# Growth performance and carcass characteristics of conventionally raised lambs implanted with zeranol versus naturally raised lambs[1]

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*The objective of this research was to elucidate the advantages of conventional lamb feeding systems in comparison to lambs raised in accordance with naturally raised guidelines. Voluntary standards released by the Agriculture Marketing Service provide feedlot operations with procedures to produce naturally raised lamb in agreement with consumer perceptions of the product. If lambs can be raised within these guidelines as cost effectively as lambs raised in a best management practice operation and sold at a premium, it could provide lamb feedlot operations with an alternative to conventional programs while increasing profitability.*

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## Summary

The objective of this research was to compare the growth performance and carcass characteristics between naturally raised and conventionally raised lambs. Two hundred eighty eight crossbred lambs (75 lbs.) were finished in twelve feedlot pens according to treatment over a 112 day trial. Treatments were Naturally Raised (**NR**) or Conventional (**C**). Naturally Raised lambs were fed a basal diet (80% corn, 20% concentrate) with decoquinate added for coccidiosis control, and could not be treated with antibiotics. Conventional lambs were fed a similar 80:20 basal ration, but with decoquinate, chlortetracycline and lasalocid added. Conventional lambs were also implanted with 36 mg zeranol (Ralgro®, Schering-Plough) on day 28, and could be treated with antibiotics as necessary. After 112 days, lambs were harvested and carcass data was collected. Conventional lambs had increased average daily gain ($P = 0.06$). Naturally Raised lambs had increased rib eye area ($P = 0.03$), decreased body wall thickness ($P = 0.05$), and increased boneless, closely trimmed retail cuts ($P = 0.05$). Conventional lambs also had increased percentage of lambs with rectal or vaginal prolapses ($P = 0.001$) and increased percent mortality ($P = 0.01$). Conventional lambs trended to be heavier at the final weight ($P = 0.07$) and have increased dry matter intake ($P = 0.09$). There were no differences in yield grade ($P = 0.25$), feed efficiency ($P = 0.47$), or quality grade ($P = 0.85$). While C lambs gained more, the viability of the zeranol is put into question by the high incidence of prolapse and mortality. Future research should evaluate graded levels of zeranol implants to discern if the incidence of prolapse and mortality can be decreased.

## Introduction

The USDA Agriculture Marketing Service released voluntary standards for the production of naturally raised livestock in January of 2009. *The United States Standards for Livestock and Meat Marketing Claims, Naturally Raised Claim for Livestock and the Meat*

*and Meat Products Derived From Such Livestock* provided guidelines for what should be marketed as naturally raised livestock. The core of the report stated that naturally raised livestock should be raised "… without growth promotants and antibiotics and that have never been fed mammalian or avian by-products…" Niche marketing (including naturally raised or organic) has steadily grown in popularity over the last decade. Farmers and ranchers could take advantage of this growing market if the requirements were better understood, and the economic benefits were clearly demonstrated.

Naturally raised lambs must be able to compete with conventional lambs that can be both supplemented with lasalocid or chlortetracycline at levels to improve growth efficiency and be implanted with zeranol. Zeranol has been shown to increase average daily gain (**ADG**) and feed efficiency in lambs (Hustfedler et al., 1996; Nold et al., 1992; Salisbury et al., 2007). Chlortetracycline (**CTC**), an antibiotic often used as a broad-spectrum antibiotic in livestock operations, has been shown to improve ADG, feed efficiency, and survival rate (Johnson et al., 1956; Bridges et al., 1953; Kunkel et al., 1956). Lasalocid, a polyether ionophore, has also been shown to increase ADG and feed efficiency and decrease incidence of coccidia in steers (Anderson et al, 1988; Bartley et al., 1979; Berger et al., 1981) and increase ADG and improve feed efficiency in lambs (Funk et al., 1986). Naturally raised lambs must perform at the same level as conventional lambs or producers must receive a premium in order to justify naturally raised lamb production.

