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Length of docked tail and the incidence of rectal prolapse in lambs¹

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ABSTRACT: A multistate cooperative study was conducted to study the current issue of tail length in docked lambs and its relationship to incidence of rectal prolapse. A total of 1,227 lambs at six locations were randomly allocated to two or three tail dock treatments: 1) short—tail was removed as close to the body as possible, 2) medium—tail was removed at a location midway between the attachment of the tail to the body and the attachment of the caudal folds to the tail, and 3) long—tail was removed at the attachment of the caudal folds to the tail. Short-docked lambs had a greater ($P < 0.05$) incidence of rectal prolapse (7.8%) than lambs with a medium (4.0%) or a long (1.8%) dock. Female lambs had a higher ($P < 0.05$) incidence of rectal prolapse than male lambs. At two stations, lambs were finished either

in a feedlot on a high-concentrate diet or on pasture with no grain supplementation. At one station, with a very low incidence of rectal prolapse, there was no difference in incidence between lambs finished in the feedlot or on pasture; however, at the station with a relatively high incidence of rectal prolapse, lambs in the feedlot had a higher ($P < 0.05$) incidence than lambs on pasture. The half-sib estimate of heritability for the incidence of rectal prolapse was low (0.14). The results of this study strongly implicate short dock length as a cause of rectal prolapse in lambs finished on high-concentrate diets. Furthermore, the results of this study and the only other study known conducted on this issue strongly suggest that docking lambs at the site of the attachment of the caudal folds to the tail will result in a negligible incidence of rectal prolapse.

Key Words: Docking, Heritability, Lambs, Rectal Prolapse, Sheep, Tail

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Introduction

Manure accumulated on long, wooly tails of sheep provides an attractive environment for flies to lay their eggs. Resulting fly larvae irritate, injure, and kill successive layers of skin on the sheep, and infected animals that are not treated may die from shock, intoxication, or

infection (Merck, 1998). Lambs with docked (shortened) tails have a lower incidence of fly strike than lambs with undocked tails (French et al., 1994; Webb-Ware et al., 2000). Also, most buyers of lambs pay less for lambs with an undocked tail because the tail is inedible and may have considerable weight (Battaglia, 1998). Therefore, tails on lambs are usually docked at a young age.

However, complete removal of the tail actually results in an increased incidence of fly strike compared to lambs with shortened tails (Watts and Marchant, 1977; Watts and Luff, 1978). Several U.S. sheep management references (e.g., Williams, 1990; ASI, 1996; Battaglia, 1998) recommend longer dock lengths (2.5 to 7.6 cm in young lambs) compared to complete removal of the tail but primarily to decrease the incidence of rectal prolapse. Windels (1990) had found that short dock lengths resulted in an increased incidence of rectal

¹Results of a cooperative study by five member stations of the North Central Regional Coordinating Committee on Increased Efficiency of Sheep Production (NCR-190).

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prolapse. However, many purebred sheep breeders and most producers of wether lambs for shows (club lamb producers) completely remove the tails of their lambs to create an illusion of greater rear leg muscularity. They remain unconvinced of any detrimental effects of complete tail removal (Breeders' World, 2002). Some U.S. agricultural organizations have recently condemned the practice of complete removal of tails in lambs (USAHA, 1999; AVMA, 2000; AFBF, 2002).

The objective of this study was to determine the effects of three dock lengths on the incidence of rectal prolapse in lambs.

Materials and Methods

Docking Treatments

Lambs born in the winter and spring of 2000 in research flocks at the Iowa State University, Texas A&M University, Ohio State University, Oregon State University, and University of Wisconsin-Madison were utilized in the trial. All lambs were docked using Elastrator bands. Docking treatments were as follows: 1) Short—Elastrator band placed on the tail as close to the body as possible so that virtually the entire tail was removed, 2) Medium—Elastrator band placed on the tail at a location midway between the attachment of the tail to the body and the attachment of the caudal folds to the tail, and 3) Long—Elastrator band placed on the tail at the attachment of the caudal folds to the tail. Caudal folds are webs of skin on both sides of the anus with one end connected to the ventral side of the tail and the other end connected to the body. In lambs docked at less than 1 wk of age, the Long treatment left a dock of 5.0 to 7.5 cm in length and the Medium treatment left a dock of 2.5 to 3.8 cm in length.

