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The Texas Agricultural Experiment Station
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CONTENTS

NEED 3. CONTROL OF ANIMAL PREDATIONS ON DOMESTIC LIVESTOCK

Losses of domestic animals due to predation are a major problem, particularly for sheep and goat production. Domestic dogs and wildlife species kill sheep and goats, inflicting significant economic losses on individual ranchers. The research objective is to reduce animal predations on domestic livestock by developing safe, effective, acceptable methods of protection or prevention.

NEED 4. IMPROVED KNOWLEDGE OF NUTRITION OF SHEEP AND GOATS

Production costs and animal performance are largely dependent upon range management, utilization of native species, and feedlot performance. Supplemental feeding is an economic alternative in some situations to improve animal performance, particularly to increase lamb or kid crops or to advance animal growth when merited by prices. Sheep and goat nutrition is directly related to management practices as the most efficient means of improving performance.

NEED 5. PREVENTION AND CONTROL OF INFECTIOUS DISEASES OF SHEEP AND GOATS

The prevention and control of diseases in sheep and goats is essential to maintain healthy flocks which produce efficiently. Death losses may range from 0.5 to 5% annually, caused by a wide number of disease problems, some of which may have spontaneous outbreak. Research in animal management and veterinary medicine is targeted for effective prevention, control and therapeutic measures, including investigation of vaccines, rapid accurate diagnostic procedures, and investigation of new diseases which may occur in the industry.

NEED 6. PRODUCTION AND MARKETING TECHNOLOGY FOR SHEEP AND GOAT MEAT

Approximately 75% of the income from the sheep industry comes from the sale of slaughtered animals. Mohair prices may fluctuate but the meat value of Angora Goats is significant for some ranchers. Overall, the industry is faced with low carcass weights and meat yields, and small-sized cuts of meat, representing certain inefficiencies in the production, processing, and marketing of meat products. The research objective is to improve the production and marketing technology of lamb, mutton and goat meat and related products. Processing techniques, consumer acceptance, and improved market channels are included in the research scope.

NEED 7. CONTROL OF INTERNAL AND EXTERNAL PARASITES OF SHEEP AND GOATS

Nearly all commercial sheep and goat flocks are infested with internal and external parasites. Parasitism may be particularly severe in periods of heavy rain/warm weather or when animals are under stress from food shortages or weather conditions. Investigations concentrate on the control of internal and external parasites, including new therapeutic and control measures for parasitism, evaluation of anthelmintics and investigation of pest management systems, including potential genetic resistance.

NEED 8. IMPROVEMENTS IN PRODUCTION AND MARKETING OF WOOL AND MOHAIR

A portion of the above reported research is jointly financed by the Texas Agricultural Experiment Station and the U.S. AID Title XII Small Ruminant Collaborative Research Support Program.

FOREWORD

For many years, research has been summarized annually for the sheep and goat industry. This report maintains the continuity of that effort highlighting recent technical advancements and scientific investigations dealing with animal production and management and with meat and fiber products.

Sheep and goat research in Texas is a consolidated effort involving the Main Station (at College Station), San Angelo, Sonora, and other field research sites. Scientists in Texas maintain close communication with scientists in other states, including those with the USDA. Additionally, linkages are established with research organizations in other countries where sheep and goat research is being conducted. Through this network, we maintain a prompt awareness of new developments and emerging technology which may be useful in Texas. The research program maintains relationships with private organizations involved in animal health care, feed additives, and other products and concepts which may be useful in sheep and goat production.

Research is carefully targeted to address priority needs. The Texas Station maintains a five-year research plan in coordination with the sheep and goat industry. Research needs for 1982-1986 were reviewed by Texas Sheep and Goat Raisers Association, Mohair Council, Texas Angora Goat Raisers Association, and breed associations. This five-year plan for research is reviewed periodically for roll-forward changes based on new needs or shifts in priorities in the industry.

To a large extent, the order of contents in this report reflect the priority and needs for research in Texas. Each section is prefaced by a short perspective statement.

It is anticipated that this report will be distributed at field days and other events in addition to distribution by specialists and county agents with the Texas Agricultural Extension Service. The Experiment Station and Extension Service have several joint initiatives to assure that producers receive prompt, timely information impacting on their operations.

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FIVE-YEAR PLAN FOR RESEARCH AND DEVELOPMENT (1982-1986) TEXAS AGRICULTURAL EXPERIMENT STATION

The sheep and goat industries of Texas are important as a means of employment and income generation (approximately $150 million per year) and contribute to more efficient utilization of grazing resources. The ecological benefits of mixed species grazing (cattle, sheep, goats) are of particular long range importance to rangeland resources. These renewable resources are somewhat unique to this state and should be supported by an active research program.

Loss to predation is a major deterrent to maintaining or expanding the sheep and goat industries of Texas. However, solutions to this problem may well be found in the political arena or through organizational efforts; therefore, this need is no longer the top priority it was in previous planning efforts. Improved reproductive efficiency provides a major opportunity for improved biological efficiency, and research in this area should be strengthened. Reproductive efficiency is also a high national priority, and work in Texas should be coordinated with that of other institutions. Toxic plants continue to be a serious problem; research in this area should be continued at about the present level. Studies related to animal depredation should be continued, with particular emphasis on supporting efforts to implement predator control practices. Nutrition, and disease and parasite control, as well as marketing of meat and fiber should be supported by an active research program. Additional research needs include the high labor requirements of sheep and goat industries and forage production.

NEEDS

1. Improvement of reproductive efficiency of sheep and goats.
2. Reduction of toxic plant diseases of sheep and goats.
3. Control of animal predations on domestic livestock.
4. Improved knowledge of nutrition of sheep and goats.
5. Prevention and control of infectious diseases of sheep and goats.
6. Production and marketing technology for sheep and goat meat.
7. Control of internal and external parasites of sheep and goats.
8. Improvements in production and marketing of wool and mohair.
9. Improved labor efficiency of sheep and goat production.
10. Improvement of forage quality for sheep and goats.

REPRODUCTIVE RESPONSE TO SUCKLING MANIPULATION IN SPANISH DOES

J. L. Lawson, D. W. Forrest and Maurice Shelton

SUMMARY

One hundred and sixty fall- and early winter-kidding Spanish does were used to evaluate the effect of suckling manipulation on rebreeding efficiency. Does were divided into four groups dependent upon their kidding dates and location. All animals were maintained within their groups until their kids reached approximately 30 days of age. Groups were then subdivided and does with kids randomly alloted to one of the following treatment groups: 1) Control (CO) unlimited nursing; 2) Once-daily suckling (ODS); 3) Early weaning (EW); and 4) Dry does (DD) which had either lost a kid or aborted. Each treatment group had at least one fertile male equipped with a marking harness for estrus detection. After 30 days, ODS kids were returned to their dams. The proportion of does exhibiting estrus within 60 days postpartum was greater for ODS and EW does compared to controls. Postpartum intervals to first estrus and to conception were shorter for ODS does (41.7 and 43.6 days) than for CO does (48.0 and 50.4 days). The percentage of does conceiving within 60 days post-partum was 24.44, 46.80, 70.45 and 57.14% for CO, ODS, EW and DD does, respectively. Early weaned does had a significantly greater conception rate than control does. Kid production was 1.87 kids/doe/year. These results indicate that reducing the suckling stimulus in Spanish does during the breeding season may result in an earlier return to estrus with a greater percentage of does rebreeding within 60 days postpartum.

INTRODUCTION

Female goats are seasonally polyestrus and are commonly referred to as short-day breeders (1). This restricted breeding season limits reproductive efficiency of small ruminants, restricts the potential of multiple kidding programs and production of a year-round milk supply. Lactation also imposes limitations on the reproductive efficiency of a number of species (4). Previous work with sheep has indicated that this possible benefit may be effective only when the regimen is initiated during the normal breeding season. Short-term calf removal and suckling manipulation have been shown useful for promoting postpartum breeding of cows (2,6). Manipulating the suckling stimulus of goats in a similar manner might prove useful in certain months of the year.

Therefore, the objective of this study was to assess reproductive performance of fall- and early winter-kidding does subjected to early weaning or a restricted suckling treatment. Response to treatment was measured by length of the postpartum interval to estrus and conception and by the percentage of does in estrus and conceiving within 60 days postpartum. In addition, kid production was evaluated.

EXPERIMENTAL PROCEDURE

A group of 174 fall- and early winter-kidding Spanish does managed in three locations in Texas were used in this study. These does were divided into four groups based upon their expected kidding dates. The groups, kidding dates and locations were:

Group I	October 9 - October 16	Brady, Texas
Group II	November 10 - December 10	San Angelo, Texas
Group III	December 5 - December 20	College Station, Texas
Group IV	December 21 - January 13	Brady, Texas

All does were maintained with their kids until the kids reached approximately 30 days of age. At that time, does in each group were alloted to one of three treatments such that kidding date and suckling intensity were balanced. Treatments were as follows: 1) Early weaning (EW) - weaning to a creep ration at 30-40 days of age; 2) Once-daily suckling (ODS) - allowed one hour of nursing per day, from 1700 to 1800 hrs; 3) Control (CO) - unlimited nursing; 4) Dry does (DD) - does which aborted or had kids that died soon after birth were considered as a fourth group. In Brady and San Angelo, does were managed on pasture and learned to come into the pens where their kids were held for nursing. In group III where does were maintained in pens, a ration composed of cottonseed meal and alfalfa leaf meal (C.P. content of approximately 13.5%) was fed ad libitum. Early weaned kids received a similar ration except that crude protein content was approximately 19%. At least one mature fertile buck equipped with a marking harness for estrus detection was maintained with each treatment group. Does were observed twice daily for estrus and bucks were rotated twice weekly. Kid and doe weights were recorded on a weekly basis. When the last kid within each group had been on treatment for thirty days, all animals were once again mixed as a single group. Estrus detection continued for another thirty days.

RESULTS AND DISCUSSION

The effects of the once-daily suckling practice and early weaning on the percentage of does which returned to estrus and conceived within 60 days postpartum are summarized in Tables 1 and 2. In group I, the percentage of does observed in estrus was similar among treatments. One-hundred percent of the ODS, EW, and DD does exhibited estrus compared with 84.6% of the controls. Approximately one month later, group II exhibited a more even distribution of estrus between the treatments. The percentage of CO does displaying estrus remained near 85% while the percentage of ODS and EW does observed in estrus declined to 76.92% and 88.88%, respectively. There were significant treatment effects on the occurrence of estrus for does which kidded in December (group III). A greater percentage of does were observed in estrus in the ODS and EW treatments than in the CO treatment. The percentage of DD does recycling remained the same as noted in group II (50%, n=4). In group IV, where does kidded as late as January 13, 1982, early weaning still appeared to have some influence on the number of

does recycling. When compared with group I does, which were managed in the same location (Brady, Texas), a distinct seasonal effect was noted. None of the control does in group IV exhibited estrus, while earlier in the breeding season, 84.61% of the control does in group I exhibited estrus.

The proportion of does observed in estrus was greater for the EW does than for the CO does when the four groups were pooled. Of the EW fall-kidding does, 84.00% displayed estrus compared with 47.00% of control does. When group IV was excluded from the data analysis (this group was nearest the anestrus season and there were few animals breeding in any treatment), the percentage of ODS does exhibiting estrus (87.17%) was greater than for CO does (61.76%).

Allowing nursing for one hour per day resulted in a greater percentage of does conceiving within 60 days postpartum (Table 2). When groups I through IV were pooled, 46.80% and 24.44% of ODS and CO does, covceived, respectively. Total removal of the suckling stimulus by early-weaning at 30 days postpartum did, however, result in a significantly greater proportion of does conceiving in groups I, III and the pooled group. A greater percentage of the does in the EW treatment conceived than in the CO treatment for each of the groups. The effect of the EW treatment is in agreement with Mallampati et. al. (5) for Targhee ewes and Sefidbakht and Farid (7) for Karakul ewes. Those does which aborted or which lost a kid soon after birth had a higher conception rate than controls in all but group II.

Table 3 depicts the influence of the treatments on the length of the postpartum interval to first estrus. For group I, the interval to estrus was approximately five to six days shorter for ODS and EW does than for control does. When all four groups were pooled, only the ODS does had a significantly shorter interval to estrus than control does. The effect of suckling manipulation on the postpartum interval to conception is summarized in Table 4. The interval to conception was shorter for both ODS and EW does than for control does in group I. The mean interval to conception for all groups was shorter for does in the ODS treatment than does in the control treatment.

Two-hundred kids were produced from the does in the first kid crop with a 34.45% multiple birth rate. Kid mortality averaged 10% and there were no significant differences between treatments. There were 126 kids produced subsequent to the treatments with a 70% twinning rate. Thus, 1.84 kids/does/year were produced. This is a conservative estimate because, although the experiment was begun with 174 does, the number of producing does was reduced to 160 (14 does died of unknown causes).

As shown in Figure 1, the influence of treatment appears to diminish as the anestrus season nears. In all treatments, with the exception of the DD does, there was a general decline in the conception rate across the groups. When groups I and IV, which were managed in the same location at Brady, Texas were compared, there was a distinct seasonality effect. None of the control does exhibited estrus in group IV compared with nearly

85% earlier in the breeding season. While weight or condition of the animal undoubtedly influences reproductive status, the results obtained in the present study indicate that reducing the suckling intensity at 30 days postpartum in fall-kidding Spanish does may promote early return to estrus. In addition, suckling manipulation may increase the percentage of fall-kidding does that conceive during the early postpartum period.

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TABLE 1. EFFECT OF ONCE-DAILY SUCKLING AND EARLY WEANING ON RETURN TO ESTRUS IN FALL-KIDDING SPANISH DOES

	PERCENT IN ESTRUS BY GROUP[c]				
TREATMENT	I	II	III	IV	POOLED (I-IV)
CONTROL	84.61	87.50	23.07	0.00	47.00
n	13	8	13	11	45
ONCE-DAILY SUCKLING	100.00	76.92	76.92[a]	10.00	71.00
n	13	13	13	10	49
EARLY WEANED	100.00	88.88	100.00[a]	40.00	84.00[b]
n	13	9	12	10	44
DRY DOES	100.00	25.00	50.00	83.00	70.00
n	7	4	4	6	36
TREATMENTS COMBINED	95.00	74.28	68.29	27.80	68.00
	46	35	41	37	174

[a] number of does displaying estrus differs from controls in same column (P<.001)

[b] number of does displaying estrus differs from controls in same column (P<.05)

[c] number of does displaying estrus differs between groups (P<.0001)

TABLE 2. EFFECT OF ONCE-DAILY SUCKLING AND EARLY WEANING ON POSTPARTUM CONCEPTION IN FALL-KIDDING SPANISH DOES

	PERCENT CONCEPTION BY GROUP[d]				
TREATMENT	I	II	III	IV	POOLED (I-IV)
CONTROL	38.46	33.33	25.08	0.00	24.44
n	13	8	13	11	45
ONCE-DAILY SUCKLING	61.53	61.53	45.45	10.00	46.80
n	13	13	13	10	47
EARLY WEANING	92.30[b]	66.70[a]	83.33[b]	33.33	70.45[c]
n	13	9	12	10	44
DRY DOES	100.00[b]	25.00	50.00	66.66	57.14
n	7	4	4	6	21
TREATMENTS[d] COMBINED	69.56	51.42	51.28	21.62	50.00
n	46	35	39	37	157[e]

[a] Treatments differ from control (P<.10)

[b] Treatments differ from control (P<.05)

[c] Treatments differ from control (P<.001)

[d] Conception between groups differs (P<.05)

[e] Three does were removed from group III because they kidded outside the the average of that groups kidding range.

TABLE 3. EFFECT OF SUCKLING MANIPULATION TREATMENT ON POST-PARTUM INTERVAL TO ESTRUS (PPIE) IN FALL KIDDING SPANISH DOES

	LEASTSQUARE MEANS (days)				
	GROUP				
	I	II	III	IV	POOLED (I-IV)
TREATMENT					
CONTROL	54.1 ± 1.1[a]	41.8 ± 3.1[a]	38.0 ± 4.5[a]	--------	48.0 ± 1.9[b]
n	10	5	3	8	18
ONCE-DAILY SUCKLING	49.0 ± .9[b]	37.6 ± 2.0[a]	37.2 ± 2.5[a]	58.0 ± 4.3[a]	42.2 ± 1.4[a]
n	13	12	10	1	36
EARLY WEANING	48.3 ± .9[b]	40.2 ± 2.4[a]	43.8 ± 2.3[a]	53.7 ± 2.1[ab]	45.7 ± 1.3[a]
n	13	8	12	4	42
DRY DOES	53.3 ± 1.4[a]	36.0 ± 6.9[a]	31.5 ± 5.5[a]	42.8 ± 1.9[ab]	45.2 ± 2.2[a]
n	6	1	2	5	14

[a,b] Treatments within groups with different superscripts differ (P<.05)

TABLE 4. EFFECT OF SUCKLING MANIPULATION ON POSTPARTUM INTERVAL TO CONCEPTION (PPIC) IN FALL-KIDDING SPANISH DOES

	LEAST SQUARE MEANS (days)				
	GROUP				
TREATMENT	I	II	III	IV	POOLED (I-IV)
CONTROL	54.9 ± 1.1[a]	45.3 ± 4.5[a]	40.3 ± 3.8[a]	---------	50.4 ± 2.0[a]
n	10	3	3	0	16
ONCE-DAILY SUCKLING	50.1 ± 1.3[bc]	41.4 ± 2.6[a]	38.2 ± 2.9[a]	58.0 ± 5.8[a]	44.2 ± 1.7[b]
n	7	9	5	1	22
EARLY WEANING	48.2 ± 1.0[c]	47.3 ± 2.9[a]	39.2 ± 2.9[a]	54.7 ± 3.4[a]	46.3 ± 1.5[a]
n	12	7	8	3	30
DRY DOES	53.3 ± 1.5[ab]	------- ----	31.5 ± 4.5[a]	41.0 ± 4.1[a]	46.5 ± 2.5[a]
n	6	0	2	2	10

[a,b,c] Treatments within group with different superscripts differ (P<.05)

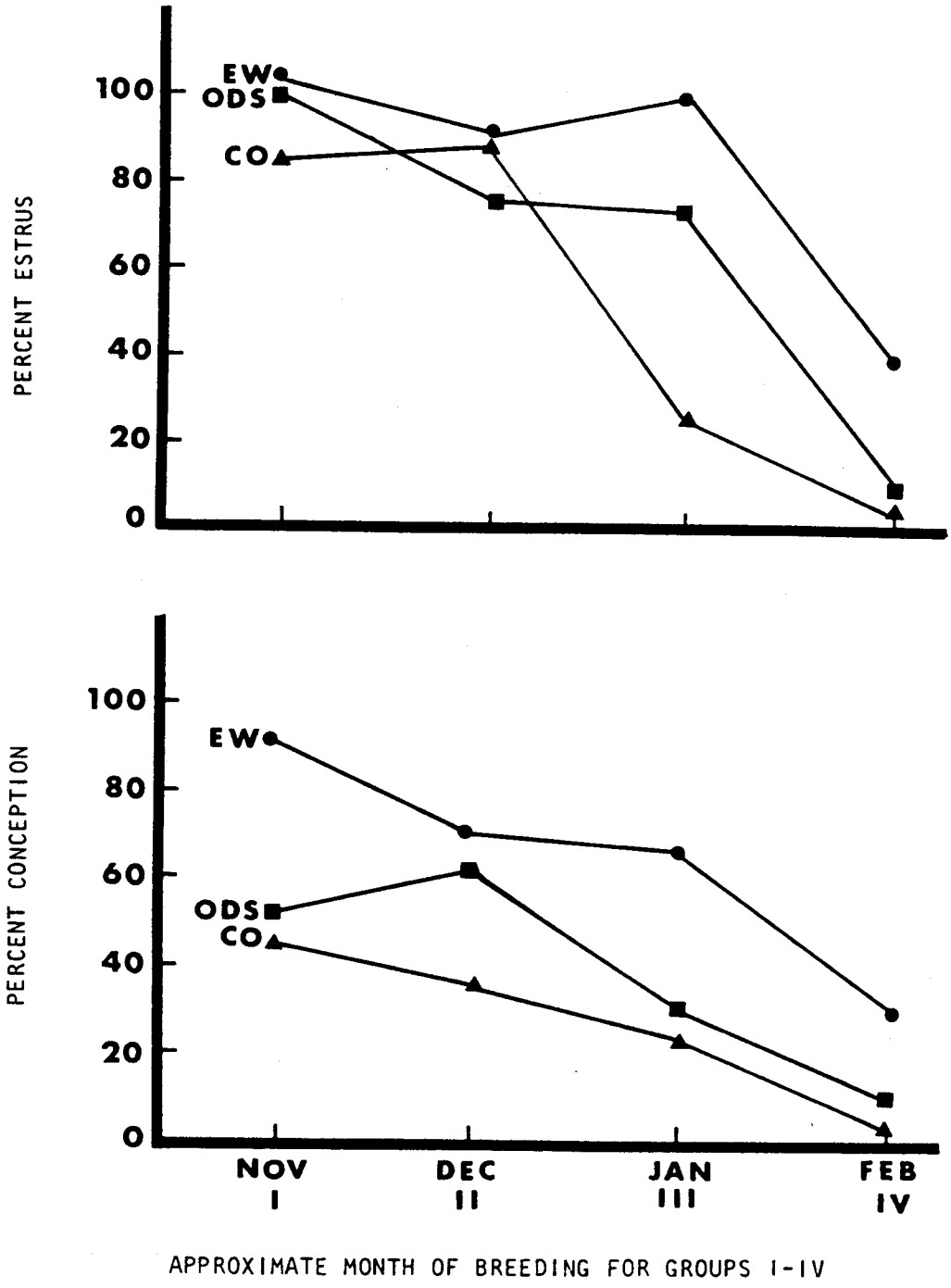

FIGURE 1. Percentage of early weaned (EW), once-daily suckled (ODS), and control (CO) does exhibiting estrus or conceiving by month.

PLASMA LH IN THE PREPUBERAL LAMB AS A POSSIBLE INDICATOR OF FECUNDITY

Tim Willingham, Maurice Shelton and Max Amoss

SUMMARY

An experiment was conducted in which plasma LH levels for three groups of four breeds of sheep (Booroola, Dorset, Rambouillet and Finnish Landrace) were examined to determine if basal LH values or LH values in response to GnRH injections could be used as an indicator of future fecundity. LH values were also evaluated on their usefulness as a tool to differentiate if Booroola offspring were carriers for increased fertility, which has been suggested to be a single gene trait in Booroola sheep (3). Dorset sheep were not evaluated in Group 2 and 3.

The data indicated a highly significant difference between breeds at 0 minutes and 30 minutes after GnRH challenge. Finnish Landrace (Finn) sheep exhibit a higher basal plasma LH value at 0 minutes. At 30 minutes the Rambouillet appear to have the highest LH values in response to GnRH injections, but this difference is not clear-cut. The Booroola lambs did not show higher LH value initially or in response to GnRH. Also, there is no indication of a bimodal distribution as might be expected if only the carrier animals were responding.

INTRODUCTION

It can be shown that improved reproductive efficiency is the major factor contributing to increased lamb production. The sheep has a great potential for an increased reproductive rate, and the exploitation of this potential may well be necessary for the survival of this industry. In recent years it has become increasingly clear that selecting for a higher lambing rate or a higher rate of lamb production is a primary means of approaching this goal. The currently accepted method of selecting for lambing rate is to select rams out of ewes which have done a good job of lamb production for a period of years. This approach requires considerable record keeping and requires long generation intervals which slows genetic progress. These problems would be eliminated if a means could be developed to predict reproductive potential in young growing males which are being considered for future sire selection. Also a type of sheep known as the Booroola Merino has been introduced to this country which allegedly possess a single gene trait resulting in a markedly higher lambing rate. This gene does not exist in a homozygous state in the total Booroola population but some individual animals can be homozygous. There is a serious need to develop a mechanism to identify those individual animals which carry the high fertility gene, as an alternative to progeny testing and waiting for the female offspring to

develop a reproductive history. Plasma leutenizing hormone (LH) level or LH level in response to injections of gonadotrophin releasing hormone (GnRH) in prepuberal lambs has been suggested as a potential means to accomplish these objectives.

EXPERIMENTAL PROCEDURE

In the spring of 1982, data were collected from lambs out of Rambouillet ewes that were bred to Booroola, Dorset, Rambouillet or Finnish Landrace sires. Lambs were located at the Winters Ranch in Brady or the Hill Ranch in Edwards County. Lambs were treated as 3 groups with Group 1 being at the Winters Ranch and out of yearling ewes, Group 2 were at the Hill Ranch and mixed ages, and Group 3 at the Winters Ranch and out of 3-year-old ewes. All ewes lambed on range so it was not possible to obtain individual lambing dates. Single sire matings were used within group. Thus, the sire of each is known and for the Booroola this will constitute a progeny test to determine if they carry the gene for a higher ovulation rate. Each of the three Booroola rams used were presumed, based on pedigree, to be heterozygotes.

An initial plasma sample was collected then lambs were given 1 μg. of GnRH intravenously. GnRH was given to overcome the fluctuation of plasma LH concentration in individuals with time as suggested by Carr and Land (2). Plasma samples were then taken 30 and 60 minutes after GnRH challenge for all lambs except Group 2 ram lambs which were not sampled at 60 minutes. Group 1 ewe lambs were sampled March 16, 1983, and ram lambs were sampled the following day. Group 2 ewes were sampled 16 days before ram lambs and Group 3 were all sampled on the same day. Thus, group and sex differences are compounded somewhat by sampling dates. Lambs were less than 90 days of age when samples were taken. All were definitely prepuberal.

All blood samples were centrifuged and plasma drawn off and frozen until analysis by radioimmunoassay. LH levels were then reported in ng./ml.

RESULTS AND DISCUSSION

The results by group, breed, sex and time in respect to GnRH injection are shown in Table 1. The results of the LH determinations were somewhat erratic, and some values have been discarded. Some animals failed to show a response to GnRH injections, and these were discarded from the data in the belief that this was due to a failure to place the GnRH in the vein. A few animals showed a high LH value initially, and these were not included in the means reported. The possible explanations for this is not known at the present time. The numbers actually

used in the calculations are shown in parenthesis in the table. Statistically significant breed (and sire) differences were noted for 0 and 30 minute collections, but not for the 60 minute collection. At 0 minutes it appears that the Finn sheep have a higher basal level of LH. This should be of interest since this is the breed that would be expected to have the highest lambing rate with the possible exception of the Booroola which carry the high fertility gene. Although a significant breed difference was noted at 30 minutes in response to GnRH injection, it is not clear what this means. There appears to be a tendency for the Rambouillet to show the greatest response. The values obtained at 60 minutes were highly erratic and not statistically significant by breed. A number of individual animals showed a prolonged response while others had returned to near basal levels. The significance of these prolonged responses are not clear.

There is no indication from these data that the Booroola-sired lambs have a higher basal LH value or that they show an elevated response to GnRH injections. Theoretically only one-half of these lambs would carry the gene, but even this would be expected to affect the mean values if they were in fact different. Also, if the carrier animals were responding differently, one would expect to see a bimodal distribution in basal levels or in response to GnRH. No such an effect is evident. It should be of interest if those showing the prolonged response to GnRH were in the Booroola group, however, this is not the case as those with prolonged response are found in all breeds.

Thus, it appears that the high fertility breed such as the Finn may have an elevated LH level as a prepuberal lamb. It is not clear if this could serve a predictive role for selection within breed. There is no evidence in the present data to suggest that LH values can be used to predict the carrier state in the Booroola breed.

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ACKNOWLEDGMENT

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Table 1. Mean LH Values at Three Time Intervals

Group 1: Winters Ranch

	Overall Mean LH Levels			Mean LH Levels by Sex					
				Females			Males		
Breed	0 min	30 min	60 min	0 min	30 min	60 min	0 min	30 min	60 min
Booroola	.582(24)	15.82(20)	8.91(21)	.636(12)	14.98(11)	6.43(11)	.528(12)	16.84(9)	11.65(10)
Dorset	.512(12)	18.29(12)	10.33(12)	.482(5)	21.72(5)	10.30(5)	.533(7)	15.84(7)	10.35(7)
Rambouillet	.481(7)	20.06(7)	9.91(6)	.497(2)	26.75(2)	12.20(1)	.475(5)	17.39(5)	9.45(5)
Finn	.783(11)	18.09(11)	11.52(11)	.700(5)	17.91(5)	12.30(5)	.852(6)	18.25(6)	10.88(6)

Group 2: Hill Ranch

Breed	0 min	30 min	60 min	0 min	30 min	60 min	0 min	30 min	60 min
Booroola	.750(34)	17.42(31)	5.41(12)	.529(15)	19.33(13)	5.41(12)	.925(19)	16.03(18)	
Rambouillet	.765(11)	18.69(10)	10.30(5)	.504(6)	23.10(5)	10.30(5)	1.078(5)	14.27(5)	
Finn	.937(10)	12.82(8)	4.21(5)	.687(5)	14.05(5)	4.21(5)	1.188(5)	10.77(3)	

Group 3: Winters Ranch

Breed	0 min	30 min	60 min	0 min	30 min	60 min	0 min	30 min	60 min
Booroola	.902(14)	18.47(14)	11.34(13)	.868(4)	13.15(4)	6.76(4)	.916(10)	20.60(10)	13.37(9)
Rambouillet	1.460(4)	23.01(7)	14.64(7)	1.245(2)	22.23(5)	14.59(5)	1.670(2)	24.95(2)	14.77(2)
Finn	1.640(5)	23.44(5)	16.22(5)	.955(2)	22.95(2)	15.09(2)	2.038(4)	23.94(4)	18.31(4)

Numbers in parenthesis are the number of animals on which the average was determined.

All values shown are in ng./ml.

EMBRYONIC DEVELOPMENT OF SHEEP GONADS BETWEEN DAY 22 AND DAY 40 POSTBREEDING

Nat M. Kieffer, Maxine Stiles, Maurice Shelton and David Morris

INTRODUCTION

The appearance of specific cell types and new tissues is a primary feature of differentiation. Differentiation of tissues and organs is complex and involves cell to cell surface interactions and specific inducer molecules coded for by structural genes under precise control by regulatory genes. An inducible organ is sensitive to critical levels of inducer for only a short time, and once the course of differentiation begins it cannot be reversed; only modified. The early embryonic mammalian gonad, regardless of sex chromosome composition, is capable of developing either as a testis, ovary or ovotestis. With the discovery that a cell surface antigen known as H-Y might be a testis inducer, the intriguing possibility exists that indifferent gonads of genetic females could be induced to develop as testis at some critical period during early embryogenesis. Since male phenotypic sex normally develops in conformity with the dictates of hormones produced by the testes, phenotypic males with the sex chromosomes of females would result. From the standpoint of practical livestock production, such sex reversed females could possibly function as males with the result that when mated with normal females, their progeny would all be females.

The purpose of the research reported here was to determine the embryological age in days postbreeding at which sheep gonads were first histologically identifiable as ovaries or testes. This age would then serve as a baseline in determining the critical time in which the indifferent gonads of embryonic female sheep are most sensitive to testis inducer (H-Y antigen).

MATERIALS AND METHODS

A flock of 40 ewes were checked for estrus morning and evening with teaser rams. Ewes found to be in estrus were left in confinement with a ram for 24 hours following the first sign of estrus. Day one of the postbreeding count was the first day after 24 hours of confinement with the ram. Embryos were removed by laparotomy beginning at 22 days postbreeding and then at two day intervals up to and including day 40 with one exception: the ewe bred for a 30 day embryo was barren. A 31 day embryo from a separate experiment was substituted for the postbreeding day 30 embryo. Following removal from the uterus the embryos were placed in sterile tissue culture medium 199 for transport to the laboratory. In the laboratory the head region was removed and minced into small pieces and these pieces were pipetted into T flasks to initiate fibrobast cultures for chromosomal analysis to determine genetic sex. The remainder of each embryo was fixed in 10 percent buffered formalin. Day 22 through day 31 embryos were serially sectioned along a sagittal body plane, whereas day

32 through day 40 embryos were serially sectioned across the body beginning immediately behind the front limbs and continuing in a caudal direction. All sections were five microns thick. The sections were stained in Harris' hematoxylin and alcoholic eosin in a regressive staining procedure. The sections were examined at 20X magnification with a bright field condenser.

RESULTS AND DISCUSSION

Progressive development of the germinal epithelium is shown in figures I through XIII. The gonadal ridge is visible by day 22 and consists of a distinct germinal epithelium accompanied by an increased mesenchymal layer between the thickened epithelium and the mesonephric tubules (Fig I). By day 28 the gonadal ridge has expanded into a hemicord protruding into the coelom and blending into the wall of the mesonephros at both ends (Fig IV E).

The original gonadal ridge increases rapidly in diameter but little in length, resulting in a globular gonad by day 32 (Fig VI C). At this age the gonads of both sexes is still indifferent. By day 34 the male indifferent gonad has become a testis. A thin layer of mesenchyme cells can now be seen to constitute a true tunica albuginea (Fig VIII E). The female gonad at day 34 remains histologically indifferent (Fig VII E). Thus, the gonadal sex of sheep embryos can be first detected histologically at day 34 by the appearance of the tunica albuginea in males and the absence of a similar structure in females. By day 36 the first signs of seminiferous tubule formation can be seen in the male gonad (Fig IX B). The ovary remains seemingly indifferent through day 40. By day 40 the seminiferous tubules as well as the tunica albuginea are well developed in the male gonad. Sertoli cells make up the majority of the cells within the simininferous tubules.

SUMMARY

We have followed gonadal development in sheep embryos from day 22 post-breeding through day 40. By day 34 the male indifferent gonad has become a testis. The female gonad remains histologically indifferent through day 40.

