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CONTENTS

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AGE EFFECTS ON WEIGHT AND REPRODUCTION OF EWES

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Consideration of the effects of age of ewe on productivity is important in making effective decisions concerning culling, replacement ewe requirements and related activities. Change in weight of ewe with age may be used as an indicator of ability of the ewe to thrive under prevailing ranch conditions. Change in reproductive performance with age is realized in the direct effects on lamb crop and subsequent cash receipts. This report contains estimates of age and year effects on weight of ewe at the beginning of the breeding season, percentage ewes lambing of ewes exposed, lambing date and numbers of lambs born and weaned.

EXPERIMENTAL PROCEDURE

The data for this study were collected at the Texas A&M University Agricultural Research Center at McGregor; the Rambouillet and Merino ewes were part of larger flocks at the station. The ewe flocks were grazed on available pasture from late spring through fall. The ewes generally were sheared and separated into breeding groups during the last week of May or the first two weeks of June. Rams were usually placed with the ewes at this time although in some years some of the ewes were exposed to rams year around. Ewes were lambed in drylot, then the ewes and their lambs were grazed on oat pastures; lambs were weaned at approximately 4 months of age. Minimal culling was practiced; ewes were generally retained in the flock unless they were barren in two consecutive years; some broken-mouthed ewes were culled.

Information recorded for each ewe included her breed, age in years, prebreeding body weight, lambing date and number of lambs born and weaned, as well as the year of the record. The year of record was begun on June 1 of the year and ended on May 31 of the following year. June 1 was chosen as the beginning of the year of record because it coincided with the first day of the month closest to the beginning of the breeding season. Ewe age in years was calculated by subtracting the year of record in which the ewe was born from the current year of record. Ewes were weighed at the beginning of the breeding season, with the exceptions of 1957, when no weights were taken, and in 1967, when weights were taken in July. Lambing date and litter size at birth and weaning were determined from the ewe's lambing record. From the actual lambing date a Julian lambing date, days from June 1, was calculated. Litter size at birth included all lambs born, regardless of whether the lambs were alive

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or dead at birth. Lambs were considered alive at weaning unless a record of death at less than 120 days of age was recorded.

The data were analyzed using a least squares model to estimate effects of year of record and age of dam on the weight and reproduction variables. Estimates were obtained separately for Rambouillet and Merino ewes. In addition, simple correlations between each pair of variables were estimated.

RESULTS

Overall and least squares means for prebreeding weight, percent ewes lambing, lambing date and number of lambs born and weaned are presented separately for Rambouillet and Merino ewes in Tables 1 and 2, respectively. Numbers of observations in each year or age of dam class are given for each character analyzed. The confidence which can be placed in a particular class mean estimate is proportional to the number of observations in the particular class. For example, the means for 2- and 3-year-old dams are estimated with greater precision and smaller standard errors than are means for dams 9 years old and older.

YEARS

The least squares means for years may be taken as a good indication of the magnitude of differences which can be associated with changes from year to year. These changes include both direct effects on the ewes and indirect effects on forage that result from climatic and managerial variables. Climatic variables include rainfall, ambient temperature and days sunlight; managerial variables include supplemental feeding, ram power and parasite control. Both the Rambouillet and Merino data sets contained good samples of years. The effects estimated provide information which may be used in planning production operations as a guide to the kind of year to year variation to expect in production and subsequently in gross income that is tied to lamb production.

AGE OF EWE

The effects of age of ewe on weight and reproduction warrant consideration when making decisions with respect to culling a flock. Furthermore, knowledge of productivity changes with age is useful in projecting flock output.

Prebreeding Weight. Similar, but not identical, patterns were observed in weight changes with age of Rambouillet and Merino ewes. Weight increased up to four or five years of age, where it stabilized. The decline in weight of older ewes was observed to be somewhat variable; this may have been due in part to smaller number of ewes in the older age categories. Weights of ewes were not adjusted for previous year's reproduction; differences among ewes with respect to lambs reared during the previous year would be expected to contribute to variability in weight. Alternative culling procedures may also result in more variation in weights at older ages.

Percent Ewes Lambing. The percentage of ewes lambing of ewes exposed reached stable levels at three to four years of age in the breeds of ewe examined. Percent ewes lambing was found to be relatively stable through eight or nine years of age with a small decline at nine years in Rambouillet ewes. Small numbers of observations in ten year and older age classes indicate that little emphasis should be placed on these older age class means. While one may expect this trait to decrease more rapidly with age, management adjustments and culling of unsound ewes may have helped to maintain levels of percent ewes lambing.

Lambing Date. Increasing age was associated with increasingly earlier lambing date until about four years of age. Lambing date then remained relatively stable from ages five through nine years. Ewes older than nine years, based on these small numbers, tended to lamb later in the season. Earlier lambing date may be due to a combination of events. For example, earlier cycling and earlier conception both reflect a closer approach to optimal conditions for reproduction and probably include effects of such factors as nutritional level and body condition.

Number of Lambs. The patterns observed for numbers of lambs born and weaned were more consistent in Rambouillet (exhibited less variability) than in Merino ewes. Numbers of lambs born and weaned peaked at seven years of age in the Rambouillet ewes; however, values at four, five and six years were near the peak value. In Merino ewes, with smaller numbers of observations per age class, the pattern was similar but much more eratic. With a character such as number of lambs in breeds which produce mostly singles, the nature of the character is such that a difference of one lamb has a tremendous impact on means and on variation. Larger numbers of observations are required to accurately estimate means of this type of character than for a character such as weight. Therefore, the confidence one can place in the Rambouillet age means is considerably greater than that which can be put in the Merino age means.