In order to have a relatively large number of lambs within treatment groups at each station, it was not possible to have all three docking treatments represented at every station. All stations had the Short treatment. Wisconsin and Oregon had all three treatments, and the remaining four sites had two treatments: the Medium or Long treatment plus the Short treatment (Table 1). Examples of the three dock lengths in finishing lambs are presented in Figure 1.

A rectal prolapse was defined as an inversion of the rectum that protruded 4 cm or more outside the body and remained exterior to the body while the animal was standing. If a lamb was observed with a rectal prolapse and in the future was not observed with a rectal prolapse, it was still classified as having a rectal prolapse. This situation occurred with one lamb. All animals were examined for rectal prolapse during routine weighings. In addition, any new rectal prolapses observed during routine feeding and caring of lambs were recorded.

Description of Animals and Locations

Iowa State University. Lambs were born at the McNay Research and Demonstration Farm in February and

March 2000. They were the result of multiple-sire mating Suffolk and East Friesian rams to crossbred white-face ewes of Polypay, Romanov, Dorset, Columbia, and/or East Friesian breeding. Most of the East Friesian-sired ewe lambs were not included in the trial because they were to be retained as replacements, and a uniform dock length was desired in the group. Trial lambs were randomly assigned to the Short or Long treatments and were docked prior to 3 d of age. Male lambs were castrated. Lambs were born and raised in confinement, weaned at approximately 10 wk of age, and offered an 18% CP creep diet from shortly after birth through 12 wk of age. During lactation, dams were fed approximately 2 kg of alfalfa hay and 1.2 kg of whole shelled corn per day. Lambs were placed on a finishing diet of whole shelled corn and a high-protein pellet with no roughage at approximately 12 wk of age in groups starting on May 3, 2000, and sold as market lambs from July through September 2000 at approximately 60 kg live weight. Lambs gained approximately 0.3 kg/d during the postweaning period.

Ohio State University. Two separate trials were conducted in Ohio, one at the campus sheep farm at Columbus and the other at the Ohio Agricultural Research and Development Center (OARDC), at Wooster.

At Columbus, purebred Suffolk and Dorset lambs were born in a barn in January through March, and crossbred lambs (Dorper or Suffolk sires and Merino × Targhee dams) were born in March through May on pasture. All lambs were from single-sire matings. Purebred male lambs were left intact, and crossbred male lambs were castrated. Lambs were docked at 3 to 7 d of age and randomly assigned to the Short or Medium treatments. Purebred lambs were raised in confinement on a creep diet, weaned at 55 to 70 d of age, and finished on a whole shelled corn/pelleted supplement diet in a feedlot. Crossbred lambs were raised on pasture with no access to creep feed, weaned at 70 to 85 d of age, and finished in a feedlot on a whole shelled corn/pelleted supplement diet.

At OARDC, Dorset × Targhee lambs and Hampshire-sired (1/2 to 7/8 Hampshire breeding) lambs were born in January and February. All lambs were from single-sire matings. Lambs were docked at 3 to 7 d of age and randomly assigned to the Short or Medium treatments. All but four male lambs were castrated at the time of docking. All lambs had access to a creep feed containing 30% alfalfa meal, 27.2% soybean meal, 38.1% ground corn, and 4.7% vitamin and mineral premix. Lambs were weaned at 45 to 60 d of age, and the last weaning occurred on April 11, 2000. Lambs remained in the barn at weaning and were fed their creep diet. All Dorset × Targhee lambs and approximately 1/3 of the Hampshire-sired lambs were moved to pasture on April 25, 2000. The pasture lambs were rotationally grazed on either alfalfa or ryegrass pastures, finished with no grain supplementation, and gained approximately 0.2 kg/d. The remaining lambs stayed in the barn and were fed one of five complete pelleted diets for an average of