FIG. I SAGITTAL SECTION THROUGH THE MESONEPHROS OF A 22-DAY OLD SHEEP EMBRYO. A. SOMITE, B. LIVER, C. MESONEPHROS, D. GERMINAL EPITHELIUM. (X20)

FIG. II SAGITTAL SECTION THROUGH A 24-DAY SHEEP EMBRYO. A. SOMITE, B. LIVER, C. MESONEPHROS, D. MESONEPHRIC DUCT, E. GERMINAL EPITHELIUM. (X20)

FIG. III SAGITTAL SECTION THROUGH A 26-DAY FEMALE EMBRYO. A. SOMITE, B. MESONEPHROS, C. GENITAL RIDGE. (X20)

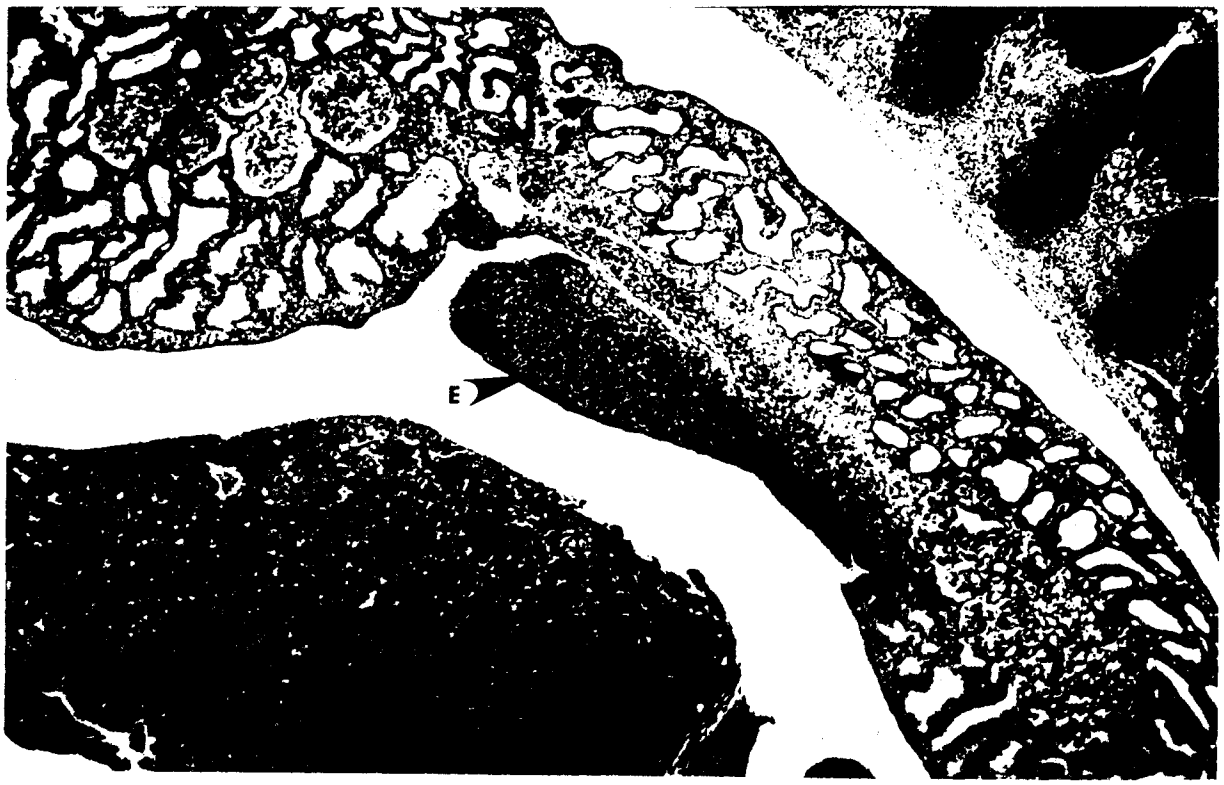

FIG. IV SAGITTAL SECTION THROUGH A 28-DAY FEMALE EMBRYO. A. SOMITE, B. LIVER, C. MESONEPHROS, D. MESONEPHRIC DUCT, E. INDIFFERENT GONAD. (X20)

FIG. V SAGITTAL SECTION THROUGH A 31-DAY SHEEP EMBRYO. A. SOMITE, B. MESONEPHROS, C. MESONEPHRIC DUCT, D. METANEPHROS, E. INDIFFERENT GONAD. (X20)

FIG. VI CROSS SECTION THROUGH THE GONAD OF A 32-DAY EMBRYO. A. MESONEPHROS, B. METANEPHROS, C. INDIFFERENT GONAD. (X20)

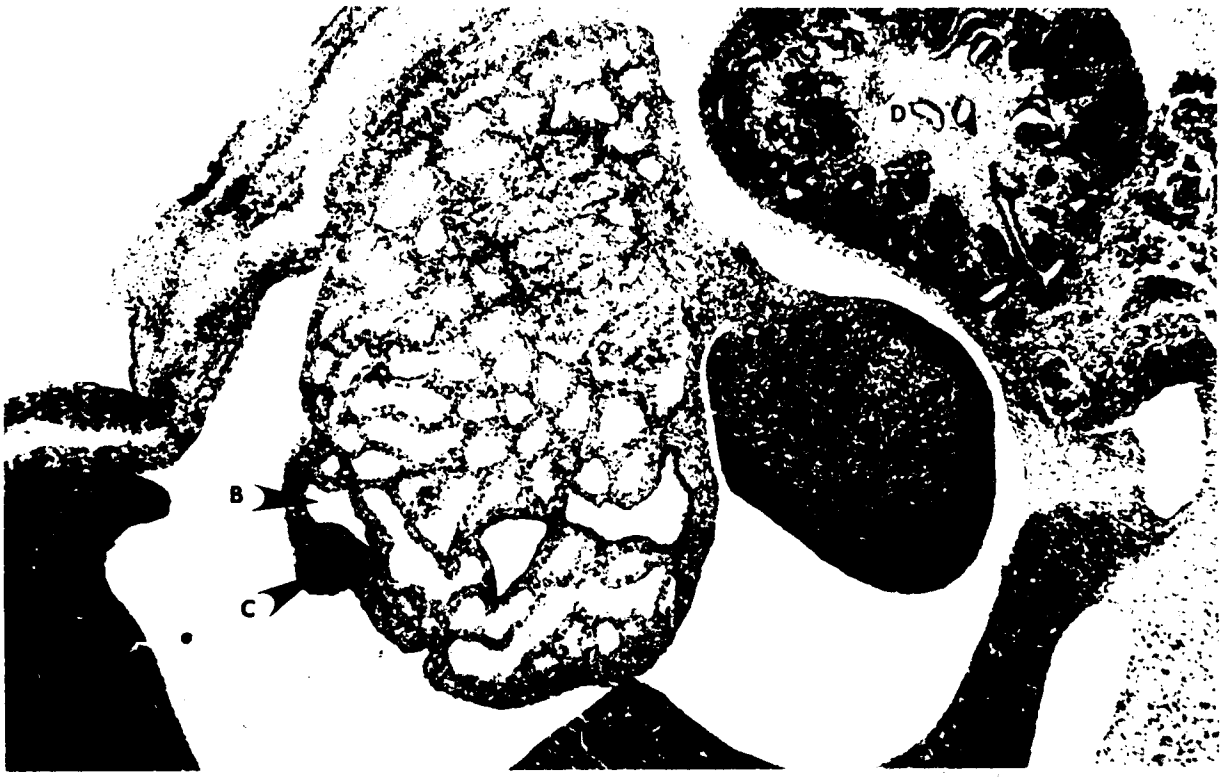

FIG. VII CROSS SECTION THROUGH THE OVARY OF A 34-DAY FEMALE EMBRYO.
A. MESONEPHROS, B. MESONEPHRIC DUCT, C. PARAMESONEPHRIC DUCT,
D. METANEPHROS, E. OVARY. (X20)

FIG. VIII CROSS SECTION THEOUGH THE TESTIS OF A 34-DAY MALE EMBRYO.
A. MESONEPHROS, B. MESONEPHRIC DUCT, C. PARAMESONEPHRIC DUCT,
D. TESTIS, E. TUNICA ALBUGINEA. (X20)

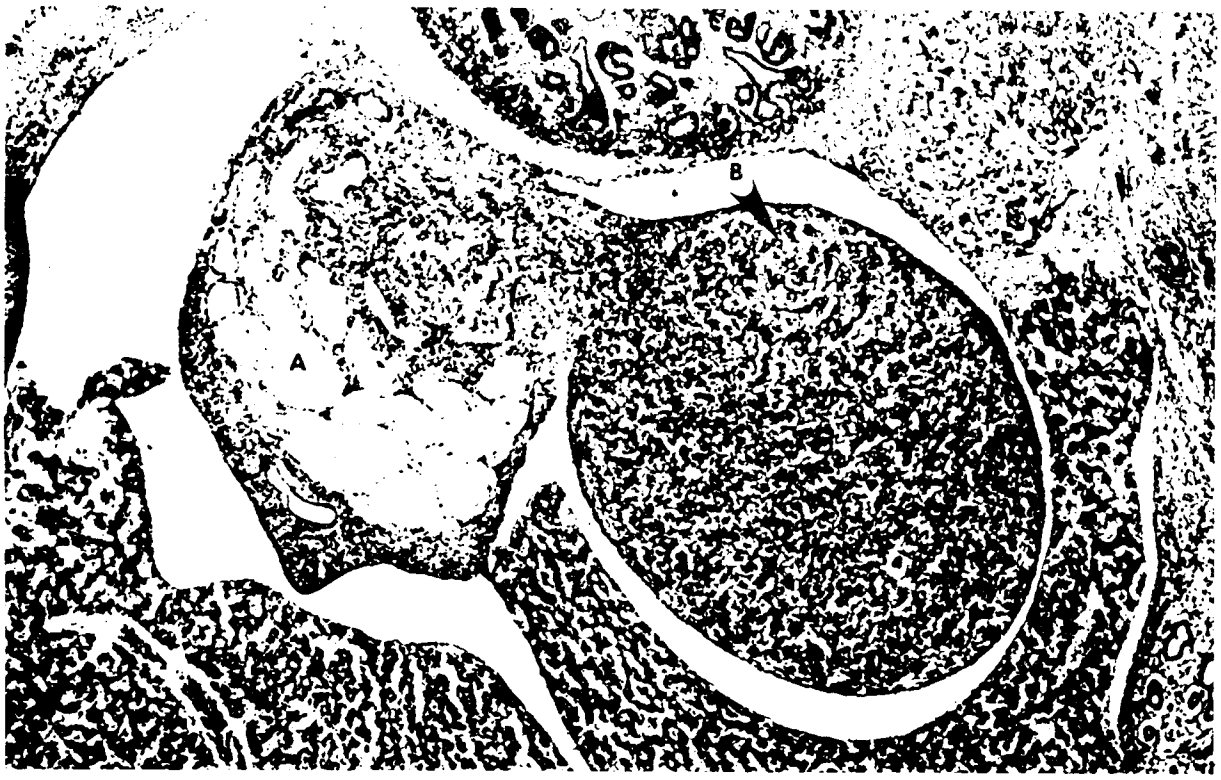

FIG. IX CROSS SECTION THROUGH THE TESIS OF A 36-DAY MALE EMBRYO. A. MESONEPHROS, B. TESTIS, SHOWING THE FIRST VISIBLE INDICATION OF SEMINIFEROUS TUBULE FORMATION. (X20)

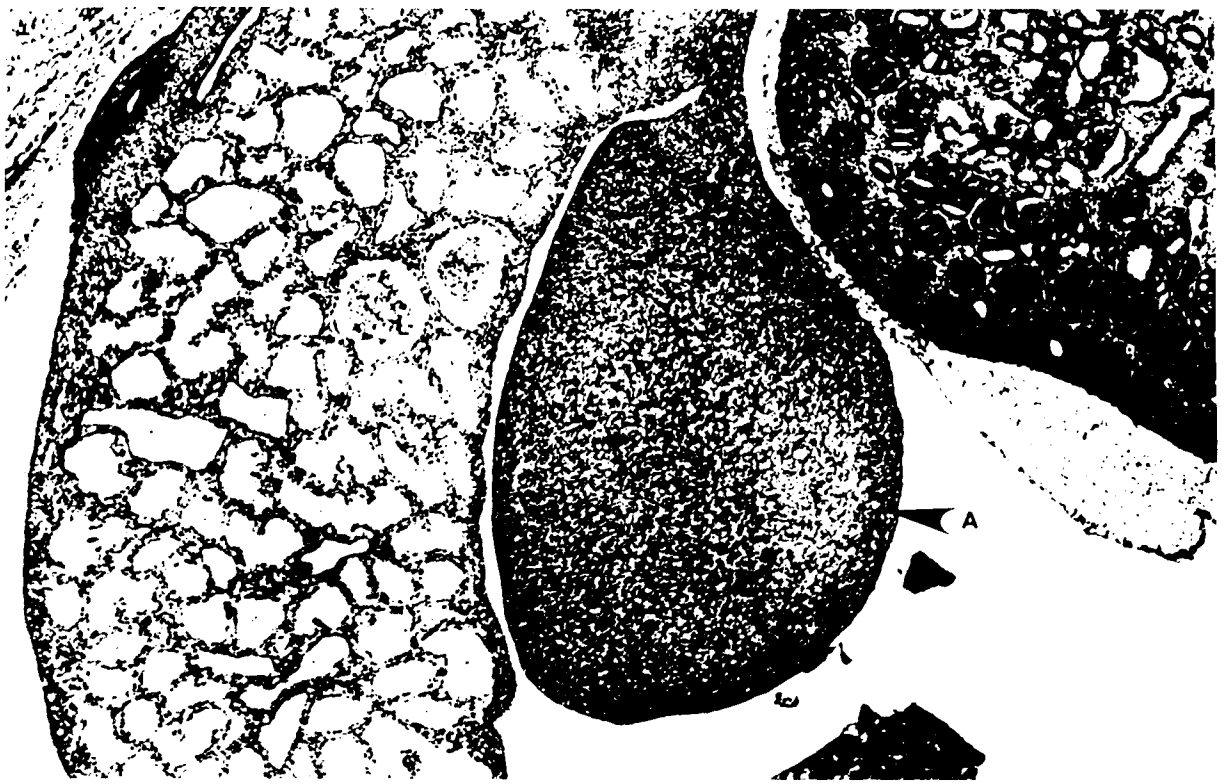

FIG. X CROSS SECTION THROUGH THE OVARY OF A 38-DAY FEMALE EMBRYO. A. OVARY. NOTE ABSENCE OF TUBULAR DEVELOPMENT. (X20)

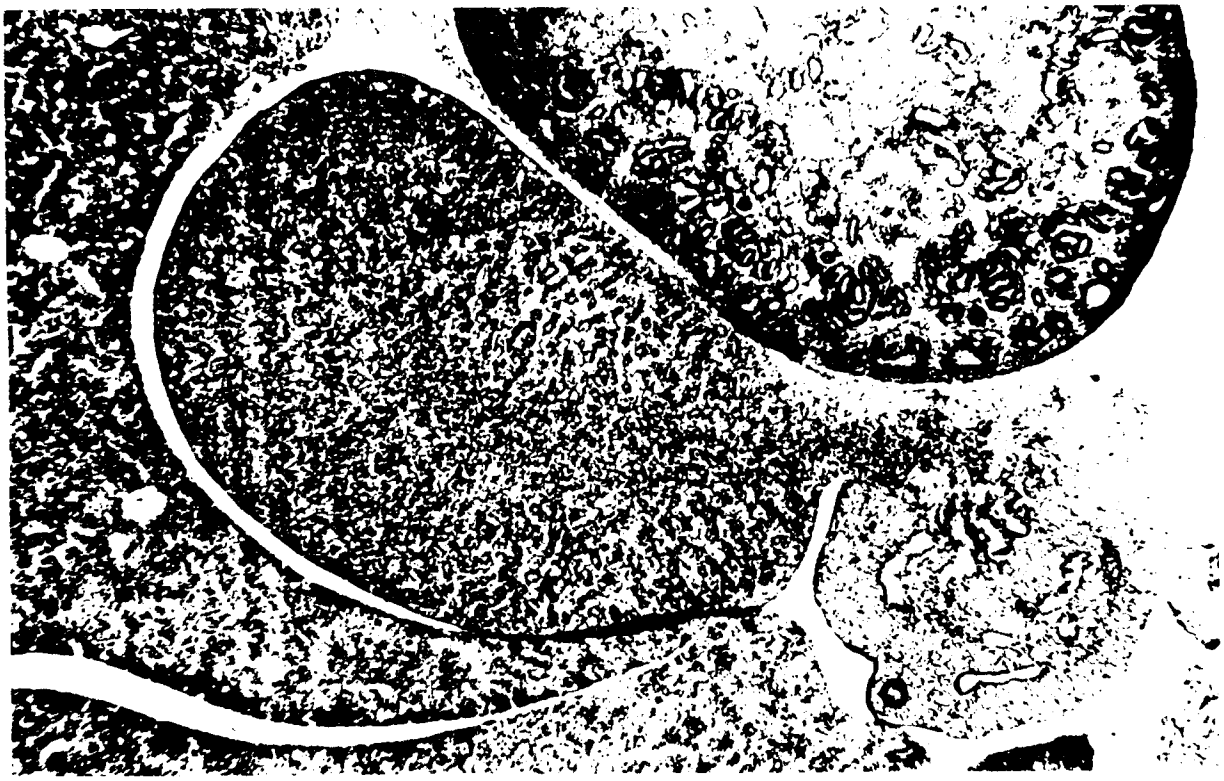

FIG. XI CROSS SECTION THROUGH THE TESTIS OF A 38-DAY EMBRYO. A. TESTIS WITH DEVELOPING SEMINIFEROUS TUBULES (ARROWS). (X20)

FIG. XII CROSS SECTION THROUGH THE OVARY OF A 40-DAY SHEEP EMBRYO. (X20)

FIG. XIII CROSS SECTION THROUGH THE TESTIS OF A 40-DAY MALE EMBRYO. A. TESTIS WITH SEMINIFEROUS TUBULES. B TUNICA ALBUGINEA. (X20)

COMPARATIVE HEAT TOLERANCE OF SEVERAL BREEDS OF SHEEP AND GOATS

J. L. Lawson and Maurice Shelton

SUMMARY

Respiration rates and rectal temperatures were measured during the summer of 1981 for docked and undocked Karakul ewes and ewe lambs, Barbados ewes, Spanish does and during the summer of 1982 for docked and undocked Karakul, Rambouillet, and Barbados yearling rams and yearling Spanish bucks. The results indicate that fat-tail Karakul animals may be able to maintain lower body temperatures than their docked counterparts during periods of thermal stress. Spanish does had the lowest rectal temperatures compared with ewes while Spanish bucks had the lowest respiration rates compared with all animals tested.

INTRODUCTION

Comparative adaptation of various breeds of sheep and goats to hot climates has been a subject of debate. Some researchers claim that physiological characteristics of the goat do not make it superior to sheep in withstanding heat stress (1). In contrast, others have noted that when ambient temperatures exceed 37°C for 12+ hours, sheep attain higher body temperatures than goats (4). However, some sheep breeds, such as the fat-tail Karakul, are thought to be particularly adapted to the tropics. The tail provides a reservoir of energy and metabolic water. Also, storage of fat in the tail, rather than insulating the body, may allow for greater heat dissipation. In the past, Karakul ewes have been docked to evaluate the possible benefit in breeding performance. It is possible that this treatment reduces the Karakul's adaptability to hot climates. The ultimate test of adaptation would be to compare production parameters (2). However, one may argue that one aspect of adaptation may be the ability to restrict production levels under adverse conditions. Respiration rates and body temperatures may, however, give some indication of the suitability of a breed type to certain climatic conditions. No comparative data on body temperatures and respiration rates in response to heat stress have been reported for the various sheep and goat breeds in Texas. Thus the present study was conducted to begin evaluating breed and species differences and differences between docked and undocked Karakuls in regard to adaptation to hot climates.

EXPERIMENTAL PROCEDURE

Six types of female small ruminants, docked and undocked Karakul ewes and lambs, Barbados Blackbelly sheep and Spanish does (n=34) were held for 2-3 hours in direct sunlight without access to feed or water. Rectal temperatures were taken with a battery operated thermometer probe which was inserted to a depth of 6 inches. Respiration rates were determined by observing flank movements and timing with a stop watch. Daily ambient temperature and humidity was also recorded. These measurements were taken on 12 days (between July 27 and August 24, 1981 at the Texas A&M Research Station in San Angelo, Texas) which were presumed to be hot enough to cause some heat stress. (95-105°F at 1400 hours).

Similar measurements were recorded on a second groups of yearling males, docked and undocked Karakuls, Barbados Blackbelly and Rambouillet sheep and Spanish goats (n=50) the following summer (for 4 days between August 31 and September 17) at Brady, Texas. These data were analyzed by general linear model procedures utilizing the Statistical Analysis System (SAS) to evaluate body temperature and respiration differences between groups.

RESULTS AND DISCUSSION

The data indicate that although respiration rate means were higher for both fat-tail ewes and fat-tail lambs over their docked counterparts, for all days, this difference was not significant (Table 1). Docked and undocked lambs had significantly higher temperatures and respiration rates compared with adult ewes ($P<.05$). Respiration rate for Spanish does was 144.29 breaths/minute which was significantly less than all but the Karakul ewes. Rectal temperatures were lowest for Spanish does and Barbados ewes at 103.18°and 103.44°F, respectively. Fat-tail and docked Karakul lamb temperatures did not differ but docked Karakul ewes did have higher rectal temperatures than the fat-tail ewes ($P<.05$).

In the second group of animals examined, Rambouillets had the highest respiration rate average with over 200 breaths/minute (Table 2). This was followed by Barbados yearling rams with 167 breaths/minute. Docked Karakul rams had a higher respiration rate than fat-tail rams but this was not significant. As expected, Rambouillets had the highest body temperature but this was not significantly greater than Barbados rams. Spanish bucks had temperatures comparable with docked Karakuls at 104.12 F.° Fat-tail Karakuls had the lowest rectal temperature (103.97°F). Some differences were seen between breeds, species and docked vs. undocked animals even though both summers were relatively cool. These differences may be more apparent and significant under temperature extremes. Additionally, high body temperatures are not necessarily indicative of less adaptive ability (3). Further studies are required to more clearly establish breed and species differences.

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TABLE 1. LEASTSQUARE MEAN RESPIRATION RATE AND BODY TEMPERATURE MEASUREMENTS FOR SIX TYPES OF FEMALE SMALL RUMINANTS

	Docked Karakul ewe lambs	Fat-tail Karakul ewe lambs	Docked Karakul ewes	Fat-tail Karakul ewes	Barbados ewes	Spanish does
	n=5	n=5	n=6	n=6	n=5	n=7
Rectal temperature (F°)	104.66 ± 0.11^{a1}	104.65 ± 0.11^{a}	103.94 ± 0.09^{b}	103.58 ± 0.08^{c}	103.44 ± 0.09^{c}	103.18 ± 0.08^{d}
Respiration Breaths/min.	173.15 ± 5.81^{ab}	180.29 ± 5.46^{a}	141.72 ± 4.35^{d}	149.47 ± 4.60^{dc}	161.73 ± 4.86^{cb}	144.29 ± 7.54^{b}

[1]Leastsquare means with different superscripts differ by ($P < .05$).

TABLE 2. LEASTSQUARE MEAN RESPIRATION RATE AND BODY TEMPERATURE MEASUREMENTS FOR FIVE TYPES OF MALE SMALL RUMINANTS

	Rambouillet rams	Barbados rams	Spanish bucks	Docked Karakul rams	Fat-tail Karakul rams
	n=10	n=10	n=10	n=10	n=10
Rectal Temperature (F°)	104.51 ± 0.12^{a1}	104.33 ± 0.12^{ab}	104.12 ± 0.12^{b}	104.10 ± 0.12^{b}	103.97 ± 0.12^{b}
Respiration Breaths/min.	200.47 ± 4.96^{a}	167.37 ± 5.09^{b}	116.92 ± 4.95^{d}	148.18 ± 5.02^{c}	143.56 ± 4.96^{c}

[1]Leastsquare means with different superscripts differ by ($P < .05$).

THE INFLUENCE OF ORAL PROGESTINS (MGA) DURING PREGNANCY ON KID PRODUCTION OF ANGORA DOES

Maurice Shelton, Ron Lewis and C. W. Livingston

In any technical discussions of the problem of abortion in goats, the suggestion is likely to be made that supplemental progesterone be considered as a preventive treatment. Crystalline progesterone is available in synthetic form, but this would require daily or frequent injections which seems impracticable. Other materials with progestational properties are available which can be used as long acting injectable or oral preparations. In earlier years one of the authors used a long acting injectable progestin (Depo-provera) on a small number of Angora does early in the mid-trimester of pregnancy. A high percentage of these does carried their kids past term and a number of the does and their kids were lost due to dystocia. Another potential form of progestins is in the oral form. MGA (Melengesteral Acetate) is one such oral progestin. Critical questions concern the effect of such an oral progestin on endogenous progesterone production and the effect of its presence in the ration on the ability of the doe to kid normally. In an earlier study (1), the effect of MGA in the ration on endogenous progesterone production appeared to be minimal. Also with the small numbers involved in the previous study, there did not appear to be an adverse effect of MGA in the ration on parturition. Accordingly, a second study was initiated in which 0.50 mg of MGA was added to the daily ration of Angora does either in a range supplement or in a complete ration during kidding. A control group was also maintained. The results are shown in Table 1. These data show the control group to

Table 1. Influence of 0.50 mg daily intake of MGA on kid production of Angora does

	Test Group	Control Group
Total number of does assigned	33	34
Number kidding	21	28
Percent kidding	64.6	82.4
Number kids dropped	27	36
Percent kids dropped	81.8	105.9
Number live kids	25	32
Percent live kids	75.8	94.1

have produced more kids. No observed and recorded abortions occurred in either group. It is not clear if the difference is a real effect or is merely natural variation. Although the does were randomly assigned the control group averaged 5 pounds heavier and this would be

expected to have an influence on kid production. The breeding dates or pregnancy status of the does were not known at the time the does were assigned to the various treatments. More significantly two of the does in the treated group had difficulty kidding. One of these died which on autopsy had a dead edematous kid in the utero which appeared to be past term. A second doe had difficulty kidding and a dead kid was delivered by cesarean which also appeared to be past term. Although these two cases constitute only 9.5% of the total does kidding, the uniqueness of their condition appeared to strongly suggest a treatment effect. Thus, it appears inadvisable to continue further testing involving MGA in the ration during kidding. The only alternative to this would be to include this material in the ration during the critical phase in respect to abortion (90-120 days of gestation) and remove it before parturition could be expected. This approach might warrant further investigation.

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SHORT CYCLING IN ANGORA GOATS AFTER INTRODUCTION OF THE MALE AT THE INITIATION OF THE BREEDING SEASON

J. L. Lawson and Maurice Shelton

The phenomenon of short cycling in cows, ewes, and does has become a topic of interest in recent years. Short cycling in does is defined as an estrus interval less than 15 days (20-21 days is the normal cycle length). Most studies have reported short cycle lengths of 2 to 7 days. In both puberal heifers and in ewe lambs approaching the transition period into the estrus season, an increase in the plasma progesterone level has been noted several days before standing estrus. This transient rise in plasma progesterone has also been reported to occur in does after introduction of the buck at the start of the breeding season or after artificial photoperiod stimulation. This was noted to occur as early as 5 days (4 of 17 does) and as late as 17 days (15 of 19 yearling does) after exposure to the male. In contrast to ewes, this elevation in plasma progesterone may be preceded by standing estrus. Furthermore, this first estrus may be anovulatory whereas ewes are thought to have several "silent" ovulations before exhibiting estrus. While it has been known for some years that introduction of the buck will stimulate Angora does to breed within 10 days, it is not known how early does respond to the male as evidenced by plasma progesterone profiles and estrus detection. Additionally, short cycling has not been well documented in this animal. Thus, the purpose of this study was to begin to investigate these phenomena in the Angora.

Beginning in late September, forty does, ranging in age from 2 to 8 years, were divided into one of two groups. Thirty does were allowed to run with two intact bucks which were each equipped with a marking harness. Ten of these does were sampled daily via jugular vein for a period of ten days; another ten does were laparotomized to assess ovarian activity throughout this study. All thirty does were observed daily for estrus. The remaining ten does, which were considered controls, were maintained on pasture and isolated from males. Blood samples were collected from these control does on 5 days during the 10 day test period. All forty does were sampled on the twelvth day after initiation of the experiment.

Seventy-five percent of the does were mated within 4 days of introduction of the bucks. Of these, 78.0% rebred within an average of 4.57 days. Laparotomy confirmed the presence of active follicular development within 5 days of male exposure and corpora lutea formation with 8 days. Preliminary analysis of the plasma progesterone data correlated well with the estrual activity noted. A small rise in plasma progesterone (300 pg/ml) was noted within 5-6 days after male introduction. This was followed six days later by a sustained rise in progesterone (2.5 ng/ml), which was presumably the luteal progesterone resulting from the second estrus. Data from Spanish does involved in a similar study are currently being evaluated.

ASSOCIATION BETWEEN HYMENOXON CONTENT OF BITTERWEED (HYMENOXYS ODORATA, AS MEASURED BY GAS CHROMATOGRAPHY, AND IT'S TOXICITY TO SHEEP

M.C. Calhoun, H.L. Kim, F.A. Pfeiffer and
B.C. Baldwin, Jr.

SUMMARY

Bitterweed plants harvested on January 29, 1982 and April 16, 1982 from the same population (location) growing on a ranch 35 km southwest of San Angelo, Texas in southeastern Tom Green County were used in this study. The hymenoxon contents, as determined by a gas chromatography procedure, were 1.62 and 2.18%, respectively, for the January and April collections. Feeding sheep the bitterweed collected in January depressed feed intake and increased serum urea nitrogen, creatinine, glutamic-oxalacetic transaminase and γ-glutamyl transpeptidase. Whereas, feeding sheep the bitterweed collected in April only produced a slight increase in serum urea nitrogen and no changes in the other measurements. In both cases the bitterweed was fed for four consecutive days at a level calculated to give each sheep 25 mg hymenoxon/kg live weight daily. Thus it is evident that a difference in toxicity exists between these bitterweed collections which is not evident by comparison of their hymenoxon content. The reason for this lack of agreement between hymenoxon content and animal toxicity is unknown but research is underway to determine the factor(s) involved.

INTRODUCTION

Research during the past 10 years has resulted in identification of the toxic constituent of bitterweed (Hymenoxys odorata) (5,6). The compound isolated by these research groups is an unsaturated sesquiterpene lactone ($C_{15}H_{22}O_5$) called hymenoxon by Kim et al. (6) and hymenovin by Ivie et al. (5). Hymenolane, a second sesquiterpene lactone isolated from bitterweed, has been shown to be relatively nontoxic (7,8). To date no other toxic compound has been isolated from bitterweed and hymenoxon appears to be the principle toxic compound present.

A gas chromatographic procedure reported by Hill et al. (4) has been routinely used to measure the hymenoxon content of bitterweed plants. With a single exception, there has been good agreement between the hymenoxon content determined by gas chromatography and animal toxicity when the same plant material was force-fed to sheep (1,8). The exception is a collection of bitterweed plants harvested in April 1982 which contained ~2% hymenoxon (determined by gas

chromatography), but was found to be relatively nontoxic when force-fed to sheep (M.E. Bailey, personal communication; M.C. Calhoun, unpublished data). The purpose of this report is to document this instance of a lack of association between the hymenoxon content of a bitterweed collection and its animal toxicity and to present possible reasons for this occurring.

EXPERIMENTAL PROCEDURE

Bitterweed plants harvested on January 29, 1982 and April 16, 1982 from the same population (location) growing on a ranch 35 km southeast of San Angelo, Texas in southeastern Tom Green County were used in this study. The January collection contained 1.62% hymenoxon (air-dry basis) and the April collection 2.18% hymenoxon.

Each of these collections were force-fed daily for four consecutive days to four blackfaced, wether lambs at a rate calculated to give each lamb 25 mg hymenoxon/kg live weight/day.

Blood samples were collected at 0900 h just prior to the first bitterweed dose (day 1) and again on days three and five. The blood samples taken on day five was 24 h after the last bitterweed dose was administered. Urea nitrogen, creatinine, glutamic-oxalacetic transaminase and γ-glutamyl transpeptidase were determined using blood serum.

The ration shown in Table 1 was fed at a rate of 1 kg/head/day and feed intakes were recorded daily.

Feed intake and the above serum measurements were used to ascertain the toxicity of the bitterweed since changes in these criteria have been shown to be related to hymenoxon dose (1,2).

RESULTS AND DISCUSSION

Feeding sheep bitterweed that was collected in January depressed feed intake and increased serum urea nitrogen, creatinine, glutamic-oxalacetic transaminase and γ-glutamyl transpeptidase. Whereas, feeding sheep bitterweed that was collected from the same site in April only produced a slight increase in serum urea nitrogen and no changes in the other measurements (Figures 1, 2, 3, 4 and 5). Thus it is very apparent that a difference in toxicity of these two bitterweed collections exists which is not evident by examination of their hymenoxon content as determined by the gas chromatographic procedure described by Hill et al. (4).

The exact reason for this lack of correspondence between hymenoxon content and animal toxicity is unknown. Possible explanations are (1) a factor(s) exists in bitterweed which is modifying animal response to hymenoxon and (2) a less toxic compound, with a chemical structure closely related to hymenoxon (for example an isomer of hymenoxon), exists which is being converted to the same

chemical entity as is hymenoxon under the conditions used in the gas chromatography procedure.

In the case of factors in bitterweed which modify animal response, the only evidence is indirect and relates to our inability, thus far, to separate out a second compound. Under basic conditions, hymenoxon is converted to isomeric dilactones, psilotropin, and greenein. This reaction has been used to confirm the structure of hymenoxon (6) and to produce derivatives that aid in the rapid screening of plants for the presence of hymenoxon (3). When ethyl acetate extracts of bitterweed plants collected in January and April were treated with sodium hydroxide as described by Hill et al. (3), in both instances, the hymenoxon peak on the chromatogram disappeared and was replaced by a peak which corresponded to that for psilotropin. Also a sample of pure hymenoxon cochromatographed with the hymenoxon peaks from the two bitterweed samples over a range of column temperatures (Calhoun, unpublished data).

There is better evidence to support the second possibility; that a closely related, nontoxic compound is interfering with the hymenoxon assay. Ivie et al. (5) reported that the toxic component of bitterweed was a mixture of epimers which they were not able to resolve. Also, the high temperatures conditions at which the gas chromatography column is operated (220°C) causes changes in the molecule. For example, when mass spectroscopy is coupled with gas chromatography the molecular ion for hymenoxon ($C_{15}H_{20}O_5$ is not observed. Instead the molecular ion minus a molecule of water is found as the composition of the peak of highest mass number (3,5). Furthermore, attempts to isolate hymenoxon from the bitterweed harvested in April, using the procedure described by Kim et al. (6), were unsuccessful (Kim, personal communication).

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ACKNOWLEDGEMENTS

This research was supported in part by the Natural Fibers and Food Protein Commission of Texas. The assistance of Dr. Bennie J. Camp, Department of Veterinary Physiology and Pharmacology, Texas A&M University, College Station, Texas, with the determinations of hymenoxon concentration of bitterweed is gratefully acknowledged. The cooperation of Bill Pfluger in allowing collection of bitterweed plants from his ranch is also appreciated.