CORRELATIONS

Simple correlations estimated among the characters reveal positive relationships of prebreeding weight with percent ewes lambing and number of lambs born and weaned; also, heavier ewes tended to lamb earlier in the season. Ewes lambing earlier in the season tended to produce more lambs at birth and weaning.

SUMMARY

The results of the analyses of data on Rambouillet and Merino ewes indicate that year of record and age of dam exert significant influence on weight and reproductive performance of ewes. Effects of age of ewe generally followed a pattern in that peak levels in weight, percent ewes lambing and lambing date were reached at four or five years of age. For number of lambs, the peak was reached at seven years in Rambouillet but was approached by five years of age. Ewes with heavier prebreeding weights tended to lamb earlier and produce a larger number of lambs, on average, per parturition. These results indicate the importance of age of ewe on lamb production; that is, age composition of a flock should be considered in projecting total production and in making selection or culling decisions.

TABLE 1. OVERALL AND LEAST SQUARES MEANS FOR WEIGHT, PERCENT EWES LAMBING, LAMBING DATE AND NUMBER OF LAMBS BORN AND WEANED FROM RAMBOUILLET EWES[a]

Item	N	Weight (pounds)	N	Ewes lambing (percent)	N	Lambing date (days)	Number born (lambs)	Number weaned (lambs)
Overall mean (unadj.)	3380	124.1	4327	81.0	3492	170.3	1.32	1.03
Standard deviation		16.3		37.5		42.0	.46	.58
Adjusted overall mean		126.6±1.6		75.9±2.7		175.7±3.2	1.33±.04	1.04±.04
Year 1957		----	91	89.7±3.7	89	170.2±4.2	1.35±.05	1.16±.06
1958	145	140.3±1.3	145	79.7±3.0	113	161.0±3.7	1.53±.04	1.22±.05
1959	216	136.4±1.1	216	79.9±2.6	152	166.6±3.3	1.45±.04	1.13±.05
1960	268	133.6±1.0	273	72.4±2.2	187	168.5±3.0	1.42±.03	1.19±.04
1961	412	136.9± .8	414	78.4±1.9	352	171.6±2.3	1.35±.03	1.11±.03
1962	322	137.7± .9	323	73.8±2.1	266	166.1±2.5	1.44±.03	1.00±.03
1963	285	128.3± .9	513	77.3±1.7	433	202.2±2.1	1.27±.02	.96±.03
1964	418	122.6± .8	449	68.2±1.9	345	179.8±2.3	1.27±.03	1.01±.03
1965	406	121.4± .8	429	70.2±1.9	345	149.6±2.4	1.17±.03	.92±.03
1966	424	120.4± .8	450	70.7±1.9	359	187.1±2.4	1.23±.03	.95±.03
1967	393	109.7± .9	423	76.9±2.0	364	202.8±2.3	1.33±.03	.92±.03
1968	308	118.3±1.0	318	71.7±2.2	245	184.3±2.8	1.24±.03	.89±.04
1969	283	113.6	283	77.8	242	174.3	1.24	1.06
Age (years)								
1	116	80.4±2.2	117	14.3±4.4	18	214.4±9.8	.99±.11	.79±.14
2	810	108.4±1.7	1070	80.5±2.9	865	175.1±3.6	1.16±.04	.92±.05
3	748	122.3±1.7	802	83.6±3.0	653	165.0±3.6	1.32±.04	1.04±.05
4	635	130.6±1.7	672	86.6±3.0	557	153.0±3.7	1.39±.04	1.11±.05
5	541	135.4±1.7	561	86.1±3.1	467	164.6±3.8	1.44±.04	1.12±.05
6	422	139.4±1.8	459	87.0±3.2	309	174.1±3.9	1.43±.04	1.16±.05
7	330	136.8±1.8	346	87.7±3.3	293	166.4±4.1	1.51±.05	1.21±.06
8	195	135.3±1.9	212	85.2±3.6	181	169.5±4.4	1.46±.05	1.08±.06
9	68	138.7±2.4	72	77.3±4.8	55	160.3±6.1	1.39±.07	1.07±.08
10	13	130.9±4.4	14	55.4±9.5	8	187.2±13.9	1.14±.15	1.09±.19
11	1	134.4	2	91.2	2	203.1	1.40	.85

[a] Means ± SE

[b] Days from June 1

TABLE 2. OVERALL AND LEAST SQUARES MEANS FOR WEIGHT, PERCENT EWES LAMBING, LAMBING DATE AND NUMBER OF LAMBS BORN AND WEANED FROM MERINO EWES[a]

