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FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS OF FEEDER LAMBS IMPLANTED AND RE-IMPLANTED WITH ZERANOL

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ABSTRACT

One hundred-twenty Rambouillet feeder lambs (Mean BW = 29.5 kg) were used to compare the effects of double and single implanting with Zeranol hormonal implants on lamb performance and carcass characteristics. Lambs were randomly assigned to three treatments: no implant (treatment 1), single implant (treatment 2), and double implant (treatment 3). On d 0, lambs in treatments 2 and 3 were implanted. Lambs in treatment 3 were re-implanted on d 56. Lambs were weighed every 28 d and slaughtered at 120 lb BW. Backfat thickness, leg circumference, hot carcass weight, USDA yield and quality grades were recorded, dressing percentage and calculated yield grade (CYG) were calculated. Treatments 2 and 3 had higher ($P < 0.05$) ADG than non-implanted lambs on d 28, 56, 84, and overall. Days on feed and feed to gain ratio were lower ($P < 0.05$) for implanted lambs than non-implanted lambs. Treatment 3 lambs had a lower ($P < 0.05$) dressing percentage and a lower ($P < 0.05$) percentage of choice grade carcasses and higher ($P < 0.05$) percentage of no grades. Treatment 2 and 3 wether lambs had a higher ($P < 0.05$) value and profit margin than implanted ewes and control lambs.

Key Words: Sheep, Feedlot, Zeranol, Carcass

INTRODUCTION

Texas Rambouillet feeder lambs have been known to produce carcasses of a low lean to fat ratio. This inefficiency puts the Texas Rambouillet sheep feeder at a disadvantage when competing with northern U.S. sheep producers. Low prices and lack of federal support for the fine Rambouillet wool further compounds this disadvantage.

Hormonal implants in the beef industry have been efficiently used for increasing lean deposition instead of fat deposition (Lemieux et al. 1990). Anabolic implants are widely used in the beef industry, but only 1.7% of sheep operations utilize growth promoting implants (USDA 1996). Zeranol is an anabolic agent that has been used in implants for growing-finishing cattle (Sharp and Dyer 1971). Zeranol, an estrogen-like compound, was found in corn mold *Giberella zeae* (Sharp and Dyer 1971).

Zeranol has been known to enhance ADG, feed efficiency, and lean tissue deposition. Both Hutcheson et al. (1992) and Jones et al. (1997) found that Zeranol improves ADG and feed efficiency of lambs. Hufstedler et al. (1996) found Zeranol implants will enhance profit related performance and exhibit the capacity for producing leaner, more acceptable carcasses.

A few negative attributes are associated with Zeranol implants. Estrogen-like compounds, like Zeranol, increase bone ossification, causing the closure of the distal metacarpal cartilage leading to a spool joint. However, Hufstedler et al. (1996) reported spool joint formation is usually observed when Zeranol's effects are prolonged by repeat implantation or extended feeding periods. Rectal prolapses are another concern when Zeranol implants are used. However, Jones et al. (1997) and Stultz (2000) both found no incidence of rectal prolapses in their trials.

In 2000, Stultz looked at feedlot performance and carcass characteristics of feeder lambs implanted with Zeranol implants. Average daily gain (ADG) and gain to feed ratio was higher for implanted lambs. The average rib eye area and carcass weights of the implanted lambs were larger compared to that of the non-implanted lambs.

Studies of Zeranol implantation in lambs have focused on the use of one implant, but little information is available on the effect of re-implanting lambs with Zeranol. The purpose of this study is to determine the effects of implanting and re-implanting Rambouillet feeder lambs with Zeranol implants on feedlot performance and carcass characteristics.

MATERIALS AND METHODS

This study was conducted at the Angelo State University Management, Instruction and Research Center, located in Tom Green County north of San Angelo, Texas. The lambs were slaughtered and carcasses evaluated at Ranchers' Lamb of Texas, Inc. located east of San Angelo.

