL diets in the current trial. However, GCNL fed lambs had similar growth, which is quite interesting. A possible explanation is that the smaller particle size of the GCNL diet increased overall digestibility, although, this is speculation and was not tested in the current trial. The most interesting result is that lambs fed WCNL diets had a numerical reduction in performance compared to lambs fed the three other diets. Lasalocid is most likely needed to increase propionate production with this whole-grain diet to attain the increased growth rate observed for lambs fed other diets. In the current trial, GCNL fed lambs had greater %BCTRC, however these lambs also had increased loin eye area, although statistically similar to WCL, which could have driven the increase in %BCTRC. Interestingly, the current trial showed that particle size also affected loin eye area ($P = 0.008$), while prior research in ground vs. whole grains has shown no effect of diet processing on loin eye area (Erickson et al., 1988; Erickson et al., 1989).

Nitrogen Balance Study

There were no interactions or main effects among diets for DMI, N intake, N balance, or serum urea-N concentration (Table 3; $P \geq 0.18$), however, there was a day effect ($P = 0.0018$). Serum urea-N concentrations on days 1, 2, and 3 were generally lower than on d 4 to d 6

Table 3. Effects of lasalocid and particle size of feed on N intake, excretion, balance, and serum urea-N concentration in lambs.

	Diets[1]					P-value[3]		
Item	WCNL	WCL	GCNL	GCL	SEM[2]	PS	ION	PS*ION
Daily DMI, g/ kg BW	38.43	36.99	66.16	37.97	12.9	0.29	0.28	0.32
Daily N intake, g/ kg BW	1.06	0.94	1.11	1.04	0.06	0.26	0.18	0.69
Daily N excretion, g/ kg BW								
Fecal	0.23	0.14	0.21	0.16	0.01	0.87	0.01	0.45
Urinary	0.05	0.04	0.05	0.05	0.004	0.23	0.97	0.25
Daily N balance, g/ kg BW	0.78	0.76	0.84	0.83	0.05	0.22	0.76	0.99
Serum urea-N[4], mM	10.29	10.11	10.87	10.37	0.53	0.50	0.65	0.77

[1] Diets: WCNL= whole corn and market lamb pellet without lasalocid (Bovatec, Alpharma Inc., Bridgewater, NJ); WCL= whole corn and market lamb pellet with lasalocid; GCNL= ground corn and market lamb pellet without lasalocid; GCL= ground corn and market lamb pellet with lasalocid.
[2] $n = 4$.
[3] PS = particle size of the diet and ION = ionophores.
[4] P-values for serum urea-N: day ($P = 0.0018$) and diet × day ($P = 0.33$).

($P < 0.05$; data not shown). There is conflicting research on particle size and its effects on N digestion, N balance, and serum urea-N concentration. Although there was no particle size effect ($P \geq 0.22$) in the current trial, previous research by Kerley et al. (1985) reported that N digestion was increased in lambs fed 6.5 mm, 5.4 mm and 0.8 mm particle size corncob diets, while the 1.4-mm diet was decreased. The 1.4-mm diet also had higher fecal N loss when compared to the other diets. Other research by Perez-Torres et al. (2011) reported no differences in DM or OM intake or digestibility in diets that differed in particle size, agreeing with results from the current trial.

However, the addition of lasalocid decreased ($P = 0.01$) fecal-N excretion. This is similar to findings by Ricke et al. (1984), in which lasalocid-fed lambs had decreased fecal-N excretion when compared to lambs fed monensin or no ionophore. Varying results exist on the effect of lasalocid on N digestibility, with some reporting it increased N digestibility (Paterson et al., 1983; Ricke et al., 1984), while others report that it remained unaffected (Funk et al., 1986) along with N balance (Funk et al., 1986). Ricke et al., (1984) also reported that lasalocid-fed lambs had lower fecal N loss and therefore higher N retention, which could reflect increased digestibility. Differences among reported experiments could be due to the different types of collection, ranging from N-balance trials, to in situ techniques.

Conclusions

Grinding lamb finishing diets containing 80 percent corn and 20 percent market lamb pellet had no beneficial, or negative, impact on lamb growth rate or feed efficiency, mortality, or carcass traits. However, including lasalocid in diets containing whole corn and market lamb pellet tended to increase average daily gain, final body weight, and carcass weight. Additional research is needed to further quantify the benefits of grinding diets with feed ingredients of differing particle size (i.e. combing corn and dried distillers grains), as well as the impacts of ionophores in feedlot diets for lambs.

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