Item	N	Weight (pounds)	N	Ewes lambing (percent)	N	Lambing date[b] (days)	Number born (lambs)	Number weaned (lambs)
Overall mean (unadj.)	528	102.2	582	70.3	409	170.2	1.27	.93
Standard deviation		14.2		43.7		33.1	.43	.53
Adjusted overall mean		101.8±2.0		67.2±6.0		175.2±4.4	1.28±.06	.85±.07
Year								
1958	19	95.8±3.2	21	78.2±9.4	18	165.6±7.5	1.50±.10	.94±.12
1959	38	102.1±2.5	38	74.2±7.7	22	169.5±6.9	1.22±.09	1.03±.11
1960	37	104.5±2.3	37	77.1±7.1	27	158.7±6.3	1.37±.08	.93±.10
1961	35	113.6±2.3	36	63.6±7.1	26	170.0±6.3	1.33±.08	.67±.10
1962	49	113.6±2.0	52	66.7±6.0	34	164.4±5.6	1.43±.07	1.00±.09
1963	71	94.7±1.8	74	53.7±5.4	41	188.1±5.2	1.22±.07	.81±.08
1964	69	103.2±1.8	73	61.6±5.3	52	174.9±4.7	1.14±.06	.76±.08
1965	59	103.0±1.9	71	63.4±5.5	52	166.2±4.8	1.14±.06	.78±.08
1966	53	99.2±2.1	62	66.4±6.0	47	185.6±5.2	1.06±.07	.74±.08
1967	40	94.9±2.3	54	66.8±6.4	41	207.2±5.6	1.35±.07	.95±.09
1968	30	101.8±2.6	34	79.6±7.6	29	183.9±6.4	1.34±.08	.85±.10
1969	28	95.2	30	55.1	20	168.3	1.26	.74
Age (years)								
1	29	75.6±3.5	29	19.0±10.6	7	209.4±12.5	1.27±.16	.66±.20
2	120	89.0±2.5	125	60.1±7.3	71	172.6±5.9	1.13±.08	.94±.10
3	115	103.6±2.5	117	84.6±7.3	95	171.2±5.7	1.22±.07	.94±.09
4	93	109.8±2.6	101	76.1±7.5	75	161.7±6.0	1.41±.08	1.04±.10
5	64	111.4±2.8	74	77.7±8.1	56	161.4±6.5	1.37±.08	1.10±.10
6	46	109.8±2.9	60	76.9±8.4	46	168.8±6.8	1.40±.09	.89±.11
7	35	111.1±3.0	43	76.6±8.8	34	169.0±6.9	1.30±.09	.65±.11
8	17	110.8±3.8	21	79.0±10.7	16	170.9±8.7	1.47±.11	.95±.14
9	5	113.2±6.2	7	87.3±16.4	6	144.7±13.0	1.52±.17	.50±.21
10	2	122.8±9.5	3	67.8±24.0	2	216.6±21.9	.98±.28	.55±.35
11	1	90.6±13.3	1	100.0±41.0	1	180.9	1.01	1.13
12	1	73.9	-	-	-	----	----	----

[a] Means ± SE

[b] Days from June 1.

TABLE 3. CORRELATIONS OF WEIGHT, PERCENT EWES LAMBING, LAMBING DATE, LITTER SIZE AT BIRTH AND LITTER SIZE AT WEANING FOR RAMBOUILLET AND MERINO EWES[a]

Rambouillet / Merino	Weight	Lambing date	Number of lambs born	Number of lambs weaned	Percent ewes lambing
Weight		-.13	.25	.17	.14
Lambing date	-.20		-.02	-.05	
Number of lambs born	.38	-.01		.71	
Number of lambs weaned	.28	-.04	.75		
Percent ewes lambing	.37				

[a] Correlations from Rambouillet data are above the diagonal; from Merino data, below. With the numbers of animals included, correlations greater than .05 in magnitude were statistically significant (P<.01).

PR-3563

PERFORMANCE TEST PROCEDURES FOR ANGORA GOATS

J. W. Bassett, Maurice Shelton and Gary Snowder[1,2]

A performance test program for Angora goats was initiated in 1967 at the Texas A&M University Agricultural Research Station at Sonora and continued for five years. The test procedure was patterned after the ram performance test procedure except for time of initiation. The Angora goat test was started in February after the normal second shearing, so that fleece measurements would represent the yearling fleece period. The feeding period initially was 150 days, which carried into the summer months, but was reduced to 105 days during the fifth year of testing. The tests were discontinued at that point since shearing the goats hindered customary fall selection or sales practices as a result of the short fleeces.

Performance testing is still considered to be a desirable method for genetic improvement for Angora goats, so an alternative testing program for Angora goats was evaluated in 1978-79 at the Texas A&M University Agricultural Research and Extension Center, San Angelo.

PROCEDURE

Feeding was started in October to determine animal performance during the fall-winter season when the animals were younger than previous test periods and also coincided with the rutting season. The test period was continued for 125 days. A total of 72 spring-born Angora males were fed. These were divided into five pens of 11 or 12 goats in order to test potential rations for use in this type of program or for general use with goats. Two basic rations were used as outlined below:

Ingredient	High Protein, %	Low Protein, %
Dehydrated alfalfa	30.0	30.0
Cottonseed hulls	15.0	15.0
Cottonseed meal	22.0	5.0
Ground sorghum grain	27.5	44.5
Molasses	4.0	4.0
Salt	1.0	1.0
Ammonium chloride	0.5	0.5

[1]Respectively, professor, Texas Agricultural Experiment Station, College Station; professor and technician, Texas Agricultural Experiment Station, San Angelo.

[2]Appreciation is expressed to Mr. James Wittenburg, Rocksprings for providing some of the animals for this test.

In addition, methionine hydroxy analog (MHA) was added at both low and high protein levels to measure animal response to this material. Methionine which had been encapsulated in fat to potentially protect it from rumen degradation was added at the low protein level. There was not sufficient material to feed this material at both protein levels. Methionine is an amino acid which is known to stimulate fiber production when present at the tissue level. However, when used as a ration additive it is broken down in the rumen and does not provide the desired stimulation of fiber production. Encapsulation is one potential way to get it past the rumen undegraded. MHA is a synthetic analog of methionine without the amino group which has been alleged to possess the property of passing the rumen undegraded. Following are listed the resulting treatments.

Pen Number	Treatment
1	Low protein
2	Low protein plus MHA
3	Low protein plus encapsulated methionine
4	High protein
5	High protein plus MHA

Animals were self-fed the indicated feeds and feed consumption recorded at weekly intervals. The goats were sheared prior to starting the test and again upon completion of the test to measure fleece production. In addition to grease fleece weight, lock length and type, face cover and kemp were measured or scored and samples taken for measurement of fiber diameter, which has not yet been completed.