TABLE 1. PERCENTAGE INGREDIENT COMPOSITION AND CALCULATED NUTRIENT CONTENT OF THE EXPERIMENTAL RATION

Ingredient	% (As Fed Basis)
Sorghum grain, milo	55.2
Cottonseed hulls	29.9
Cottonseed meal	7.9
Molasses	4.0
Salt, plain	1.0
Calcium carbonate	1.5
Ammonium chloride	0.5
Nutrient values	
Total digestible nutrients, %	65.1
Digestible energy, Mcal/lb	1.29
Crude protein, %	10.0
Digestible protein, %	7.1
Calcium, %	.71
Phosphorus, %	.28

FIGURE 1

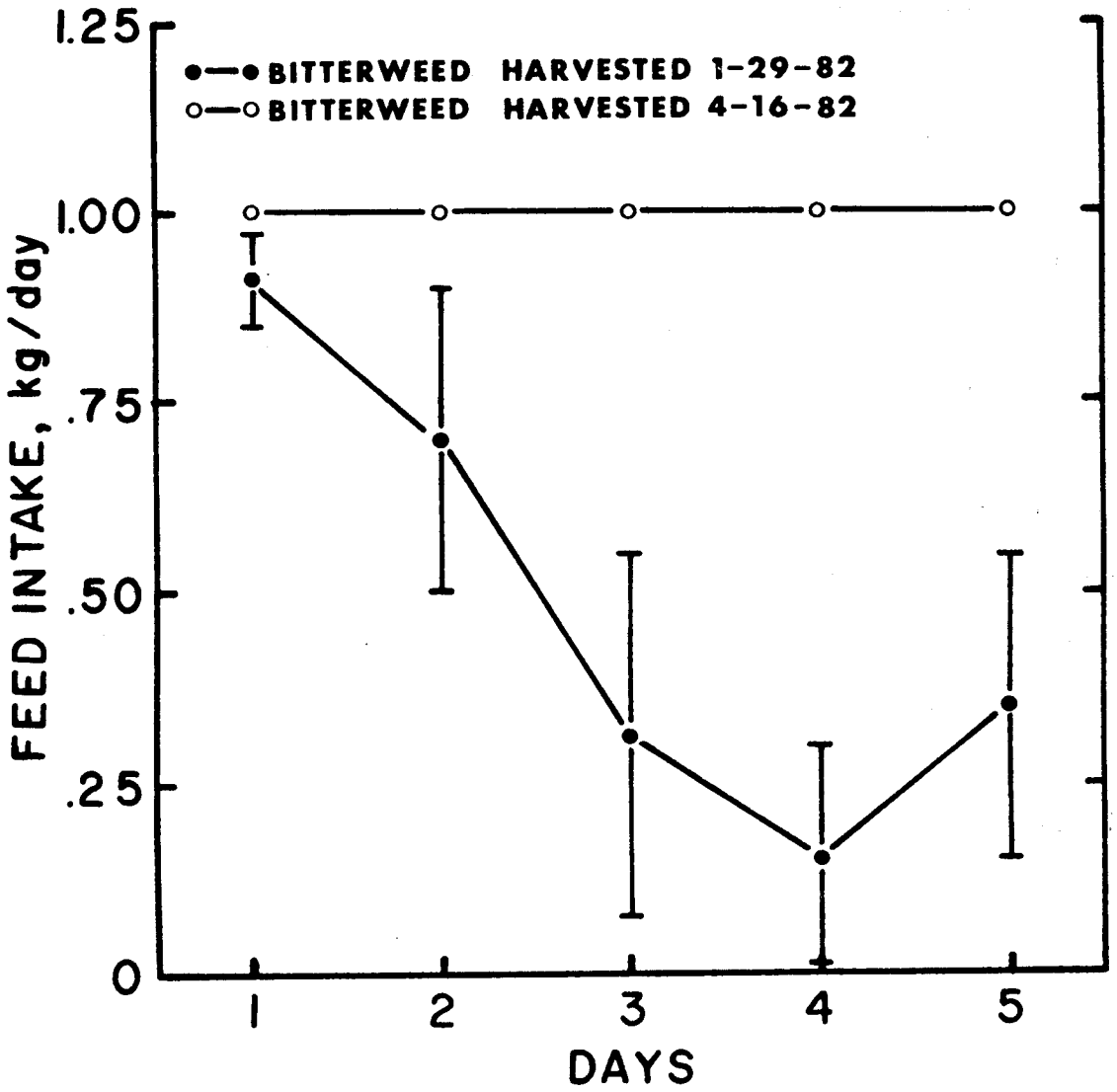

1.25
1.00
.75
.50
.25
0
FEED INTAKE, kg/day
●—● BITTERWEED HARVESTED 1-29-82
○—○ BITTERWEED HARVESTED 4-16-82
1
2
3
4
5
DAYS

FIGURE 2

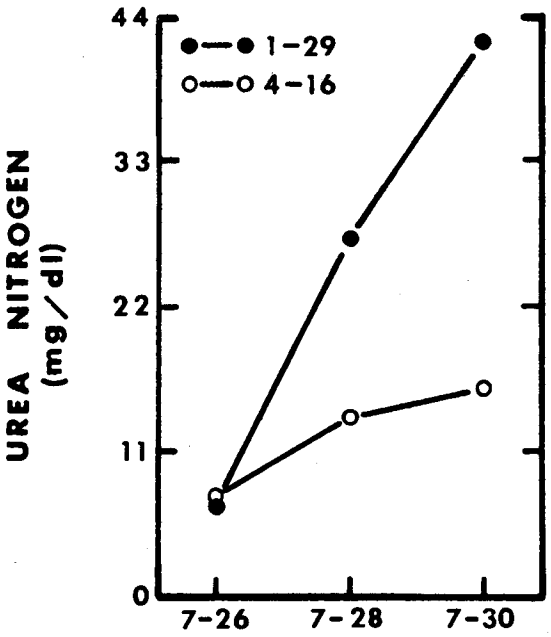


FIGURE 3

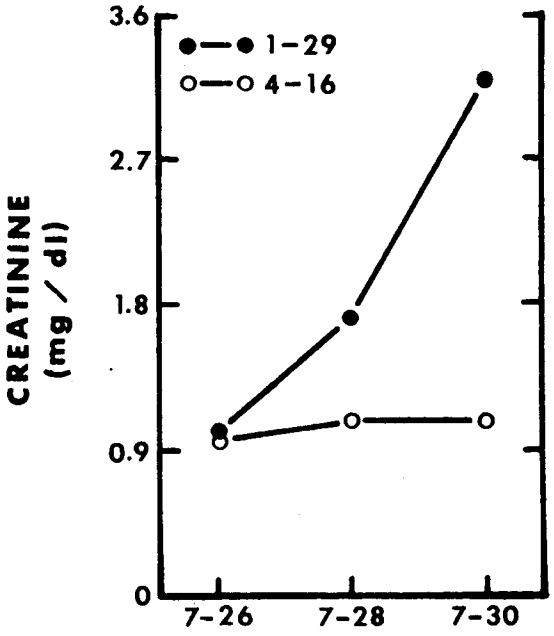


FIGURE 4

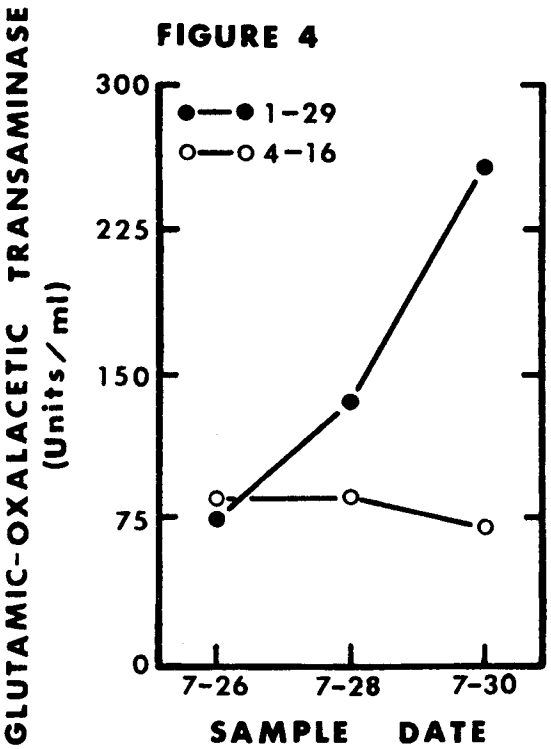
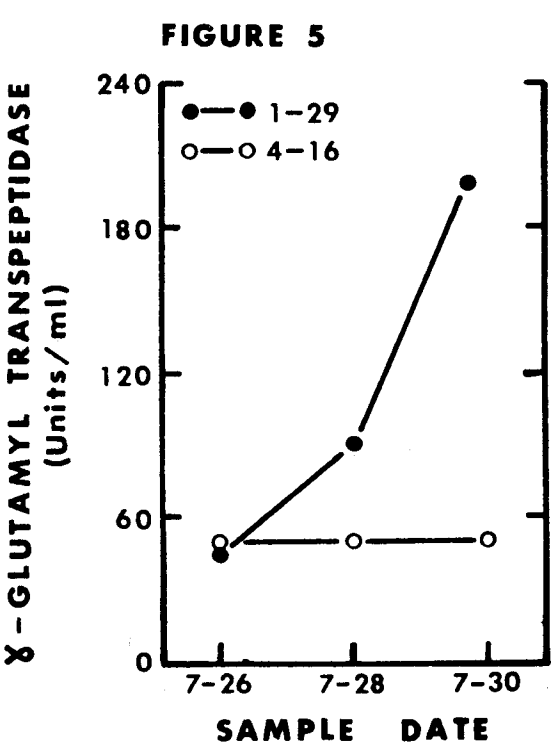


FIGURE 5



VARIATION IN THE HYMENOXON CONTENT OF BITTERWEED PLANTS

M.C. Calhoun, D.N. Ueckert, S. Hatch and F.A. Pfeiffer

The principle toxic constituent of bitterweed is hymenoxon, an unsaturated sesquiterpene lactone. Significant differences were observed in hymenoxon content of four populations of bitterweed growing on the Edwards Plateau during 1980-81. Research was initiated in 1982 to determine if bitterweed from these four different populations has the same hymenoxon content when grown under identical environmental conditions. To accomplish this, seeds were collected from randomly selected bitterweed plants at the four locations (H&H Cattle Co. Ranch, Sterling County; Pfluger Ranch, Tom Green County; Oglesby Ranch, Schleicher County and Texas A&M University's Agricultural Research Station, Edwards County) during summer 1982. These bitterweed seed were germinated in peat pellets in a greenhouse during November 1982. Subsequently they were transplanted in a nursery the third week in December. Forty bitterweed seedlings from each location were randomly assigned to each of three rows in the nursery. Five plants selected at random from each row were collected for hymenoxon analyses on March 23, and five more were collected on April 28, 1983. Number of surviving plants, plant phenology, height, diameter and fresh and dry weights of bitterweed were recorded for each sampling date. Plant phenology was not different among locations for either sampling date. The number of surviving plants was least for bitterweed grown from seed obtained at the H&H Cattle Co. Ranch. For the March 23 sampling date the fresh weight of bitterweed plants (above ground portion in grams) were 1.52, 1.71, 2.80 and 3.30, respectively, for the H&H Cattle Co., Pfluger, Oglesby and Experiment Station locations. None of these differences were significant. Hymenoxon contents (% on an air-dry basis) for this sampling date averaged 1.20, 1.78, 1.09 and 1.52, respectively, for the H&H Cattle Co., Pfluger, Oglesby and Experiment Station locations. Only the averages for Pfluger and Oglesby are significantly different. Hymenoxon analyses have not been completed for the second sampling date, but the results so far support the differences in hymenoxon content of bitterweed populations observed when sampled at the four ranch locations during 1980-81. Thus, these preliminary data support the hypothesis that hymenoxon content is a genotypic phenomenon. To provide additional evidence to support this, chromosome numbers of the four bitterweed populations are being determined.

EFFICACY AND RANCHER USE OF THE 1080 TOXIC COLLAR

Terry L. Blankenship

Toxic collar data were collected for 28 months on 14 private ranches. Placement of collars on small kids or lambs has generally been the most successful targeting strategy unless there are a large number of similar size uncollared individuals in the herd. During 76,000 collar days, 121 collared animals were killed and 73 collars were punctured. Field studies indicate that ranchers can safely use the collar and there were no indications of harmful affects to nontarget species. The toxic collar can remove predators killing sheep or goats if the rancher has the time and facilities to effectively target coyotes to collared animals.

INTRODUCTION

Coyote predation on sheep and goats has been identified as an increasing problem in many areas. Sheep and lamb losses due to predation in Texas have increased from 25% of all losses in 1967 to 58% of all losses in 1978. Goat and kid losses to predators increased from 45% of total losses in 1967 to 72% in 1978 (2). Predation is cited by many ranchers as the major reason for leaving sheep and goat ranching. The toxic collar was developed as a tool to remove predators killing sheep or goats. Toxic collar data were collected from September 1980 to December 1982 on 1 intensive site and 13 rancher sites in Texas to determine effectiveness, safety, and potential hazards to nontarget species.

EXPERIMENTAL PROCEDURE

Test sites were located through personal contact with ranchers, Texas Department of Agriculture personnel, and the Texas Rodent and Predatory Animal Control Service field personnel. Ranchers were selected due to the severity of present coyote predation, past predation problems, husbandry practices, and the agreement to abide by the restrictions contained in the 1080 Experimental Use Permit. TDA and TAMU personnel contacted and periodically monitored the rancher sites to determine the status of the research, identify problems, and collect data on the use of the toxic collar. TAMU personnel carried out most of the field activities and observations related to the toxic collar at the intensive site. Data were collected on potential hazards to nontarget species during field observations.

RESULTS AND DISCUSSION

The effectiveness of the collar is determined by the type of ranch operation, targeting strategy, and attack characteristics of individual coyotes. Ranching operations and facilities vary from ranch to ranch.

These factors should be considered when developing targeting strategies. Studies indicate that coyotes generally will select for small animals and the most effective targeting strategy has been to collar a few animals and place them in a group of grown animals. Another effective method is to pen the main group of goats and place a small number (5 to 20) of collared goats in the pasture where the trouble is occurring. However, this may not be an option for ranchers who have neither adequate penning facilities, nor the manpower to pen animals each night. Strategies that have not been successful include collaring a small number of animals in a larger flock in similar-sized individuals or placing collared animals in a pasture with other groups of animals in surrounding pastures.

Attack characteristics of coyotes may also determine the effectiveness of the collar. Some coyotes attack hindquarters and some throat attacks do not puncture the collar. Data show that 121 coyote attacks on collared animals resulted in 73 punctured collars or approximately 60% of all attacks resulted in a collar puncture--and presumably a coyote kill.

Another objective of this project has been to determine the ability of the rancher to handle and use the toxic collar. Ranchers and research personnel have used approximately 500 collars for 76,000 collar days without a mishap. Certain ranchers effectively employed the collar while others had little success. Reasons for this lack of success include: (1) limited ability to move livestock or target predation to collared animals, (2) lack of time to devote to collar use, and (3) use of collars on certain types of livestock. Generally, collaring spanish goats has been ineffective because they break, rip, and lose collars more frequently than sheep or angora goats. Ranchers have indicated that the toxic collar has removed coyotes which could not be caught using other control methods.

Studies have been conducted to determine the potential hazards of the toxic collar to nontarget species (skunks, raccoons, opossum, vultures). Potential hazards that may result from use of the collar are: (1) carcasses of poisoned coyotes, which generally cannot be found and removed for disposal; (2) vomitus from poisoned coyotes; (3) sheep or goat carcasses with broken (punctured) or unbroken collars; and (4) toxicant spilled on vegetation and soil from broken collars (1). Data collected during field studies show no indication of harmful affects to nontarget species.

Data indicates the toxic collar is a useful tool when used in conjunction with other control techniques to remove predators killing sheep and goats, but the collar is a technique which requires time to effectively target coyotes to collared animals.

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ECONOMICS OF RANCHER USE OF THE 1080 TOXIC COLLAR

Jerry H. Scrivner

SUMMARY

The purpose of this study was to identify costs associated with field use of the 1080 toxic collar. Primary costs resulting from collar use included collared animals killed or missing, toxic collars punctured or missing, transportation, labor, feed, and miscellaneous. Cost data associated with each of these factors were gathered from 12 ranch sites. Ranchers also were questioned regarding their evaluation of the toxic collar. Of 11 ranchers questioned, 8 thought the collar was cost effective, 2 did not, 1 was not sure. Major factors which ranchers thought decreased cost effectiveness included labor required to manage livestock properly in order to direct predation towards collared animals, coyotes which kill elsewhere than at the throat, and brush, fence, and other objects which may puncture collars or pull collars out of position.

INTRODUCTION

Considerable research on the toxic collar as a predator control method has been done (1,2,3,4). The 1080 toxic collar is thought to be one of the most selective methods available for removal of coyotes which prey upon sheep and goats (5). To date, however, no studies have addressed the economics of collar use. The purpose of this study was to identify costs associated with field use of the 1080 toxic collar.

EXPERIMENTAL PROCEDURE

Twelve test sites in Texas were established through personal contact with ranchers, Texas Department of Agriculture (TDA) personnel, and Texas Rodent and Predatory Animal Control Service (TRPACS) field personnel. The TDA, Texas Agricultural Extension Service (TAES), and the Texas Agricultural Experiment Station (TAEX) cooperated in determining suitable sites to carry out the toxic collar tests. Study sites were selected due to the severity of current coyote predation, their history of predation, and their husbandry practices.

Ranchers purchased the collars, and paid for other normal operating expenses, such as the penning and release of animals that would be used in the test. Ranchers were periodically questioned regarding costs resulting from use of the collar. Costs factors included collared animals killed, collars punctured or missing, labor, transportation, feed, and miscellaneous.

RESULTS AND DISCUSSION

Of 11 ranchers questioned regarding the cost effectiveness of the toxic collar, 8 thought the collar was cost effective, 2 did not, and 1 was uncertain. In general, the factors which ranchers thought decreased cost effectiveness included the labor required to manage livestock to direct predation at collared animals, losses to coyotes which killed elsewhere that at the throat, and brush, fence, and other objects which may puncture collars or pull collars out of position.

Ranchers used the collars for an average of 30 weeks. During this time, an average of 4.75 sheep or goats/ranch, valued at $31.79/head, were killed or missing (Table 1). Collared animals normally were placed as a target flock in areas where the probability of attack by coyotes was greatest. The need to "sacrifice" collared animals in order to take depredating coyotes is essential and generally is considered a disadvantage of using collars (Wade and Connolly 1980). Thus, the loss of collared animals was a cost due to collar use. Often, however, collared animals were run with the main herd. Under these circumstances, it could be argued that the loss of collared animals represents no additional cost to ranchers, since if coyotes enter a pasture to kill livestock, some animals will be killed whether or not they are collared.

An average of 19.25 collars/ranch were purchased at $16.00/collar (1980-1981 price). The price of collars has increased since 1981. Should the collar be registered for use, the price may decrease as a result of lower costs from more efficient production. In addition, an average of 6.58 collars/ranch valued at $105.28 were punctured or lost. Collars were punctured not only by coyotes, but also by wire and thorns. For this analysis, costs were calculated only for collars which were punctured or missing during the 30-week accounting period (Table 1).

During the 30-week period collars were in use, ranchers drove an average of 466.09 mi (valued at $107.20) extra to monitor collared livestock. Use of collars also required an additional 161.70 hours labor/ranch valued at $590.21 (Table 1). Labor to use collars primarily involved periodic checking and adjusting of collars on livestock and managing livestock to direct predation towards collared animals. Adjusting collars is particularily important on young, growing animals to prevent collars from becoming too tight. Effective targeting of coyotes to collared animals usually involves exposing a target group of 15 to 25 collared animals on pasture by themselves, or placing collared kids or lambs with uncollared adult sheep or goats.

Labor also included occasions when animals were gathered for application or removal of collars. This often involved considerable time, but, on most ranches was infrequent and accounted for a relatively small proportion of the total labor required. Labor requirements were minimized by handling collared livestock during period when livestock were gathered for other purposes such as shearing or drenching.

Ranchers spent an average of $80.51/ranch extra on feed for collared livestock (Table 1). Feed usually consisted of corn or protein supplement. Feed was used to attract collared animals to examine collar fit and condition. Occasionally livestock were provided feed during a 24-48 hour period when animals were penned for observation to assure that collars were properly fitted.

Miscellaneous costs were estimated to be $18.93/ranch for all ranches (Table 1). Miscellaneous expenditures included a locked box to keep collars in, ear tags for collared animals, tag applicator, and warning signs regarding toxic collar use in test pastures.

Based on these tests and other research, 1080 toxic collars deserve further consideration for use in predation control. They offer an additional tool which may be used with other control methods to help alleviate losses. The capabilities of and limitations to managing livestock, as well as the history of predation losses, should be examined for each case to determine the potential utility of toxic collars. If predation is severe and if livestock can be managed to direct predation at collared animals, toxic collars can be an effective tool for reducing predation losses. Future analyses will use collar-use data to predict when the collar has the greatest potential to be cost effective.

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Table 1. Average costs resulting from use of the 1080 toxic collar on 12 ranches in Texas during an average 30-week period. Total costs are adjusted to a 52-week period

	Average no./ ranch	Value/ unit ($)	Value/ ranch ($)
Collared animals killed or missing	4.75 head	31.79/head	151.00
Collars punctured or missing	6.56 collars	16.00/collar	105.28
Transportation	466.09/mi	0.23/mi	107.20
Labor	161.70 hours	3.65/hour	590.21
Feed	-[a]	-[a]	80.51
Miscellaneous[b]	-	-	18.93
Total (30-week period)			1,053.13
Total (52-week period)			1,825.43

[a]Not applicable since different types of feed were used by ranchers.

[b]Miscellaneous costs were estimated by the author. They include the cost of a locked box to keep collars in, ear tags for collared animals, tag applicator, and warning signs. The cost of these items were depreciated over their expected life by author.

INTAKE IN EWES AT FOUR LEVELS OF SUPPLEMENTAL FEEDING DURING FALL, WINTER, AND SPRING

J.E. Huston and B.S. Engdahl

SUMMARY

Forage intake was determined in grazing ewes fed at four levels during fall, winter and spring. Nonpregnant, pregnant and lactating ewes were observed. Consumption of forage and intake of total digestible dry matter were similar for nonpregnant ewes during fall and spring and higher than during winter. Intake by nonpregnant and pregnant ewes did not differ. Lactating ewes consumed 45% more forage during spring than nonlactating ewes. Increasing levels of supplemental feed decreased forage intake but increased total digestible dry matter. The ewes consumed substantially less digestible dry matter (energy) than reported requirements. Supplemental feed up to 500 g/d failed to increase energy intake to approach reported requirements.

INTRODUCTION

Feeding concentrates to ewes on rangeland has been a common practice in the Edwards Plateau region of Texas, but the most desirable kinds and amounts of feeds and the most beneficial periods of feeding remain very much in doubt. A 4-yr study showed little benefit from feeding up to 340g (.75 lb) per day of a high energy supplement during the late fall and winter to Feb.-Mar. lambing ewes (1). Most ewe flocks are not fed at that level but even higher levels of feeding are not rare. The lack of a response to feeding leads to the question of whether the supplemental feed is depressing forage intake and thereby failing to increase total nutrient intake. A study was conducted to measure the effects of increasing levels of supplemental feed on forage intake and total digestible dry matter intake in nonpregnant and pregnant ewes during fall and winter and in nonlactating and lactating ewes during spring.

EXPERIMENTAL PROCEDURE

The study involved 76 adult fine-wool ewes assigned to four groups of 19 each and fed according to predetermined feed treatments (Table 1) for the period from 11/16/81 through 4/2/82. Intake trials were conducted during Nov. 30-Dec. 4 (Trial 1), Jan. 26-31 (Trial 2), and Mar. 29-Apr. 2 (Trial 3) and were designated as fall, winter, and spring trials, respectively. The ewes were fed individually one-third of their weekly allowance on three occasions each week. Intake was computed from fecal output predictions derived through the use of a single dose marker technique described by Pond et al. (4). Details on feeding procedure and implementation of the marker technique are given in a related report (2).

RESULTS AND DISCUSSION

Data are presented on only 72, 75, and 72 ewes in trials 1, 2 and 3 respectively, because of unrelated problems encountered during the study (Table 2). Also, because of unforeseen logistic problems that arose during breeding, there was a disproportionately large number of nonpregnant ewes compared with the number that became pregnant and later lambed.

Average forage intake in nonpregnant ewes was similar during the fall and spring trials but lower in the winter. This is attributed to a low forage digestibility during the winter trial which led to a long gastrointestinal retention time and slow rate of flow of undigested residues (2). Forage digestibility was unusually high in the fall because of prolonged favorable growing conditions. Fall values often more closely resemble the winter values.

Nonpregnant and pregnant ewes were very close in average forage intake even during late pregnancy (winter). It was suspected that ewes in very late pregnancy would show a marked decline in intake. However, there was no clear indication that this occurred, even in ewes within 5 days of lambing. On the other hand, lactating ewes consumed an average of 45% more forage compared with nonlactating ewes in the spring trial. This magnitude of difference is similar to previously reported data (1).

Increasing levels of supplemental feed generally decreased forage intake (Table 2) but increased digestible dry matter (DDM) intake (Table 3). In nonpregnant ewes the decreases in forage consumption were fairly large and increases in DDM were rather small during fall and spring suggesting that the concentrate feed was being substituted for relatively high quality forage. During winter, forage consumption actually increased at the intermediate feeding levels and declined less overall indicating that supplemental feed was more additive when the forage was poorly digested. This can be explained in that concentrate feeding increases rate of flow of indigestible residues (2). Also, poorly digested material has a higher proportion of indigestible residues that appear in the feces. Thus, the small amount of indigestible residues that arise from the highly digestible concentrate must displace less of a poorly digested forage than of a forage having a higher digestibility. The pattern is reversed in pregnant ewes and an explanation is not apparent. Supplemental feed appeared to have minimal effects on total nutrient intake in lactating ewes during spring.

Comparing DDM intake in the ewes in this study (Table 3) with TDN requirements (Table 4) reveals that ewes exceeded requirements during the fall, approached requirements while lactating in the spring but were greatly underfed during late gestation in the winter. Moreover, supplemental feeding at up to 500g of sorghum grain per day did not

rectify the deficiency. Other approaches that should be investigated include feeding the ewe to store fat during the fall and high level feeding (<1000 g/d) for a short period surrounding parturition.

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TABLE 1. Supplemental Feeding Levels During Fall, Winter, and Spring Forage Intake Trials[1]

Item	Feeding Levels			
	Control	Low	Medium	High
Supplement, no.[2]	0	1	2	3
Feeding level, g/d[3]	0	125	250	500
Nutrients provided, g/d[4]				
Crude protein	0	50	50	50
Digestible dry matter	0	70	160	350

[1] Feeding period was from 11/16/81 to 4/2/82.

[2] Supplements were:
Supplement 1 - Cottonseed meal
Supplement 2 - 32% cottonseed meal, 68% sorghum grain
Supplement 3 - Sorghum grain

[3] Air dry basis.

[4] Approximated based on crude protein and digestible dry matter determinations in a separate experiment.

TABLE 2. Forage Intake in Ewes at Four Levels of Feeding During Fall, Winter, and Spring

Season and Productive Stage	Item	Feeding Level				Ave
		Control	Low	Medium	High	
Fall						
Nonpregnant	Ewes, no.	11	15	10	12	
	Forage intake, g/d	1672	1567	1591	1394	1556
Early pregnant	Ewes, no.	8	3	8	5	
	Forage intake, g/d	1603	1468	1434	1603	1527
Winter						
Nonpregnant	Ewes, no.	11	15	10	14	
	Forage intake, g/d	1260	1343	1392	1040	1259
Late pregnant	Ewes, no.	8	4	8	5	
	Forage intake, g/d	1516	1521	1296	929	1316
Spring						
Nonlactating	Ewes, no.	14	17	10	12	
	Forage intake, g/d	1808	1733	1514	1218	1568
Lactating	Ewes, no.	5	2	8	4	
	Forage intake, g/d	2438	2190	2527	1933	2272

TABLE 3. Total Digestible Dry Matter (DDM) Intake in Ewes at Four Levels of Feeding During Fall, Winter, and Spring[1]

Season	Productive Stage	Ave DDM Intake (g/d) by Ewes in Groups[2]				
		Control	Low	Medium	High	Ave
Fall	Nonpregnant	919	931	1038	1115	1001
	Early pregnant	882	876	951	1230	985
Winter	Nonpregnant	489	590	702	751	633
	Late pregnant	588	659	665	709	655
Spring	Nonlactating	994	1022	995	1018	1007
	Lactating	1340	1274	1552	1412	1394

[1]The numbers of ewes in the respective groups were the same as those reported in Table 2.

[2]These values include contributions from both forage and supplements.

TABLE 4. Crude Protein (CP) and Total Digestible Nutrient (TDN) Requirements for a 60 Kg Ewe at Different Stages of Production[1]

Stage of Production	Nutrient	
	CP	TDN[2]
	g/d	
Nonpregnant	98	610
Early pregnant	117	720
Late pregnant	177	1100
Early lactation	269	1600

[1]NRC (3).

[2]TDN and DDM are similar in magnitude.

CHANGES IN THE DIGESTIVE PHYSIOLOGY OF EWES FED AT DIFFERENT LEVELS DURING FALL, WINTER AND SPRING

J. E. Huston and B. S. Engdahl

SUMMARY

A single dose marker technique was used to determine gastrointestinal fill, retention time and rate of flow of indigestible residues in nonpregnant ewes at four feeding levels during fall, winter and spring. Season affected the measured parameters more than level of feeding. In general, fill and retention time decreased and rate of flow increased as quality of diet increased either through change of season or increased supplemental feeding.

INTRODUCTION

Feeding of sheep and goats on rangeland is very common in the Edwards Plateau region of Texas, yet, quantitative measures of the effects of feeding have been very elusive. Such factors as climate, location, plant composition of the rangeland, and the productive stage and potential of the animal seem to affect the practical results of feeding. Recent results in sheep studies (2, 3) indicate that concentrates displace forage in ewe diets and the net increase in the productivity level as a result of feeding concentrates may be small. However, studies with goats (1) showed a large increase in productivity with concentrate feeding, especially when the feeding was during the late gestation-early lactation period. A study was conducted with adult, nonpregnant Rambouillet ewes to determine the effects of feeding concentrates during the late fall, midwinter, and early spring on several physiological factors including gastrointestinal fill, retention time and rate of flow.

EXPERIMENTAL PROCEDURE

This report includes data from 48, 50 and 53 ewes during fall, winter and spring trials, respectively. The ewes were neither pregnant nor lactating during any of the trials, and with a few exceptions, the same ewes were used in each of the trials. All ewes were placed on their respective feed treatments on November 16, 1981, and remained on it through the completion of the third trial on April 2, 1982. Trial dates were Nov. 30-Dec. 4 (Trial 1), Jan. 26-31 (Trial 2), and Mar. 29-Apr. 2 (Trial 3).

Feed treatments were imposed by penning and feeding the ewes individually three times per week. At each feeding, the ewes were fed one-third of the weekly feeding allowance. Rations, feeding levels (daily basis), and approximations of the nutrients supplied in the supplemental feed are included in Table 1.

Gastrointestinal fill, retention time and flow rate were determined on each ewe during each of the three trials by the marker procedure described by Pond et al. (4). Hydrated ytterbium nitrate was injected into the mid-dorsal portion of the rumen by use of an 18-gauge spinal tap needle at approximately 11:00 A.M. on the first day of the trials. Fecal samples were taken from the rectum at approximately 6, 9, 12, and 20 hr post-dose and at approximately 24-hr intervals for the next four days. Minor departures from this schedule were necessary but actual dosing and collection times were recorded. Fecal samples were dried at 60°C, ground through a 20 mesh screen and ashed at 550°C for 8 hr. Yb was determined in an acid extract of the ash by use of an atomic absorption spectrophotometer with an acetylene-nitrous oxide flame.

Yb concentrations were analyzed by use of an age dependent, one-compartment model (4) which predicted gastrointestinal fill, retention time and rate of flow of undigested particles. It is necessary to reiterate that these estimates apply to undigested residues (particles excreted in the feces). Gastrointestinal fill includes undigested particles in the total tract. Retention time is defined as the average time required for undigested particles to move from mouth to rectum. Some particles move quickly while others are delayed. Retention time is an expression of the average. Rate of flow is defined as the fraction of the gastrointestinal fill appearing in the feces per hour.

RESULTS AND DISCUSSION

Greater differences were observed among trials (seasons) than among feeding levels. Ewes had the highest fill, longest retention time, and slowest rate of flow during winter. Lowest fill, shortest retention time and fastest rate of flow were observed during the spring trial. Fall values were always intermediate but nearer the spring values. These values are consistent with expectations based on forage quality. Winter forage was dormant, fibrous, and low in digestibility. These larger, fibrous particles were less dense and highly matted in the rumen. These particles accumulated, remained longer and moved on through the rest of the tract slower than the more succulent and dense particles consumed in the spring. Because of the good moisture and growing conditions during the fall of 1981, fall forage was similar to spring forage. This may not be true in some years when fall values may approach or equal winter values.

Increasing levels of supplemental feed tended to decrease fill, shorten retention time and increase rate of flow. The largest single effect was observed in fill at the high level of feeding during winter. The least noticeable effects were in the spring when retention time and flow rate appeared unaffected.

These data suggest that the physiological parameters measured are closely related to diet quality. Furthermore, these factors would appear to be highly related to forage consumption and subsequently to overall nutrition level. These variables will be addressed in a separate but related report.

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TABLE 1. Feeding Levels and Rations Used During a Supplemental Feeding Study with Nonpregnant Ewes

Feeding Treatment	Ration Ingredients		Feeding Levels	Nutrients Supplied (Estimated)	
	CSM	Sorghum Grain		Crude Protein	Digestible Dry Matter
	%		g/d		
Control	0	0	0	0	0
Low	100	0	125	50	70
Medium	32	68	250	50	160
High	0	100	500	50	350

TABLE 2. Gastrointestinal Fill in Ewes During Different Seasons and at Different Levels of Feeding

Season	Feeding Level				
	Control	Low	Medium	High	Average
	g				
Fall	645	613	607	545	602
Winter	890	874	901	688	831
Spring	580	583	507	447	537
Average	695	685	672	567	

TABLE 3. Gastrointestinal Retention Time in Ewes During Different Seasons and at Different Levels of Feeding

Season	Feeding Level				
	Control	Low	Medium	High	Average
	hr				
Fall	37.3	32.0	34.6	30.7	33.4
Winter	47.0	41.3	38.2	38.5	41.2
Spring	29.0	29.9	29.4	30.8	29.8
Average	37.0	34.2	34.0	33.6	

TABLE 4. Rate of Flow of Digesta Through the Gastrointestinal Tract at Different Levels of Feeding and During Different Seasons

Season	Feeding Level				
	Control	Low	Medium	High	Average
	fraction of fill/hr				
Fall	.049	.052	.053	.056	.053
Winter	.036	.042	.043	.045	.042
Spring	.060	.059	.062	.061	.060
Average	.050	.051	.053	.054	

INFLUENCE OF NUMBER OF LAMBS DROPPED OR RAISED ON THE PRE- AND POSTPARTUM DAILY FEED INTAKE OF FINNISH LANDRACE AND RAMBOUILLET EWES

Ron Lewis and Maurice Shelton

SUMMARY

The voluntary feed intakes of Finnish Landrace and Rambouillet ewes carrying single or multiple lambs were recorded during late gestation and early lactation to determine the relation of the number of foetuses carried to pre-lambing and post-lambing levels of feed intake. A depression in the ewes feed consumption late in pregnancy has been suggested to result from an increasing competition for space within the abdominal cavity between the rapidly growing foetus and the rumen. Undernourishment in the days preceding lambing is more likely to occur in ewes carrying twin and triplet lambs than those with a single and may be linked to a physical inability to eat enough feed. Our data indicates that foetal crowding depresses level of feed intake, on a breed or ewe specific basis. Ewes carrying more pounds of lamb in terms of their maternal body weight, had more difficulty maintaining their feed intake. In this study there was no indication that Rambouillet ewes carrying twin lambs suffered a limitation on feed intake due to space limitation. Finnish Landrace ewes carrying triplet lambs did appear to show evidence of a reduced intake, but this did not appear to present serious problems with the ration employed. In early lactation, ewes nursing multiple lambs consumed more feed than those with singles or those not nursing lambs. The lactating ewes nursing more than one lamb tended to consume between 5.5 and 7.5% of their body weight each day.