Table 1. Observed incidence of rectal prolapse in lambs with short-, medium-, and long-docked tails

| Location | Breed | Sex ^b | Nutrition ^c | No. of lambs/treatment ^a | | | No. of rectal prolapses | | | Rectal prolapses, % | | |
|-----------------------------------|---------------|------------------|------------------------|-------------------------------------|-------|-----|-------------------------|----|---|---------------------|------|-----|
| | | | | S | M | L | S | M | L | S | M | L |
| Iowa | E. Friesian × | F | Feedlot | 3 | — | 2 | 0 | — | 0 | 0.0 | — | 0.0 |
| Iowa | E. Friesian × | M | Feedlot | 19 | — | 19 | 1 | — | 0 | 5.3 | — | 0.0 |
| Iowa | Suffolk × | F | Feedlot | 30 | — | 33 | 5 | — | 1 | 16.7 | — | 3.0 |
| Iowa | Suffolk × | M | Feedlot | 26 | — | 30 | 2 | — | 2 | 7.7 | — | 6.7 |
| Ohio-C ^d | Dorper × | F | Feedlot | 3 | 6 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Ohio-C | Dorper × | M | Feedlot | 5 | 2 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Ohio-C | Dorset | F | Feedlot | 9 | 10 | — | 1 | 1 | — | 11.1 | 10.0 | — |
| Ohio-C | Dorset | M | Feedlot | 6 | 2 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Ohio-C | Suffolk | F | Feedlot | 21 | 25 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Ohio-C | Suffolk | M | Feedlot | 16 | 15 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Ohio-C | Suffolk × | F | Feedlot | 20 | 25 | — | 2 | 2 | — | 10.0 | 8.0 | — |
| Ohio-C | Suffolk × | M | Feedlot | 25 | 20 | — | 2 | 0 | — | 8.0 | 0.0 | — |
| Ohio-W ^e | Dorset × | F | Pasture | 9 | 9 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Ohio-W | Dorset × | M | Pasture | 7 | 6 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Ohio-W | Hampshire × | F | Feedlot | 30 | 25 | — | 9 | 1 | — | 30.0 | 4.0 | — |
| Ohio-W | Hampshire × | M | Feedlot | 31 | 35 | — | 2 | 3 | — | 6.5 | 8.6 | — |
| Ohio-W | Hampshire × | F | Pasture | 12 | 17 | — | 1 | 0 | — | 8.3 | 0.0 | — |
| Ohio-W | Hampshire × | M | Pasture | 14 | 20 | — | 0 | 0 | — | 0.0 | 0.0 | — |
| Oregon | Dorper × | M | Feedlot | 2 | 4 | 6 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Oregon | Dorper × | F | Pasture | 25 | 20 | 25 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Oregon | Dorper × | M | Pasture | 16 | 17 | 15 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Oregon | Suffolk × | M | Feedlot | 7 | 3 | 6 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Oregon | Suffolk × | F | Pasture | 28 | 38 | 27 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Oregon | Suffolk × | M | Pasture | 19 | 19 | 16 | 1 | 0 | 0 | 5.3 | 0.0 | 0.0 |
| Texas | Rambouillet | F | Feedlot | 14 | — | 15 | 1 | — | 0 | 7.1 | — | 0.0 |
| Texas | Rambouillet | M | Feedlot | 17 | — | 20 | 3 | — | 0 | 17.6 | — | 0.0 |
| Texas | Suffolk × | F | Feedlot | 4 | — | 4 | 0 | — | 0 | 0.0 | — | 0.0 |
| Texas | Suffolk × | M | Feedlot | 4 | — | 4 | 0 | — | 0 | 0.0 | — | 0.0 |
| Wisconsin | Suffolk × | F | Feedlot | 40 | 44 | 39 | 7 | 6 | 2 | 17.5 | 13.6 | 5.1 |
| Wisconsin | Suffolk × | M | Feedlot | 52 | 40 | 50 | 3 | 1 | 1 | 5.8 | 2.5 | 2.0 |
| Overall—within docking treatment | | | | 514 | 402 | 311 | 40 | 14 | 6 | 7.8 | 3.5 | 1.9 |
| Overall—across docking treatments | | | | | 1,227 | | | 60 | | 4.9 | | |

^aDocking treatment: S = Short, M = Medium, L = Long.

^bSex: F = female, M = male.

^cNutrition refers to finishing diet before marketing. Feedlot = high-grain diet in confinement, and Pasture = no grain, pasture only.

^dOhio-Columbus.

^eOhio-Wooster.

42 d. The diets consisted of alfalfa meal (33 or 67%) with either ground corn (33 or 67%) and/or soy hulls (33 or 67%), and lambs gained approximately 0.37 kg/d.