RESULTS AND DISCUSSION

The goats weighed from 24 to 62 pounds starting the test, with an average of 42.48 pounds (Table 1). Individual animals had average daily gains ranging from a low of 0.24 pounds to a high of 0.64, but pen averages show very little difference. The low level of performance in the low protein plus MHA group may have been the result of lower feed intake as a consequence of reduced palatability. These average daily gains tend to be higher than those obtained during the first three years of the performance tests and comparable to the last two years when shorter feeding schedules were used.

Average grease fleece weights, lock length, kemp and face scores are again given in Table 2. Individual fleece weights and lock lengths ranged from 2.4 to 7.3 pounds and 3.25 to 5.5 inches, respectively. Kemp and face scores also show a wide variation for these characters. The high protein feed gave a substantial boost in fleece weight as compared to the low protein levels. This was true even while these had shown only a minimal advantage in average daily gain. The addition of MHA decreased fleece weights when added to either the low or high protein rations, as did the addition of encapsulated methionine to the low protein level. This was true even though there appeared to be an increase in lock length with the addition of MHA or encapsulated methionine.

Kemp scores were assigned in a range of 0 to 4, with higher values indicating more kemp. Differences reported here probably do not indicate any differences which can be attributed to the nutritional regimes.

Face cover was scored similarly, from 0 to 4, with the higher numbers indicating more cover over the face. The variation within lots and the small differences between treatment averages indicates that the particular feed treatments had no apparent influence on face cover scores.

SUMMARY

The difference in protein levels had a major influence on grease fleece weights while giving little difference in average daily gains. The addition of methionine hydroxy analog or encapsulated methionine tended to decrease feed consumption at the low protein level and decrease grease fleece weights while increasing lock length. Grease fleece weight was decreased and lock length increased when MHA was added at the high protein level but with the numbers involved these differences would not be statistically significant. The animals appeared to perform satisfactorily when fed during this age and season suggesting the possibility that they could be performance tested during this period of time. The fleece weights are lower than would be expected when the animals were more developed.

The large range of variability for growth and fleece traits among individuals represents the genetic potential for increased fiber production to be gained by selection.

Table 1. BODY WEIGHT MEASUREMENTS*

Treatment	Initial weight lbs.	Final weight lbs.	Gain lbs.	Average daily gain lbs.	Average daily feed consumption, lbs.
Low protein	44.0	101.8	57.8	0.42 (.30-.50)	2.85
Low protein + MHA	43.0	91.0	48.0	0.36 (.24-.51)	2.77
Low protein + encapsulated methionine	41.0	96.0	55.0	0.41 (.31-.49)	2.76
High protein	42.0	101.0	59.0	0.44 (.38-.64)	3.08
High protein + MHA	42.0	102.0	60.0	0.45 (.33-.58)	3.16

*Values in parenthesis represent the range.

Table 2. FLEECE MEASUREMENTS AND FACE SCORES*

Treatment	Fleece weight lbs.	6 mo. basis	Lock Length Side(in.)	6 mo. basis	Kemp Score	Face Cover Score
Low protein	4.70 (3.5-6.4)	6.86	3.9 (3.25-4.7)	5.7	1.3 (0.0-3.0)	1.4 (1.0-2.5)
Low protein + MHA	4.19 (2.9-5.6)	6.12	4.5 (4.1-5.00)	6.5	1.9 (1.0-3.0)	1.4 (0.0-3.5)
Low protein + encapsulated methionine	4.13 (2.4-5.4)	6.03	4.3 (3.4-4.8)	6.3	1.6 (0.0-3.0)	1.2 (0.0-2.5)
High protein	5.93 (3.8-7.3)	8.66	4.4 (3.4-5.5)	6.4	1.2 (0.0-3.0)	1.5 (1.0-3.0)
High protein + MHA	5.34 (4.0-7.0)	7.80	4.6 (4.3-5.05)	6.7	1.9 (1.0-3.0)	1.5 (0.0-3.0)

*Values in parenthesis represent the range.

BREEDING FREQUENCY AND WINTER FEEDING EFFECTS ON LAMB PRODUCTION AND TOTAL EFFICIENCY IN FINEWOOL EWES

J.E. Huston*

Accelerated breeding programs have been used with success to increase the number of lambs produced. They are especially suited to confinement and semi-confinement operations in which the level of nutrition is closely regulated. Less success has been met in the traditional range setting in which nutritional levels fluctuate with changing climatic conditions. A study was initiated during the fall of 1974 to compare the productive efficiency of flocks managed as either conventional fall bred ewes or accelerated ewes, which were exposed to rams at four-month intervals. Five supplemental feed sub-groups were designated within each breeding group to study the possible effects of supplemental feed on productivity.

EXPERIMENTAL PROCEDURE

Details of ewe management and feeding are described elsewhere in this consolidated report (Huston, 1979). Lambs were weaned from the conventional ewes on or about June 1 each year during the four-year study. Lambs weighing 85 pounds or more at weaning were sold as milk lambs. Lighter lambs were placed on a high concentrate feeder lamb ration and were sold as they reached acceptable size and finish for slaughter. Lambs from accelerated ewes were weaned at about 75 days of age, placed on feed and sold as they reached acceptable market quality. All lambs were sold at public auction. All ewes were one-year old when added to the study. The experiment was terminated when the last lambs that were produced during the fourth year of the experiment were sold.

RESULTS AND DISCUSSION

Accelerated ewes gave birth to more lambs and weaned more lambs than conventional ewes (Table 1). However, the average weaning weight was higher in lambs from conventional ewes, resulting in approximately equal total weaned lamb between the two groups. The lighter average weaning weight for the accelerated lambs was a result of less advantageous growth periods for the summer and fall lambs and because they were younger at weaning.