INTRODUCTION

With the sheep industry's increasing emphasis on lamb production, selection for multiple lamb bearing ewes is gaining support. However, the management of twin and triplet lambing ewes requires special attention since undernourishment of heavy ewes late in pregnancy may be linked to smaller, weaker lambs, low initial levels of milk production and pregnancy disease (2,3,5,6). In the winters (January through May) of 1982 and 1983, at the Texas A&M University Research Center at San Angelo, a study was conducted to obtain data on the influence of multifetation on prepartum feed intake and the influence of the number of lambs nursing on the level of intake in the early postpartum period.

EXPERIMENTAL PROCEDURE

Nineteen Finnish Landrace and 14 Rambouillet ewes observed to be heavy springers (breeding dates unknown) were taken from their respective flocks, vaccinated for Clostridium perfringens C&D and group fed a limited diet for one to three days. The ration was a commercially prepared complete lamb feed not less than 10% crude protein nor more than 20% crude fiber. The ewes were weighed and confined individually under an open-sided shed in 4x6 pens with expanded metal flooring. Following three additional days of limited feeding, each was provided the ration on a self-feed basis. Daily feed intake, parturient and weekly maternal weights, and lamb birth and weekly weights were recorded throughout the study. The ewes were revaccinated for overeating disease after three weeks. Ewes not adapting well to the experimental routine were removed.

The Finnish Landrace ewes were tested in both 1982 and 1983 while the Rambouillets were tested only in 1983. A total of 6 open ewes of each breed was tested in the same procedure in April of each year. The data on the open Rambouillets was significantly reduced since four of the six ewes "bagged-up" late in the month apparently having been bred late in the season. Data on these were discarded.

RESULTS AND DISCUSSION

The data obtained are presented in Figure 1. In the days preceding parturition those Finnish Landrace ewes bearing multiple foetuses, most commonly three, showed a mean intake considerably less than ewes carrying singles. In early lactation, consumption levels correlated with the number of lambs being nursed; ewes suckling twin and triplet lambs tended to eat more feed. Although the post-lambing feed consumption of the Rambouillets followed the same pattern as that for the Finnish Landrace, pre-lambing feed intake of Rambouillet ewes supporting single versus twin lambs was nearly identical. Twin lambs accounted for all multiple births in the Rambouillet sheep whereas 7 of the 12 multiple birth Finnish Landrace dropped more than two lambs. The drop in feed intake observed for both breeds a few days prior to lambing may be of some interest. Where this information is available on a single animal basis, it may offer a means of predicting the parturition date.

A year effect between Finnish Landrace ewes tested in 1982 and 1983 was of concern. No significant difference in feed intake during late gestation was noted for the two years. The level of feed consumption during early lactation, however, was consistently higher in 1982 than in 1983 for both single and multiple lambing ewes. Data collected on ewes losing all their lambs was included in pre-lambing analysis, but are not included in the post-lambing data. In one case a Rambouillet ewe gave birth to twins with one dying shortly thereafter. She was considered a

multiple lambing ewe during late gestation yet was credited for nursing only a single lamb.

The ration fed throughout the study, upon analysis in 1981, was slightly deficient in TDN for ewes in the first eight weeks of lactation suckling twins by NRC standards. The rations actually fed in this study may have marginally differed from the 1981 feed due to changes in feed ingredient prices. Studies conducted by the Ohio Agricultural Research and Development Center indicate, however, that TDN requirements for gestating ewes reared in confinement housing are considerably less than suggested NRC levels (4). The daily voluntary feed intake of gestating ewes averaged 4.4% of their body weight (5.9 lbs) while the average daily intake of lactating ewes was 6.4% of their body weight (8.7 lbs). These high intake values were somewhat surprising, and seem to indicate that with highly palatable rations a lower quality ration than is often recommended could be used and still meet the ewes nutrient requirements.

The initial and maternal body weights, being 137.4 lbs and 127.4 lbs for the Finnish Landrace and 153.7 lbs and 149.3 lbs for the Rambouillets respectively, indicate a considerable difference in size between the breeds. The Rambouillet ewes tested are recognized as being heavier than the average range ewe possibly confounding their feed intake data. On a percentage basis (Table 1), multiple lamb-bearing Finnish Landrace ewes carried a greater volume of lamb than Rambouillets. The high incidence of triplets in the Finns also suggests they carried additional extra-foetal tissues than twin-bearing ewes.

Past research suggests that foetal volume within the abdominal cavity depresses rumen volume and contents and hence voluntary feed intake (1,5). The number of foetuses carried would seem to directly relate to the degree of intake depression observed. This study indicates that crowding within the abdomen is not only a function of the total number and pounds of lambs carried but is also affected by the maternal body weight which is an indicator of an ewe's size and frame. On the reasonably high quality ration used (appx. 62% TDN on a dry matter basis) in this study, abdominal crowding does not appear to have been a serious problem even for the Finnish Landrace ewes. The large amounts of feed consumed when provided on an ad-libitum basis makes such a practice prohibitive in cost for most Texas producers as they would be forced to purchase the ration on open-market channels.

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Table 1. Mean initial and parturient body weights and lamb weights of multiple and single lambing and open Finnish Landrace and Rambouillet ewes

Finnish Landrace Ewes:

Group	No.	Initial Body Weight	Parturient Body Weight	Lamb[a] Birth Weight	Lamb Birth Wt. % of Ewe Wt.[b]
Single Lambing	3	137.3	128.0	8.4	6.56
Multiple Lambing	12[c]	137.4	124.1	18.2	14.67
Open	5	116.4	132.0[d]	--	--

Rambouillet Ewes:

Group	No.	Initial Body Weight	Parturient Body Weight	Lamb[a] Birth Weight	Lamb Birth Wt. % of Ewe Wt.[b]
Single Lambing	6	145.0	139.2	12.0	8.62
Multiple Lambing	5[c]	164.2	161.4	20.7	12.83

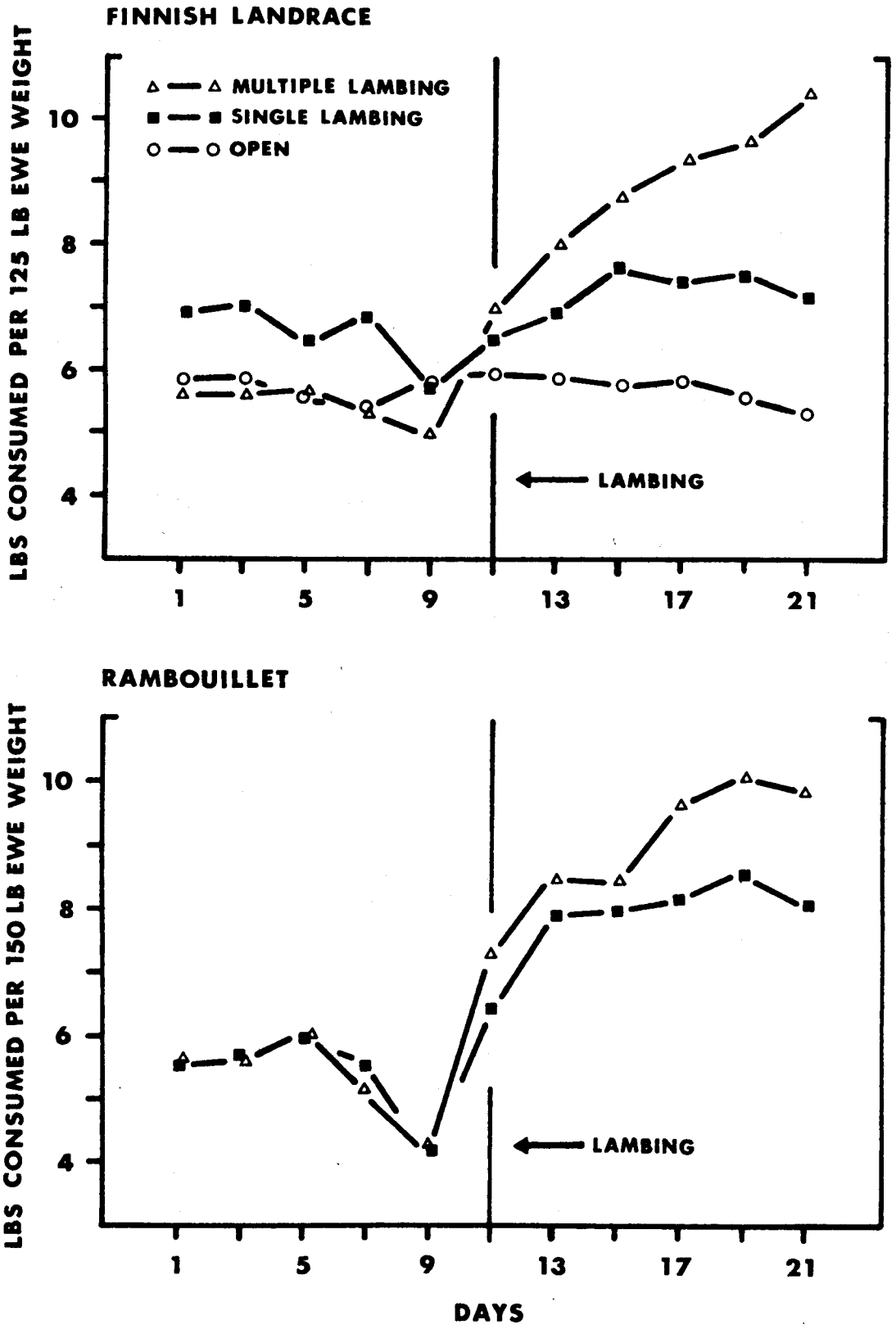
[a] Mean combined weight of lambs for multiple lambings.

[b] Calculated by dividing lamb birth weight by parturient body weight.

[c] A total of 7 of the 12 Finn ewes had 3 or more lambs whereas all the Rambouillet ewes had twin births.

[d] Mean open ewe body weight over test period.

Figure 1. Mean feed intake of multiple and single lambing and open Finnish Landrace and Rambouillet ewes.



Each point is the averaged intake of two consecutive days.

Mineral Balance in Lambs Fed With or Without Monensin

Kirk, D.J., L.W. Greene, G.T. Schelling and F.M. Byers

Summary

A ten-day mineral balance trial was conducted to determine the effect of monensin on the metabolism of Na, K, Ca, Mg, Zn and P. Eight crossbred wether lambs (average weight 85 lb) were used in a randomized block design, blocked by weight, and fed a 70% concentrate control diet, or control diet + 20 ppm monensin. The balance study was preceded by a 28-day diet adjustment period. During the first 18 days of the adjustment period animals were penned by treatment group and fed ad libitum. During the last ten days of adjustment, and throughout the collection period, animals were kept in metabolism stalls for the total collection of feces and urine, and fed 600 g each, twice daily, at twelve hour intervals. Feed, feces and urine were collected daily, composited and analyzed for Na, K, Ca, Mg, Zn and P. Apparent absorption and retention of Na, K and Ca did not differ statistically. Magnesium and P absorption were not affected, however, apparent retention increased ($P<.05$), 37% and 10% respectively, when monensin was fed. The addition of monensin to the diet depressed ($P<.05$) fecal Zn excretion 20% and increased ($P<.05$) apparent Zn absorption 17%. Zinc retention increased ($P<.05$) 17% when expressed as g/day or percent of intake, but not when expressed as percent of absorbed Zn.

Introduction

Although a major portion of the investigations on monensin have been conducted with cattle, a good deal of analogous work has been done with sheep. Studies with lambs have found that monensin increases feed efficiency (1, 4), and dry matter digestibility (2). As an ionophore, monensin's primary effect is to facilitate the passage of minerals, in their ionized state, through cell membranes. Monensin is known to have a strong affinity for Na and K, increasing the Na concentration inside the cell, while increasing K concentration outside the cell. It has been shown that monensin actually increases the action of the sodium-potassium pump (6), and it is believed that Ca may also be associated with this effect (5).

Animal nutrition research concerning monensin's effects on minerals has been especially limited. Lemenager et al. (3) found that in cows fed a ration supplemented with 20 mg of monensin/head/day, rumen fluid potassium was increased 21.6% compared to cows not receiving monensin. Monensin supplementation has also been shown to significantly increase P concentration in the livers of steers (7).

The objective of this study was to identify monensin's effects upon mineral metabolism by using lambs in a mineral balance trial.

Experimental Procedure

Eight crossbred wethers (average weight 85 lbs) were used in a randomized block design, blocked by weight, and fed a 70% concentrate control diet (table 1), or control diet plus 20 ppm monensin (fed as Rumensin). The trial consisted of a 28-day adjustment period to the diets and a 10 day collection of feed, feces and urine. During the first 18 days of the adjustment period, animals were penned by treatment group and fed ad libitum. During the final ten days of the adjustment period and the following ten-day collection period, lambs were kept in metabolism stalls for the total collection of feces and urine, and fed 600 g each, twice daily, at twelve hour intervals. During the collection period, feed, feces and urine were collected daily and composited for mineral analysis. Urine was frozen, and feces oven-dried at 70 C in a forced-air oven, and allowed to air-equilibrate for subsequent analysis. Feed and feces were ground through a 1 mm screen and wet digested with nitric and perchloric acids. Feed, feces and urine were then analyzed for Na, K, Ca, Mg, Zn and P content, to determine the mean digestibility and retention of these minerals for each treatment.

Results and Discussion

Sodium balance data are shown in table 2. Total Na absorption and balance was not significantly different due to treatment; however, Na excretion increased 10.6% in lambs fed the monensin supplemented diet as compared to those fed the control diet. This increase was due primarily to a 31.79% increase in urinary Na excretion. The increase in urinary Na tended to decrease Na retention in these animals by 57.8% as % of intake and 65.6% as % of absorbed Na. Sodium balance data between treatment groups were not statistically significant due to the wide variation among animals in each group.

As seen in table 3, differences in K balance in lambs fed with or without monensin were not statistically significant. However, K absorption was 12% greater in lambs fed monensin, while K retention expressed as g/day, % of intake, and % of absorbed K were also increased. This increased absorption accounts for the 28.9% decrease in fecal K. Negative K balance for lambs fed the control diet are the result of the excretion of more potassium than was present in the feed. This may have been due to K in the drinking water - to which all animals had unlimited and unmeasured access -, increased K loss due to stress, or analytical evaluation of the samples.

Table 4 shows the mean results of Ca metabolism for lambs fed the two diets. Calcium balance was not affected by including monensin in the diet. Calcium was primarily excreted in the feces and represents both absorbed and re-excreted, and unabsorbed Ca.

Magnesium excretion and absorption data (table 5) were similar

between treatments; however, lambs fed monensin retained significantly ($P<.05$) more Mg expressed as grams/day (+37.0%), percentage of intake (+37.0%) or as a fraction of absorbed Mg (+24.9%).

Table 6 shows the zinc balance in lambs for these treatment groups. Total Zn excretion was decreased ($P<.05$) by 18.9% for lambs fed monensin. Most of this decrease is seen in the 20% decrease in fecal zinc for lambs supplemented with monensin, which resulted from greater ($P<.05$) quantities of Zn absorbed in the lambs fed monensin. Due to the low urinary excretion of Zn, retained Zn was similar to the quantity absorbed. Monensin increased Zn retention by 17%.

Although urinary Zn was increased by over 150% in lambs fed the monensin supplemented diet, this increase was insignificant due to the minute amount of Zn excreted in the urine.

Phosphorus metabolism data for lambs fed either the control diet or control diet plus monensin are shown in Table 7. Total P excretion was 8.2% lower ($P<.05$) for lambs fed the monensin supplemented diet. Fecal P excretion was 34.6% lower resulting in a 24.4% increase in P absorption. A 179% increase in urinary P excretion in lambs fed monensin reflected increased quantities of P absorbed. Lambs fed monensin retained 9.5% more P than the control fed lambs. Phosphorus retained as a % of absorbed P was decreased due to the increase in urinary excretion when P absorption increased.

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Table 1. Basal Diet Composition

	% of diet
Cornmeal	66.36
Cottonseed hulls	30.98
Urea	0.93
Trace mineral salt	0.46
Calcium diphosphate	1.27
Total	100.00

Table 2. Sodium Balance in Lambs Fed With or Without Monensin

	Basal diet	Basal diet + monensin
Intake, (g/day)	4.19	4.19
Excretion, (g/day)		
Fecal	1.79	1.67
Urine	1.46	1.92
Total	3.25	3.60
Absorption		
g/day	2.40	2.52
% of intake	52.26	60.13
Retention		
g/day	0.94	0.60
% of intake	22.42	14.21
% of absorbed	38.85	23.47

Table 3. Potassium Balance in Lambs Fed With or Without Monensin

	Basal diet	Basal diet + monensin
Intake, (g/day)	5.34	5.34
Excretion, (g/day)		
Fecal	1.86	1.44
Urine	3.74	3.44
Total	5.60	4.89
Absorption		
g/day	3.48	3.90
% of intake	65.12	72.95
Retention		
g/day	- 0.27	0.45
% of intake	- 4.98	8.47
% of absorbed	- 9.78	11.76

Table 4. Calcium Balance in Lambs Fed With or Without Monensin

	Basal diet	Basal diet + monensin
Intake, (g/day)	11.06	11.06
Excretion, (g/day)		
Fecal	4.90	5.06
Urine	0.05	0.06
Total	4.95	5.12
Absorption		
g/day	6.16	6.00
% of intake	55.74	54.24
Retention		
g/day	6.11	5.94
% of intake	55.27	53.68
% of absorbed	99.17	98.96

Table 5. Magnesium Balance in Lambs Fed With or Without Monensin

	Basal diet	Basal diet + monensin
Intake, (g/day)	1.36	1.36
Excretion, (g/day)		
Fecal	0.78	0.75
Urine	0.49	0.49
Total	1.27	1.24
Absorption		
g/day	0.58	0.61
% of intake	42.32	45.09
Retention		
g/day*	0.09	0.12
% of intake*	6.62	9.07
% of absorbed	16.06	20.06

* P<.05

Table 6. Zinc Balance in Lambs Fed With or Without Monensin

	Basal diet	Basal diet + monensin
Intake, (g/day)	.134	.134
Excretion, (g/day)		
Fecal	.068	.057
Urine	.0003	.0008
Total*	.069	.058
Absorption		
g/day*	.066	.078
% of intake*	49.17	57.69
Retention		
g/day*	.066	.077
% of intake*	48.94	57.07
% of absorbed	99.51	98.90

*P<.05

Table 7. Phosphorus Balance in Lambs Fed With and Without Monensin

	Basal diet	Basal diet + monensin
Intake, (g/day)	9.47	9.47
Excretion, (g/day)		
Fecal	4.80	3.56
Urine	0.46	1.30
Total*	5.26	4.86
Absorption		
g/day	4.67	5.90
% of intake	49.33	62.34
Retention		
g/day*	4.20	4.61
% of intake*	44.42	48.66
% of absorbed	90.96	78.97

*P<.05

INFLUENCE OF HEREDITY ON THE SELECTION OF VARIOUS FORAGE SPECIES BY GOATS

Lee Warren, Maurice Shelton, D. N. Ueckert, and Gary Snowder

SUMMARY

Botanical diet composition was determined for different sire groups of young meat-type (Spanish) male goats in an effort to determine the influence of sire effect on diet selection. The Spanish goats grazed during the summer months of 1980 and 1981 at the Texas Agricultural Experiment Station in San Angelo, Texas. Seven sire groups were represented in 1980 and 10 in 1981. Three sire groups were common for both years. Statistical analyses indicated that sire effect does influence food-plant preference. This suggests that heredity has an impact on diet selectivity. Heritability estimates were calculated for those plant species which showed a significant sire effect. The mean heritability estimate was 30%, which would indicate moderate-to-high heritability. However, this mean value does not consider food plants which did not show a significant sire effect.

INTRODUCTION

Invading and undesirable plant species are a major problem confronting livestock producers over much of the Southwestern United States. Traditional control methods include mechanical or chemical treatments. However, the increasing costs of these methods preclude their use by many ranchers. Prescribed fire has rapidly become a popular tool for suppression of undesirable plants and range improvement, primarily due to lower costs. Biological control of undesirable plants should also be favorably considered. One approach to biological control involves the use of the grazing animal, and the possibilities for plant control by the grazing animal deserves further attention.

Specific information regarding food plant selection among or within animal species to enhance utilization of undesirable plant species is insufficient. Grazing behavior differences among animal species is well documented, and is the primary reason that goats have been historically raised in the Edwards Plateau region. Recent studies (2) have shown that breed differences within species exist.

Some of the plant species which present major problems in this region are honey mesquite (Prosopis glandulosa), junipers (Juniperus sp.), algerita (Berberis trifoliolata), and catclaw acacia (Acacia greggii). The above are all classified as browse, but a similar listing could be made for forbs. The purpose of this study was to determine the

possibility of demonstrating sire differences within the Spanish goat breed which would suggest a potential for selecting for animals for increased utilization of selected undesirable plant species.

EXPERIMENTAL PROCEDURE

This study was conducted at the Texas Agricultural Experiment Station near San Angelo during the summers of 1980 and 1981. Young Spanish goat males (7-9 months) with known sires were grazed on a mixed grass-mesquite plant community. Oak species were not present in this plant community. Goat diets were determined by the microhistological examination of fresh fecal material (1). Grazing periods were in July and August with samples being collected in August. The sampling method and forage data collection procedure generally followed that of Warren (2).

Sixty (60) young males were used in 1980 and 95 in 1981. The kids used in 1980 were sired by seven different sires, while 10 sires were used in 1981, and 3 sires were represented in both years. One of the sires used to produce the 1981 kid crop was a 1/2 Ibex male (No. 50) resulting in kids which carried 1/4 Ibex breeding. Sire effects were evaluated by paternal half-sib analyses on a within year basis.

RESULTS AND DISCUSSION

The plant species identified in the diets of goats for the two years are shown in Table 1. This table also shows the level of significance of sire effects on the intake of individual plant species. As expected, browse made up the larger portion of the diet (61.3% in 1980 and 49.3% in 1981). Grasses composed about 28% of the goat diets in both years. Moisture conditions improved in 1981, resulting in a number of forbs replacing some of the browse plants in the goat diets. Forage availability data for the experimental site is shown in Table 2. The sampling methods for determining forage availability and dietary analysis leads to considerable variability. However, it is reasonably clear that among the browse species the goats were selecting littleleaf sumac and lotebush, while avoiding mesquite. Indianmallow and globemallow were the most commonly selected forbs. Grass consumption appeared to be more closely related to availability except that the goats were avoiding tobosagrass.

Intake variability by sire groups for three browse species are shown in Fig. 1 and 2. The conclusions to be drawn from this data are not clear. The goats consumed noticeably more algerita in the dry year 1980 than 1981.

Nested analyses of variance were used to test for significance of year and sire effect on the level of intake on 33 different plant species. Year effects were significant for most species. The results with respect to sire are shown in Table 3.

These data seem to confirm that there was a sire effect on diet selectivity. It may be of interest to note that there was a significant sire effect for the undesirable plant species algerita, mesquite, lotebush, and whitebrush. There was not a significant sire effect on a highly palatable species such as littleleaf sumac. Apparently, all the goats tended to feed on this plant.

These data are generally inadequate to provide heritability estimates with any degree of confidence. Heritability estimates based on half-sib analyses were calculated for the intake of those species which showed a significant sire effect. The mean of these values was approximately 30% which would be moderate to high, but this mean ignores plant species which did not show a significant sire effect.

The authors interpret these data to confirm that even within species within breed, heredity is playing a part in diet selectivity. However, we are not yet ready to propose a program to select for animals which would more readily consume a plant species such as mesquite. It should be of interest to look at dietary habits of animals which have lived in a given resource area or plant community for a number of generations to see if they have altered their grazing habits relative to more recently introduced animals. This also may be a factor to consider in developing animals specifically adapted to a given resource area.

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ACKNOWLEDGMENT

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Table 1. Plant species identified in the diets of male goats grazing near San Angelo, Texas in August 1980 and 1981

	Food Plants		% of Diet		Level of Significance of Sire Effect
	Common Name	Scientific Name	1980	1981	
Grasses	Grama	Bouteloua spp.	6.6	3.3	* *
	Sand Dropseed	Sporobolus cryptandrus	5.1	3.2	*
	Buffalograss	Buchloe dactyloides	8.3	3.8	--
	Curlymesquitegrass	Hilaria belangeri	3.5	7.0	--
	Tobosagrass	Hilaria mutica	1.5	1.6	+
	Texas Wintergrass	Stipa leucotricha	0.2	0	--
	Tridens	Tridens spp.	0.9	7.2	* *
	Threeawn	Aristida spp.	0.6	1.1	*
	Muhly	Muhlenbergia spp.	0.5	0.1	*
	Panicum	Panicum spp.	0.5	0.7	*
	Bluestem	Bothriochloa spp.	0.3	0.7	* *
	Ozarkgrass	Limnodea arkansana	0	0.1	--
		Total Grasses	28.0	28.8	
Browse	Morman tea	Ephedra sp.	1.5	1.3	--
	Littleleaf sumac	Rhus microphylla	33.3	43.0	--
	Lotebush	Condalia obtusifolia	15.6	0.7	* *
	Persimmon	Diospyros texana	0	0.02	--
	Catclaw acacia	Acacia greggii	0.2	0.6	--
	Honey mesquite	Prospis glandulosa	0.6	0.7	*
	Juniper	Juniperus pinchoti	0.2	0.2	+
	Wolfberry	Lycium texanum	1.6	0	+
	Whitebrush	Aloysia lycioides	0.5	0	* *
	Algerita	Berberis trifoliolata	7.8	2.8	* *
		Total Browse	61.3	49.32	
Forbs	Indianmallow	Abutilon incanum	0.8	16.0	--
	Globemallow	Sphaeralcea spp.	5.5	2.2	*
	Plaintain	Plantago spp.	0	1.4	--
	Nuttalls milkvetch	Astragalus nuttallianus	0.1	1.2	--
	Solanum	Solanum spp.	1.7	0.2	* *
	Bladderpod	Lesquerella gracilis	0	0.04	--
	Huisachedaisy	Amblyolepis setigera	0	0.6	*
	Horehound	Marrubium vulgare	0	0.02	--
	Sage	Salvia sp.	0.1	0.04	+
	Croton	Croton sp.	0.1	0	--
		Total Forbs	8.3	21.7	
Succulents	Pricklypear	Opuntia spp.	2.4	0.6	--

-- not significant
+ sig. at .10 level
* sig. at .05 level
* * sig. at .01 level

Figure 1. Variability in intake of three plant species by the offspring of seven sires studied in summer of 1980.

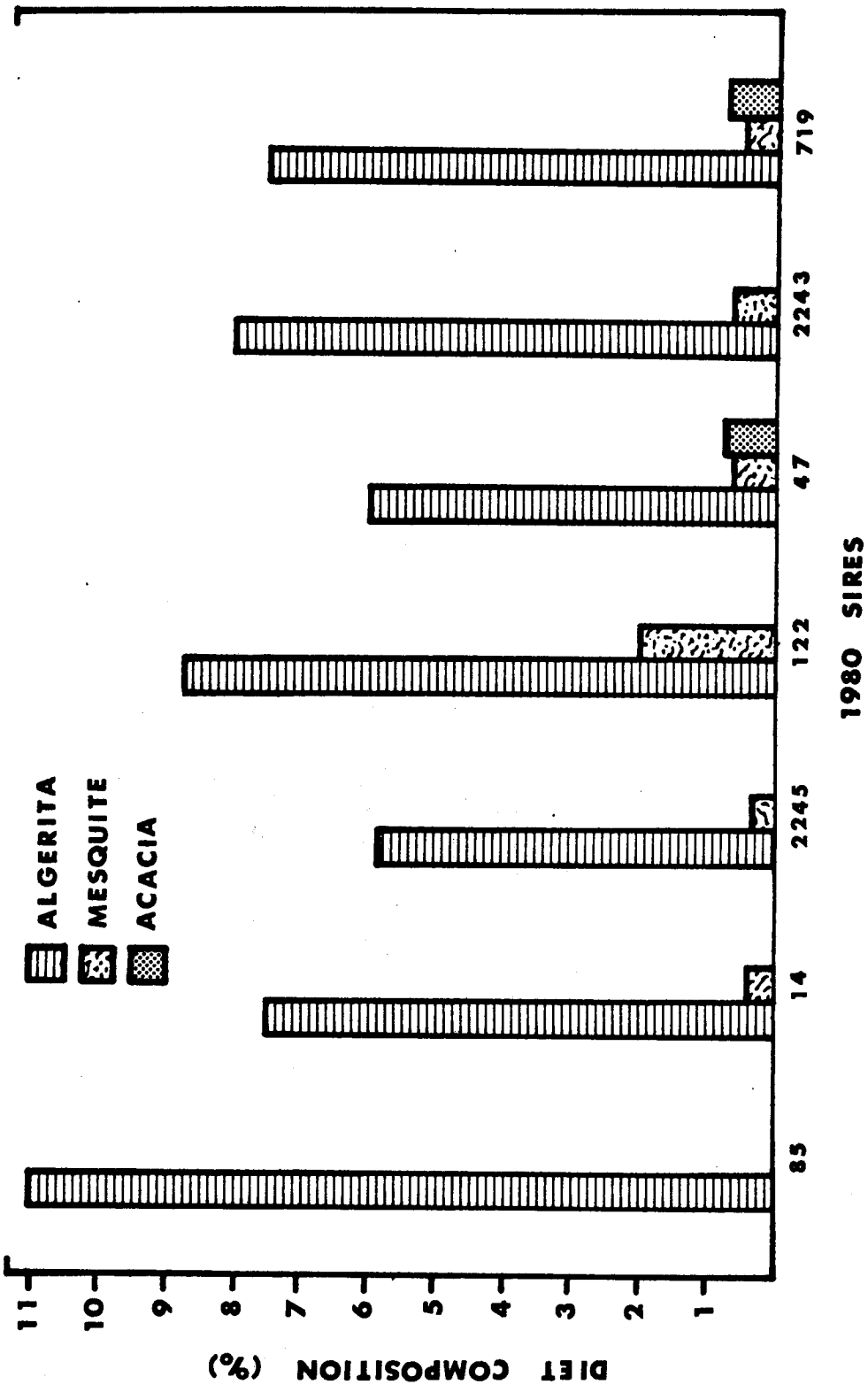
ALGERITA
MESQUITE
ACACIA
DIET COMPOSITION (%)
1
2
3
4
5
6
7
8
9
10
11
85
14
2245
122
47
2243
719
1980 SIRES

Figure 2. Variability in intake of three plant species by the offspring of ten sires studied in the summer of 1981.

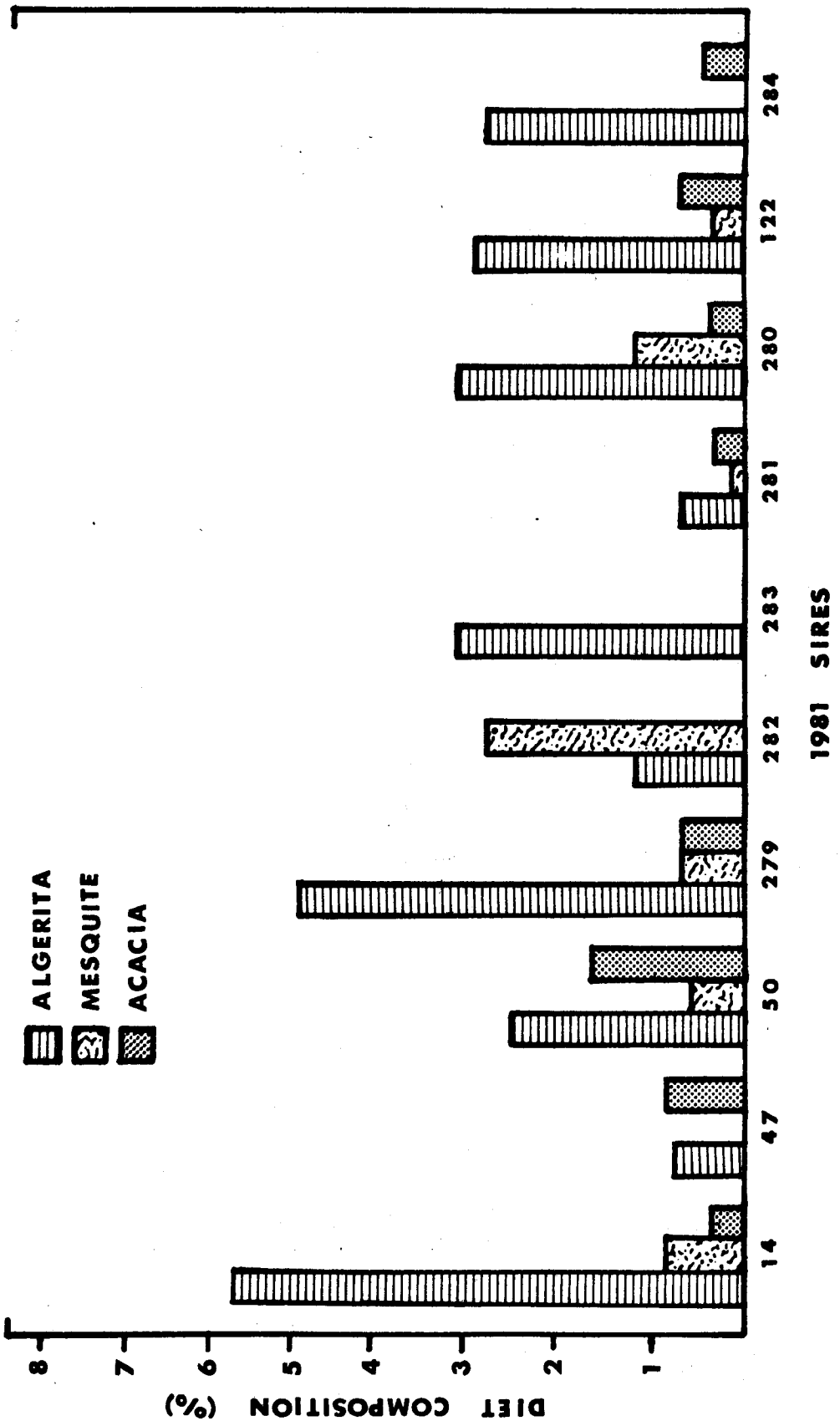
ALGERITA
MESQUITE
ACACIA
DIET COMPOSITION (%)
1
2
3
4
5
6
7
8
14
47
50
279
282
283
281
280
122
284
1981 SIRES

Table 2. Standing crop of available forage on experimental site in July 1980 and 1981

Forage Species	1980 Standing Crop (kg/ha)	1981 Standing Crop (kg/ha)
Grasses		
Tobosagrass	844	790
Threeawn	131	133
Texas wintergrass	20	81
Buffalograss	31	79
Grama	34	52
Tridens	12	49
Common curlymesquitegrass	75	35
Muhly	--	12
Sand dropseed	66	7
Silver bluestem	45	--
Total Grasses	1258	1238
Forbs		
Annual broomweed	--	173
Redseed plantago	--	25
Ragweed	--	25
Globemallow	--	22
Bush sunflower	--	5
Englemanndaisy	--	5
Rough Nama	--	5
Croton	--	2
Pepperweed	--	1
Evax	--	1
Flatspine stickseed	--	1
Desert holly	--	0.5
Unknown forb	--	0.5
Total Forbs	0	271
Browse		
Mesquite	31	282
Littleleaf sumac	--	59
Catclaw acacia	--	35
Lotebush	3	15
Morman tea	--	10
Algerita	2	--[1]
Total Browse	36	401

[1]Algerita was obviously present on the range in 1981 as goats fed heavily on this species, but the sampling procedure used in collecting forage availability data failed to pick up this species.