Oregon State University. Mature whiteface (predominantly Polypay breeding) and blackface (at least 3/4 Suffolk breeding) ewes were randomized within genotype into four mating groups. Two of the groups were single sire-mated to Dorper rams and the other two groups were combined for group mating with three Suffolk rams. Ewes lambed indoors starting in late February; mean lambing date was March 9, 2000. Lambs were docked at 1 d of age, and Short, Medium, and Long dock treatments were applied in the order in which lambs were processed irrespective of sex or genotype. Lambs and their dams were grazed to weaning on pastures without supplementation. Lambs were weaned as one group at a mean age of 92 d and averaged

31 kg in BW. Following weaning, 28 wether lambs (12 from Dorper sires and 16 from Suffolk sires) were placed in drylot and grown on a 14% protein, pelleted, high-concentrate diet to a mean slaughter weight of 56 kg. Average daily gain during this period was approximately 0.27 kg. Remaining lambs grazed dry pasture over summer and were finished over winter on ryegrass seed fields. The pasture lambs had a mean weight of 61 kg when sold at near 1 yr of age.

Texas A&M University. The trial was conducted at the San Angelo Research and Extension Center. Rambouillet and Suffolk sires were mated to Rambouillet dams in single-sire mating groups to produce straightbred Rambouillet and F₁ Suffolk × Rambouillet lambs. The animals were born from January through April 2000 in drylot. Docking was done when lambs were approximately 5 d old. Lambs were randomly allo-

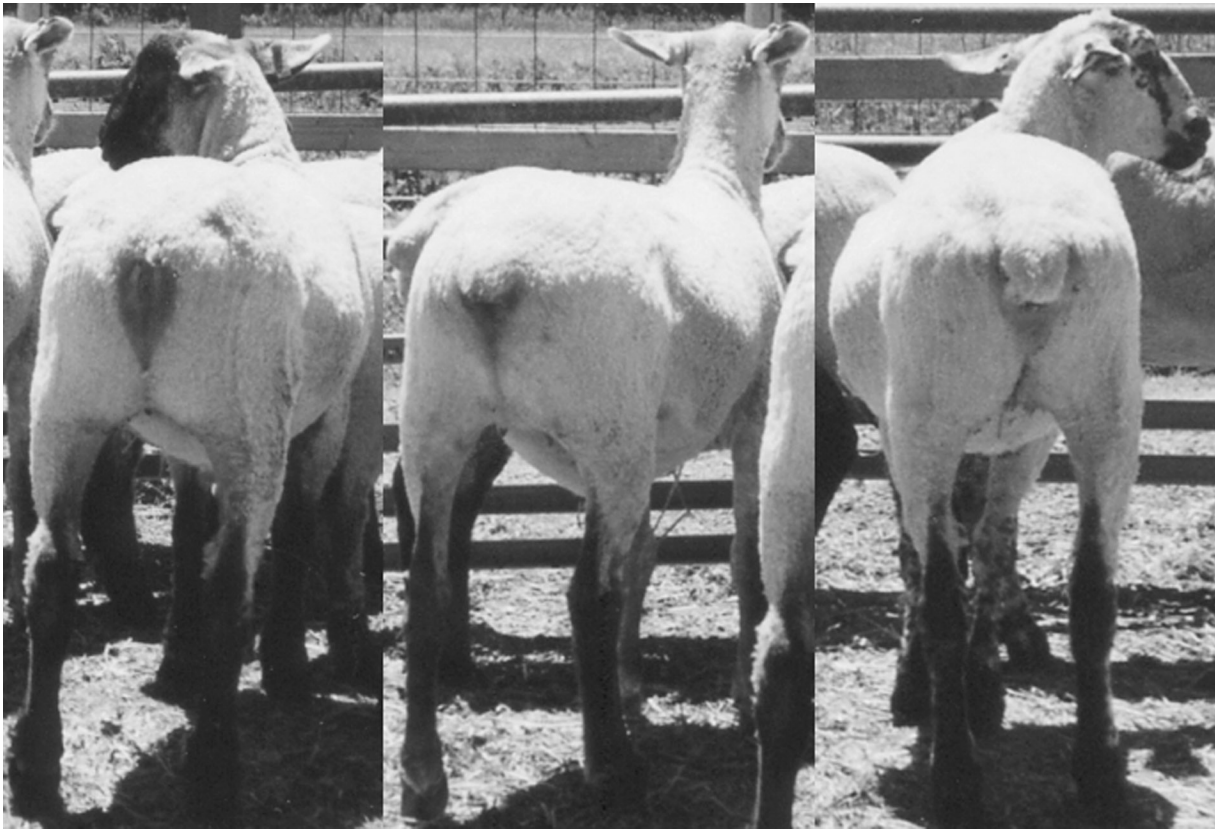


Figure 1. Examples of the three dock lengths on lambs at the University of Wisconsin-Madison. From left to right: Short, Medium, and Long.