Accelerated lambs required an additional 25.5 days, on the average, to reach approximately the same sell weight as conventional lambs (Table 2). However, the accelerated lambs gained faster and more efficiently in the feedlot because they were younger when placed on feed and were fed during the cooler seasons of the year. More weight of lamb was sold from the accelerated group, but at an additional cost of lamb feed of just over 100 pounds per ewe per year.

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The greater total lamb weight sold from the accelerated group, plus a slightly higher price received, resulted in a greater gross return of $14.38. After the cost of feed is deducted, the difference in gross return above feed cost was reduced to $7.63 per ewe per year.

It is surprising that the data on the effects of supplemental feed (Tables 4,5, and 6) does not show any consistent benefit from feeding at any level. The small differences recorded are not statistically significant ($P>.05$) and may be a result of chance. These results indicate that the most desirable feed treatment was the control, no feed at all. Results discussed in a following report on attrition rate (Huston, 1979) are consistent with this conclusion. However, an unqualified acceptance of this would be dangerous, since mitigating circumstances could totally change these results. It was the author's observation that this study was conducted during a series of years having unusually favorable growing conditions. Conventional ewes that were in varying degrees of body condition at the beginning of the growing season tended to be rather uniform in condition by September. Accelerated ewes had a good conception rate in May and June of the first year but did not breed well during the January-February breeding season; thus, they became locked into a once-a-year fall lambing flock. Although feed levels did affect body weight as reported earlier (Huston, 1979), rapid recovery that occurred during these favorable growing seasons tended to mask the effect of supplemental feed. These results are a dramatic example of fallacy of blanket recommendations for supplemental feeding of sheep. Meaningful recommendations must be based on a broader aspect than average seasonal changes.

LITERATURE CITED

1. Huston, J. E. 1979. Breeding frequency and winter feeding program effects on attrition rate in finewool ewes. Texas Agr. Exp. Sta. PR-3565.

TABLE 1. EFFECTS OF BREEDING SYSTEM ON NUMBER OF LAMBS AND LAMB WEIGHTS

	Breeding System	
Item	Conventional	Accelerated
Ewe years	240	254
Lambs born/ewe/yr.	1.15[a]	1.34[b]
Lambs weaned/ewe/yr.	0.88[a]	1.15[b]
Average weaning wt. (lb)	69.4[a]	49.3[b]
Lamb wt. weaned/ewe/yr. (lb)	61.1[a]	56.9[a]

[a,b] Values having different superscript letter in the same row differ significantly ($P<.05$).

TABLE 2. EFFECTS OF BREEDING SYSTEM ON FEEDLOT PERFORMANCE AND TOTAL SALE OF LAMBS

Item	Breeding System: Conventional	Breeding System: Accelerated
Number of days in feedlot	62.7[a]	88.2[b]
Average daily gain (lb)	0.43[a]	0.54[b]
Average daily feed intake (lb)	2.7	3.1
Feed conversion	6.3	5.7
Average sell wt. (lb)	97.8	97.4
Wt. of lamb sold/ewe/yr. (lb)	81.1[a]	100.4[b]
Lamb feed required/ewe/yr. (lb)	171.6	276.8

[a,b] Values having different superscript letters in the same row differ significantly ($P<.05$).

TABLE 3. EFFECTS OF BREEDING SYSTEM ON PRICE RECEIVED AND OVERALL RETURN ON LAMBS

Item	Breeding System: Conventional	Breeding System: Accelerated
Ave. price received/lb.	$ 0.52	$ 0.57
Gross return/lamb	50.98	55.30
Gross return/ewe/year	42.27	56.65
Feed costs		
Lamb feed @ 6¢/lb.	10.29	16.61
Ewe feed @ 8¢/lb.	3.52	3.65
Total	13.81	20.26
Return above feed cost	28.46	36.39

TABLE 4. EFFECTS OF SUPPLEMENTAL FEED TREATMENTS ON NUMBER OF LAMBS BORN AND WEANED, WEANING WEIGHTS, AND TOTAL WEANED LAMB

	Feed Treatment Groups				
Item	1 Control	2 Low	3 Medium	4 High	5 Low-High
Ewe years	101	94	100	98	101
Lambs born/ewe/yr.	1.16	1.32	1.16	1.30	1.31
Lambs sold/ewe/yr.	0.92	0.90	0.91	1.02	0.91
Ave. weaning wt.	56.2	55.9	59.3	57.2	60.1
Weight of lamb weaned/ewe/yr.	56.7	56.5	56.9	61.9	62.5

TABLE 5. EFFECTS OF SUPPLEMENTAL FEED TREATMENTS ON FEEDLOT PERFORMANCE AND TOTAL SALE OF LAMBS

	Feed Treatment Groups				
Item	1 Control	2 Low	3 Medium	4 High	5 Low-High
Ewe years	101	94	100	98	101
Lambs weaned/ewe/yr.	1.01	1.01	0.96	1.08	1.04
Lambs sold/ewe/yr.	0.92	0.90	0.91	1.02	0.91
Days in feedlot	80.2	77.4	75.2	79.9	72.9
Ave. daily gain	0.50	0.51	0.48	0.48	0.52
Daily consumption	3.1	3.1	2.9	2.8	3.2
Total feed consumption					
Per lamb	245	242	217	222	233
Per ewe/yr.	225	217	197	226	212