Table 3. Significance of sire effects on the intake level of different plant species

Number of plants with significant sire effect	Level of Significance	Expected frequency without sire effect
18	$P \leq 0.10$	3-4
14	$P \leq 0.05$	1-2
7	$P \leq 0.01$	1

OBSERVATIONS ON THE TANNIN CONTENT OF VARIOUS BROWSE SPECIES IN THE EDWARDS PLATEAU OF TEXAS

Lee Warren and Maurice Shelton

INTRODUCTION

Tannins are considered to have an inhibtory effect on protein digestion, either by direct enzymatic action or by forming relatively indigestible complexes with leaf protein. Tannin may also have an effect on the acceptability of various plant species or plant parts by animals. As a group, many browse species are known to have a relatively high tannin content. Research is needed to obtain a better understanding of plant-animal interaction which contributes to browse utilization. The present study is conserved with a study of the tannin content of various browse species in the Edwards Plateau and the relationship of this to utilization by certain animal species. The data being currently reported relate to tannic acid content. A second phase of the study will relate this more directly to animal intake of selected species.

EXPERIMENTAL PROCEDURE

Fresh leaf material was collected by hand for tannin analysis on a monthly basis for selected browse species from April through December. Samples were collected in Tom Green (San Angelo Research Center), McCulloch (H. D. Winters Ranch) and Edwards (Hill Ranch) counties. The species collected are shown in Table 1. Not all species were present at each location.

The Folin-Denis method as described by Burns (1) was used for tannin determination. This is a non-specific spectrophotometric method and results are expressed as tannic acid equivalents (Table 1). This method was employed by Nastis and Malechek (2) for a tannin study and in gambel oak (Quercus gambelii). However, it is considered that only hydrolyzable tannins were extracted by this procedure. Apparently, condensed tannins are not extracted by this method.

RESULTS AND DISCUSSION

Tannins are responsible for astringent or bitter taste of many plants which make them unpalatable to man and other animals (3). In this study, the tannin or more properly the hydrolyzed tannin content of various plant species at various times ranged from a low of 1.5% (Ephedra sp.) to a high of 29.2% (littleleaf sumac). Generally, certain species such as Morman tea, mesquite, lime pricklyash and persimmon

are low in hydrolyzable tannins whereas others such as acacia, algerita, littleleaf sumac and various oak species are high in tannins.

A preliminary or hypothetical preference order based on studies by Warren (4) of selected browse species are listed as follows:

High Preference

1.) Littleleaf sumac

2.) Liveoak and Vasey shinoak

3.) Lotebush

Low Preference

4.) Catclaw acacia

5.) Algerita

6.) Honey mesquite

These data appear to suggest that goats are selecting for high tannin plants. At least three listed as being preferred by goats are moderate or high in hydrolyzed tannins. Also, a high hydrolyzable tannin content does not appear to be the explanation for the low intake of mesquite. If indeed tannins reduce digestibility, it is an enigma that an animal such as the goat developed a preference for plant species which should prove to be less useful to it.

Plants with the most astringency, based on human taste may be ranked as follows:

1.) Littleleaf sumac
2.) Honey mesquite
3.) Vasey shinoak
4.) Liveoak

Thus, this factor is not apparently explained by hydrolyzable tannins and does not explain preference order by the grazing animal.

Investigation of secondary plant compounds which influence plant selectivity by livestock is a confusing and complex problem. However, the physiological understanding of certain secondary plant compounds is an integral part of a more complete comprehension of livestock selection and preference for range forage species.

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Table 1. Tannin analysis results (%) of various browse species collected on three different locations in the Edwards Plateau

Location	Plant Species		Monthly Percentages								
	Common Name	Scientific Name	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Average
San Angelo	Catclaw acacia	Acacia greggii	12.8	8.8	9.4	12.1	14.9	14.9	14.6	-	-	12.5
	Morman tea	Ephedra sp.	2.0	1.6	1.5	1.9	1.7	1.5	1.9	-	-	1.7
	Algerita	Berberis trifoliolata	13.9	10.1	11.1	12.3	12.4	15.9	10.3	12.7	11.7	12.3
	Honey mesquite	Prosopis glandulosa	4.0	3.3	4.5	4.9	5.5	4.9	5.6	6.1	-	4.9
	Lotebush	Condalia obtusifolia	9.6	11.5	11.7	- *	13.7	13.7	13.7	-	-	12.3
	Littleleaf sumac	Rhus microphylla	29.2	19.9	23.1	24.6	24.3	21.6	24.8	-	-	23.9
Brady	Vasey shinoak	Quercus pungens	22.0	15.1	15.9	14.9	17.4	16.7	16.4	12.8	-	16.4
	Liveoak	Quercus fusiformis	20.8	12.5	12.8	14.0	14.0	13.5	13.7	11.9	11.4	13.8
	Spanish oak	Quercus shumardii	13.2	12.8	13.5	14.3	14.1	13.6	13.3	13.3	-	13.5
	Catclaw acacia	Acacia greggii	17.4	17.8	17.0	15.4	15.0	-	-	-	-	16.5
	Lime pricklyash	Zanthoxylum fagara	3.9	3.6	3.7	3.9	4.5	5.0	5.3	-	-	4.3
	Honey mesquite	Prosopis glandulosa	3.8	4.1	4.9	5.4	6.1	5.7	5.7	-	-	5.1
	Algerita	Berberis trifoliolata	15.0	12.4	11.4	11.6	12.7	13.4	14.1	-	11.0	12.7
Sonora	Persimmon	Diospyros texana	2.5	3.2	3.2	3.3	3.4	3.2	3.8	-	-	3.2
	Vasey shinoak	Quercus pungens	14.8	13.0	15.0	14.1	14.4	14.4	14.1	15.8	-	14.5
	Lime pricklyash	Zanthoxylum fagara	5.2	3.5	4.0	3.6	4.2	3.8	4.9	-	-	4.2
	Liveoak	Quercus fusiformis	13.8	13.5	13.4	14.2	14.0	13.6	14.0	13.7	13.1	13.7
	Algerita	Berberis trifoliolata	15.0	13.9	11.4	11.7	12.6	13.5	13.3	11.3	11.2	12.7
	Redberry Juniper	Juniperus pinchoti	12.0	11.6	10.3	11.2	12.0	12.8	14.8	13.9	14.7	12.6
	Catclaw acacia	Acacia greggii	15.7	18.6	16.9	19.3	17.4	-	-	-	-	17.6
	Honey mesquite	Prosopis glandulosa	4.0	4.6	6.4	7.2	7.5	7.2	7.7	7.8	-	6.6

* data not available

Potassium and Sodium Influence on Magnesium Availability in Ruminants

Poe, J.H., L.W. Greene, W.C. Ellis and G.T. Schelling

Summary

A study was conducted with crossbred wether lambs to determine the effect of altering the ratio of sodium and potassium upon magnesium availabilty in ruminants. Three dietary treatments consisting of a control, a high potassium and a high potassium-high sodium diet were fed to yield sodium (Na):potassium (K) ratios of 3:1, 15:1 and 3:1 respectively. Fecal magnesium (Mg) excretion increased and absorption (availability) decreased when high K or high K - high Na diets were fed. Increasing dietary K and Na increased apparent K and Na absorption and increased K and Na urinary excretion respectively. The addition of Na did not alleviate the decrease in Mg absorption when high levels of K were fed.

Introduction

A major factor in the problem of grass tetany of ruminants is the low content and availability of Mg in the diet. Most tetany prone forages, however, also contain high levels of K. Previous studies have illustrated that increased K levels will result in elevated fecal Mg excretion and depressed Mg absorption and availability (1, 2, 5). Theories as to the exact mechanisms of Mg absorption are complex, but appear to be related to a Mg - Na - K interrelationship (4). Previous research has only evaluated the effect of K on Mg absorption (1, 3, 5, 6). Therefore, it is of interest in this study to determine the involvement of Na and K and their ratios in influencing Mg balance and availability in ruminants.

Experimental Procedure

Nine crossbred wether lambs (average weight 60 pounds) were used in two experimental periods. The lambs were blocked by breed type and weight into three treatment groups. Treatments consisted of K to Na ratios: 3:1 (control); 15:1 (high K); 3:1 (high K, high Na). Potassium (potassium carbonate) and Na (sodium chloride) were added to a basal diet. Each animal received 400 g, twice daily, of the basal diet (table 1). Potassium carbonate (15.28 g/day) and sodium chloride (7.34 g/day) were added to the basal diet at feeding and hand mixed to supply the appropriate amount of K and Na. Animals were fed their assigned diet for a 10 day preliminary followed by a five-day total collection of urine, feces, and feed samples. Blood serum was taken by jugular puncture 3 hours after feeding the last day of collection. All samples were analyzed for Na, K, Mg and Ca by atomic absorption spectrophotometry. Rumen fluid pH was measured 5 hours after feeding on the last day.

Results and Discussion

Magnesium excretion (table 2) was higher in animals fed supplemental K. The addition of Na to the diet did not alleviate the increase in fecal Mg excretion. Animals fed elevated K had less Mg absorbed and subsequently excreted in the urine. Supplementation of K lowered Mg absorption 26% and the addition of Na further depressed Mg absorption by 29%. Magnesium retention was depressed in animals consuming elevated K and Na, apparently due to the increase in fecal Mg excretion. The values suggest that the Mg requirements of the animals were being met.

Animals consuming supplemental K had higher quantities of K excreted in the urine than the control (table 3). Addition of K to the diet increased apparent availability 25% (76.05% vs 94.77%, respectively). This was probably due to constant endogenous K secretions with increasing K intake. The addition of Na did not alter K absorption. Potassium retention was higher ($P < .05$) in animals supplemented with K. The addition of Na did not significantly alter K retention.

Fecal excretion of Na (table 4) was not statistically different in any of the three treatments. Supplementation of Na significantly increased urinary and total Na excretion. Sodium absorption was not altered with the addition of K to the diet however Na absorption was significantly increased upon Na supplementation. Sodium retention expressed as g/d, % of intake or % of absorbed, tended to be lower in those animals consuming supplemental K.

Fecal Ca excretion (table 5) tended to be highest in the control lambs and depressed with K supplementation. The addition of Na did not further alter Ca excretion. Calcium absorption and retention were not different between any of the three treatments.

Serum mineral values were not altered in any of the treatments. This is probably due to the fact that the animals were consuming enough nutrients to meet their daily metabolic needs and in times of excess, an increase in excretion was observed. Rumen fluid pH was not significantly altered between the three treatments.

The results of this study support previous research on the effects of K upon Mg balance in ruminants. The effect of high K upon depressing Mg availability can be reduced with adequate Mg intake (3). In the present study, the addition of Na further decreases the apparent availability of Mg. Therefore, to reduce the incidence of grass tetany, Mg intake must be considered relative to the intake of other minerals.

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Table 1. Ration Composition

Ingredient	% of Total[a]
Cottonseed Hulls	30.00
Soybean Meal	2.90
Ground Corn	64.00
Urea	1.23
T.M. Salt	.50
Dicalcium Phosphate	1.37

[a] As fed basis.

Table 2. Magnesium (Mg) intake, Excretion, Absorption and Retention in Lambs

	Control	High K	High K High Na	SE
Intake, g/d	.94	.92	.92	.01
Excretion, g/d				
Feces	.54	.61	.68	.12
Urine	.14	.10	.04	.06
Total	.68	.65	.72	.10
Absorption				
g/d	.40	.31	.24	.12
% of intake	42.71	33.81	26.19	12.58
Retention				
g/d	.26	.27	.20	.10
% of intake	28.12	29.61	22.09	10.81
% of absorbed	---	---	---	---

Table 3. Potassium (K) Intake, Excretion, Absorption and Retention in Lambs

	Control	High K	High K High Na	SE
Intake, g/d	4.29	17.50	17.25	.37
Excretion, g/d				
Feces	1.03_a	$.91_b$	$.97_b$	.43
Urine	2.49_a	12.52_b	12.88_b	2.05
Total	3.47^a	13.43^b	13.85^b	1.08
Absorption				
g/d	3.26^a	16.59^b	16.28^b	.73
% of intake	76.05^a	94.77^b	94.32^b	8.50
Retention				
g/d	$.82^a$	4.07^b	3.40^b	1.72
% of intake	19.08	23.49	20.00	11.93
% of absorbed	23.48	25.01	21.32	13.64

a,b Means within the same line and block with different superscripts differ significantly ($P<.05$).

Table 4. Sodium (Na) Intake, Excretion, Absorption and Retention in Lambs

	Control	High K	High K High Na	SE
Intake, g/d	3.57	3.49	8.46	.24
Excretion, g/d				
Feces	$.93_a$	$.78_a$	$.8_b$	.29
Urine	1.40^a	1.91^a	6.29^b	1.31
Total	2.27^a	2.69^a	7.10^b	1.35
Absorption				
g/d	2.64^a	2.71^a	7.25^b	.35
% of intake	73.91^a	77.58^a	90.49^b	7.63
Retention				
g/d	1.26	.80	1.36	1.17
% of intake	35.10	22.16	16.70	16.75
% of absorbed	45.20	28.08	18.59	19.57

a,b Means within the same line and block with different superscripts differ significantly ($P<.05$).

Table 5. Calcium (Ca) Intake, Excretion, Absorption and Retention in Lambs

	Control	High K	High K High Na	SE
Intake, g/d	8.20	8.11	8.08	.07
Excretion, g/d				
Feces	4.43	3.74	3.94	.45
Urine	.06	.05	.04	.47
Total	4.61	3.80	3.98	.48
Absorption				
g/d	3.77	4.36	4.14	.45
% of intake	46.10	53.84	51.31	5.49
Retention				
g/d	3.62	4.31	4.10	.47
% of intake	44.03	53.17	50.85	5.77
% of absorbed	98.32	98.75	99.08	.63

MILK SOLIDS CONTENT FROM GOATS ADMINISTERED SUPPLEMENTAL ENERGY AS GLUCOSE, PROPIONATE OR OLEATE

D.C. Kenison, G.T. Schelling, L.W. Greene and W.C. Ellis

SUMMARY

The effect of supplemental energy from three different substrates on milk solids secretion was measured in abomasally cannulated, lactating dairy goats. Milk production averaged 1.47 liters per day throughout the trial. Glucose, propionate and oleate solutions were infused into the abomasum at nine percent of daily digestible energy intake. The extra energy supplied as glucose decreased ($P<.05$) milk fat 25.6%. Propionate infusion increased ($P<.05$) milk protein percentage by 14.8% and had no effect on milk fat. Supplemental energy in the form of oleate increased ($P<.05$) milk fat levels 28.2% and decreased milk protein 10%. Lactose content was not affected. This study indicates that the form in which additional energy is supplied to the lactating ruminant can affect the partitioning of energy secreted in milk.

INTRODUCTION

The fermentative effects of the rumen cause ruminants to absorb limited amounts of glucose from the digestive tract. Consequently, forage-fed ruminants must synthesize the greater part of their glucose requirement. The demand for glucose increases substantially with the onset of lactation since it is the primary, if not only, substrate for lactose synthesis (6).

While several metabolites can potentially be used in gluconeogenesis, propionate is generally considered to be the major contributor to glucose carbon, with amino acids as second most important. Increases in the genetic potential for milk production in lactating ruminants have created animals with higher energy and glucose demands. This has necessitated the feeding of high grain rations; which provide more glucose to the animal either directly through increased rumen starch escape or indirectly via enhanced rumen propionate production.

Higher solids-not-fat percentages have resulted in milk from dairy cows fed high grain rations, although depressions in milk fat have also been observed (1). Previous studies by a number of investigators have demonstrated a negative effect of both glucose and propionate infusions on milk fat levels (2, 3, 4, 5). However, the relationship between infusions of these two substrates and milk

protein levels is not as clear, since increases in milk protein have not always resulted.

This study was designed to measure whether additional energy supplied either as glucose, a glucose precursor (propionate) or as a non-gluconoegenic energy source (oleate) would have differential effects on milk solids secretion.

EXPERIMENTAL PROCEDURE

Three abomasally cannulated dairy goats, averaging 50 kg in body weight, were housed in individual metabolism cages and fed a diet of alfalfa hay (three times daily) and concentrate (twice daily at milking). The combined daily ration was approximately 13.5% crude protein on a dry matter basis. The three energy substrates, glucose, propionate and oleate, were administered as solutions via the abomasal cannula by constant infusion for six days at nine percent of daily DE intake. A control period, where water alone was infused, preceded and followed each treatment. All animals were on the same treatment or control at the same time. Milk samples from days 5 and 6 of each infusion period were analyzed for milk fat, protein and lactose content.

RESULTS AND DISCUSSION

Daily milk production was not different between any of the treatments and their corresponding controls (table 1). Milk fat values were lower with the infusion of glucose and propionate (0.82 and 0.55 percentage units, respectively), but only the decrease due to glucose was significant (table 2). Infusion of oleate increased milk fat content 1.02 percentage units. Milk protein levels were significantly increased by propionate infusion (0.46 units). Additional energy alone, in the form of oleate, decreased milk protein 0.25 percentage units (table 3), and glucose infusion had no significant effect. Milk lactose levels were not affected by any of the infused energy sources (table 4). Although there were minor differences in milk production between treatments and controls, the changes in milk constituent percentages reflect the same relative changes in total daily secretion.

The results of this study indicate that extra energy supplied to the lactating ruminant as glucose or glucose precursors can decrease milk fat and increase milk protein. The increase in milk protein content is possibly due to the sparing of amino acids from use in glucose synthesis. Furthermore, it appears that milk fat content can be increased by extra energy supplied by a non-gluconeogenic long chain fatty acid. This data indicates that, in general, the form of added energy has an affect on the form in which it is secreted in milk.

TABLE 1. ADJUSTED MILK PRODUCTION OF GOATS DURING INFUSION EXPERIMENT

	Glucose	Propionate	Oleate
	%	%	%
Treatment[a]	1.07	0.94	0.85
Control	1.00	1.00	1.00
Difference	+0.07 NS	-0.06 NS	-0.15 NS

[a] Controls arbitrarily set at 1.00 with treatments expressed as a fraction of corresponding control.

TABLE 2. MILK FAT CONTENT

	Glucose	Propionate	Oleate
	%	%	%
Treatment	2.94	3.27	4.97
Control	3.76	3.82	3.95
Difference	-0.82 (P<.05)	-0.55 (NS)	+1.02 (P<.05)

TABLE 3. MILK PROTEIN CONTENT

	Glucose	Propionate	Oleate
	%	%	%
Treatment	2.94	3.13	2.73
Control	2.79	2.67	2.98
Difference	+0.15 NS	+0.46 (P<.05)	-0.25 (P<.05)

TABLE 4. MILK LACTOSE CONTENT

	Glucose	Propionate	Oleate
	%	%	%
Treatment	4.12	4.01	3.89
Control	4.20	4.12	3.99
Difference	-0.08 NS	-0.11 NS	-0.10 NS

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Nutritive Value of Alfalfa and Live Oak Leaves for Goats

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Summary

Spanish goats were used to evaluate four rations of alfalfa hay and live oak leaves (100/0, 75/25, 50/50, 25/75) in feeding trials. Total collections of feed, feces and urine were used to determine intake, digestibility and N-balance. Increasing quantities of live oak leaves in the diet increased the dietary fiber, but decreased crude protein ($P<.1$). Furthermore, live oak incorporation in the diet decreased ($P<.05$) dry matter, NDF and ADF digestibility while reducing the N-balance for the diet with the highest live oak incorporation (25/75). The retention time of forage dry matter was reduced with increasing quantities of live oak and was associated with a decrease ($P<.05$) in intake at the highest level of live oak incorporation (25/75).

Introduction

The optimum productivity from any grazing system is determined by a basic understanding of its integral parts and in many situations these factors are constantly changing. In the Southwestern United States multiple use of animal species has become a common practice to maximize land use. Many of the commonly used management practices have been used without fundamental knowledge of the influence upon the animal and plant interaction.

Cattle, sheep and goats have been grazed together although their forage preference and grazing habits differ considerably. Goats have been used effectively in the control of oak-brush (Quercus spp.) (2) but limited information has been gathered concerning its nutritive value and influence upon other feedstuffs in the diet.

This study was conducted to obtain information on the nutritive value of live oak when fed with varying proportions of alfalfa hay to Spanish goats and to validate current laboratory procedures used in the evaluation of dietary components.

Materials and Methods

This study was conducted in the summer of 1980 at the Texas A&M Experiment Station at College Station, Texas. Four diets of varying proportions of alfalfa hay and live oak leaves were fed to Spanish goats equipped with rumen cannula in a 4 x 4 Latin Square metabolism

study (table 1).

The diets consisted of fresh hand picked live oak leaves and average quality alfalfa hay. Both the hay and liveoak leaves were ground through a hammer mill equipped with a 5 mm screen. Four diets were mixed on an as fed basis with varying proportions of alfalfa and live oak leaves in combination (100/0, 75/25, 50/50, 25/75) stored in containers and refrigerated until they were fed.

The four Spanish goats (average body weight 53 pounds) were fed in open-type metabolism cages in a room environmentally controlled for temperature and light. The goats were fed alfalfa hay for seven days and then randomly assigned to the four diets. There was a minimum of seven days in the adjustment period followed by a five day collection period.

Feed was offered twice daily at 0800 h and 1600 h at 105% ad libitum intake to determine dietary influence upon each feed combination. Daily feed intake was determined by offering the goats known quantities of feed on an as fed basis and measuring the orts before the subsequent feeding period. Feed and orts samples were taken twice during each period and each time a new batch of hay and/or liveoak leaves were acquired. The goats had free access to clean water and loose minerals throughout the experiments.

Total urinary and fecal outputs were collected and measured daily. Volitization of ammonia from the urine samples was prevented by the addition of dilute (.1N) H_2SO_4. A ten percent aliquot of urine was stored in plastic bottles and fecal samples stored in plastic whirl-pak bags and frozen for subsequent analysis.

Feed, orts and fecal samples were analyzed for dry matter and feed, orts, feces and urine samples analyzed for nitrogen content using the micro-kjeldahl procedure (1). Feed and fecal samples were subsequently composited across days within trials and analyzed for neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent fiber nitrogen (ADFN) (7).

In vitro dry matter digestibility coefficients for diets from 0 to 144 h were determined by fermentation of samples innoculated with rumen liquor from an animal fed part of the alfalfa diet which was being studied and followed by extraction with neutral detergent fiber (8). The 48 h samples for in vitro digestibility were adjusted with a standard forage of known in vivo digestibility (6).

In vivo digestibility of diets was determined for dry matter, NDF and ADF. The difference between adjusted daily feed intake lagged by one day for calculations using fecal outputs. In addition, in vivo dry matter digestibility was estimated using a ratio of the indigestible neutral detergent fiber (INDF) of the feed and feces. The INDF values were determined by the in vitro fermentation of

samples for 6 days, followed by the refluxing with neutral detergent solution (6).

The retention time of marked particles was determined by using a single dose of rare earth marker followed by fitting concentrations post dose to a 2CTD D model (3). The alfalfa was refluxed in neutral detergent solution for one h and then washed with copious amounts of water until residual detergent was removed. The refluxed forage (50 g DM/dose) was allowed to air dry for 24 hr, then labelled with 1.2 g (i.e., .3 g/ml x 4 ml) of Erbium and again allowed to dry. The labelled forage was then introduced into the goat's rumen through the cannula at 1600 hr. Post dose fecal sampling began the next morning at 1800 hr. Subsequent sampling was completed at 4 hr intervals for the first 4 days and then at 6 hr intervals for the last 2 days. The collected samples were dried, ground through a Wiley mill equipped with a 2 mm screen and analyzed for dry matter (1) and Erbium content (5). Concentration of Erbium was plotted against time post dose and retention determined:

$$(RT = ((1/L1 * 2) + 1/K2 + TD)$$

Where: RT = Retention Time
L1 = Initial mixing, time dependent rate
K2 = Turnover, time independent rate
TD = Time Delay

The data gathered was evaluated by analysis of variance and means tested for significance by Tukeys - Q (4).

Results and Discussion

The mean composition, N-balance, digestibility and retention time of diets fed to Spanish goats are summarized in table 2. The crude protein content of the diets tended ($P<.1$) to decrease with increasing quantities of live oak incorporation in the alfalfa diet. There was a concomitant increase in the fiber component in the diet for both the NDF and ADF fractions of the diets. Similarily the bound cell wall nitrogen as measured by acid detergent fiber nitrogen (ADFN) increased with increasing live oak addition to the diet.

The summary for N-balance data indicated that the total grams of N intake decreased with increasing live oak incorporation into the diet. Of the nitrogen consumed, the major pathway of excretion was via urinary output and the output was proportional to total intake of N while fecal nitrogen excretion remained rather constant in these sets of trials. The net result in N balance was positive for all diets but was significantly less ($P<.05$) for diet of greatest live oak incorporation (25/75). The biological value was greatest for the 50/50 diet and lowest for the 25/75 diet (table 2).

The apparent crude protein digestibility of the diets decreased with increasing live oak incorporation into the diet. This decrease was a total of 25 percentage units or a 32% relative decrease. The dry matter digestibility also decreased with increasing live oak incorporation into the diet but the decrease was only 16 percentage units which was less than the reduction for crude protein. Similar reductions ($P<.1$) were noted for NDF and ADF fractions of the diets.

There was a 15 percent increase in retention time of DM between the alfalfa diet and diet with greatest live oak incorporation (25/75). The net result of reduced digestibility and increased retention time was a significant ($P<.05$) reduction in both dry matter intake and digestible dry matter intake for the diet with greatest live oak incorporation (25/75). One effect of live oak incorporation into the diet was to increase the time the indigestible components of the diet resided in the rumen and yet it was not digested as efficiently. It was observed that the abrupt change in diet from an all alfalfa diet (100/0) to a high live oak diet (25/75) required a substantially longer adjustment period to obtain a plateau in voluntary intake than when a gradual increase in the live oak component ocurred. However, in all cases where live oak was a portion of the diet , it was the first component in the diet sampled by the goats.

The comparison of different methods of measuring dry matter digestibility are summarized in table 3. The digestibility of the diets when measured by total collection or in vitro 48 hr ranked the diets similarly and gave comparable results ($r=.94$). The ratio of INDF of feed and feces ranked the diets in the same order but the relative values were consistently lower and became progressively less accurate with increasing live oak incorporation in the diet. Although good results have been obtained with this latter method with forages (6), these current findings suggest that the method may not be as useful for mixed diets such as used in this study. An explanation for the lack of accuracy might be the relationship which high quantities of polyphenols or tannins have upon digestibility and/or the chemical action they have upon the indigestible component of the diet. These effects are most observable in the increased bound cell wall nitrogen as measured by ADFN of the fecal samples which corresponded to greater quantities of NDF and ADF in the diet.

The results from a rate of digestion study are presented in figure 1. The all alfalfa diet (100/0) achieved a greater end digestibility than did other diets and was followed by reductions in digestibilty with increasing quantities of live oak in the diet. The diet with greatest live oak incorporation (25/75) reached a greater proportion of its potential digestibility at 6 hr while pure alfalfa continued at an accelerated rate through 24 hr. These differences can be accounted for by variations in the plant composition for forbs vs. browse. These differences would be accentuated by greater incorporation of one component or the other as observed by the rate

curves for the mixed diets.

It is not known to what extent poly-phenols had upon the microbial population or upon chemical breakdown of the diet in this study. Although increasing live oak incorporation into the alfalfa diet did increase residence time and reduce digestibility. It is also not known what effects live oak incorporation into the diet has upon poor quality grasses such as commonly found during the latter dormancy period of winter when other forbs and browse become scarce. Live oak can provide a moderate level of protein and digestible dry matter to the diet but it appears high quantities for long periods of time may require an adaptation time. These changes may occur as a consequence of microbial or metabolic shifts since palatability did not seem to be a factor.

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Table 1. Composition (%) of Alfalfa Hay and Live Oak Leaves in The Diets on an As Is and Dry Matter Basis

Ration Number	As Fed Basis		Dry Matter Basis	
	Alfalfa	Live Oak	Alfalfa	Live Oak
	%		%	
1	100	0	100	0
2	75	25	79	21
3	50	50	55	45
4	25	75	29	71

Acknowledgement:
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Table 2. The Mean Composition, N-balance, Digestibility and Retention Time of Diets Fed to Spanish Goats

	100/0	75/25	50/50	25/75
Composition				
CP, %	17.56	15.00	14.36	13.85
NDF, %	51.27	53.21	59.56	59.74
ADF, %	35.61	38.33	39.19	46.18
ADFN Diet, %	1.44^{c}	2.12^{b}	2.30^{b}	3.43^{a}
ADFN Feces, %	.59^{c}	.93^{b}	1.26^{a}	1.21^{a}
N-Balance				
Intake (g)	24.79	21.46	19.47	14.43
Fecal (g)	5.79	6.07	7.55	6.90
Urine (g)	15.15	12.69	8.10	6.98
Balance (g)	3.85^{a}	2.75^{a}	3.80^{a}	.56^{b}
Biological Value	20.26^{b}	17.54^{bc}	32.05^{a}	7.30^{c}
Digestibility				
CP, %	76.64	71.71	61.22	52.18
DM, %	66.94^{a}	58.49^{b}	53.93^{b}	51.00^{b}
NDF, %	55.51	43.83	42.52	40.55
ADF, %	49.08^{a}	37.86^{ab}	27.46^{b}	31.36^{b}
Retention time, h	40.57	41.60	45.67	46.81
DDMI (g)	597^{a}	519^{a}	449^{ab}	334^{b}
Intake (g)	892^{a}	887^{a}	833^{a}	655^{b}

a,b,c
Means between treatments are significantly different ($P<.05$).

Table 3. Comparison of Various Methods[a] of Measuring Dry Matter Digestibility of Diets

Item	Ration 100/0	75/25	50/50	25/75
	% DM			
In Vivo, Total	66.94[b]	58.49[c]	53.93[c]	51.00[c]
In Vitro, 48 hr	65.45[b]	60.52[bc]	55.33[c]	52.77[c]
In Vivo, Ratio	60.40[b]	52.99[c]	44.98[c]	35.23[c]

[a] Estimates of digestibility by 48 hr incubation in vitro, ratio of esophageal and fecal indigestible neutral detergent fiber (1-EINDF/FINDF), and total collections.

[b,c,d] Means with different superscripts are significantly different ($P<.05$).

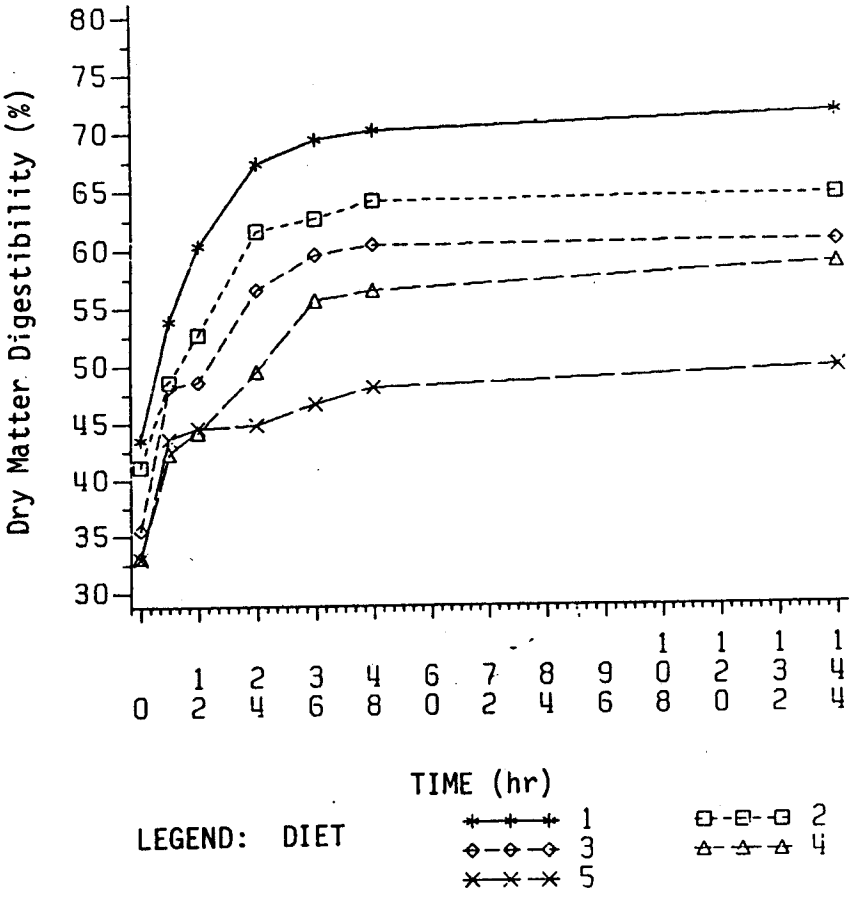

Fig. 1. The digestibility of dry matter of diets incubated in vitro from 0 to 144 hr. Ratio of alfalfa and live oak leaves as fed: 1 (100/0), 2 (75/25), 3 (50/50), 4 (25/75), 5 (0/100).

EFFECTS OF LASALOCID, PROTEIN AND ENERGY ON PERFORMANCE OF EWE LAMBS

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Lasalocid, a polyether ionophore derived from the fermentation of Streptomyces lasaliensis, is effective in treating experimentally induced and naturally occurring coccidiosis in sheep. The effect of lasalocid on performance of growing and finishing lambs without coccidiosis problems is less clear; however, it has been shown to be of value in improving gains and efficiency of feedlot cattle. The objective of this study is to determine the effects of lasalocid on live weight gain and feed efficiency of growing ewe lambs fed diets varying in crude protein and energy contents. Ninety six Rambouillet ewe lambs are being used for this study. They were randomly assigned to 16 pens with 6 sheep/pen. The overall design of this study is a 2x2x2 factorial with two replications. The treatments are: (1) lasalocid at 0 and 25 g/ton; (2) 8 and 12% crude protein and (3) 1.2 and 1.4 Mcal of digestible energy per pound of feed. Summarized at the end of 56 days, the ewes receiving 25 g of lasalocid/ton of feed consumed 12.5% less feed and required 10.1% less feed per pound of live weight gain. During this period, lasalocid was without effect on live weight gain. Few coccidial oocysts were observed in fecal samples collected during the test period indicating coccidiosis was not a factor in the results obtained. Increasing dietary energy from 1.2 to 1.4 Mcal/lb of feed and crude protein from 8 to 12% both significantly improved performance. This study will continue for an additional 28 day period during which rumen volatile fatty acids and ration digestibility will be determined.

EFFECT OF TYLOSIN ON THE INCIDENCE AND SEVERITY OF POLYARTHRITIS IN SHEEP CHALLENGED WITH CHLAMYDIA PSITTACI

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SUMMARY

Forty-two lambs were challenged with a yolk sac culture of Chlamydia psittaci of sheep origin, at two levels, to ascertain the value of tylosin in treating chlamydial polyarthritis in feedlot lambs. The two challenge levels were a 1/10,000 and a 1/100,000 dilution of the yolk sac culture. Tylosin was fed at levels of 0, 50 and 100 g/ton. In all lambs, clinical signs of polyarthritis were preceeded by a rise in rectal temperature. The incidence and severity of polyarthritis were less in those lambs receiving the more dilute (1/100,000) chlamydial challenge. The effects of tylosin on the incidence and severity of polyarthritis in lambs challenged with a chlamydial culture were inconsistent. When fed at the 50 g/ton level there appeared to be some benefit compared with the control group. Whereas, the responses observed for the lambs receiving 100 g tylosin/ton were essentially no different than the controls.