cated to the Short or Long dock treatments. Male lambs were castrated. When lambs were approximately 10 d old, ewes and lambs were moved to a large pasture with access to a creep diet containing sorghum grain and cottonseed meal. Ewes received no supplementation during the nursing period. Lambs were weaned at approximately 60 d of age and moved to a feedlot where they were transitioned from a low-energy to a high-energy diet over a 4-wk period. The final ground diet contained 73% sorghum grain, 6.5% cottonseed meal, and 21.5% hay. Lamb postweaning average daily gain was approximately 0.25 kg. Lambs were sold through October 2000 after reaching a target weight of 51.4 kg for wethers and 47.7 kg for ewes or after rectal prolapses were observed.

University of Wisconsin-Madison. Lambs were born at the Spooner Agricultural Research Station in a barn in February and March 2000 and were the result of single-sire matings of Suffolk sires to East Friesian-cross dams. Lambs were docked by 3 d of age and randomly assigned to the Short, Medium, or Long treatments. All male lambs were castrated. Lambs were raised artificially on milk replacer and weaned at approximately 30 d of age or by their dams until weaned at approximately 30 or 60 d of age. From shortly after birth through weaning, lambs had ad libitum access to a 22% crude protein creep diet in confinement. Lambs were finished in a feedlot at the Arlington Agricultural

Research Station on a whole shelled corn and high-protein pellet with no roughage and marketed at approximately 57 kg live weight. Lamb postweaning average daily gain was approximately 0.3 kg.

The animal research protocols at all institutions were approved by an institutional animal care and use committee or followed the guidelines stated in the *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching* (FASS, 1999).

Statistical Analyses

Lambs were recorded a 1 if they produced a rectal prolapse and a 0 if they did not. Prolapse data were analyzed using the MIXED procedures of SAS (SAS Inst. Inc., Cary, NC) in order to develop the final model to be used. The initial model included the fixed effects of docking treatment (Short, Medium, Long), sex of lamb (male, female), location (Iowa, Texas, Ohio-Columbus, Ohio-Wooster, Oregon, Wisconsin), postweaning nutrition within location (feedlot vs. pasture at Ohio-Wooster and Oregon), breeding of lamb within location (see Table 1 for breed type of lambs), and all possible two-way interactions among fixed effects and the random effect of residual. Breeding of lamb within location and all of the two-way interactions except location \times sex of lamb failed to approach significance ($P > 0.10$) and were deleted from the final model.

Table 2. Number of lambs and least squares means \pm standard errors for incidence (%) of rectal prolapse by location, sex of lamb, and dock length

| Fixed effects | Level of fixed effects | No. of lambs | Rectal prolapse, % |
|---------------|------------------------|--------------|--------------------------------|
| Location | Iowa | 162 | 6.89 \pm 1.75 ^a |
| | Ohio-Columbus | 210 | 2.24 \pm 1.56 ^{bc} |
| | Ohio-Wooster | 215 | 5.63 \pm 1.54 ^{ab} |
| | Oregon | 293 | 0.12 \pm 2.16 ^c |
| | Texas | 82 | 4.54 \pm 2.39 ^{abc} |
| | Wisconsin | 265 | 7.81 \pm 1.30 ^a |
| Sex of lamb | Female | 612 | 5.98 \pm 1.03 ^a |
| | Male | 615 | 3.10 \pm .95 ^b |
| Dock length | Short | 514 | 7.81 \pm 1.01 ^a |
| | Medium | 402 | 3.97 \pm 1.26 ^b |
| | Long | 311 | 1.85 \pm 1.32 ^b |

^{a,b}Within a fixed effect, means without a common superscript letter differ ($P < 0.05$).

The final model was used with the GLIMMIX macro of SAS. This macro is recommended for use with mixed models with categorical data. Unfortunately, convergence did not occur with the GLIMMIX procedure, and the final analysis was completed using the MIXED procedure of SAS. A subsequent analysis was performed with the MIXED procedure of SAS to determine the effect of individual sire on the incidence of rectal prolapse in order to estimate the heritability of the trait. All the Iowa lambs and the Suffolk-sired lambs at Oregon were deleted from this analysis because individual sire was not known for these lambs. The above final model was used with the addition of the random effect of sire within location.