TABLE 6. EFFECTS OF SUPPLEMENTAL FEED TREATMENTS ON PRICE RECEIVED AND OVERALL RETURN ON LAMBS

	Feed Treatment Groups				
Item	1 Control	2 Low	3 Medium	4 High	5 Low-High
Ewe years	101	94	100	98	101
Ave. sell wt.	97.8	96.2	97.8	96.7	98.9
Price received/lb.	$0.56	0.54	0.54	0.55	0.55
Gross return/lamb	54.77	51.95	52.81	53.18	54.40
Gross return/ewe/yr.	50.46	47.14	48.06	54.23	49.56
Feed costs					
Lamb feed @ 6¢/lb.	13.53	13.04	11.83	13.58	12.73
Ewe feed @ 8¢/lb.	-	2.26	4.52	6.78	4.40
Total	13.53	15.30	16.35	20.36	17.13
Return above feed cost	36.93	31.84	31.71	33.87	32.43

PR-3565

BREEDING FREQUENCY AND WINTER FEEDING PROGRAM EFFECTS ON ATTRITION RATE IN FINEWOOL EWES

J.E. Huston*

One method of increasing the reproductive rate of Texas finewool ewes is to shorten the breeding interval to less than one year. Except for a few weeks between late March and early May, Texas finewool ewes cycle at a sufficient rate to breed throughout the year. Earlier reports have documented that finewool ewes can produce more lambs if they are exposed to breeding more frequently than once per year. Some have voiced concern that frequent breeding may result in a higher attrition rate. A four-year study was conducted to determine the effects of breeding frequency and winter feeding practices on various aspects of wool and lamb production. The following data and discussion are related to the weights and attrition rates of ewes in the study.

EXPERIMENTAL PROCEDURE

A total of 165 yearling, commercial Rambouillet ewes were selected visually for uniformity and were assigned randomly to experimental groups. One-half of the ewes were treated as a conventional breeding group (i.e., bred to lamb in Feb.-Mar.) and the other half were exposed to rams for 40 days at four-month intervals beginning September 15, January 15 and May 15. This accelerated breeding made an eight-month lambing interval possible. In four years, the accelerated group could potentially produce six lamb crops, compared with a maximum of four for the conventional group. Within each breeding group, the ewes were divided into five sub-groups to study the effects of winter supplementation on the observed performance. Two ration formulations differing in protein content (table 1) were used. Feed was provided during a 100-day feeding period from December 20 through March 31 (table 2). The ewes were grazed in a mixed grass and forb area that provided for diets lower in quality (protein and energy) than the suggested requirements (Huston, 1978). The entire flock, including control ewes, was penned three times per week during the feeding period and fed individually so that each ewe received the assigned supplement in the proper amount. Ewe weights and deaths were recorded.

RESULTS AND DISCUSSION

Some small differences were observed in the average weight changes of the ewes during the four-year period (table 3). Since beginning and ending weight data is available for only the surviving ewes, the trends may not accurately reflect the total effects of the treatments. The control ewes were the lightest in both breeding groups. The small differences among the fed groups do not appear to follow a definite trend. Overall, the conventional ewes outgained the accelerated ewes by 4.9 pounds or about 20%.

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Several ewes were lost from the study during incidents not related to treatments. These included hauling accidents, dog predation, etc. and are referred to as non-related deaths. These deaths were not considered in determining attrition rates. Deaths from unknown causes were considered to be related to treatment since they were likely caused by lack of vigor and lowered resistance to disease, parasites, adverse climate, etc.

The attrition rate was not decreased as a result of increased winter feeding level in this study (Table 4). On the contrary, there appears to be a higher death rate in fed ewes, especially those fed at a low level. A previously reported diet study (Huston, 1978) showed that supplemental feed replaces part of the forage and the total forage consumption is actually decreased. However, total feed and total nutrient consumption becomes greater as greater amounts of supplemental feed are given. Therefore, the fed groups should have been receiving a higher level of nutrition, which is consistent with the weight data (Table 3). It is possible that the fed groups were exhibiting a type of psychological addiction to feed that resulted in an adverse behavioral change. Further studies on the influence of feeding practices on animal behavior are planned.

A higher attrition rate was observed in the conventional breeding group than in the accelerated group (Table 4). This documents that accelerated breeding does not result in a greater attrition rate in ewes up to five years of age.

LITERATURE CITED

1. Huston, J.E. 1978. Effect of supplemental feed on voluntary forage consumption by pregnant and lactating ewes. Texas Agr. Exp. Sta. PR-3501.

TABLE 1. COMPOSITION OF FEED CONCENTRATES USED IN A FOUR-YEAR STUDY COMPARING BREEDING FREQUENCY AND FEEDING LEVEL

	Feed Concentrate	
	1	2
	%	%
Ingredients		
Cottonseed meal	80	50
Sorghum grain	18	48
Molasses	2	2
	100	100
Approximate Nutrient Composition		
Crude protein	36	24
Digestible organic matter[1]	75	77
Phosphorus	0.86	0.65

[1]Approximately equivalent to Total Digestible Nutrients (TDN).

TABLE 2. FEEDING SCHEME FOR EWES DURING A FOUR-YEAR STUDY COMPARING BREEDING FREQUENCY AND FEEDING LEVEL

Item	Feed Treatment Groups				
	Control	Low	Medium	High	Low-High
Nutrients supplied (% of required)					
Crude protein	0	33	66	66	33-66
Digestible energy	0	10	20	30	10-30
Feed and level of feeding					
Non-lactating ewes					
Concentrate[1]	0	1	1	2	1
Amount (lb/day)	0	0.25	0.50	0.75	0.25
Lactating ewes					
Concentrate[1]	0	1	1	2	2
Amount (lb/day)	0	0.33	0.67	1.0	1.0

[1] Table 1.