INTRODUCTION

Polyarthritis has been observed in range and feedlot lambs (2). The disease is characterized by fever, stiffness, lameness, anorexia and frequently conjunctivitis. Economic losses result from approximately 10% reduction in live weight of affected feedlot lambs, prolonged fattening time, decreased feed efficiency and increased labor costs for care of sick animals (1). Chlamydia psittaci has been identified as a causitive organism. Tetracyclines and tylosin are effective inhibitors of chlamydial multiplication and daily feeding of 150 to 200 mg of chlortetracycline to lambs in feedlots appeared to reduce the incidence of chlamydial polyarthritis, but it did not completely prevent the disease (3). Studies have not been conducted to examine the value of tylosin for treatment of chlamydial polyarthritis in sheep. Tylosin has the advantage of being an antibiotic which is not used in human medicine. Because of the concern over the continued use of tetracycline antibiotics for animals and the fact that tylosin may be effective for treatment of chlamydial infections, this research was initiated to evaluate the effect of tylosin on the incidence and severity of polyarthritis in sheep challenged with Chlamydia psittaci.

EXPERIMENTAL PROCEDURE

Forty-two Suffolk x Rambouillet wether lambs weighing 88.8 ± 1.6 lb were used in this study. Initially they were maintained as a group and fed ad libitum the ration shown in Table 1. Serum complement fixation (CF) titers for these lambs ranged from <1:8 to 1:8 indicating they were negative for chlamydial antibodies and probably had not been previously exposed to chlamydial organisms. Subsequently all sheep were assigned at random (but balanced with respect to CF titer) to six pens with seven lambs per pen. Tylosin[1,2] was then added to the diets at levels of 0, 50 and 100 g/ton. Two pens received each of the tylosin levels. Seven days after tylosin feeding started all lambs were challenged with a yolk sac culture of Chlamydia psittaci of sheep origin. The yolk sac material had a chick embryo LD_{50} of $10^{7.2}$. Intravenous injections of 0.2 ml of this material was used at dilutions of 1/10,000 and 1/100,000. Each of the dilutions was administered to one pen of lambs (seven lambs) receiving each tylosin treatment.

Rectal temperatures were measured twice daily (8:30 A.M. and 3:30 P.M.) starting seven days prior to challenge and continuing for 21 days. Lambs were observed for signs of polyarthritis when temperatures were taken and given a polyarthritis score when there was evidence of the disease.

Polyarthritis score	Description of condition
1	Slightly stiff
2	Limping with 1 or more legs involved
3	Lame with 1 or more legs involved
4	Very stiff, reluctant to move

Serum complement fixation tests were run on blood samples collected on the day the lambs were challenged and again 21 days after chlamydial challenge.

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1 Tylosin - Tylan® 10 Premix, Elanco Products Co., a Division of Eli Lilly and Co., Indianapolis, Ind. 46206. Each pound contains 10 g of tylosin as tylosin phosphate.

2 Tylosin is not approved for use in sheep feeds. The sheep used in this study were not slaughtered for human consumption.

RESULTS

A summary of live weight changes and feed intakes by weeks for a three week period after the lambs were challenged with Chlamydia psittaci is presented in Table 2. In general lambs gained weight during the first week post-challenge and lost weight the second week. The response during the third week was mixed. Lambs receiving the 1/100,000 dilution of Chlamydia psittaci gained more during the first week post-challenge than did those getting the 1/10,000 dilution. This was believed due to the fact that the 1/10,000 lambs received 10 times the challenge dose of the 1/100,000 lambs. However, during weeks two and three live weight changes were not significantly different for the two dilutions. Tylosin was without effect on live weight gains during the first two weeks post-challenge but resulted in improved gains during the third week compared to controls.

Feed intakes were slightly greater during the second and third weeks for the lambs given the 1/100,000 compared to the 1/10,000 dilution. The effects of tylosin on feed intakes were not consistent. When fed at 50 g/ton of feed, feed intakes were slightly greater during the second and third weeks; whereas, at 100 g/ton feed intakes were considerably less than controls during the first and second weeks.

The effects of dietary tylosin on the incidence and severity of signs of polyarthritis, rectal temperatures and CF titers of lambs challenged with two dilutions of Chlamydia psittaci are presented in Table 3.

The incidence and severity of polyarthritis were less with the 1/100,000 dilution of a yolk sac culture of Chlamydia psittaci compared with the response to the 1/10,000 dilution. Evidence for this was the decreased number of cases of polyarthritis and the lower maximum polyarthritis score. Likewise, the length of time (post-challenge) to show a temperature rise $\geq$ 1°F above the base was longer and the total number of days with elevated temperatures was less when lambs were challenged with the 1/100,000 dilution.

The effects of tylosin on the incidence and severity of polyarthritis in lambs challenged with Chlamydia psittaci were inconsistent. When fed at the 50 g/ton level there appeared to be some benefit. When compared with the control group, the number of polyarthritis cases was lower, the average number of days till signs of polyarthritis first occurred was greater, the maximum polyarthritis score was lower, a longer time was required before temperatures were elevated $\geq$ 1°F above the baseline, the total number of days with elevated temperature was less as was the average maximum temperature recorded. However, the responses observed for the lambs receiving 100 g tylosin/ton were essentially no different than the control lambs.

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TABLE 1. PERCENTAGE INGREDIENT COMPOSITION AND CALCULATED NUTRIENT CONTENT OF THE EXPERIMENTAL RATION

Ingredient	% (As Fed Basis)
Sorghum grain, milo	55.2
Cottonseed hulls	29.9
Cottonseed meal	7.9
Molasses	4.0
Salt, plain	1.0
Calcium carbonate	1.5
Ammonium chloride	0.5
Nutrient values	
Total digestible nutrients, %	65.1
Digestible energy, Mcal/lb	1.29
Crude protein, %	10.0
Digestible protein, %	7.1
Calcium, %	.71
Phosphorus, %	.28

TABLE 2. EFFECTS OF DIETARY TYLOSIN ON LIVE WEIGHT CHANGES AND FEED INTAKES OF LAMBS CHALLENGED WITH CHLAMYDIA PSITTACI

Criterion	Chlamydia psittaci challenge[a]		Statistical[b] Comments	Tylosin, g/ton			Statistical[b] Comments	S.D.[c]
	1/10,000	1/100,000		0	50	100		
Lambs, number	21	21		14	14	14		
Initial live weight, lb	88.6	88.9	N.S.	92.2	89.3	84.8	N.S.	10.5
Live weight change, lb/wk								
Week 1	1.86	4.57	P<.01	3.43	3.43	2.79	N.S.	2.92
Week 2	-3.90	-2.48	N.S.	-4.14	-1.64	-3.79	N.S.	5.35
Week 3	1.90	- .10	N.S.	-1.50	1.21	3.00	P<.05	3.91
Feed intake, lb/wk								
Week 1	25.0	25.8		26.9	25.8	23.6		
Week 2	18.1	22.1		20.9	22.8	16.6		
Week 3	17.6	19.4		17.4	20.9	17.2		

a/ A yolk sac culture of Chlamydia psittaci, of sheep origin, with a chick embryo LD_{50} of $10^{7.2}$ was diluted 1/10,000 and 1/100,000; 0.2 ml was administered intravenously.

b/ N.S. = no significant difference
P<.05 = treatment means are significantly different at the 5% level of probability
P<.01 = treatment means are significantly different at the 1% level of probability

c/ Standard deviation

TABLE 3. EFFECTS OF DIETARY TYLOSIN ON INCIDENCE AND SEVERITY OF SIGNS OF POLYARTHRITIS, RECTAL TEMPERATURES AND COMPLEMENT FIXATION TITERS OF LAMBS CHALLENGED WITH CHLAMYDIA PSITTACI

Criterion	Chlaymdia psittaci challenge[a/]		Statistical[b/] Comments	Tylosin, g/ton			Statistical[b/] Comments	S.D.[c/]
	1/10,000	1/100,000		0	50	100		
Lambs, number	21	21		14	14	14		
Lambs with polyarthritis, number	18	14		11	8	13		
Day polyarthritis first observed	9.5	10.6	N.S.	9.7	10.2	10.0	N.S.	3.0
Maximum polyarthritis score[d/]	2.6	1.6	P<.05	2.4	1.5	2.4	N.S.	1.4
Base temperature, °F	103.8	103.8	N.S.	104.0	103.6	103.8	N.S.	.46
First day temp. ≥ 1°F above base	5.3	8.2	P<.01	6.2	7.0	6.5	N.S.	2.1
Total days temp. ≥ 1°F above base	4.1	2.3	P<.05	3.6	2.2	3.8	N.S.	2.5
Maximum temp., °F	105.4	105.2	N.S.	105.4	104.8	105.7	P<.05	.76
Day maximum temp. occurred	7.4	8.4	N.S.	7.8	8.3	7.6	N.S.	2.3
Complement fixation titer								
Initial <1:8	6	10		4	2	10		
1:8	11	7		7	9	2		
1:16	3	3		3	2	1		
1:32	1	0		0	0	1		
1:64	0	1		0	1	0		
Final 1:16	3	4		1	4	2		
1:32	13	12		10	8	7		
1:64	5	4		3	1	5		
1:128	0	1		0	1	0		

[a/] A yolk sac culture of Chlamydia psittaci, of sheep origin, with a chick embryo LD_{50} of $10^{7.2}$ was diluted 1/10,000 and 1/100,000; 0.2 ml was administered intravenously.

[b/] N.S. = no significant difference; P<.05 and P<.01, treatment means are significantly different at the 5 and 1% level of probability, respectively.

[c/] Standard deviation.

[d/] Polyarthritis scores were: 1 = slightly stiff, 2 = limping with one or more legs involved, 3 = lame with one or more legs involved and 4 = very stiff and reluctant to move.

AN UNUSUAL MYCOPLASMA ISOLATED FROM OUTBREAKS OF MASTITIS AND ARTHRITIS IN TEXAS DAIRY ANIMALS

C.W. Livingston, Jr., Howard Whitford and Betty B. Gauer

Milk specimens from a herd with mastitis problems were submitted to the Texas Veterinary Medical Diagnostic Laboratory at College Station, Texas. Mycoplasmas were isolated from several specimens. Some were identified as Mycoplasma bovis and others as M. bovigenitalium as these were not pure cultures. Subsequent filtration and single colony selection of these mixed cultures resulted in the appearance of an unusual mycoplasma that could not be identified with the diagnostic reagents available in this laboratory. This isolate was sensitive to digitonin, metabolized glucose and arginine. The growth of this isolate was not inhibited by antisera to M. arginini, M. capricolum, M. fermentens or M. putrefaciens. Some, but not all, colonies fluoresced when M. iowae conjugate was applied. Another unusual isolate was obtained from the joint of a dairy goat with arthritis. This mycoplasma was identified as M. mycoides subs mycoides (L.C.) which has been identified in Texas animals only once previously. This mycoplasmal isolate although apparently not capable of producing an active infection in the bovine species, does create an identification problem for animal health authorities.

ISOLATION OF AN UNUSUAL ANTHROPOD-BORN VIRUS FROM TEXAS RUMINANTS

C.W. Livingston, Jr., S. McConnell, C.H. Calisher, G. Cummings and B.B. Gauer

During a survey evaluating an experimental bluetongue vaccine under field conditions, an unusual virus was encountered. This virus, apparently, is an arbor virus that had not been reported to be isolated previously from vertebrates. Two viral isolations were made, one from cattle located near Texarkana, Texas and the other from a sheep flock located near Mertzon, Texas. Both isolates are in the Bunyamwera serogroup and appear to be identical serologically. These isolates are very similar serologically to the Tlacotalpan virus which was isolated from mosquitoes in Mexico. The first isolate was obtained from a ram showing stiffness and febrile signs but with no evidence of coronitis, buccal lesions, or dental pad erosions characteristic of bluetongue infection. The owner stated that several rams in this pasture had been sick and two died prior to submission of this ram to the laboratory. Since these rams had been vaccinated approximately 30 days previously with an experimental bluetongue vaccine, a search for bluetongue virus was initiated. The second isolate was obtained from a cattle herd with reproductive problems but with no other unusual signs of illness. This individual in this herd was bled prior to vaccination with an experimental bluetongue vaccine in order to establish a serological baseline. Limited experimental infections of gnotobiotic lambs and kids with these isolates results in a febrile response followed by signs of a central nervous system disturbance.

EXPERIMENTAL INFECTION OF THE URINARY TRACT OF MUTTONS WITH UREAPLASMA

C.W. Livingston, Jr., M.C. Calhoun, Betty B. Gauer and B.C. Baldwin, Jr.

Forty aged muttons culturally negative for Ureaplasma sp. were divided into four equal groups. Two groups were experimentally infected with an ovine ureaplasmal isolate. Two groups remained uninfected throughout the experiment. Two rations were formulated and fed to selected groups. One was a completely balanced ration and the other contained an imbalance of minerals especially formulated to make it a highly calculogenic ration. Each ration was fed to a ureaplasma-infected group and a ureaplasma-free group. Muttons were selected and necropsied from each of the four groups of sheep at selected intervals. Experimental inoculations were successful in every attempt and the muttons remained infected throughout this experiment. At necropsy swabs for ureaplasmal cultures were obtained from the prepuce and renal pelvis. Bladder urine was collected, total volume measured, pH determined, and total calculi present weighed. Aliquaots for cultural purposes were obtained at the same time. In the uninoculated group receiving the balanced ration, only one animal was observed with a calculi problem. A small plug occurred in the tip of the urethral process. In the inoculated group receiving the balanced ration, one mutton was affected with calculi weighing 0.7 g and another in this group had a urinary bladder with greatly thickened walls, but no other evidence of calculi. In the uninoculated group receiving the calculogenic ration, eight sheep were affected with calculi with a group total weight of 6.4 g of stones. In the inoculated group receiving the calculogenic ration, seven sheep were affected with calculi with a group total weight of 21.2 g of stones. The urine pH of the inoculated group appeared to be higher than that of the uninoculated group.

ACUTE TOXICITY OF SMALLHEAD SNEEZEWEED IN SHEEP

A.C. Anderson, L.P. Jones, R.D. Wilson, H.L. Kim, and E.M. Bailey

The acute toxicity of smallhead Sneezeweed (Helenium microcephalum) in sheep was studied. Dried and ground whole plants were administered through fistulae in graded doses. Toxic doses ranged from an accumulated dose of 5 to 60 gm/kg. Animals died within 1 to 10 days after exposure to the plant. The clinical manifestations of toxicity were salivation, loose poorly formed feces, wheezing, intermittent convulsions, and ataxia. The post mortem findings were grossly similar to that of bitterweed (Hymenoxys odorata DC.). The rumen and reticular walls were edematous and a dense proteinaceous fluid containing much fibrin collects under the omentum. The mucosa of the rumen remained intact but the submucosal vessels were congested. The other organ systems appeared grossly normal. A mild toxic tubular nephrosis and an acute nonspecific toxic hepatosis were observed. Blood, urine, bile, cerebrospinal fluid, and tissue samples collected during the experiment and post mortem are being analyzed in an effort to define the involvement of organ systems.

CUTABILITY AND PALATABILITY OF RAMBOUILLET, BLACKFACE-CROSSBRED AND KARAKUL LAMBS

Ronnie L. Edwards, D.D. Crenwelge, J.W. Savell, M. Shelton and G.C. Smith

SUMMARY

Data were obtained to compare yield grades, quality grades, fat thickness, fat trim, and cooked meat palatability characteristics of 30 rams and 26 wethers from three breeds of sheep--Rambouillet, blackface-crossbred, and Karakul. USDA yield grades were significantly lower for Karakul sheep than for Rambouillet or blackface-crossbred sheep. There were no significant breed differences for USDA quality grade. Karakul lambs had a higher dressing percentage, but lower percentages of trimmed wholesale cuts. This resulted from significantly greater fat trim and greater fat thickness over the twelfth rib indicating a marked tendency for increased fat deposition of the fat-tail type. Breed differences in sensory panel scores for leg steaks or loin chops were not significant. However, sensory panel scores for the Karakul were consistently higher and approached significance for flavor and overall palatability. Shear force values for leg steaks from Rambouillet lambs were significantly higher than those from other breeds.

INTRODUCTION

Fat-tailed carpet-wool breeds of sheep, such as the Karakul, are found in large numbers in many parts of the world and are well adapted to poor range conditions. Except for the Merino, fat-tailed sheep are the most prevalent in the world. The large deposits of fat in the tail and over the leg and loin of these breeds have led to speculation that the lean cuts from these carcasses might contain less fat than those from other breeds and therefore alter the flavor and other eating qualities of the carcass. This study was undertaken to investigate the cutability and palatability characteristics of a fat-tailed breed of sheep (Karakul) when compared to more traditional breeds raised in other parts of the world.

MATERIALS AND METHODS

Fifty-six ram or wether lambs from Rambouillet, blackface-crossbred (lambs out of Rambouillet ewes and sired by Suffolk or Hampshire rams), or Karakul breeding were used to study the effect of gender and breed of lamb on certain carcass characteristics. Lambs were purchased from producers in Texas and New Mexico and were considered to

be representative of the three breed groups. Lambs were maintained on a diet consisting of approximately 50% concentrates for approximately 60 days and slaughtered at approximately 110 lbs live weight and at less than one year of age. USDA yield grade and USDA quality grade data were collected 24 hr postmortem. Leg steaks and loin chops (1.0 in. thick) obtained from each carcass were cooked to an internal temperature of 170 F and subjected to sensory panel evaluations (six-member panel) and Warner-Bratzler shear force determinations. Sensory panel evaluation included ratings for tenderness, flavor, juiciness and overall palatability.

RESULTS AND DISCUSSION

Carcasses from ram lambs had significantly higher yield grades, lower dressing percentages, a higher percentage of trimmed wholesale cuts, larger ribeyes and less fat thickness at the 12th rib than wether lambs (Table 1). Other researchers have reported superior growth and leaner carcasses for ram lambs as compared to wethers (4,5,8)

Rambouillet lambs and blackface-crossbred lambs had higher leg conformation scores than Karakul lambs. Due primarily to excess fat over the leg and loin, Karakul carcasses had higher dressing percentages, lower yield grades and a higher percentage of fat trim than carcasses from Rambouillet or crossbred lambs. For instance, Karakul lambs had 8.8 percent greater fat trim than Rambouillet lambs. They also had significantly greater fat thickness over the 12th rib indicating a marked tendency for greater fat deposition by the Karakul. Ribeye area did not differ significantly among the three groups.

Sensory panel evaluation of loin chops and leg steaks are presented in Tables 2 and 3, respectively. Loin chops from ram lambs had significantly lower ratings for flavor and overall palatability than those from wether carcasses. Leg steaks from ram carcasses had significantly lower ratings for juiciness and overall palatability. Misock et al. (6) reported that meat from ram lambs with carcass weights of 65 lbs was similar in tenderness and juiciness to meat from wethers. Similar results using light weight carcasses, have been reported by numerous workers (1,2,3,7).

Leg steaks from Rambouillet carcasses had higher Warner-Bratzler shear force values than those from either crossbred or Karakul lambs. No significant breed differences were found in tenderness, flavor, juiciness or overall palatability as evaluated by the sensory panel. However, mean ratings or values for flavor, overall palatability and Warner-Bratzler shear force tended to favor the fat-tailed sheep. Results of this study suggest that fat-tailed sheep are at least equal to some Rambouillet and blackface-crossbreds with respect to sensory attributes of their cooked product. The major problem with fat-tailed sheep continues to be the lower percentage of trimmed wholesale cuts.

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Table 1. Effect of gender and breed on selected carcass characteristics

Carcass trait	Gender		Breed group		
	Ram	Wether	Rambouillet	Crossbred	Karakul
Observations	30	26	20	16	20
USDA yield grade	2.5[a]	2.9[b]	2.7[c]	2.4[c]	3.0[d]
USDA quality grade*	11.1[a]	11.2[b]	11.1[c]	11.5[c]	10.9[d]
Dressing percentage	52.5[a]	55.5[b]	52.6[c]	53.8[c]	56.1[d]
Carcass fat trim (%)	9.5	10.0	6.6[c]	6.7[c]	15.4[d]
Trimmed wholesale cuts (%)	78.1[a]	75.9[b]	78.9[c]	80.2[c]	72.7[d]
Fat trim from leg (%)	16.8	16.9	8.7[c]	8.1[c]	32.1[d]
Fat trim from loin (%)	12.4	14.9	9.8[c]	9.0[c]	21.0[d]
Ribeye area, 12th rib ($in.^2$)	2.3[a]	2.1[b]	2.2[c]	2.3[d]	2.2[e]
Leg conformation score*	11.5	11.6	11.7[c]	12.7[d]	9.2[e]
Fat thickness, 12th rib (in.)	.12[a]	.17[b]	.13[c]	.12[c]	.17[d]

[a,b]Means on the same line for gender with different superscripts are statistically different.

[c,d,e]Means on the same line for breed group with different superscripts are statistically different.

*Coded as follows: high Prime = 15, avg. Prime = 14, et cetera.

Table 2. Effect of gender and breed of lamb on sensory panel characteristics of loin chops

Palatability trait*	Gender		Breed group		
	Ram	Wether	Rambouillet	Crossbred	Karakul
Tenderness	5.2[a]	5.7[b]	5.2	5.5	5.7
Flavor	5.5[a]	5.9[b]	5.6	5.7	5.9
Juiciness	4.7[a]	5.0[b]	5.0	4.9	4.7
Overall palatability	4.9[a]	5.4[b]	4.9	5.1	5.4
Warner-Bratzler shear force (lbs)	9.9	8.4	10.4	9.3	7.9

[a,b]Means on the same line for gender with different superscripts are statistically different.

*Coded as follows: 1 = extremely tough, undesirable, dry or undesirable; 8 = extremely tender, desirable, juicy or desirable.

Table 3. Effect of gender and breed of lamb on sensory panel characteristics of leg steaks

Palatability trait*	Gender		Breed group		
	Ram	Wether	Rambouillet	Crossbred	Karakul
Tenderness	4.4	4.6	4.1	4.9	4.6
Flavor	5.4[a]	5.6[b]	5.4	5.4	5.6
Juiciness	4.6[a]	4.9[b]	4.8	4.7	4.8
Overall palatability	4.5[a]	4.9[b]	4.4	4.8	4.8
Warner-Bratzler shear force (lbs)	9.7	10.6	11.5[c]	9.3[d]	9.3[d]

[a,b]Means on the same line for gender with different superscripts are statistically different.

[c,d]Means on the same line for breed group with different superscripts are statistically different.

*Coded as follows: 1 = extremely tough, undesirable, dry or undesirable; 8 = extremely tender, desirable, juicy or desirable.

CARCASS AND OFFAL YIELDS OF SHEEP AND GOATS AS INFLUENCED BY MARKET CLASS AND BREED

R.R. Riley, M. Shelton, J.W. Savell and G.C. Smith

SUMMARY

Sheep and goats (n=120) of two market classes and five breeds were slaughtered and weights of the carcass and offal items were obtained. Offal item yields were computed as percentages of live weight minus the weight of the gastro-intestinal tract and its contents. Sheep weighed more, dressed higher and had lower yields of most dress-off items than goats of comparable market class. Aged female and young intact male sheep or goats (within specie) differed in heart, liver, blood and pelt yields; within breeds, aged female and young intact males did not differ in live or carcass weights, dressing percentage or lung percentage. Angora goats dressed lower than Spanish goats. Karakul sheep dressed higher than all other breeds of sheep and had higher carcass weights and lower head percentages. Data of this study emphasize importance of consideration of yields of all offal items that can be used as food rather than simply basing live value of sheep and(or) goats on quantitative or qualitative aspects of their carcasses when decisions regarding species, breed or market class are to be made for other parts of the world.

INTRODUCTION

Sheep and goats are valued primarily for the production of meat, milk and fiber. In the United States, and perhaps in other developed countries, the industry is most interested in the qualitative and quantitative characteristics of the carcass and tend not to be concerned with edible and non-edible offal items. However, in many areas of the world, offal items are important, rivaling meat production in economic concern while qualitative aspects of the carcass receive little attention. Thus, much of the research on meat or meat production from these species has little relevance to those areas where sheep and especially goats make their greatest contribution.

Research relating specifically to offal item percentages of sheep and goats is very limited. In some societies, however, some of these components may be treasured or given a higher preference order than the carcass itself. It has been reported that offal yield percentages can be affected by nutrition (5), live weight (3), sex class (2) and species (1).

In stable animal populations, especially those with low reproductive success, the primary market classes available for slaughter would be surplus young intact males and cull or aged females which had surpassed their usefulness as breeding animals. Therefore, the present research was undertaken to characterize yields of carcass and of certain

offal items from sheep and goats with regards to specie, market class and breed.

MATERIALS AND METHODS

One hundred-twenty sheep and goats consisting of two market classes and representing five breeds (Angora and Spanish goats and Rambouillet, Barbados and Karakul sheep) were obtained from the Texas Agricultural Experiment Station (TAES) at San Angelo. Except for the absence of dairy goats, these represented examples of the more important or more prevalent types of those likely to be most important in developing countries. The two market classes were young intact males and aged females. The aged females were surplus or culled females from station-owned flocks or were purchased at local markets. As would be true under production conditions, no attempt was made to provide a controlled feeding period prior to slaughter. The young intact males (less than one year of age) were produced from station-owned flocks and were held on pasture or feed until the animals obtained what was thought to be comparable physiological equivalents for the various breed or sex classes. The distribution by breed and market classes was as the following: Angora goats--9 young intact males, 10 aged females; Spanish goats--7 young intact males, 17 aged females; Rambouillet sheep--12 young intact males, 13 aged females; Barbados sheep--11 young intact males, 10 aged females; Karakul sheep--21 young intact males, 10 aged females.

Animals were slaughtered at the TAES Meats Laboratory. Animals which were of fiber-producing types (Angora goats, Rambouillet and Karakul sheep) were shorn just before slaughter. Weights of all offal items (blood, head, feet, pelt, lungs, liver, heart and viscera) were taken during the slaughter procedure. Viscera weight (gastro-intestinal tract and all of its contents) was subtracted from the live weight to correct, in part, for variations in fill. Offal item percentages were then calculated as a percentage of live weight minus the weight of the viscera.

RESULTS AND DISCUSSION

Meat is normally included in human diets for two reasons: (a) because people desire it and (b) because of the need for protein of animal origin. The latter may be particularly important in areas where people are largely dependent on starchy diets. Insofar as is known, the nutritive value of many of the offal items is comparable to or superior to that of the carcass (4). Therefore, in evaluating the suitability of various animals for meat production, attention should be paid to their total yield of usable products.

Comparisons of live and carcass weights and percentages of offal items between species within market class were analyzed and are reported in Table 1. In the present study, within each market class, sheep had significantly heavier live and carcass weights, higher carcass weight percentage but goats had higher head, feet, pelt and heart percentages.

No significant differences were found between species for blood, lungs or liver percentages.

Because differences were found between sheep and goats within each market class, comparisions were then made between market classes within sheep and goats (Table 2). Young intact male goats had higher head and pelt percentages and lower blood, liver and heart percentages than did aged female goats. Live and carcass weights and percentage of feet and carcass weight did not differ between the market classes of goats. Aged female sheep had higher blood, liver and heart percentages and lower pelt percentages than did young intact male sheep. Market class within sheep did not differ for live and carcass weights or for head, feet, lung and carcass weight percentages.

Comparisons of mean values for live and carcass weights and for mean percentages of offal items between breeds of goats stratified according to market class are reported in Table 3. Among young intact males, those of Angora breeding were lighter in live and carcass weights and had higher percentages of head and pelt than did those of Spanish goat breeding; young intact males of the two breeds did not differ in percentages of blood, feet, lung, liver or head. Among aged females (Table 3), those of the Angora breed had higher percentages of blood, head, feet, pelt, liver and heart and had lower percentages of carcass weight and lighter carcass weights than did those of the Spanish breed. These data suggest that Angora goats have lower carcass weight percentage primarily due to their higher percentages of head and pelt.

Table 4 reports comparisons of live and carcass weights and percentage of offal items among breeds of sheep stratified according to market class. Among young intact males, those of Karakul breeding had higher carcass weights, higher percentages of carcass weight and lower percentage of head than did those of Barbado and Rambouillet breedings and had higher live weights than those of Barbados breeding. Those of Rambouillet breeding had higher live and carcass weights, higher pelt percentages, and lower head percentage than those of Barbados breeding among young intact males. Young intact male sheep breeds did not differ in blood, feet, lungs, liver and heart percentages. Among aged females, those of Rambouillet and Karakul breeding had higher live and carcass weights than did those of Barbados breeding. Rambouillet aged females had higher heart percentages than did Barbados and Karakul aged females and lower carcass weight percentage and higher liver percentage than did Barbados and Karakul aged females. Among aged females, sheep breeds did not differ for percentages of blood, head, pelt and lung.

Comparisons of mean values for live and carcass weights and for mean percentages of offal items between market classes within breed are reported in Table 5. Young intact males and aged females did not differ within each breed for live weights, carcass weights and lung or carcass weight percentages. Furthermore, with the exception of Angora and Spanish goats, market classes did not differ within each breed in percentage of feet or blood and, with the exception of Barbados sheep, the market classes did not differ within each breed in head percentages. Young intact males within the Spanish, Rambouillet, Barbados and Karakul breeds had higher pelt percentages than did aged females and had lower liver and heart percentages than aged females within the Angora, Spanish

and Rambouillet breeds.

In conclusion, regardless of market class, sheep have heavier live weights and produce heavier carcasses, higher percentages of carcass weight and lungs, and lower percentages of head, feet, pelt and heart than goats. Furthermore, live weights, carcass weights and offal item percentages do differ between breeds within young intact males and aged females. Finally, the offal item yields which differed most between sexes within breeds are those for the pelt, liver and heart.

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Table 1. Comparisons of Mean Values for Live and Carcass Weights and Mean Percentages of Offal Items Between Species, Stratified According to Market Class

Trait	Young intact males		Aged females	
	Goats (n=16)	Sheep (n=44)	Goats (n=27)	Sheep (n=33)
Live weight, lb	63.70[b]	87.10[a]	69.70[b]	87.10[a]
Blood, (%)	5.31[a]	5.28[a]	6.40[a]	5.82[a]
Head, (%)	10.06[a]	9.12[b]	9.48[a]	8.84[b]
Feet, (%)	1.77[a]	1.53[b]	1.89[a]	1.58[b]
Pelt, (%)	15.16[a]	11.32[b]	11.75[a]	9.40[b]
Lungs, (%)	2.08[a]	2.21[a]	2.29[a]	2.36[a]
Liver, (%)	1.99[a]	1.92[a]	2.50[a]	2.32[a]
Heart, (%)	0.87[a]	0.72[b]	1.24[a]	0.92[b]
Carcass weight, (%)	61.48[b]	66.99[a]	63.13[b]	67.13[a]
Carcass weight, lb	31.20[b]	45.60[a]	32.90[b]	44.70[a]

[a,b] Means within a market class in the same row with a common superscript letter are not statistically different.

Table 2. Comparisons of Mean Values for Live and Carcass Weights and Mean Percentages of Offal Items Between Market Classes Within Specie

Trait	Goats		Sheep	
	Young intact males (n=16)	Aged females (n=27)	Young intact males (n=44)	Aged females (n=33)
Live weight, lb	63.70[a]	69.70[a]	87.10[a]	87.10[a]
Blood, (%)	5.31[b]	6.40[a]	5.28[b]	5.82[a]
Head, (%)	10.06[a]	9.48[b]	9.12[a]	8.84[a]
Feet, (%)	1.77[a]	1.89[a]	1.53[a]	1.58[a]
Pelt, (%)	15.16[a]	11.75[b]	11.32[a]	9.40[b]
Lungs, (%)	2.08[a]	2.29[a]	2.21[a]	2.36[a]
Liver, (%)	1.99[b]	2.50[a]	1.92[b]	2.32[a]
Heart, (%)	0.87[b]	1.24[a]	0.72[b]	0.92[a]
Carcass weight, (%)	61.48[a]	63.14[a]	66.99[a]	67.13[a]
Carcass weight, lb	31.20[a]	32.90[a]	45.60[a]	44.70[a]

[a,b,c] Means within a specie in the same row with a common superscript letter are not statistically different.

Table 3. Mean Values for Live and Carcass Weights and Mean Percentages of Offal Items Between Breeds of Goats, Stratified According to Market Class

Trait	Young intact males		Aged females	
	Angora (n=9)	Spanish (n=7)	Angora (n=10)	Spanish (n=17)
Live weight, lb	58.20[b]	70.90[a]	65.00[a]	72.50[a]
Blood, (%)	5.57[a]	4.98[a]	7.47[a]	5.78[b]
Head, (%)	10.54[a]	9.43[b]	10.33[a]	8.98[b]
Feet, (%)	1.76[a]	1.80[a]	2.10[a]	1.76[b]
Pelt, (%)	17.81[a]	11.77[b]	15.10[a]	9.77[b]
Lungs, (%)	2.00[a]	2.18[a]	2.18[a]	2.36[a]
Liver, (%)	2.15[a]	1.79[a]	2.81[a]	2.32[b]
Heart, (%)	0.84[a]	0.90[a]	1.21[a]	1.25[a]
Carcass weight, (%)	58.50[b]	65.32[a]	57.89[b]	66.23[a]
Carcass weight, lb	27.10[b]	36.50[a]	27.50[b]	36.00[a]

[a,b,c] Means within a market class in the same row with a common superscript letter are not statistically different.

Table 4. Mean Values for Live and Carcass Weights and Mean Percentages of Offal Items Among Sheep Between Species, Stratified According to Class

	Young intact males			Aged females		
	Rambouillet (n=12)	Barbados (n=11)	Karakul (n=21)	Rambouillet (n=13)	Barbados (n=10)	Karakul (n=10)
Live weight, lb	90.30[a]	69.40[b]	94.50[a]	94.90[a]	69.10[b]	95.00[a]
Blood, (%)	5.01[a]	5.21[a]	5.47[a]	6.04[a]	5.60[a]	5.77[a]
Head, (%)	9.44[b]	10.97[a]	7.97[c]	8.99[a]	9.03[a]	8.46[a]
Feet, (%)	1.63[a]	1.49[a]	1.49[a]	1.61[a]	1.50[a]	1.64[a]
Pelt, (%)	12.19[a]	10.50[b]	11.24[ab]	9.74[a]	9.13[a]	9.24[a]
Lungs, (%)	2.31[a]	2.31[a]	2.10[a]	2.17[a]	2.66[a]	2.31[a]
Liver, (%)	2.06[a]	1.82[a]	1.90[a]	2.57[a]	2.27[ab]	2.04[b]
Heart, (%)	0.80[a]	0.72[a]	0.68[a]	1.08[a]	0.85[b]	0.77[b]
Carcass weight, (%)	65.34[b]	66.16[b]	68.37[a]	66.26[b]	67.03[ab]	68.37[a]
Carcass weight, lb	46.00[b]	36.80[c]	50.00[a]	47.50[a]	34.80[b]	51.00[a]

[a,b] Means within a market class in the same row with a common superscript letter are not statistically different.