Results

A summary of the data is presented in Table 1. A total of 60 rectal prolapses occurred among the 1,227 lambs in the study, for an overall incidence of 4.9%. Considerable variation existed among fixed effect combinations for incidence of rectal prolapse ranging from 0.0 to 30.0%. No rectal prolapses were observed in lambs in 44 of the 68 location-breed-sex-nutrition-dock treatment combinations. Location-breed-sex-dock length combinations with the largest incidences of rectal prolapse were as follows: Ohio-Wooster, Hampshire-cross, ewes, short dock (9/30 = 30.0%); Texas, Rambouillet, wethers, short dock (3/17 = 17.6%); Wisconsin, Suffolk-cross, ewes, short dock (7/40 = 17.5%); and Iowa, Suffolk-cross, ewes, short dock (5/30 = 16.7%).

Least squares means for incidence of rectal prolapse for the fixed effects of location, sex of lamb, and dock length are presented in Table 2. Wisconsin and Iowa had higher ($P < 0.05$) incidences of rectal prolapse (7.81 and 6.89%, respectively) than did Ohio-Columbus or Oregon (2.24 and 0.12%, respectively). The incidences at Ohio-Wooster and Texas were intermediate (5.63 and 4.54%, respectively).

Ewe lambs had an incidence of rectal prolapse 1.9 times greater ($P < 0.05$) than male lambs (5.98 vs.

3.10%, respectively). This result supports the observation of Windels (1990), where ewe lambs had an incidence 2.3 times greater than male lambs; however, the difference between sexes was not statistically significant in that study. However, ewe lambs did not have a significantly higher incidence of rectal prolapse than male lambs at all locations (Table 3), and the location \times sex of lamb interaction tended toward significance ($P < 0.06$). Ewe lambs had a higher ($P < 0.05$) incidence of rectal prolapse than male lambs at Ohio-Wooster and Wisconsin, but differences between sexes at the other four locations were not statistically significant.

Incidence of rectal prolapse was greater ($P < 0.05$) for Short-docked lambs (7.81%) than for either Medium- (3.97%) or Long-docked (1.85%) lambs (Table 2), but the difference between the Medium- and Long-docked groups was not statistically significant. Using a Medium dock length instead of a Short dock length decreased the incidence of rectal prolapse by 49.2%, and using a Long dock length instead of a Short dock length decreased the incidence of rectal prolapse by 76.3%. Windels (1990) also reported a lower ($P < 0.05$) incidence of rectal prolapse in lambs with a longer dock length.

All lambs at Iowa, Ohio-Columbus, Texas, and Wisconsin were finished in a feedlot on high-concentrate diets. At Ohio-Wooster and Oregon, 44 and 90%, respectively, of the lambs were finished on pasture with no grain supplementation, and the remainder of the lambs were finished in a feedlot on high-concentrate diets. At Ohio-Wooster, there was only one lamb that had a rectal prolapse in the group of lambs that went to pasture, and this lamb actually prolapsed in the barn before being placed on pasture and recovered once on pasture. Therefore, no lambs prolapsed while on pasture. During the same time that these lambs were on pasture, the group in the feedlot experienced 13 new prolapse incidences. The least squares mean for incidence of rectal prolapse for pasture-raised lambs at Ohio-Wooster presented in Table 4 was a negative value, which is nonsensical. This arises due to the very low incidence in this group and the statistical adjustments that are done in

Table 3. Least squares means \pm standard errors for incidence (%) of rectal prolapse by location and sex of lamb combinations

| Location | Female | | Male | |
|---------------|--------|-------------------------------|------|------------------------------|
| | No. | Rectal prolapse, % | No. | Rectal prolapse, % |
| Iowa | 68 | 8.62 \pm 2.60 ^a | 94 | 5.16 \pm 2.23 ^a |
| Ohio-Columbus | 119 | 3.91 \pm 2.01 ^a | 91 | 0.58 \pm 2.27 ^a |
| Ohio-Wooster | 102 | 8.99 \pm 2.16 ^a | 113 | 2.27 \pm 2.07 ^b |
| Oregon | 163 | 0.00 \pm 2.79 ^{*a} | 130 | 0.56 \pm 2.25 ^a |
| Texas | 37 | 2.50 \pm 3.50 ^a | 45 | 6.58 \pm 3.18 ^a |
| Wisconsin | 123 | 12.19 \pm 1.90 ^a | 142 | 3.44 \pm 1.77 ^b |

*Value was -0.32% (not significantly different from zero), so a zero value is reported.