## Procedures

Two hundred eighty eight spring born crossbred lambs (wethers and ewes) were stratified by weight and assigned randomly within stratification to one of two treatments (Naturally Raised or Conventional) in a completely randomized design to evaluate lamb growth performance and carcass characteristics under naturally raised and conventional management practices. At the start of the trial, lambs were moved to 12 feedlot pens (n = 6). Each pen represented one experimental unit and contained 24 lambs. Treatments were randomly assigned to pens. Treatments consisted of Naturally Raised and Conventional. Naturally raised (**NR**) lambs were fed the basal feedlot ration, and supplemented with decoquinate (Deccox®). Naturally raised lambs could not receive any other antibiotics. If treatment with antibiotics was necessary, an ear notch was administered to the treated lamb and it was removed from the data set. Conventional (**C**) lambs were raised using best management practices, including supplementation with decoquinate (Deccox®), lasalocid (Bovatec®), CTC, and implanted with zeranol (Ralgro®). Thirty six mg zeranol were administered via subcutaneous implant in the ear on d 28. The feedlot ration for treatment C consisted of 78.7% corn, 19.7% market lamb pellet, 1.2% Deccox®, and 0.4% CTC on a dry matter basis. The C market lamb pellet contained lasalocid and 38% crude protein. The feedlot ration for treatment NR was 80% corn and 20% market lamb pellet, which contained decoquinate and 38% crude protein. Lambs were fed ad-libitum via bulk feeders and had access to fresh water. Refusals were collected every 28 days.

**Experimental Periods and Sampling Procedures.** The experiment began May 15, with lambs weighed two consecutive days to determine starting body weight. Lambs were weighed once every 28 days after initial weights, with two consecutive weights taken at the end of the trial. Lambs were then shipped for harvest and carcass data collection at Iowa Lamb Corporation in Hawarden, IA. Feed samples (approximately 0.44 lb) were collected approximately once every 28 d, dried at 55°C for 48 h, ground through a Wiley mill (1-mm screen), and composited for analysis of ADF and NDF, N, and OM.

**Statistical Analysis**. Lamb performance data was analyzed as a completely randomized design using the MIXED procedure of SAS with replication serving as experimental unit. The contrast statements included the linear effects of management practices. Response variables included: 1) lamb growth performance; 2) carcass data; 3) incidence of rectal and vaginal prolapse; and 4) mortality.

## Results and Discussion

Conventional management practices showed advantages and disadvantages in comparison to naturally raised management. Conventional lambs had increased ADG ($P = 0.06$) and subsequently increased gain ($P = 0.06$) over the 112 d trial, illustrating the growth effects of CTC, lasalocid, and zeranol displayed in previous research. The increase in gain, which averaged approximately five pounds across treatments, makes conventional management an economically viable option when compared to naturally raised lambs. The implants costs roughly one dollar per head, and the five pounds gained (assuming market price of one dollar per pound) covered the cost of implants as well as provided a four dollar increase in profit compared to naturally raised lambs (not including labor). Extrapolated to a 2000 head feedlot, conventional practices with zeranol could result in an $8,000 per year increase return. While C lambs had a trend of increased DMI ($P = 0.09$) the overall economic effects were minimal. Conventional lambs also showed a trend of increased ADG and gain during early treatment periods. The difference between treatments may have been larger had the lambs been slaughtered earlier. Lambs were slaughtered at an average weight of 159 lbs, and differences between treatments may have diminished as gain decreased in the larger C lambs late in the trial.

Most carcass characteristics were similar between treatments ($P \geq 0.25$), with the exceptions of rib eye area (**REA**), body wall thickness (**BWT**), and boneless, closely-trimmed retail cuts (**BCTRC**). Naturally Raised lambs had larger REA when compared to C lambs ($P = 0.03$). However, the numeric difference between treatment averages was less than one tenth of an inch (2.66 vs. 2.57 $in^2$). Naturally raised lambs also had a thicker body wall ($P = 0.05$) and greater BCTRC ($P = 0.05$). This could suggest C lambs had decreased carcass performance, but the authors feel this was influenced by the extended trial length. However, the major cause for concern in the trial was the high incidence of rectal and vaginal prolapses and mortality in the C treatment. The twelve prolapses in the C treatment were significantly more than the NR treatment, which resulted in no prolapses ($P = 0.001$). Of the twelve lambs prolapsed, some had to be treated repeatedly, and eventually four died ($P = 0.01$). The advantages of the increased gain are most likely negated by the cost of treating prolapsed lambs and mortality as a result of complications from prolapses. Zeranol has often been cited as an instigator in increased prolapses anecdotally, and a trend of increased prolapses was observed in a trial by Salisbury et al (2007).