Table 5. Comparisons of Mean Values for Live and Carcass Weights and Mean Percentages of Offal Items Between Market Class Within Breed

Trait	Angora		Spanish		Rambouillet		Barbados		Karakul	
	Young intact males (n=9)	Aged females (n=10)	Young intact males (n=7)	Aged females (n=17)	Young intact males (n=12)	Aged females (n=13)	Young intact males (n=11)	Aged females (n=10)	Young intact males (n=21)	Aged females (n=10)
Live weight, lb	58.20[a]	65.00[a]	70.90[a]	72.50[a]	90.30[a]	94.90[a]	69.40[a]	69.10[a]	94.50[a]	95.00[a]
Blood, (%)	5.57[b]	7.47[a]	4.98[b]	5.78[a]	5.01[a]	6.04[a]	5.21[a]	5.60[a]	5.47[a]	5.77[a]
Head, (%)	10.54[a]	10.33[a]	9.43[a]	8.98[a]	9.44[a]	8.99[a]	10.97[a]	9.03[b]	7.97[a]	8.46[a]
Feet, (%)	1.76[b]	2.10[a]	1.80[a]	1.76[a]	1.63[a]	1.61[a]	1.49[a]	1.50[a]	1.49[a]	1.64[a]
Pelt, (%)	17.81[a]	15.10[a]	11.77[a]	9.77[b]	12.19[a]	9.74[b]	10.50[a]	9.13[b]	11.24[a]	9.24[b]
Lungs, (%)	2.00[a]	2.18[a]	2.18[a]	2.36[a]	2.31[a]	2.17[a]	2.31[a]	2.66[a]	2.10[a]	2.31[a]
Liver, (%)	2.15[b]	2.81[a]	1.79[b]	2.32[a]	2.06[b]	2.57[a]	1.82[a]	2.27[b]	1.90[a]	2.04[a]
Heart, (%)	0.84[b]	1.21[a]	0.90[b]	1.25[a]	0.80[b]	1.08[a]	0.72[a]	0.85[a]	0.68[a]	0.77[a]
Carcass wt., (%)	58.50[a]	57.89[a]	65.32[a]	66.23[a]	65.34[a]	66.26[a]	66.16[a]	67.03[a]	68.37[a]	68.37[a]
Carcass wt., lb	27.10[a]	27.50[a]	36.50[a]	36.00[a]	46.00[a]	47.50[a]	36.80[a]	34.80[a]	50.00[a]	51.00[a]

[a,b] Means within a breed in the same row with a common superscript letter are not statistically different.

A COMPARISON OF MEAT GOATS (SPANISH), HAIR SHEEP (BARBADOS BLACK BELLY) AND FINEWOOL (RAMBOUILLET) EWES AS MEAT PRODUCERS UNDER TEXAS CONDITIONS

Maurice Shelton, Phil Thompson and Ron Lewis

SUMMARY

Lamb or kid production was measured for Spanish goats, Barbado sheep and Rambouillet sheep managed on a continuous mating regime and compared with Rambouillet which were mated only at one season per year. Spanish goats and Barbado sheep produced more offspring than the Rambouillet in either management system. However, the overall reproductive level of these was lower than expected with 114% lamb or kid crop weaned for Spanish or Barbado and 95.5% for the Rambouillet in each management system. Income data are not reported, but would definitely favor the Rambouillet. Therefore, the two more exotic types would be recommended only where they are better adapted to the resources or environment. Examples of this would be brush or browse for goats, or the more tropical areas for Barbado sheep. All three types tend to produce some offspring throughout the year, but considerable seasonal as well as breed or species variation appeared to exist.

INTRODUCTION

In the sheep and goat industry, there are two basic types of animals in each species. These are fiber producers and non-fiber producers. In the case of goats the two prevalent types or breeds are Angora (fiber producing) and Spanish (meat type or non-fiber producing). Under price structures existing in recent years, Angora goats have returned substantially more income than meat-type goats (3), but some producers continue to produce the latter because of reduced labor requirements. For sheep, one type of non-wool producing sheep (Barbado Black Belly) is found in the state in relatively small numbers. There are many breeds of wool producing sheep, but in this state most of the sheep population is of the Rambouillet breed. There appeared to be a need to evaluate the potential of these types for use in Texas. The Spanish goats and Barbado sheep are usually minimal-care animals in which the male remains with the flock year long.

EXPERIMENTAL PROCEDURE

Flocks of each of these types were available or were established at the Winters-Wall Ranch in McCulloch County, Texas. A continuous lambing flock of Rambouillet ewes were also established on the same

property. A comparable number of Rambouillet ewes on the station which were bred to lamb one time per year were used for comparison. These various flocks were not set up for direct experimental comparisons, but rather to investigate the production level which might be obtained from each. All the groups were run under native range conditions on the same property, but for obvious reasons they were not run in the same pastures. Lambing data were collected under free-ranging conditions, and it should be assumed that there are instances of lambs or kids having been born, but which died before they were recorded. Thus, total production (lambs or kids born) no doubt exceed those reported. The Spanish goats and Barbado sheep were managed as minimal-care animals. The Rambouillet sheep required (shearing, lamb marking, etc.) and received more care and a modestly higher level of supplemental feeding. This was highly variable during years and seasons.

RESULTS AND DISCUSSION

The results are reported in Table 1. The data requires some clarification. Fleece data are not shown for Spanish goats and Barbado sheep because they are not shorn. Weaning weights are not shown for the continuously mated Rambouillet ewes because they were, in general, weaned at an earlier age than other types and fed for a period of time in dry lot. Thus early weaned weight or weights off feed would not be comparable. Weaning weights for those ewes which were mated once per year are essentially comparable to normal weaning age of 5-7 months. It is not possible to calculate years in the flock for single lambing Rambouillet ewes in a manner comparable to other groups.

The Spanish goats and Barbado sheep each weaned only approximately 114 offspring per 100 females per year. This is substanitally below that which might have been expected. Still this was approximately a 20% greater lamb or kid crop than was realized for the Rambouillet. The goats appeared to produce more total weight than the Barbado sheep. In this comparison there is no advantage of the continuously lambed Rambouillet ewes over those lambed once per year. In fact there was a disadvantage of continuous mating. As shown in Figure 1, many of the lambs in the continuously mated group were dropped in less favorable seasons and required more care to insure their survival, and often sold at a disadvantage. Even at the reduced lambing rate, the single annual lambing Rambouillet ewes produced greater total lamb weight than the Spanish goats or Barbado sheep. In addition they produced a clip of finewool. In addition the Barbado sheep bred straight would not produce a choice market lamb (1). The kid goats weaned off the Spanish does represent the type market product from this species which would be readily accepted in market channels, but the per-head income realized from these would not approach that of market lambs.

The distribution of births throughout the year for the three continuously mated groups are shown in Figure 1. This represents a period

of years summary. Both types of sheep produced lambs in each month of the year. However, relatively few lambs were born from matings made in the spring months of February to April. There appears to be a real difference in the lambing pattern. The Rambouillet has a peak of lamb production in the period May-July. One possible explanation for this is that the ewes may have a shorter postpartum interval following lambing in the fall than is true with goats.

The goats did not kid in every month of the year, and their kidding pattern appears to be more erratic. It should be recalled that the data in the chart represents a compilation of a period of years data. When these data are plotted out by parturitions over the total period, there is a distinct tendency for the goats to kid in groups. This appears to suggest that in addition to photoperiod, other factors or interactions within the flock or between the sexes is influencing mating patterns.

These data do not suggest a reason for any major replacement of finewool ewes by either hair sheep or meat goats. However, the latter two types may serve important functions in total resource utilization. The goats certainly serve a useful purpose where browse resources are available to be utilized. Research efforts should be directed at improving their usefulness. There is little reason at present to suggest an increase in Barbado sheep under Edwards Plateau conditions. However, they may well serve a useful purpose under more tropical conditions including some areas in Texas, where wool-type sheep are poorly adapted. Also, the productivity of the Barbados could be markedly improved by a crossbreeding program. For instance, the statement is made that when bred straight they will not produce choice lambs. However, when crossed to sires of other breeds they will produce choice lambs. Also, F1 ewes derived from Barbado x Rambouillet cross have proved to be good lamb producers (2).

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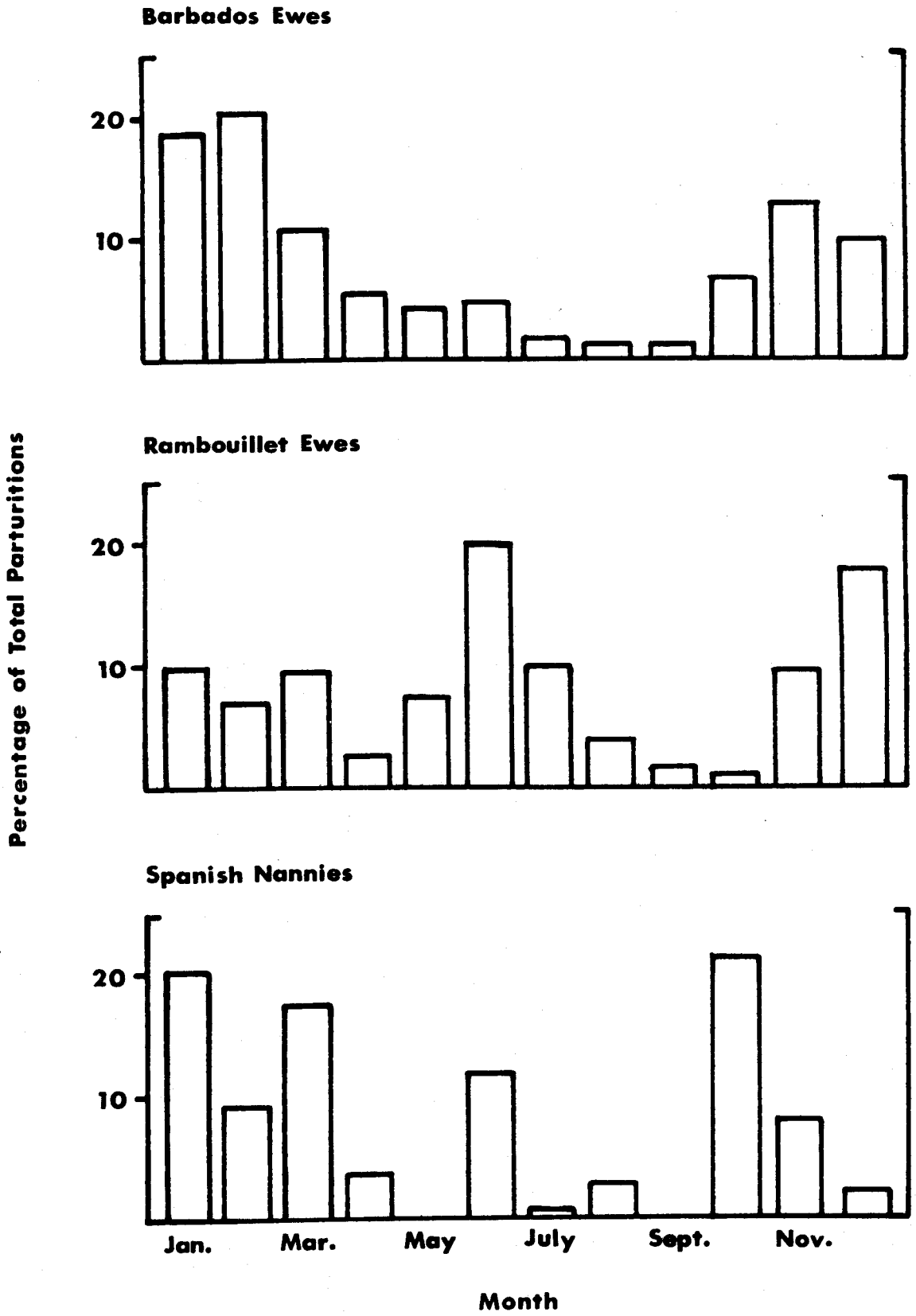
Table 1. A comparison of meat and fiber production by species, breed and management system

Species, Breed and Treatment Group	Total No. Animals Contributing	Ave. No. Yrs. in Flock	Ave. No. Parturitions Per ewe year	Ave. No. Offspring Born	Ave. No. Offspring Weaned	Ave. Wean. Wt.	Ave. Annual Fleece Wt.
Spanish Goat	75	2.54	1.088	1.487	1.145	53.07	--
Barbado Sheep	87	2.48	1.088	1.579	1.144	46.43	--
Rambouillet (Continuous mating)	110	2.80	0.814	1.064	0.948	--	8.4
Rambouillet (Single annual lambing)	99	--	0.918	1.021	0.955	76.60	7.9

Figure 1. Distribution of births for three types of small ruminants exposed to males throughout the year.



THE EFFECT OF VARIOUS GRAZING SYSTEMS ON GASTROINTESTINAL HELMINTHS OF SHEEP ON NATIVE PASTURE

S. Tembely, T.M. Craig, L.B. Merrill and R. Dusik

SUMMARY

The magnitude of infection by gastrointestinal parasites of lambs exposed to four different grazing management systems was investigated over a one year period at the Texas Range Station, Barnhart, Texas. Parasite - free lambs were placed with the grazing herds of sheep and cattle in each of the following management schemes: continuous, switchback, Merrill 4-pasture and intensive short-duration grazing systems. Regardless of the stocking density there was no significant difference among the 4 systems in the number of parasites acquired with the exception of Nematodirus. Nematodirus, the thread-necked strongyle, was transmitted in higher numbers in the intensive grazing system. The intensive system had twice the stocking rate of the other systems in the trial.

INTRODUCTION

Gastrointestinal parasitism is an ever present problem associated with the raising of productive lambs, even in arid regions. The cost, and in some instances inefficacy of anthelmintics, forces the producer to turn to other methods of controlling worms.

For years, rotational grazing has been recommended to aid in the control of parasitism in sheep, but little information is available on how to carry out such programs in a practical and productive basis. A number of rotation systems which were believed to have relevance to the control of nematode infection now are known to be ineffective.

However, those rotational systems which give sufficient rest to the pastures (3-6 months) for significant die off of infective larvae, may not produce maximum in forage utilization. Systems such as the intensive short-duration grazing system have an insufficient rest period (38 days) to allow appreciable numbers of larvae in the pasture to die. However, the better nutritional plane obtained from immature forages may offset increased exposure to parasites. In addition the intensive systems allow enough forage recovery that the stocking rate can be increased without deterioration of the range.

The present study was initiated to determine if the level of parasites acquired by lambs in a intensive short-duration system would be greater than that acquired in other deferred or continuous grazing systems.

EXPERIMENTAL PROCEDURE

Groups of three, 30-40 kg Rambouillet, black-face lambs raised in parasite-free conditions were used as sentinels in each pasture management system. The lambs were individually identified and released with the grazing herd of sheep and cattle on the first day of each exposure period (4 to 6 weeks). The lambs were slaughtered a week after removal form pastures. The gastrointestinal tract was examined and the number and kinds of parasites determined. Eggs per gram of feces was determined. Blood was collected for estimation of packed cell volume and total serum protein.

RESULTS AND DISCUSSION

Regardless of the type of pasture managements utilized and the stocking density, all lambs become infected with Haemonchus, Trichostrongylus and Nematodirus spp. Nematodirus spp. was increased in the intensive system in the spring. The total mean worm counts of the lambs at necropsy had a temporal pattern similar to that of the fecal egg counts throughout the experiment (Figs. 1 and 2). A similar study done in the summer of the following year indicated the same pattern. Mean packed cell volume and serum protein of lambs grazing different pastures were similar, and depending on the time of year were from 25% to 42% and 5.8 g/dl to 7.1 g/dl respectively. It was concluded that the increased exposure to parasites in the intensive grazing system was not significantly greater than that of other grazing systems at Barnhart.

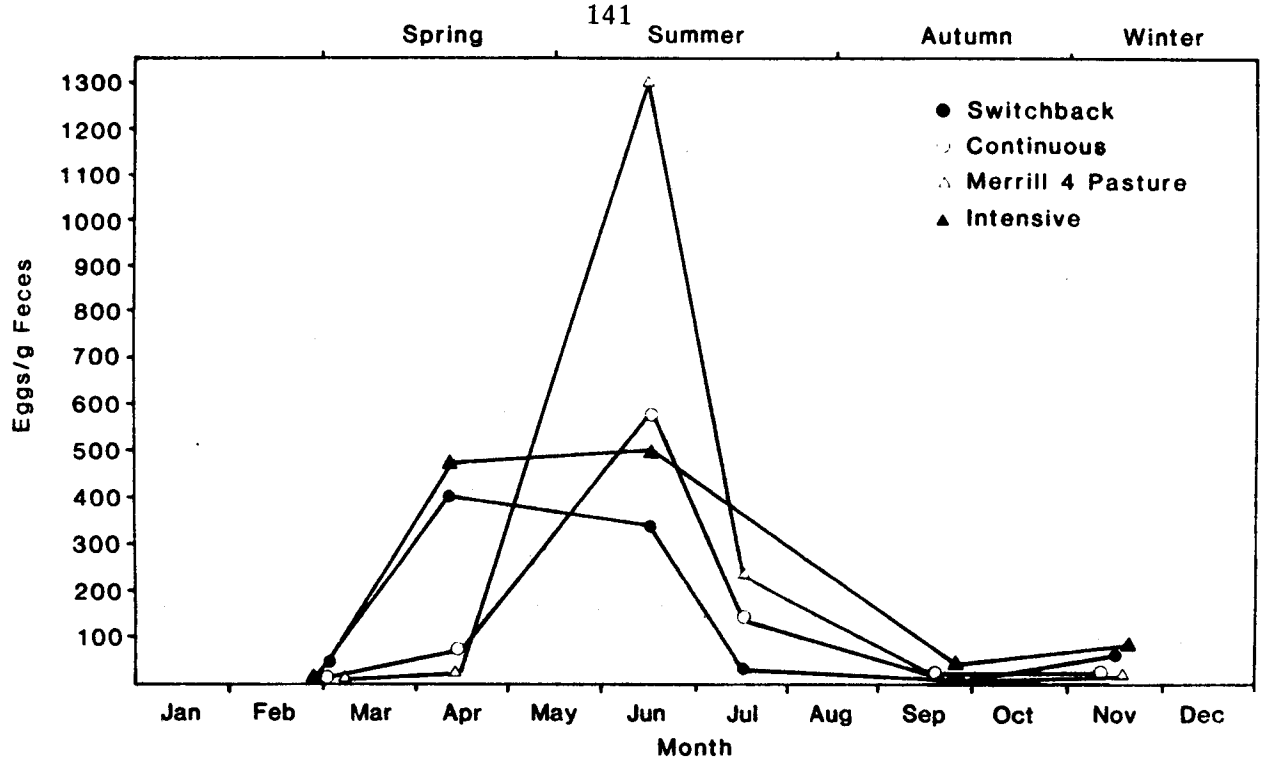


Fig. 1. Total mean egg per gram counts in sentinel lambs

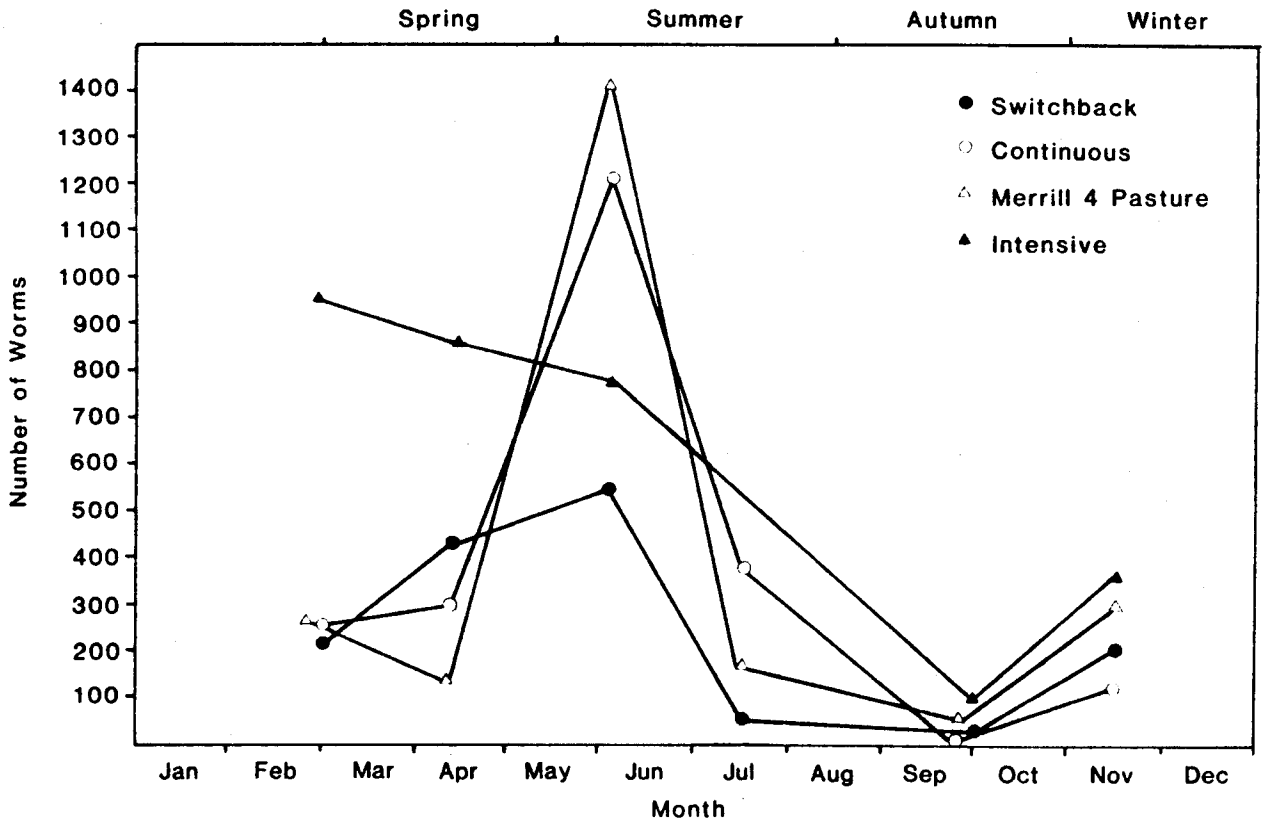


Fig. 2. Total mean worm counts in sentinel lambs

EFFECT OF MONENSIN AND PROTEIN ON FIBER PRODUCTION IN ANGORA GOATS FED A HIGH ROUGHAGE DIET

M. C. Calhoun, J. W. Bassett, B. C. Baldwin, Jr. and R. Stobart

SUMMARY

Eighty mature, castrated male Angora goats were used in a 4-month study to evaluate the effects of monensin and crude protein levels in the diet on mohair growth. The treatments were 0 and 16.5 mg/kg of monensin and 8 and 16% crude protein in a 2x2 factorial arrangement. Raising crude protein from 8 to 16% increased mohair growth by 38.4%. Overall, there was not a significant effect of monensin on mohair production and there was not a significant interaction between monensin and crude protein levels. Monensin decreased the molar percentages of acetic and butyric acid in rumen fluid and increased the proportion of propionic acid. These effects of monensin on the relative proportions of rumen volatile fatty acids are similar to those previously reported for cattle and sheep.

INTRODUCTION

Monensin,[1/] a biologically active compound produced by Streptomyces cinnamonensis, has been shown to improve feed efficiency when fed to feedlot cattle (7) and sheep (1) and to improve gains when fed to grazing cattle (6). Other studies indicate monensin may have a protein-sparing effect when fed with diets of low protein content (4,5). It is also an effective coccidiostat (1), although its effects on feed efficiency and gains are still evident in ruminant animals without clinical evidence of coccidiosis.

Angora goats are more efficient fiber producers than Rambouillet sheep (8). Protein requirements for maximum fiber production appear to be several times those required for growth, and increased mohair production has been demonstrated with increasing crude protein levels up to 20% of the diet (3). The purpose of this research was to examine the effect of monensin and protein level in the diet on mohair production by Angora goats.

1/ Monensin, sodium (Rumensin ®) Elanco Productions Company, a division of Eli Lilly and Company. Indianapolis, Indiana 46206

EXPERIMENTAL PROCEDURE

Eighty mature, castrated male Angora goats were used in this study. The dietary treatments were 0 and 16.5 mg/kg of monensin and 8 and 16% crude protein. The arrangement of treatments was a 2x2 factorial with 5 pens (4 goat/pen) assigned to each treatment combination. Experimental diets were fed ad libitum. Animals were weighed bi-weekly and rumen samples were obtained, via rumen tube, on the 90th day of the experiment and used for determination of rumen volatile fatty acid concentrations. The goats were sheared at the beginning and end of the experiment to determine the effects of treatments on mohair growth. The experimental feeding period was 112 days.

RESULTS AND DISCUSSION

The results of the chemical analyses of the experimental diets are presented in Table 1. Crude protein contents were slightly higher than expected, averaging 9.8 and 18.9%, on a dry matter basis, for the 8 and 16% crude protein diets, respectively.

Five goats were removed from the experiment because they were consistently losing weight. This problem was due to the pugnacious nature of dominant goats who refused to allow timid goats access to feed troughs. One goat died during the experiment. Cause of death was diagnosed as hepatitis. Visual examination as well as periodic measurement of fecal coccidial oocyst counts on a representative number of goats indicated there were no problems with coccidioses during this study.

Crude protein level and monensin both influenced live weight gain during the 112 day feeding period. Live weight gains (corrected for the amount of mohair produced) were 82.6% greater for goats fed the 16% crude protein diet. Monensin increased gains by 40.1%. The effects of crude protein and monensin on gains were additive (Table 2).

Dietary crude protein and monensin produced opposite effects on feed intake. When dietary crude protein increased from 8 to 16%, feed intake increased by 20.8%; whereas, adding monensin to the diet decreased feed intake by 7.2% (Table 2). Crude protein level had a significant positive effect on mohair production (grease basis). Increasing crude protein from 8 to 16% increased the amount of mohair produced by 38.4%. The addition of monensin to the diet was without effect on fiber production. However, since feed intake was reduced by monensin, feed requirements for maintenance were less and consequently fiber was produced more efficiently. Lasalocid, a chemical with effects similar to monensin, was also found to be ineffective in stimulating fiber production, i.e., wool growth of feedlot lambs (2).

A slight increase in the proportion of butyric acid and a concomitant decrease in acetic acid in rumen fluid were associated with an increase in the crude protein content of the diet. The effects of monensin on the molar percentages of rumen volatile fatty acids were similar to effects previously reported for cattle and sheep fed high roughage diets (6, 9). Molar percentages of acetic and butyric acids decreased and propionic acid increased. This type of shift in the relative proportions of volatile fatty acids in the rumen is generally associated with an improvement in the efficiency of feed utilization. Although fiber production was not stimulated by monensin in this study it was still beneficial to feed monensin in that less feed was required to maintain the goats and to produce fiber.

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ACKNOWLEDGEMENTS

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TABLE 1. INGREDIENT COMPOSITION AND CHEMICAL ANALYSES OF DIETS

Ingredient	Crude protein, % 8	16
Grain sorghum	22.45	10.20
Sorghum-sudan hay	20.00	20.00
Wheat straw	41.55	30.00
Cottonseed meal	6.85	30.00
Molasses	6.00	6.00
Dicalcium phosphate	0.30	-
Calcium carbonate	0.85	1.80
Salt, plain mixing	0.50	0.50
Vitamin-mineral premix[a/]	1.00	1.00
Ammonium chloride	0.50	0.50
Chemical analyses[b/]		
Crude protein, %	9.8 ± .3	18.9 ± .2
Acid detergent fiber, %	30.6 ± .9	28.4 ± 1.2
Calcium, %	.72 ± .09	1.15 ± .13
Phosphorus, %	.28 ± .02	.41 ± .02

a/ The vitamin-mineral premix adds 0.1% sulfur, 0.1% potassium, 22 mg/kg zinc and 0.65% salt to the complete feed. It also provides 2,200 IU of vitamin A and 276 IU of vitamin D_2/kg of complete feed.

b/ 100% dry matter basis.

TABLE 2. EFFECTS OF DIETARY CRUDE PROTEIN LEVELS AND MONENSIN ON PERFORMANCE, MOHAIR GROWTH AND RUMEN VOLATILE FATTY ACIDS OF ANGORA GOATS

Criterion	Crude protein (%)		Monensin (mg/kg)	
	8	16	0	16.5
Goats starting exp., No.	40	40	40	40
Goats finishing exp., No.	36	38	37	37
Initial weight, kg	40.3	40.8	40.2	41.0
Weight change, kg/112 day[a/]	3.3	6.0	3.9	5.4
Feed intake, kg/day	1.20	1.45	1.38	1.28
Mohair produced, kg/112 day	1.19	1.65	1.47	1.37
Rumen volatile fatty acids, moles/100 moles				
Actetic	55.4	54.2	56.6	53.0
Propionic	31.7	31.7	29.1	34.3
Butyric	12.8	14.2	14.3	12.6

[a/] Live weight change corrected for the amount of mohair produced.

EFFECT OF BRITCH REMOVAL ON FLEECE QUALITY IN TWO SHEEP FLOCKS

Tim Willingham, Maurice Shelton and J. W. Bassett

SUMMARY

An experiment was conducted in which the britch area was removed from a random sample of two flocks of ewes. Fleece weights were recorded for the control and treatment ewes as well as the removed britch. When the data for the two flocks were combined, the britch composed 5.7% of the entire fleece. Fiber diameter measurements were determined on the entire fleece, fleece with britch removed, and the removed britch in the grease, scoured state and as top. The britch wool was coarser than the rest of the fleece, but its removal had only a small effect on the mean fiber diameter of the clip. This difference had almost totally disappeared in the wool top.

INTRODUCTION

In recent years some concern has been expressed about coarse britch or hairy britch in sheep and the part this trait should play in respect to breeding or management. The options may be to breed animals which are free of a coarse britch or to possibly remove the britch at shearing. However, before either of these approaches are undertaken, it appeared necessary to evaluate the importance of this problem and the possibilities of altering it through management or breeding. The present study was undertaken to investigate the contribution of the britch area to fiber diameter of the overall clip.

EXPERIMENTAL PROCEDURE

In the spring of 1982, data were collected from 114 Rambouillet ewes belonging to the Texas Agricultural Experiment Station and located at the Hill Ranch in Edwards County, and 93 Rambouillet ewes of different breeding maintained by the Texas Agricultural Experiment Station near Barnhart, Texas. Each flock was separated into a control group, sheared in the traditional manner with the entire fleece going into the wool bag, and a treatment group in which britch or thigh wool was removed prior to shearing the entire animal with the britch and the remainder of the fleece being sacked separately. In general, the thigh or britch wool was removed from an area on the outside of each rear leg with an attempt made to be as uniform as possible between animals and ranches. The coarse spot associated with the britch is usually highly visible on the animal (Figure 1).

Weights were recorded for intact fleeces and the removed britch. Fleeces were bagged according to group and ranch. The grease wool from each lot at each ranch was core sampled to obtain samples for measurement of fiber diameter and variability. The wool was then scoured at the University of Wyoming Wool Laboratory and processed into wool top at the Textile Research Center, Texas Tech. University. Hand samples were obtained of the scoured wool as it came out of the dryer and hand samples of top were obtained at intervals during combing. Fiber diameter was determined from core samples of grease wool and grab samples of scoured wool and wool top. The micro-projection short section procedure was used for measuring fiber diameter and variability.

RESULTS AND DISCUSSION

Table 1 shows fleece weights for both flocks for treated and control groups. These data show a significant difference between the flocks in fleece weights, but this is unrelated to any treatment effect. Hill Ranch fleeces averaged 10.02 pounds whereas the Barnhart flock averaged 7.5 pounds. The fleeces from which the britch was removed weighed correspondingly less.

The britch, as removed in this study, made up 6.35% for the Hill Ranch ewes and 5.08% for the Barnhart flock. It is not known if the difference in these percentages are true flock differences or merely variation in the amount removed. Fleece plus britch weights for the Hill Ranch were 0.4 pounds lighter than the intact control fleeces, but were 0.2 heavier than control fleeces at the Barnhart Station. There are no apparent reasons why these differences are anything other than normal sampling variability.

The fiber diameters are shown in Table 2. Fiber diameter of the grease wool core samples show differences between control (entire fleece) treatment (britch removed) and britch samples. The britch is the coarsest with an average of 2.84 microns difference between the britch and the entire fleece and 3.11 microns difference between the britch and the fleece with the britch removed. Since the britch made up only an average of 5.72% of the fleece, the fleece with britch removed averaged only 0.27 microns finer than the intact fleece. This does not even approach statistical significance.

The scoured wool data for the Hill Ranch show the britch to be significantly coarser than the entire fleece or britch removed fleece, but there was no difference between control and treated. Similar differences for the Barnart wool were not statistically significant. There was no difference between ranches when comparing britch to britch, control to control, and treatment to treatment.

When examining wool top, significant differences were found between ranches and between the britch wool and the entire fleece or that from

which the britch was removed. The same pattern exists as found with grease wool and scoured wool. The britch wools are definitely coarser than the bulk of the fleece, but removal of this small amount of coarse wool did not make the balance of the fleece significantly finer than the wools from which the britch was not removed.

In Table 3 the pooled data from both flocks are shown. The britch composed only 5.7% of the entire fleece. The britch was significantly coarser than the control or treatment, but there was no difference between control and treatment. This was consistent for core, scoured, and wool top samples, showing a strong indication that the britch comprised such a small part of the clip it had no significant effect on fiber diameter of the clip or of the top made from it.

These data appear to suggest that coarse britch is not a major problem to the industry. On a flock basis the britch area is coarser than the remainder of the fleece, but the small percent this makes up of the entire fleece results in only a minor effect on the overall fiber diameter. Any difference resulting from britch removal had largely disappeared when the wool reached the top stage. From the data presented here it is not possible to determine if the ewes in the flock were uniformly coarser or if only a portion of the ewes are accounting for this problem. This will be investigated in a followup study.

In the writer's opinion, there are in effect two problems. One of these is a coarse spot on the britch. The second is a hairy britch. A hairy britch almost certainly contributes to the coarseness, but is a small part of the increased fiber diameter. However, the hairy britch could contribute kemp or kemp-like fibers to the fleece which may have an adverse effect on fleece value not expressed by average fiber diameters. It is possible to select against a hairy britch based on visual appearance. Breeders are encouraged to do this, but not to make this one of the highest priorities in selection.

ACKNOWLEDGEMENT

The authors would like to thank personnel of the Ranch Experiment Station, Sonora, for assistance in providing samples from the Barnhart flock and to the Wool Laboratory of the University of Wyoming and to the Textile Research Center, Texas Tech University for assisting in the processing of samples. This research was supported in part by funds from The Natural Fibers and Food Protein Commission of Texas.

Table 1. Wool weights (lbs.)[1]

Treatment	Ranch	
	Hill Ranch	Barnhart Station
Control (entire) fleece wt.	10.02 (49)	7.50 (46)
Treatment Group:		
Fleece Wt. (britch removed)	9.00 (65)	7.30 (47)
Britch Wt.	0.61 (65)	0.40 (47)
Total Wt.	9.61 (65)	7.70 (47)
Britch, %	6.35	5.08

[1]The number of animals involved are shown in parenthesis.