^{a,b}Within a location, means without a common superscript letter differ ($P < 0.05$).

the analysis for other fixed effects. The negative value should be interpreted as a 0% incidence of rectal prolapse in pasture-finished lambs at Ohio-Wooster, which is considerably lower ($P < 0.01$) than the 11.34% incidence in feedlot lambs at the same location. The Oregon data do not provide a good test of the effects of pasture and feedlot finishing on the incidence of rectal prolapse because only 28 lambs were finished in the feedlot, and only 1 lamb out of 293 total lambs at Oregon had a prolapse.

Nine hundred of the 1,227 lambs in the study were the result of single-sire matings. A total of 41 sires from five different breeds were represented in these single-sire matings. The half-sib estimate of heritability for incidence of rectal prolapse using data from these 900 lambs was 0.14.

Discussion

This study provides strong evidence that ultrashort docks (complete absence of any tail), such as those found on most club lambs and on many purebred breeding sheep in the United States, places these animals at a greater risk of developing a rectal prolapse compared to lambs with longer docks when they are finished on high-concentrate diets.

The incidence of rectal prolapse among Long-docked lambs (1.85%) was not significantly different from a zero incidence. Therefore, removal of the tail at the caudal folds seems to result in a length long enough to reduce the incidence of prolapse to a negligible level. Even though the incidence of prolapse in Medium-

docked lambs (3.97%) was not significantly greater than the incidence in Long-docked lambs, the 3.97% incidence in Medium-docked lambs was significantly greater than a zero incidence. Furthermore, if the results of this study are taken together with the results of the study of Windels (1990), a strong case can be made for recommending the Long dock over the Medium dock. The Short dock treatment in the study of Windels (1990) (2.5 cm of tail remaining on a 1-d-old lamb) was similar to the Medium dock treatment in the present study, and the Long dock treatments in the two studies were similar in length. Windels (1990) reported a significant difference between their Short (similar to our Medium) dock and Long dock treatments (8.0 and 0.0% incidence of rectal prolapse, respectively). Therefore, the only two studies to evaluate the effect of dock length on incidence of prolapse have shown that docking lambs at the mid-caudal folds results in a higher incidence of prolapse than docking lambs where the folds attach to the tail.

The data of Windels (1990) were described in enough detail that the 576 lambs could be added to the present data set as if they were from a seventh site that utilized the Medium and Long dock treatments. This was done, and the new data set of 1,803 lambs was analyzed with the same model as used in this study. The least squares means for incidence of rectal prolapse for Short-, Medium-, and Long-docked lambs from analysis of this combined data set were 8.1, 5.6, and 0.4%, respectively, and each mean was different ($P < 0.05$) from the other two. This provides strong evidence that lambs that are to be fed high-concentrate finishing diets should be docked where the caudal folds attach to the tail rather

Table 4. Least squares means \pm standard errors for incidence (%) of rectal prolapse of lambs finished on pasture or in the feedlot at Ohio-Wooster and Oregon

| Location | Feedlot | | Pasture | |
|--------------|---------|--------------------------------|---------|-------------------------------|
| | No. | Rectal prolapse, % | No. | Rectal prolapse, % |
| Ohio-Wooster | 121 | 11.34 \pm 1.99 ^a | 94 | 0.00 \pm 2.24 ^{*b} |
| Oregon | 28 | 0.00 \pm 4.20 ^{**a} | 265 | 0.44 \pm 1.33 ^a |

*Value was -0.08% (not significantly different from zero), so a zero value is reported.

**Value was -0.19% (not significantly different from zero), so a zero value is reported.

^{a,b}Within a location, means without a common superscript letter differ ($P < 0.05$).

than at either the mid-caudal folds or at the body to reduce the incidence of rectal prolapse.