One hundred-twenty Rambouillet feeder lambs with a mean BW of 29.5 kg were used. Lambs were randomly assigned to one of three treatments: control – no implant (treatment 1), one Zeranol implant (treatment 2), and one Zeranol implant plus re-implant at d 56 (treatment 3). The implant used was Ralgro-Zeranol (Schering-Plough Animal Health Corporation, Union, NJ). Each treatment was blocked by weight and sex and assigned to one of 30 pens measuring 10 ft. by 40 ft., with 4 lambs per pen, and 10 pens per treatment. Each lamb was vaccinated for Enterotoxemia (over-eating disease), dewormed and shorn before the trial. The first implants for treatment 2 and 3 were put in the left ear on d 0, and the second implant for treatment 3 was put into the right ear on d 56.

All lambs were fed a series of four rations (Table 1) *ad libitum*, with incremental increases in concentrate percentages, to a final finishing ration. Each ration was balanced to meet or exceed NRC requirements (NRC 1985). Lambs had *ad libitum* access to clean, fresh water and lambs were observed daily.

Lambs were weighed at the beginning of the trial and every 28 d afterwards during the 112 d trial, to determine their feedlot performance and weight gain for each treatment. Feed was weighed when it was put in the feeder and taken out and re-weighed at the end of each 28 d period to calculate each pen of four lamb's feed efficiency for all treatments.

During the trial, any lamb that reached market-end-weight (54.5 kg, best market weight for lambs slaughtered at Ranchers' Lamb of Texas, Inc.) on a weigh day was slaughtered. After slaughter, lambs were hung in a one-degree centigrade cooler overnight. The next morning, 12 to 14 hr postmortem, the carcasses were evaluated. At this time, carcass weight, backfat thickness, and leg score were measured and recorded. USDA Quality grades and USDA Yield grades were also recorded. Yield grades were calculated using backfat thickness and the standard formula.

STATISTICAL ANALYSIS

The General Linear Model procedure of SAS (1988) was used to determine the effect of Zeranol implants on lamb performance level and carcass characteristics. Pen of four lambs was considered the experimental unit. Means were considered significant at $P < 0.05$ and a Duncan's Multiple Range test was used to separate means.

Table 1. Dietary composition of lamb diets (as fed basis)

Ingredient	Ration #1	Ration #2	Ration #3	Ration #4
Corn, %	39.00	49.00	57.00	66.00
Peanut hull pellets, %	19.50	22.00	18.00	13.00
Cottonseed meal, %	29.00	16.00	8.00	8.00
Alfalfa pellets, %	7.00	7.50	11.50	7.00
Molasses, %	3.00	3.00	3.00	3.00
Sheep Mineral Premix, %	2.50	2.50	2.50	2.50

RESULTS AND DISCUSSION

A problem that has been associated with implanting lambs with Zeranol has been rectal prolapses. Prolapses usually range from 1% to 5% during the feeding period of Zeranol implanted lambs (Thornsberry 1993). During this trial, no rectal prolapses occured, but a total of 10 ewe lambs experienced vaginal prolapses. Five percent of treatment 2 and 20% of treatment 3 prolapsed vaginally (Table 2). Zeranol, an estrogen-like compound, causes uterine muscles to contract. Additionally, lambs deposit fat around the tail when finished in the feedlot on grain. The added fat plus the estrogen-like activity of the implant creates pressure in the vaginal area of the ewe lamb increasing the possibility of a vaginal prolapse.

Table 2. Prolapse and spool joint incidences on non-implanted, implanted, and double implanted Rambouillet feeder lambs fed a feedlot ration.

	Treatment[a]		
	1	2	3
Number of prolapses	0	2	8
Percent prolapses	0	5	20
Number of spool joints	1	5	7
Percent spool joints	2.5	12.5	17.5

[a]Treatment 1 = control, 2 = single, 3 = double implant.