TABLE 3. WEIGHT CHANGE IN EWES DURING A FOUR-YEAR STUDY COMPARING BREEDING FREQUENCY AND WINTER FEEDING LEVEL

	Feed Treatment Groups				
	1 Control	2 Low	3 Medium	4 High	5 Low-High
			(lb)		
Conventional Group					
Initial Weight	102.9	101.7	105.6	105.5	104.4
Final Weight	129.0	130.0	140.2	133.8	132.9
Weight Change	26.1	28.3	34.6	28.3	28.5
Accelerated Group					
Initial Weight	106.3	106.2	105.4	107.4	105.9
Final Weight	126.5	126.8	132.1	132.7	133.3
Weight Change	20.5	20.6	26.7	25.3	27.4
Total					
Initial Weight	104.6	103.7	105.5	106.6	105.2
Final Weight	127.8	128.6	136.0	133.2	133.1
Weight Change	23.2	24.9	30.5	26.6	27.9

	Conventional	Accelerated
Weight Change Across All Feed Treatments	29.3	24.4

TABLE 4. ATTRITION RATE IN EWES DURING A FOUR-YEAR STUDY COMPARING BREEDING FREQUENCY AND FEEDING LEVEL

	Feed Treatment Groups				
	Control	Low	Medium	High	Low-High
Conventional Group					
Number of ewes added	18	17	19	19	16
Non-related deaths	2	2	3	3	1
Ewes remaining	14	11	13	11	13
% Attrition	12.5	26.7	18.8	31.2	13.3
Accelerated Group					
Number of ewes added	15	15	15	15	16
Non-related deaths	0	2	0	0	0
Ewes remaining	14	9	14	14	14
% Attrition	6.7	30.8	6.7	6.7	12.5
Total					
Number of ewes added	33	32	34	34	32
Non-related deaths	2	4	3	3	1
Ewes remaining	28	20	27	25	27
% Attrition	9.7	28.6	12.9	19.4	12.9

Total Conventional Attrition - 20.5%
Total Accelerated Attrition - 12.2%

PR-3566

POTENTIAL METHODS FOR PREGNANCY DIAGNOSIS IN THE GOAT

M. Shelton, P. Thompson, J.L. Fleeger and D. Bartlett*

An accurate and economical method of diagnosing pregnancy can potentially contribute to more efficient management with any species. This subject has been extensively investigated with sheep and cattle, but less so with goats.

MATERIALS AND METHODS

In this study, a preliminary evaluation was made of several potential techniques for diagnosing pregnancy in the goat. Included among the methods tested were ballottement, the use of ultrasonics, recto-abdominal palpation, doppler shift principle and blood progesterone levels. The term ballottement refers to attempts to "bump" or palpate the fetus through the abdominal wall using the hand or fist. This method proved unsatisfactory and no data are reported for this method. The ultrasonic principle utilized an instrument known as the "scanopreg" which indicates pregnancy by the differential sound deflecting properties of uterine fluid and body tissue. This method was described in more detail by Thompson, Shelton and Ahlschwede (1978). The recto abdominal palpation consists of passing a rod into the rectum and palpating the presence of the fetus or gravid uterus between the rod and the open hand placed on the belly of the nanny immediately forward of the udder (Hulet 1972). The doppler shift procedure consists of identifying the fetal or uterine circulation based on a probe placed in the rectum. The instrument used in these studies was known as the "Scanoprobe". For both the recto abdominal palpation and doppler shift method the female must be placed on her back. Progesterone is a hormone produced by the corpus luteum of the ovary and in some cases, the placenta. One function it serves in the animal is to maintain pregnancy. Thus the presence of a high level of blood progesterone may be an indication of pregnancy. In this case, a blood sample was collected from the jugular vein and the circulating progesterone level in the blood serum was determined by a procedure known as radio-immunoassay. This work was done at the Physiology of Reproduction Laboratory, Department of Animal Science at College Station. Based on an examination of the data collected 2.0 mg or more of progesterone per ml was used as an indication of pregnancy. Actually all animals which were correctly diagnosed as open had less than 1.5 and all correctly diagnosed as pregnant had more than 2.0 mg/ml.

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The operators were generally inexperienced in the application of these procedures to goats, and this especially applies to the work with the doppler instrument. The observations were made reasonably quickly (on order of one minute or less) as one might expect to be realistic in commercial practice. Thus some improvement in accuracy might be obtained with more experience or more time per animal.

The basic part of the study consisted of evaluating a group of Spanish or Meat type females which had been with males but on which no breeding information was available. They were subsequently slaughtered at the plant operated by Swift & Co. in Brownwood, Texas with the reproductive tracts being recovered for identifying status of pregnancy. A few were carried to term. The approximate stage of gestation of slaughter animals was calculated from the following formula:

Crown rump length in inches X .149+30 = age in days

This formula was calculated from Angora goats and may have over estimated the age of the type of goats used. However, the method is thought to be satisfactory for the grouping as used. Since an embryo less than approximately 25 days is not readily observed, animals pregnant less than this period of time would have been classified as open at slaughter.

RESULTS

The results are shown in table 1. These data suggest that each of the procedures met with some success in identifying those animals which were pregnant for more than 60 days, with the "Scanopreg" and blood progesterone levels being most accurate. Only one of 28 does which was pregnant for more than 60 days was erroneously diagnosed open, utilizing blood progesterone levels. This doe kidded three days later indicating that the corpus luteum had started regressing due to imminent parturition. In commercial practice there would be no need to test an animal of this type for pregnancy. Only blood progesterone levels appeared to be useful in identifying those pregnant less than 60 days. The doppler instrument might have been expected to be more accurate in this range and the failure to do so may have been due to inexperience of the operator with the use of this equipment with goats.