Several U.S. national agricultural and animal health organizations have passed resolutions recommending that lambs not be docked ultrashort, and some have specifically recommended that lambs not be docked shorter than at the attachment of the caudal folds to the tail. These organizations include the American Farm Bureau Federation (AFBF, 2002), American Veterinary Medicine Association (AVMA, 2000), National Lamb Feeders Association (Leder, 2001), and United States Animal Health Association (USAHA, 1999). Due to a joint recommendation by the California Farm Bureau Federation (CFBF), California Wool Growers Association, and the California Veterinary Medical Association to the California Department of Food and Agriculture in 1999 (R. de Grassi, CFBF, personal communication), California was the first state to require minimum dock lengths for sheep exhibited at livestock shows in its state. Sheep exhibited after December 31, 1999 at California fairs receiving state funds are required to have a tail that can be lifted (Wagaman, 2000). Other states (e.g., Wyoming, Washington, Maryland, and West Virginia) have followed the California example and now require or are in the process of implementing a minimum dock length for sheep exhibited in their states (Inskeep, 2001). In addition, the Michigan Sheep Breeders Association has recommended that sheep exhibited in Michigan have a "tail that can be lifted from the exterior" (Warrick, 2003), and the Wisconsin Sheep Breeders Cooperative passed a resolution in 2002 recommending that the U.S. Department of Agriculture require a minimum dock length on sheep crossing state lines (Flora, 2002). The results of this study and the study of Windels (1990) provide a scientific basis for these recommendations.

The United States appears to be one of the only countries where ultrashort docks are common. Some of the major sheep-producing countries have national codes of practice or laws that set minimum dock lengths in sheep. In the United Kingdom, the law states that sufficient tail (dock) must be left on males to fully cover the anus and in females to fully cover the vulva (Henderson, 1990) to protect the anus and vulva from flies and adverse weather conditions. Similar docked tail lengths are recommended in Australia (VDNRE, 2001) and New Zealand (MAF, 1996). In justification of the New Zealand recommendation, it is stated that "the tail is left long enough to cover the vulva and the equivalent length in males. This may help ensure that when the tail is lifted for defaecation the caudal folds on either side are raised and the faeces directed away from the body, thereby helping prevent faecal contamination of wool and helping prevent blowfly strike. If tails are very short the caudal folds are not raised and soft faeces are more likely to soil the area below and on either side of the tail" (MAF, 1996). For a docked tail to be long enough to cover the vulva, it needs to be docked 1 or 2 cm posterior to the junction of the caudal folds and

the tail. Therefore, the recommended or required dock length in these countries is longer than the Long-dock treatment in this study.

Ultrashort docks appear to compromise the health and well-being of sheep through an increased incidence of fly strike and rectal prolapse. However, with particular reference to rectal prolapse, there is no doubt that there are factors other than dock length that influence its incidence. Female lambs have a greater incidence than male lambs, and the cause of this sex effect is not known. Is it due to differences between the sexes in anatomy, hormone levels, or other factors?

The fact that the incidence of rectal prolapse ranged between 0.12% (not significantly different from 0%) to 7.81% among the six locations in this study suggests that there are management and environmental factors not quantified in this study that influence the incidence of rectal prolapse. The data from Ohio-Wooster suggests that a feedlot environment postweaning is more conducive to an increased incidence of rectal prolapse than a pasture environment. What is it about the two environments that results in this difference? Is it the increased body fatness, lack of exercise, increased coughing, actual components of the grain diet, or other factors that account for the increased incidence in feedlot lambs compared to pasture-fed lambs? Studies should be conducted to answer these questions so that alternative management, health, or nutritional practices can be implemented, along with increased dock length, to reduce the incidence of prolapse in feedlot lambs to even lower levels.

We know of no other estimate of the heritability of rectal prolapse in the scientific literature. The estimate from this study was low, suggesting that the great majority of the variation between animals for presence or absence of rectal prolapse is due to environmental effects and less is due to genetic differences. However, some genetic control over rectal prolapse is indicated, and producers would be wise to cull sires that produce lambs with an incidence of rectal prolapse well above the average. Even so, greater progress in reducing incidence of prolapse will be realized by implementing changes in management and environmental factors known to affect the incidence of rectal prolapse, such as increased dock length.

Implications

Ultrashort docking of lambs at the base of the tail, so that virtually no tail remains, results in a significant increase in the incidence of rectal prolapse. Docking lambs at the site where the caudal folds on the underside of the tail attach to the tail significantly decreases the incidence of rectal prolapse to negligible levels. Ultrashort docking is a cosmetic fad promoted in the show ring that compromises the health and well-being of sheep. The practice should be abandoned.

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