Another problem associated with implanting with Zeranol is the incidence of spool joints at slaughter. During this trial, a total of 13 lambs contained spool joints with treatments 1, 2 and 3 containing 1 (2.5%, $p < 0.05$), 5 (12.5%) and 7 (17.5%), respectively (Table 2). Field et al. (1990) and Hufstedler et al. (1990) also reported spool joints with the use of Zeranol implants. Implanting with Zeranol, an estrogen-like compound, causes increased levels of estrogen, which can cause greater calcium uptake leading to faster bone ossification. An increased number of lambs with spool joints in treatment three might be attributed to an increase in growth plate closure. Hufstedler et al. (1990) found three or five Zeranol implants resulted in 40 or 100% spool joints, respectively, when given at 30-d intervals.

Urinary calculi is another problem that has been recorded in previous implant studies using Zeranol. During this 112-d feeding period, the incidence of urinary calculi was not observed.

Performance data

Average daily gain was higher ($P < 0.05$) for both implanted treatments when compared to the control lambs on d 28, 56, 84, and overall; however, implanted treatments were similar for the whole trial (Table 3). This agrees with Stultz (2000), that zeranol implanted lambs were faster gaining than non-implanted lambs. Sluiter (1998), also found on d 56 implanted lambs were higher in ADG, but no differences on d 28. However, on d 112 no difference between implanted lamb treatments and the control treatment was found for ADG. Results of this project of implanted lambs on feed over 100 d were similar to Stultz (2000), where no differences were observed in ADG on d 105. Days on feed was less for both implanted treatments when compared to the control group ($P < 0.05$), but the two treatment groups were similar.

Lambs that were single and double implanted had an increased feed efficiency ($P < 0.05$) over the non-implanted lambs on d 56 (Table 4). On d 84, treatment 3 was more efficient ($P < 0.05$) than treatments 1 and 2. However, feed efficiency was similar among treatments on d 28 and 112. Treatments 2 and 3 also had an increased overall feed efficiency ($P < 0.05$) over treatment 1. These findings agree with Stultz (2000), Hufstedler et al. (1996), Jones et al. (1997), and Nold et al. (1992) that using Zeranol implants increases feed efficiency.

Table 3. Average daily gain (kg) and days on feed of non-implanted, implanted, and double implanted Rambouillet feeder lambs fed a feedlot ration, 40 lambs/treatment.

	Treatment[a]			
Day	1	2	3	SE[b]
0-28	0.244[c]	0.290[d]	0.268[d]	0.013
28-56	0.255[c]	0.345[d]	0.327[d]	0.011
56-84	0.239[c]	0.275[d]	0.298[d]	0.014
84-112	0.212	0.174	0.184	0.018
Overall[e]	0.241[c]	0.293[d]	0.295[d]	0.008
DOF[f]	106.05[c]	96.05[d]	92.33[d]	2.029

[a]Treatment 1 = control, 2 = single implant, 3 = double implant.
[b]SE = most conservative standard error of the least square mean.
[cd]Means in the same row with different superscripts differ P < 0.05
[e]Mean overall ADG, d 0 thru slaughter date.
[f]Days on feed.

Table 4. Feed efficiency (kg feed/kg gain) of non-implanted, implanted, and double implanted Rambouillet feeder lambs fed a feedlot ration per pen by treatment 40 lambs/treatment.

	Treatment[a]			
Efficiency by period	1	2	3	SE[b]
0-28	5.92	5.33	5.29	0.271
28-56	5.85[c]	4.83[d]	4.96[d]	0.160
56-84	7.00[c]	7.20[c]	5.73[d]	0.430
84-112	7.44	12.07	7.57	2.072
Overall[e]	6.40[c]	5.84[d]	5.52[d]	0.142

[a]Treatment 1 = control, 2 = single implant, 3 = double implant.
[b]SE = most conservative standard error of the least square mean.
[cd]Means in the same row with different superscripts differ P < 0.05.
[e]Mean feed efficiency d 0-112.

Carcass data

Carcasses were evaluated 12 – 14 hours postmortem. There were no differences among treatment groups for hot carcass weight, backfat, leg circumference, yield grade, or calculated yield grade (Table 5). These results are in contrast to Stultz (2000) and Jones et al. (1997) where they found that implanted lambs had heavier carcasses ($P < 0.05$), but in this trial, lambs were slaughtered at a common weight. Therefore, no differences in slaughter weight were expected and only small differences in dressing percent resulting in even less differences in carcass weight. However, treatment 3 had a lower dressing percentage ($P < 0.05$) than treatments 1 and 2, with treatments 1 and 2 being similar. Hufstedler et al. (1996) also found that implanted lambs had lower dressing percentages.