## Implications

Decreased growth performance in naturally raised lamb demands premiums be offered to lamb producers in order for natural lamb production to be an economically viable practice, despite the possibility of improved carcass characteristics. While increased prices are afforded producers who sell products in niche markets such as

**Table 1.** Ingredient and nutritional composition of diets fed to feedlot lambs

| | Diets[1] | |
|---|---|---|
| Item | C | NR |
| Ingredient | DM basis | |
| Whole Corn, % | 78.68 | 80 |
| C Market Lamb Pellet[2], % | 19.77 | 0 |
| NR Market Lamb Pellet[3], % | 0 | 20 |
| Deccox, % | 1.18 | 0 |
| Chlortetracycline,% | 0.37 | 0 |
| Nutrient composition | | |
| CP, % | 17.59 | 17.64 |
| TDN, % | 85.99 | 86.62 |
| Ca, % | 1.00 | 1.02 |
| P, % | 0.33 | 0.33 |

[1] Treatments abbreviations C (conventional), NR (naturally raised).
[2] Conventional Market Lamb Pellet contained: 136 g/ton lasalocid, 38% CP, 3.75-4.75% Ca, 0.6% P, 3.0-4.0% salt, 1.2ppm Se, 24,000 IU/lb Vitamin A, 2,400 IU/lb Vitamin D, and 70 IU/lb Vitamin E.
[3] Naturally raised Market Lamb Pellet contained: 65mg/lb (0.01432%) decoquinate, 38% CP, 3.75-4.75% Ca, 0.6% P, 3.0-4.0% salt, 1.2ppm Se, 24,000 IU/lb Vitamin A, 2,400 IU/lb Vitamin D, and 70 IU/lb Vitamin E.

farmers markets or directly to restaurants, large-scale feedlot operations using naturally raised management techniques require a premium for naturally raised lamb to offset the potential loss in growth performance compared to conventionally raised lambs. Alternatively, the increased performance in conventionally raised lambs, which may be attributed to zeranol implants, offers economic opportunities if a level of zeranol dosage can be found to improve growth without increasing incidences of prolapse. Future research will focus on determining if decreased levels of zeranol will produce increased gain without increased prolapses and decreased carcass quality.

**Table 2.** Comparison of Conventional and Naturally Raised feeding practices on feedlot lamb performance and carcass characteristics

| | Treatment[1] | | | |
|---|---|---|---|---|
| Item | C | NR | SEM[2] | *P*-value[3] |
| Initial Wt, lbs | 75 | 75 | 0.28 | 0.96 |
| Final Wt, lbs | 162 | 157 | 1.57 | 0.07 |
| ADG, lbs/d | 0.77 | 0.73 | 0.01 | 0.06 |
| Intake, lbs DM/hd/d | 3.60 | 3.47 | 0.05 | 0.09 |
| G:F, lbs gain: lbs DMI | 0.21 | 0.21 | 0.003 | 0.47 |
| Gain, lbs | 87 | 82 | 1.48 | 0.06 |
| HCW, lbs | 81.5 | 80.4 | 0.8 | 0.35 |
| Leg Score[4] | 11.5 | 11.5 | 0.07 | 0.95 |
| Conformation score | 11.5 | 11.6 | 0.06 | 0.5 |
| Fat Depth, in[5] | 0.33 | 0.31 | 0.01 | 0.25 |
| Body Wall Thick, in | 1.11 | 1.06 | 0.01 | 0.05 |
| Ribeye Area, in$^2$ | 2.57 | 2.66 | 0.02 | 0.03 |
| Flank Streaking[6] | 351.03 | 356.89 | 5.85 | 0.5 |
| Quality Grade | 11.4 | 11.4 | 0.06 | 0.85 |
| Yield Grade[7] | 3.72 | 3.55 | 0.1 | 0.25 |
| %BCTRC[8] | 43.57 | 43.92 | 0.11 | 0.05 |
| Lean, lbs | 35.4 | 35.2 | 0.28 | 0.69 |
| Dress, % | 49.26 | 49.26 | 0.15 | 0.99 |
| Prolapse, % | 0.083 | 0 | 0.01 | 0.001 |
| Mortality, % | 0.028 | 0 | 0.006 | 0.01 |

[1]Treatments abbreviations C (conventional) NR (naturally raised)

[2]Standard Error of Mean; n = 6.

[3]*P*-value for F-tests of mean

[4]Leg score, conformation score, and quality grade: 1 = cull to 15 = high prime.

[5]Adjusted fat depth and yield grades.

[6]Flank streaking: 100-199 = practically devoid; 200-299 = traces; 300-399 = slight; 400-499 = small; 500-599 = modest.

[7]Yield Grade = 0.4 + (10 x adjusted fat depth).

[8]% Boneless closely trimmed retail cuts (49.936 – (0.0848 x Hot Carcass Weight, in.) - (4.376 x Fat Depth, in.) – (3.53 x BW, in.) + (2.456 x Ribeye Area, in$^2$)).

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