Table 2. Fiber Diameter Measurements (microns)

	Ranch	
	Hill Ranch	Barnhart Station
Grease wool - core samples		
Control (entire) fleece	20.16	19.38
Spinning Count	70's	70's
Treatment Group		
Fleece (britch removed)	20.08	18.93
Spinning Count	70's	80's
Britch	21.76	21.47
Spinning Count	64's	64's
Scoured wool		
Control (entire) fleece	19.13[a]	19.29
Spinning count	80's	70's
Treatment Group		
Fleece (britch removed)	18.78[a]	18.86
Spinning count	80's	80's
Britch	21.13[b]	20.02
Spinning count	64's	70's
Wool top		
Control (entire) fleece	19.15[a]	18.59[c]
Spinning count	70's	80's
Treatment Group		
Fleece (britch removed)	19.09[a]	18.54[c]
Spinning count	80's	80's
Britch	21.22[b]	19.81[d]
Spinning count	64's	70's

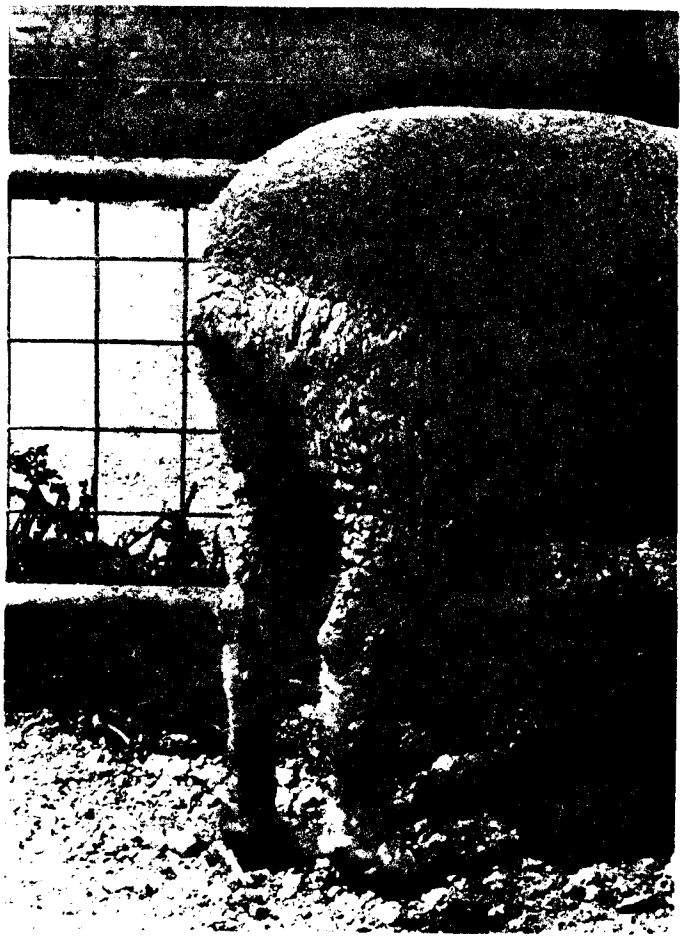
[a,b,c,d] Numbers within column or row with the same superscript are not significantly different ($P<.05$).

Table 3. Pooled data from both flocks.

	Treatment Group		
Microns	Control (Entire Fleece)	Fleece (Britch Removed)	Britch
Grease wool	19.64[a]	19.31[a]	21.62[b]
Scoured wool	19.23[a]	18.83[a]	20.58[b]
Top	18.76[a]	18.70[a]	20.59[b]
Spinning count			
Grease wool	70's	70's	64's
Scoured wool	70's	80's	70's
Top	80's	80's	70's

[a,b] Figures within a row with the same superscripts are not significantly different ($P<.05$).

Figure 1. Note the outline of the coarse britch area on a Rambouillet ewe.



A COMPARISON OF TWO METHODS OF MEASURING WOOL FIBER DIAMETER

John Campbell and J. W. Bassett

SUMMARY

Two methods were compared for measuring wool fiber diameter. Both methods used a microprojector to magnify the fibers 500X. One method used a wedge card for measuring individual fibers and a table calculator for calculating means and standard deviation. The other method used a digitizer programmable calculator for the same information. There were operator differences within both methods, but there was no difference in fiber diameter measurements between methods. Increasing the number of fibers from 91 to 106 or 175 did not influence the measurement. The time required for the wedge card method was approximately 5 times that required for the digitizer pad and programmable calculator.

INTRODUCTION

Several methods of measuring wool or mohair fiber diameter have been used. One of the methods recognized by the American Society for Testing and Materials (ASTM) is the microprojection method (CARD) (1). This method uses a microprojector that magnifies the fibers 500X. A wedge scale card is used to determine fiber diameter. This is done by marking the wedge scale at the point where the wedge lines and the width of the fiber image coincide at the fiber midlength. Another method used is the air flow method (2). This method uses a standard weight of clean sample through which air is forced. The air resistance estimates fiber diameter. A recent method of measuring fiber diameter is the use of the microprojector in conjunction with a digitizer pad and a programmable calculator (PAD). This method uses the same sample preparation as the A.S.T.M. method and the use of a microprojector. However, instead of a wedge scale, a pressure sensitive pad is used. This pad allows the measuring of a fiber by touching a point on both sides of the fiber image. The pad is calibrated so that 5 cm = 100 μm. Another difference between the PAD and CARD method is that the PAD method is attached to a programmable printing calculator. The calculator prints the average fiber diameter and standard deviation automatically upon completion whereas the CARD method requires the mean and standard deviation to be calculated by hand. This study was conducted to determine if there are significant differences in fiber diameter measurements when using the CARD method or the PAD method.

EXPERIMENTAL PROCEDURE

Two studies were conducted to determine if the PAD method is as accurate as the CARD method for measuring fiber diameter. In both studies two replicate samples of wool were used. These were from interlaboratory test samples and the average mean diameter and standard deviation from these interlaboratory tests were used as "known"

measurements. Both studies used three different total fiber counts. These total fiber counts of 91, 106 and 175 were the number of fibers needed to be measured to establish 90, 95 and 99% confidence levels. Four different operators measured the samples and participated in both studies.

In the first study, the exact same fibers were measured by both the PAD and CARD. A fiber image was projected onto the digitizer pad and the operator would digitize a point on both sides of the image. The operator would then use the wedge scale to measure the fiber diameter. For each of the total fiber counts a new series of fibers were measured. To measure 106 fibers, the operator would not use the 91 fibers from the first count, instead 106 totally different fibers were counted. This also applied to the 175 fibers measured. This study was used to determine if there is a difference in fiber diameter measurement depending on the method used.

In the second study, the operators would measure the total fiber counts using the CARD method and then the operator would measure the total fiber counts using the PAD method. In this study the individual fibers were not measured. Time was kept on how long it took to measure the fibers and do the calculations to obtain the mean fiber diameter and standard deviation. The purpose of this study was to determine time differences between the two methods and to determine if there was a difference in fiber diameter measurements.

Statistical analyses of the data included a multiple range test of the mean fiber diameters to determine if differences between the PAD vs CARD methods of measuring fiber diameter are statistically significant. A multiple range test was carried out on the mean times to determine the significance of differences in the amount of time it took to measure equal number of fibers using both methods.

RESULTS AND DISCUSSION

The effects seen within each method for operator, number of fibers, sample (replicates) or treatment (same vs. not same) are shown in table 1. This table shows the only significant difference within each method is between operators. Neither the number of fibers measured, the sample nor the way the fibers were measured (same vs not same) showed significant differences. Table 2 shows the comparison between the two methods. As shown, there is no significant difference in the mean fiber diameter when measuring either by the CARD or the PAD method. The average mean fiber diameter for the interlaboratory samples is 21.375. The PAD method was 0.064 of a micron coarser than the average of the known and the CARD was 0.117 finer than the average of the known. It should be pointed out that even though the PAD measurements were 0.181 coarser than the CARD, this difference is not statistically significant and both means indicate a spinning count of 64's. Table 3 shows the time required to measure and calculate using the CARD method was significnatly

longer than the time it took to measure and calculate using the PAD method.

These results indicate that there is no difference in the mean fiber diameters when comparing the CARD and PAD methods of measuring fiber diameter. There may be a difference in the measurements between operators using either method. This would be expected as in both methods there are times that a judgment must be made as where to digitize or mark the fiber image. However, all operators were within the 64's spinning counts in all cases. The most important consideration is the time difference. Regardless of the number of fibers measured the PAD method takes approximately 80% less time.

LITERATURE CITED

1. A.S.T.M. 1980. Diameter of wool and other animal fibers by microprojection. Annual Book of ASTM Standards, Part 33, D-2130.

2. A.S.T.M. 1980. Resistance to airflow as an indication of average fiber diameter of wool top, card sliver and scoured wool. Annual Book of ASTM Standards, Part 33, D-1282.

ACKNOWLEDGEMENTS

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TABLE 1. RESULTS OF TWO METHODS OF MEASURING WOOL FIBER DIAMETER

Operator	Mean	Spin. count	Operator	Mean	Spin. count
1	21.22[ab]	64's	1	20.99[b]	64's
2	21.60[a]	64's	2	21.61[a]	64's
3	20.87[b]	64's	3	21.57[a]	64's
4	21.35[ab]	64's	4	21.58[a]	64's
Number of fibers			Number of fibers		
91	21.41[c]	64's	91	21.43[c]	64's
106	21.13[c]	64's	106	21.42[c]	64's
175	21.23[c]	64's	175	21.47[c]	64's
Sample			Sample		
1	21.31[d]	64's	1	21.55[d]	64's
2	21.20[d]	64's	2	21.38[d]	64's
Treatment			Treatment		
Same fibers	21.31[e]	64's	Same fibers	21.45[e]	64's
Not same	21.21[e]	64's	Not same	21.43[e]	64's

[a,b,c,d,e]Means with the same superscript within a column do not differ significantly.

TABLE 2. COMPARISON OF FIBER DIAMETER MEASUREMENTS USING PAD OR CARD METHODS

Method	Mean, microns	Spinning count
PAD	21.439[a]	64's
CARD	21.258[a]	64's

[a]Means with same superscript do not differ significantly.

TABLE 3. COMPARISON OF TIME REQUIRED FOR PAD OR CARD MEASUREMENT METHODS

Fibers measured	CARD Mean, minutes	PAD Mean, minutes	Ratio CARD/PAD
91	31.125	6.00	5.01/1
106	34.00	6.75	5.0/1
175	49.00	10.875	4.5/1
Avg.	38.042[a]	7.875[b]	

[a,b]Means with differing superscripts are statistically significant, $P<.001$.

THE EFFECTS OF TWICE-A-YEAR SHEARING ON LAMB AND WOOL PRODUCTION IN FINEWOOL EWES

Maurice Shelton and Phil Thompson

SUMMARY

A research project was started in 1978 on the leased Winters-Wall Ranch in McCulloch County to study the effects of twice-a-year shearing on lamb and wool production in finewool ewes. Two hundred and four ewes were randomly sorted into 4 treatment groups; 1) shorn twice per year--bred in spring with cleanup matings in the fall, 2) shorn one time per year--bred in spring and fall, 3) shorn twice per year--bred in fall, and 4) shorn one time per year--bred in fall. In this study, twice-per-year shearing did not have a beneficial effect on either lamb or wool production. Breeding in the spring with cleanup matings in the fall did offer significant advantages in total lamb production and price. There were fewer dry ewes as a result of mating at the two seasons. However, the total number of lambs raised was approximately the same suggesting a slightly higer lambing rate in the spring. Most of the advantage in lamb production resulted from improved lamb growth rate of the early lambs.

INTRODUCTION

For a time beginning in the late 70's, there was a real interest in the possibility of producing short wool for use in what is known as the cotton system or open-end spinning. To obtain a supply of short wool, some processors have been using cut-top wool. This practice should have a great deal of inefficiency. Also, it has been traditionally considered that ewes shorn more often than once per year would produce more wool and possibly more lambs. Thus, a research study was initiated in the fall of 1978 at the leased Winters-Wall Ranch in McCulloch County to investigate the influence of twice-per-year shearing on lamb and wool production and on the suitability of the short wool produced for open-end spinning.

EXPERIMENTAL PROCEDURE

In September 1978, approximately 200 head of finewool ewes were randomly sorted into four treatment groups. The treatments imposed were: 1) shorn twice per year and bred in the spring with cleanup matings in the fall, 2) shorn twice per year and bred in the fall only, 3) shorn one time per year and bred in spring with cleanup matings in the fall, and 4) shorn one time per year and bred in the fall only.

In effect, this represents a 2x2 factorial experiment with a single vs. twice-per-year shearing and spring vs. fall matings as treatments. The animals were maintained under range conditions on the leased Winters-Wall Ranch in McCulloch County.

Shearing dates were in September and February for the twice-per-year shearing groups and May for 12-month clips with tagging done at the February shearing. Shearing, under the breeding systems imposed, could not always be done on exact 6-month intervals with the result that the February shearing represents a 5-month interval and the September shearing approximately a 7-month interval. At the initiation of the experiment, the ewes had been previously shorn in May and thus, the 1978 fall fleece data do not conform to the treatments outlined. At each shearing, inidvidual data was taken on actual length, grease fleece, and shorn body weights.

With the exception of the 1978-79 lambing season, ewes were lambed in pastures by treatment groups with the intent to measure the effect of shearing on lamb survival. Ewes were classified as wet or dry (open) based on udder development at the time the lambs were marked. All ewes which had been bred in the spring were confirmed pregnant by means of a scanopreg. Any open ewes were re-exposed to rams with the fall breeding groups. Fall-bred ewes were exposed only once to the rams. All lambs were weaned and weighed within two weeks prior to the June 1 and October 1 breeding seasons. This resulted in the spring-born lambs from the ewes which were exposed for fall lambs being weaned at a young age. This is reflected in weaning weights and total lamb weight produced. Insofar as possible, all four treatment groups were maintained as one flock except as dictated by mating and lambing strategies.

The fall-born lambs were sold as fat lambs or feeders in late May or June while the spring-born lambs were usually carried into the winter and sold at a more advanced age. Thus, directly comparable prices are not available. The short wool clips were made available to the Textile Research Laboratory at Texas Tech University for studies relating to processing of short wool. Core samples were taken to be analyzed for yield, fiber diameter, and spinning count at the wool laboratory at Texas A&M University.

RESULTS AND DISCUSSION

The mean actual staple lengths, total grease fleece, and shorn body weights are listed on Table 1. Staple length (inches) is the average of the actual wool measurement taken at the point of the shoulder, mid-rib area, and rump on each animal. This would not necessarily be comparable to fleece length due to stubble left on animal, irregular shearing, and short wool from other parts of the body. Fleece weights represent the total grease fleece. Tag and belly wools were not weighed

with the individual fleeces. The total material sorted off during a given shearing was weighed separately and a proportionate amount added back to the individual fleece weights.

These data do not show the expected advantage in fleece weights from twice-per-year shearing. In each direct comparison, the ewes shorn one time per year sheared heavier than those shorn twice-per-year. These differences were small. A mean of all the yield determinations made suggest that the short wool clips yielded higher than the 12-month clips (51.1% vs. 48.5%). This could be very easily explained by more suint or oil and more vegetable matter in the late shorn (May) 12-month fleeces. When these yield differences are applied to the fleece weights, they are essentially comparable. The February shorn fleeces were both shorter and lighter in weight than the fall fleeces. This, no doubt, reflects a shorter growth period and to the fact that the fleece was produced during the winter months. The staple length for the spring-shorn fleeces were approximately 1.5 inches which should be suitable for open-end spinning. The fall-shorn fleeces were approximately 2 inches long which for some uses may prove to be too long. The ewes involved were reasonable good wool producers and were producing more than 3 inches growth per year. Spring-bred ewes tended to produce more wool regardless of shearing treatments. This would appear to be explained by the fact that they had access to grain fields when it was available. The expected demand for short wool did not develop during the time covered by this study and in 1982-83, sold at a marked disadvantage. The logic to production and utilization of short wool on the cotton system still appears to exist, but the demand has not developed in practice. Based on the data generated in this study, the short wool should sell at a premium in order to warrant twice-per-year shearing. Also, the processing industry needs to be able to make use of wool with substantial variability in length as the production of wool of a uniform specified length (whatever this is) is not likely to be easily accomplished by the sheep industry.

Lamb production data are shown in Table 2. In these data, there is clearly no evidence that twice-per-year shearing was beneficial to lamb production. However, there is clear-cut evidence that breeding in the spring for fall lambs with cleanup matings in the fall of the year was beneficial to lamb production. There appears to be a slight reduction in the number of dry ewes following exposure to rams at the two seasons. Most of the lambs dropped in this regime (over 88%) were from spring matings. There are a number of possible explanations for a reduction in dry ewes. The most plausible one appears to be that some ewes apparently conceive, but lose the embryo very early. In the case of two mating seasons, these ewes would be rebred, but not if only a single breeding season is employed.

Weaning weights markedly favor the fall-born lambs. This, no doubt, reflects their access to small grain grazing and to the fact that the lambs were able to make their growth during the cool season of the

year. At least some winter grazing from small grains was available for three of five years involved. Small grain grazing was available in the spring of each year, but at this season small grain forage does not necessarily represent a marked advantage over range forage.

Price data are not reported, but did in all years favor the fall-born lambs. Unfortunately, this study confounds breeding season with the utilization of small grain pastures. It seems clear that if there is a reasonable liklihood of small grain grazing, fall lambs would be desirable. It is not so obvious that if there is no liklihood of small grain grazing that fall lambs would be desirable. Also, if only a limited acreage of small grain grazing is available, it may be desirable to breed only a portion of the flock for early lambs. On the property where this experiment was conducted, only approximately one-fourth of the ewes were bred for fall lambs. It has been previously established that in areas to the South and/or East of the Plateau Region, early lambs (late fall or winter) do better than late lambs regardless of small grain grazing. However, lambing at this time may incur a heavier winter feed bill and a greater risk of loss of lambs from cold weather. The prevalence of Texas wintergrass on the range may be a key to making a decision in this matter. This grass offers the potential of a winter feed supply for early lambs and the seed heads may create serious problems for the late lambs.

ACKNOWLEDGEMENT

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Table 1. Fleece and body weight data by treatments

Year	Fall No.	Fall Staple Length (in.)	Fall Fleece Wt.(lbs)	Fall Body Wt.(lbs) (Sept.)	Spring No.	Spring Staple Length (in.)	Spring Fleece Wt.(lbs)	Spring Body Wt.(lbs) (Feb.)	12-Mo. Total Fleece
Treatment: Shorn twice-per-year--bred in spring									
1978	52	1.59	3.40	92.2					
1979	47	2.14	6.75	111.7	48	1.82	4.40	100.0	11.15
1980	45	2.24	5.31	92.0	45	1.37	2.20	86.3	7.51
1981	44	2.63	5.68	112.6	43	1.78	3.76	109.3	9.44
1982	40	2.24	7.14	112.0	41	1.48	3.92	107.3	11.06
1983	—				40	1.33	2.42	80.1	
Ave.		2.15	5.56	103.6		1.56	3.36	96.7	9.79
Treatment: Shorn twice-per-year--bred in fall									
1978	52	1.60	3.20	89.5					
1979	47	2.07	5.69	101.8	49	1.77	3.77	111.9	9.46
1980	43	2.08	4.38	89.7	44	1.47	2.70	104.5	7.08
1981	42	2.37	5.11	103.7	41	1.76	3.79	122.3	8.90
1982	38	2.12	5.61	97.5	43	1.59	3.53	112.0	9.14
1983	—				36	1.41	2.74	98.2	
Ave.		2.03	4.73	96.6		1.61	3.33	110.1	8.65
Treatment: Shorn once per year--bred in spring									
1979	49	2.98	8.27	100.6					
1980	45	4.31	10.20	87.1					
1981	44	3.69	11.18	114.4					
1982	41	3.61	9.78	106.4					
Ave.		3.63	9.86	104.2					
Treatment: Shorn once per year--bred in fall									
1979	49	3.05	7.64	107.3					
1980	46	4.18	9.39	83.3					
1981	43	3.60	10.56	101.8					
1982	43	3.47	7.85	102.3					
Ave.		3.56	8.83	98.7					

Table 2. Lamb production by treatment groups

Year	No. Ewes	No. Open	No. Ewes Lambing	No. Lambs Tagged	No. Lambs Weaned	Ave. Lamb Wt.	No. Ewes	No. Open	No. Ewes Lambing	No. Lambs Tagged	No. Lambs Weaned	Ave. Lamb Wt.
Sheared twice-per-year--bred in spring							Sheared once per year--bred in spring					
1978 Fall	50	8	42	43	40	86.4	53	18	35	35	29	86.0
Spring		3	5	6	4	57.5		3	15	15	12	57.2
1979 Fall	46	4	42	43	42	59.5	49	9	40	35	35	59.7
Spring		3	1	1	1	40.0		3	6	6	6	59.8
1980 Fall	45	14	31	32	32	100.3	45	7	38	41	40	97.9
Spring		8	6	6	6	68.5		5	2	2	2	66.0
1981 Fall	44	2	42	45	44	87.2	48	3	45	46	45	86.0
Spring		0	2	3	3	87.0		0	3	3	3	82.7
1982 Fall	40	7	33	31	28	68.5	41	6	35	33	31	71.9
Spring		3	4	5	5	51.8		0	5	5	5	44.8
Totals	225	17(7.6)[1]	208(92.4)[1]	215(95.6)[1]	205(91.1)[1]	15920	236	11(4.7)[1]	225(95.3)[1]	221(93.6)[1]	208(88.1)[1]	16018
	(lbs lamb weaned per ewe mated -- 70.76)[2]						(lbs lamb weaned per ewe mated -- 68.14)[2]					
Sheared twice-per-year--fall bred							Sheared once per year--fall bred					
1979	51	9	42	44	35	65.4	50	6	44	42	31	63.4
1980	47	6	41	37	36	64.0	47	3	44	47	47	61.0
1981	41	7	34	37	37	76.1	44	6	38	43	43	69.6
1982	43	3	40	41	41	82.9	41	3	38	38	37	81.2
1983	36	5	31	31	31	---	41	0	41	43	43	---
Totals	218	30(14.0)[1]	188(86.2)[1]	190(87.2)[1]	180(82.6)[1]	10808	223	18(8.07)[1]	205(91.9)[1]	213(95.5)[1]	201(90.1)[1]	10828
	(lbs lamb weaned per ewe mated -- 56.29)[2]						(lbs lamb weaned per ewe mated -- 59.49)[2]					

[1] Values in parenthesis represent percent of ewes exposed.

[2] These values represent pounds of lamb weaned per ewe exposed. In the case of fall-bred ewes, the values are expressed as a function of the ewes mated excluding 1983 matings for which weaning weights are not available.

SOME GENETIC PARAMETER ESTIMATES FOR ANGORA GOATS

Maurice Shelton and Gary Snowder

SUMMARY

Data are reported involving genetic studies on 312 offspring of 22 sires derived from Angora goat performance testing programs. Estimates of heritability as well as phenotypic and genotypic correlation are reported and these are compared with data from other studies. Although the data are highly variable, the data indicate that all the traits of Angora goats which were studied are at least moderate in heritability. Some problems in respect to genetic correlations are presented and discussed. The relationship of sire performance on test and the performance of his offspring were lower than expected, at least for some traits. This suggests a possible need for some changes in testing techniques to improve its validity as a measure of the genetic potential of young males.

INTRODUCTION

A performance testing program for Angora goats has been periodically conducted at the Texas Agricultural Experiment Station at Sonora. From the outset of this effort, there has been a need to derive a selection index which could be used to provide a ranking of the males for breeding purposes. Such an index might be derived by a carefully prescribed scientific process or by more impirical procedures. In any case, there is a need for information on (a) the economic importance of individual traits, (b) the heritability (degree of hereditary control) of individual traits, (c) the amount of variability in these traits, and (d) the relationship between the various traits. Good information on these points does not exist for Angora goats. Good estimates of the various genetic parameters require a large volume of data collected over many generations. The requirement for large numbers, a long time period, and extensive fiber data make it unlikely that good values for goats will be available in the near future. Also, genetic studies on Angora goats tend to be erratic and often difficult to interpret. Any near-term attempt to estimate these values must be derived from a concensus of less than optimum sets of data. The present report deals with analysis of one set of data obtained at the Texas Agric. Expt. Station at Sonora and the adjacent leased Hill Ranch in Edwards County.

MATERIALS AND METHODS

For the five years (1968, 69, 70, 71, and 1980) five males were selected from Angora goat performance tests conducted at the Sonora Station. In some cases the sires were selected to provide meaningful variation in certain individual traits, but since a large number of traits are involved it is only logical that substantial variation existed in each of these. Although at least five sires were used each year, in three of the years data were recovered for only 4 sires due to confusion in sire identity or failure to sire a meaningful number of offspring.

Year Bred	Number of Males	Number Offspring[2]
1968[1]	5	35
1969	5	85
1970	4	60
1971	4	66
1980	4	66
Total	22	312

[1]Two of the sires used in this year were tested in 1967, and their records were not directly comparable. In some analyses these were treated separately.

[2]This number represents the maximum on which some data were available from first shearing. The numbers were reduced at subsequent data collection periods.

In each year the selected males were bred to a flock of commercial or grade (non-registered) Angora does. For the most part these does were purchased at auction markets and did not represent a selected population. Single sire matings were made under range conditions. In some of the years, kidding occurred on the range and date of birth or type of birth was not known. Thus, the data were not adjusted for age or type of birth. Data were collected on the offspring at the first shearing in August, 2nd shearing in February, and at the third shearing. At the third shearing some of the animals, generally the males, were put on the performance test and others were managed for a comparable period on the range. All records were adjusted for sex differences. In the third shearing where sex differences were confounded by treatment differences, they were treated as a separate group. After the third shearing they were sold or used for other purposes with no subsequent data available.

The data were analysed by paternal half-sib analyses and by sire-offspring comparisons. Phenotypic and genotypic correlations were estimated by analyses of covariance for the paternal half-sib data. In the case of sire-offspring comparisons, sires were divided into a high and low group and the difference in mean sire performance was compared to the mean difference between their offspring. Heritability was estimated based on 2 times the percent of the sire group differences which was recorded in the offspring. The sires were reclassified (high or low) based on their records for each trait. The method of calculating heritability by sire-offspring comparisons would be expected to reduce heritability estimates because of the exaggerated sire differences which occurred under test conditions. No attempt was made to calculate genotypic correlations based on sire offspring comparisons. However, some changes in other characters, especially body weight and fleece weight, were recorded based on correlated response to selection for designated traits.

Some traits such as face, neck and belly covering, and kemp were based on subjective scores as follows:

Face cover 0 - bare or open-----5 - closed

Kemp 0 - none----------5 - excessive

In the 1967-71 period, neck and belly cover were scored as above for face cover with the low values being more desirable. However, in the work conducted in the 1980's, this was reversed in which the higher values represent a greater amount of cover and thus a more desirable score. This logically led to some confusion in the analyses. In the case of heritability analyses calculated by the half-sib methods, these different scoring systems would not effect the results since all analyses were made on a within-year basis. In the correlation studies and sire offspring comparisons involving these values, attempts were made to change neck and belly cover scores to the effect that higher values represent a greater amount of cover.

RESULTS AND DISCUSSION

Heritability estimates are shown in Table 1. The values obtained by the half-sib method for the first shearing are not included. These tended to run higher than expected, and it is believed that this is due to small differences in age of the kids sired by some males. These small differences were assumed to have disappeared at later ages. In the case of the sire-offspring values, the pooled values for the offspring at various ages are compared to that of the sire on test. All of these values are in the believable or expected ranges, but tend to be erratic with respect to different ages or methods of calculation. The sire-offspring comparisons yielded disappointedly low estimates for some traits such as fleece weights. This is particularly critical since it

reflects the expected situation from selecting breeding males based on performance test data. In some cases, such as fleece weight, this low value can possibly be explained in that the magnitude or range of values for the sires on test are exaggerated and thus, the variation in the offspring values are very small relative to the variation in the sires. Another less encouraging explanation is that the testing procedure is not providing a good estimate of the genetic potential of the male. If this is the case, such factors as pre-test environment, i.e., differences in age, weight, condition, etc. as the males are placed on test may be influencing the results obtained. It is also important to recall that these data are based on relatively small numbers for an animal breeding experiment.

Heritability estimates from two other studies are also included for comparison along with an average of available values. The general concensus is that lock or staple length, yield and the various scores for body cover and possible size or growth rate are moderate in heritability. Grease and clean fleece weights, fiber diameter and kemp scores appear to be somewhat lower. A lower heritability for fleece weights probably reflects the fact that the level of mohair production is already high and further improvement will be slow.

Phenotypic and genotypic correlations based on covariance analyses are shown in Table 2. In the case of the phenotypic correlations, the actual numeric value of the correlation coefficient is reported, but only if they were statistically significant. These data suggest that open-faced does have more kemp, finer fiber diameter and larger body size. Neck and belly cover are highly related to each other, and the better covered does are less kempy, produce heavier fleeces and are lighter in body weights or slower gainers. Faster gaining animals tend to be more kempy. Longer staple goats tend to produce more fleece weight and higher yielding fleeces. Grease fleece weights are positively related to size or rate of gain and negatively related to yield. Fiber diameter (coarser fiber) is positively related to body weight and rate of growth.

Phenotypic correlation may be made of environmental or genetic correlations. Environmental and genotypic correlations may coincide or may be opposing forces. Genotypic correlations have much greater significance in respect to breeding programs, but they are difficult to estimate accurately. Environmental correlations tend only to confuse the issue in making decisions in the design of selection programs or in making individual animal selections. The methods of calculating genetic correlations often lead to widely variable values, and the methods employed to determine statistical significance are unrealistic. In Table 2, below the diagonal the actual calculated values are not shown, but the relationships are shown as not clear (NC), slightly negative or positive (-,+) or strongly negative or positive (--,++).

These data plus earlier studies indicate some problem areas with Angora goats relative to genetic correlation. The more important of these are:

Face cover is positively related to neck and belly cover-

ing making it more difficult to develop an open-faced goat with good cover on the neck and belly.

Neck and belly cover tend to be negatively related to growth rate or body size.

Fleece weight is positively related to fiber diameter making it more difficult to develop heavy shearing, fine haired goats.

Larger or faster gaining goats tend to be more kemp.

Body size or rate of growth and fleece weight tend to be either unrelated or negatively related. When expressed per unit of feed intake or on a restricted feed level, they are almost certainly negatively related as a given feed resource cannot be used for both functions.

Genetic correlations may be due to linkage or to plietropy. The term linkage is generally used to imply that the genes for two traits are closely associated (linked) on the same chromosome. In the present context the authors interpret the term in a broader sense to include segregating genotypes in the breed in which past selection history has caused traits to be associated in the same animal population. Plietropy implies that the same gene(s) or genetic codes influence more than one trait. It is not always clear or possible to determine which of these mechanisms are involved. Correlations due to linkage can usually be overcome through selection. It may require long-term selection experiments determine or demonstrate if this can be done.

Observations suggest that with time the relationship of face and neck and belly covering may be overcome. The negative relationship of neck and belly cover and body size is probably largely an alternative expression of a negative relationship between fleece weight and growth rate. In the writers' opinion, it is unlikely this will ever be overcome under conditions in which nutrition is a limiting factor. The positive relationship between fiber diameter and fleece weight is an example of plietropy in which fiber diameter is a component of weight. This could only be overcome by making up for a finer fiber with increased density. The relationship of rate of growth and kemptness may well represent linkage which could be overcome with selection, but there are possible alternative explanations.

LITERATURE CITED

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2. Shelton, M. and J. W. Bassett. 1970. Estimating certain genetic parameters relating to Angora goats. Texas Agri. Expt. Sta. PR 2750.

Table 1. Heritability estimates for various traits from this and earlier studies

Trait	This Study			Previous Texas Studies[1]	Turkish Reports[2]	Average Values
	Half-Sib 2nd Shear.	Methods Test.	Sire Offspring			
Grease fleece wt.	.135	.083	.073	.40	.13	.16
Clean fleece wt.	---[3]	---[3]	---[3]	.20	.12	.16
Fiber diameter	.242	.111	.237	.12	.19	.18
Lock length	.256	.422	.072	.59	--	.33
Fiber length	---	---	---	.22	.12	.32
Yield	.096	.338	---[3]	.48	.43	.34
Weaning wt.	---[4]	---[4]	---[4]	.33	.17	.25
Yrlg. or mature wt.	.326	.073	.159	.50	.24	.26
Face cov.	.090	.076	.192	.50	.24	.22
Neck cov.	.159	.460	---[5]	.49	--	.37
Belly cov.	.351	.075	---[5]	--	--	.21
Kemp	.190	.052	.071	.42	--	.18

[1] Taken from Shelton and Bassett (1970).

[2] Taken from Ariturk et al. (1979).

[3] Yield and thus clean fleece data not available for all age groups.

[4] Heritability of weaning traits not calculated.

[5] Methods of scoring for neck and belly covering were changed during the period of this report and heritability estimates from sire-offspring comparisons are difficult to calculate.

Table 2. Phenotypic (above diagonal) and genotypic (below diagonal) correlations for various traits of Angora goats.

	Face	Neck	Belly	Kemp	Staple	Fleece Wt.	Fiber Diam.	Body Wt.	A.D.G.	Yield
Face-1st shearing		.1223	.1305	NS	.2461	.1138	-.2382	-.2382	NA	NA
2nd shearing		NS	NS	-.2532	NS	NS	-.2239	-.2239	NA	NS
Test		NS	NS	-.2794	NS	NS	NS	NS	-.1497	NS
Neck-1st shearing			.6042	-.1279	NS	NS	-.1323	-.1596	NA	NA
2nd shearing	+		.6655	NS	.1847	.4501	.2152	NS	NA	.1863
Test			.7799	-.1373	-.5819	NC	-.4162	-.5951	-.4362	NS
Belly-1st shearing				NS	.1794	NS	NS	NS	NA	NA
2nd shearing	++	++		NS	NS	.3585	.1123	.1319	NA	NS
Test				-.1450	-.5642	NC	-.2638		-.4682	NS
Kemp-1st shearing					NS	NS	NS	.1881	NA	NA
2nd shearing	NC	-	-		NS	NS	NS	.2971	NA	NS
Test					NS	.1443	NS	.2137	.1455	NS
Staple-1st shearing						.4105	NS	NS	NA	NA
2nd shearing	-	+	+	NC		.1964	.1832	NS	NA	.3079
Test						.7599	.5116	.6209	.3934	NS
Fleece Wt.-1st shear.							.2755	.4773	NA	NA
2nd shear.	NC	+	+	-	++		.4313	.4205	NA	-.1456
Test							.5487	.8643	.7258	-.3264
Fiber Diam.-1st shear.								.5399	NA	NA
2nd shear.	NC	NC	+	NC	NC	+		.3298	NA	.2320
Test								.5933	.3402	NS
Body Wt.-1st shearing									NA	NA
2nd shearing	--	--	-	++	NC	NC	NC		NA	NS
Test									.7979	-.2901
A.D.G.-1st shearing										NA
2nd shearing	NC	-	-	++	NC	+	NC	+		NA
Test										-.3743
Yield-1st shearing										
2nd shearing	-	NC	-	NC	NC	-	+	NC	-	
Test										

NA - Not available
NS - Not statistically significant
NC - Not clear