Table 5. Hot carcass weight, backfat, dressing percentage, leg circumference, yield grade, and calculated yield grade of non-implanted, implanted, and double implanted Rambouillet feeder lambs fed a feedlot ration.

	Treatment[a]			
	1	2	3	SE[b]
Hot carcass weight, lbs	59.5	61.7	60.6	0.89
Backfat[c], in	0.261	0.267	0.247	0.009
Dressing percentage[d]	51.1[e]	51.2[e]	50.0[f]	0.30
Leg circumference, in	27.15	27.27	27.38	0.172
Yield Grade[g]	2.28	2.14	2.18	0.092
CYG[h]	3.01	3.06	2.87	0.095

[a]Treatment 1 = control, 2 = single implant, 3 = double implant.
[b]SE = most conservative standard error of the least square mean.
[c]Backfat measurement at the twelfth rib.
[d]Dressing percentage = (hot carcass weight / live weight) x 100.
[ef]Mean in the same row with different superscripts differ P < 0.05.
[g]Yield grade assigned by USDA grader.
[h]Calculated yield grade

No differences among treatment groups were observed for quality grade (Table 6). However, numerical differences were seen in total number of lambs from each treatment for the choice grade and no grade carcasses. Treatment 3 had 7 no grades, treatment 2 had 5 no grades, and treatment 1 had 1 carcass with no grade, representing 20.5, 12.8, and 2.5 percent, respectively for each treatment. No grade carcasses are carcasses that contained a spool joint and may not be graded as lamb carcasses. For treatments 1, 2, and 3, 38, 32, and 26 lamb carcasses graded choice, respectively.

Table 6. Quality grade by treatment of non-implanted, implanted, and double implanted Rambouillet feeder lambs fed a feedlot ration.[a]

	Treatment[b]		
	1	2	3
N[c]	40	39	34
Prime[d]	1 (2.5)	2 (5.1)	1 (2.9)
Choice	38 (95.0)	32 (82.0)	26 (76.5)
Ng[e]	1 (2.5)	5 (12.8)	7 (20.5)

[a]Quality was analyzed using the categorical models of SAS utilizing Chi Square. A treatment by sex interaction was present, therefore, values in this table are only for main effect demonstration purposes.
[b]Treatment 1 = control, 2 = single implant, 3 = double implant.
[c]Representing only those lambs that were graded, taking out lambs that prolapsed before being graded.
[d]Percent of each treatment in ( ).
[e]NG = Carcasses that received no grade due to the presence of a spool joint.

Double implanted ewe lambs had a lower ($P < 0.05$) percentage of choice grade carcasses and a higher ($P < 0.05$) percentage of no grade carcasses than any other treatment (Table 7). Ewe lambs that were single implanted had a higher ($P < 0.05$) percentage of no grade carcasses than the control or single implanted wether lambs.

Economic calculations were based on actual lamb purchase price, feed cost and carcass value at the time of the current experiment. The average cost of the lambs was

$53.98/lamb with an implant cost of $0.50/implant (Table 8). The cost of gain (cost of ration/weight gain) for the lambs were $19.91, 19.78, and 18.08/lamb for treatments 1, 2, and 3, respectively. The carcass value for each treatment was $88.71, 89.03, and 89.94/lamb for treatments 1, 2, and 3, respectively. The carcass value per lamb for each treatment was calculated after prolapse and spool joint discounts were taken out. The average profit ((carcass value – (lamb cost + implant cost + cost of gain)) for treatment 1, 2, and 3 were $14.82, 14.77, and 9.88, respectively. Having more total no grades because of spool joints and prolapse discounts in treatment 2 and 3 caused the overall average profit/lamb to be lower than treatment 1.

Table 7. Quality grade by sex and treatment of non-implanted, implanted, and double implanted Rambouillet feeder lambs fed a feedlot ration.[a]

	Treatment[b]					
	1		2		3	
	Ewe	Wether	Ewe	Wether	Ewe	Wether
N[c]	25	15	27	12	22	12
Prime[d]	1 (4)	0 (0)	1 (3.7)	1 (8.3)	1 (4.5)	0 (0)
Choice	24 (96)[e]	14 (93)[e]	22 (81.5)[e]	10 (83.3)[e]	14 (63.6)[f]	12 (100)[e]
Ng[h]	0 (0)[e]	1 (7)[e]	4 (14.8)[f]	1 (8.3)[e]	7 (31.8)[g]	0 (0)[e]

[a]Quality gade was analyzed using the categorical models of SAS utilizing Chi Square.
[b]Treatment 1 = control, 2 = single implant, 3 = double implant.
[c]Representing only those lambs that were graded, taking out lambs that prolapsed before being graded.
[d]Percent of each treatment in ( ).
[efg]Values in a row without common superscripts are different P < 0.05.
[h]NG = carcasses that received no grade due to the presence of a spool joint.

Table 8. Economic data on non-implanted, implanted, and double implanted Rambouillet feeder lambs fed a feedlot ration.

	Treatment[a]		
	1	2	3
Lamb cost[b]	$53.98	$53.98	$53.98
Implant cost	0.00	0.50	1.00
Cost of Gain[c]	19.91	19.78	18.08
Carcass value[d]	88.71	89.03	82.94
Average profit[e]	14.82	14.77	9.88

[a]Treatment 1 = control, 2 = single implant, 3 = double implant.
[b]Average value of all lambs on the experiment at initiation of project.
[c]Cost of ration/weight gain.
[d](Average sale value of carcass) – (Discounts)
[e]Profit = (carcass value) – (lamb cost + implant cost + cost of gain)

Economic data on no-implanted, implanted and double implanted Rambouillet wethers versus ewe feeder lambs fed a feedlot ration are presented in Table 9. No differences existed in cost of gain across all treatments. However, single and double implanted wether lamb carcasses had a higher (P < 0.05) value and profit margin than implanted ewe and control lambs. Double implanted ewe lambs had a lower ($P < 0.05$) carcass value and profit margin than all other treatments.

Table 9. Economic data on non-implanted, implanted, and double implanted Rambouillet wethers versus ewe feeder lambs fed a feedlot ration.

	Treatment[a]						
	1		2		3		
	Ewe	Wether	Ewe	Wether	Ewe	Wether	SE
Lamb cost[b]	53.98	53.98	53.98	53.98	53.98	53.98	0.00
Implant Cost	0.00	0.00	0.50	0.50	1.00	1.00	0.00
Cost of gain[c]	19.91	19.91	19.78	19.78	18.08	18.08	1.37
CarcassValue[d]	88.01[e]	89.88[e]	85.33[e]	97.66[f]	78.27[g]	93.00[e]	1.93
Profit[h]	14.12[e]	15.99[e]	11.07[e]	23.40[f]	5.21[g]	19.94[e]	1.68

[a]Treatment 1 = control, 2 = single implant, 3 = double implant.
[b]Average value of all lambs on the experiment at initiation of project.
[c]Cost of ration/weight gain.
[d](Average sale value of carcasses) – (discounts)
[efg]Means in the same row with different superscripts differ $P<0.05$.
[h]Profit = (carcass value) – (lamb cost + implant cost + cost of gain).

CONCLUSIONS

The data collected in this trial indicates that implanting Texas Ramboulliet feeder lambs with Zeranol will increase their ADG and feed efficiency. However, re-implanting the lambs did not improve performance to justify double implanting lambs. The ewe lambs that were implanted (once or twice) during the trial resulted in several discounts from spool joints and prolapses, however the wether lambs excelled on the implants. In conclusion, implanting Texas Rambouillet wether feeder lambs causes them to be more efficient, lowering the cost of gain, but implanting ewe lambs is cost prohibitive.

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