These data suggest that ultrasound (Scanopreg) and progesterone assay would hold greater interest for use with goats. The use of ultrasound procedure has found some use by the sheep industry, and these data suggest that it can also be utilized for goats. However, some experience with sorting Angora goats indicates a significant number of false positives (16%), but any abortions which occurred between testing and kidding would be recorded as a false positive. Most flocks of Angora goats do experience a few abortions. Another problem which should be mentioned is that most goats do not have a bare skin area in the flank as do sheep, and thus more problems are encountered in making good contact between the probe and the skin. It may actually be necessary to shear a spot to assure good contact between the probe and the skin. The use of progesterone assay as a means of diagnosing pregnancy would be more likely to find use as a research tool, because of the cost of using it in routine practice. These data indicate the procedure to be highly accurate except for several false positive readings. In fact, it may well be that these does were pregnant, but too recent for the fetus to be obvious. However, an equally likely explanation is that the goats were cycling and the goats were sampled at the stage in the cycle when the progesterone output from the corpus luteum was at its maximum. Thus, for this procedure to be totally satisfactory it would need to be on goats in which the breeding dates were known or during the season when the open goats would be in anestrus. If breeding dates are known testing can be done as early as 20-21 days following mating. In commercial operations a knowledge of the breeding dates would not usually be available. An alternative approach would be to do duplicate tests at something like 10 days apart. This should eliminate most of the false positive readings. In these studies progesterone levels could not be used to determine the number of embryos, but in the group of animals involved only a small number carried twins and none were carrying triplets. The data do appear to suggest some placental progesterone production by the doe. Those correctly identified as open had a mean value of 635 ng/ml, similar values for those pregnant less than 50 days were 4,412 ng/ml, 50 to 100 days - 6,906 ng/ml and over 100 days 6,952 ng/ml.

LITERATURE CITED

1. Hulet, C. V. 1972. A rectal-abdominal palpation technique for diagnosing pregnancy in the ewe. Journal of Animal Science. 34:814.

2. Thompson, P., M. Shelton and G. Ahlschwede. 1978. A pregnancy-detecting device. Texas Agriculture Experiment Station. PR-3498.

TABLE 1. RESULTS OF FOUR POTENTIAL METHODS OF PREGNANCY DIAGNOSIS

Method	Total Observations	Open Does			Preg. Less Than 60 Days			Preg. More Than 60 Days		
		No.	% Correctly Class. Open	% Erroneously Class. Preg.	No.	% Correctly Class. Preg.	% Erroneously Class. Open	No.	% Correctly Class. Preg.	% Erroneously Class. Open
Scano-Preg	254[1/]	113	96.5	3.5	65	3.1	96.9	76	96.0	4.0
Palpa-tation	81	37	83.8	16.2	16	37.5	62.5	28	82.1	17.9
Doppler	80	37	94.6	5.4	16	18.8	81.2	27	85.2	14.8
Proges-terone Assay	83	39	84.6	15.4	16	100.0	0.0	28	96.4	3.6[2/]

1/ These data contain repeat observations on the same animal taken on different dates or by different operators.

2/ This represents only one animal which kidded three days after the blood sample was taken indicating that blood progesterone levels were dropping due to imminent parturition.

PR-3567

EFFECT OF SEASON OF BIRTH ON FEEDLOT PERFORMANCE AND VALUE OF EARLY WEANED LAMBS

J.E. Huston*

Lambs produced from accelerated lambing systems tend to be very unattractive because of the disadvantageous time of birth of some of these lambs and the early age at weaning. A four-year study was conducted at the Texas A&M University Agricultural Research and Extension Center at San Angelo in which one-half of a uniform flock of Rambouillet ewes were subjected to breeding at four-month intervals. Lambs were weaned at approximately 75 days of age irrespective of season. During these four years, 12 ewes successfully weaned lambs during all three possible seasons. These were subsequently fed to market quality on an identical high concentrate ration and sold at public auction. Individual records on feedlot performance and market value are summarized and reported.

RESULTS AND DISCUSSION

Season of birth related closely to feedlot performance (Table 1). Spring lambs were heaviest and fall lambs lightest at weaning. Summer lambs were intermediate. The observed rate of gain was in reverse order; however, the difference in rate of gain between spring and summer lambs was not significant (P>.05). Time in the feedlot was extended for all groups, and the differences were not significant (P>.05). The selling price was also greater for the summer and fall than for the spring lambs (P<.05).

One of the traits of an accelerated lambing program is that each season offers a different challenge but also a different opportunity. Lambs born in the summer and fall are much less attractive than spring lambs. However, cooler feeding conditions and a usually greater demand offer a profit potential for producers who can take advantage of it. The lack of facilities and/or the lack of desire to maintain ownership of lambs during the feeding phase probably erases this opportunity.

TABLE 1. FEEDLOT PERFORMANCE AND MARKET VALUE OF EARLY WEANED LAMBS BORN DURING THREE SEASONS

Item	Season of Birth		
	Spring	Summer	Fall
Weaning wt. (lbs)	59.3[a]	49.7[b]	40.8[c]
Ave. daily gain (lbs)	.46[a]	.51[a]	.60[b]
Time in feedlot (days)	80.5[a]	100.8[a]	89.6[a]
Price received ($/100 wt)	50.40[a]	59.50[b]	61.20[b]

[a,b] Values in the same row having different superscript letters are significantly different (P<.05).

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PR-3568

AN EVALUATION OF FOUR MANAGEMENT SYSTEMS FOR THE PRODUCTION OF MARKET LAMBS

Maurice Shelton, Phil Thompson and M.C. Calhoun *

It has been shown that meat can be produced more efficiently from sheep by slaughtering lambs at heavier weights than is traditional in this country. However, these heavier weights are often discriminated against on the market. One of the reasons often given for this is that they are too fat. Thus, there is a need to devise management schemes to produce leaner carcasses. Lambs may be produced in this state at any time of the year, but the largest majority are born in the spring, with weaning in late summer or early fall. The present study was intended to study alternative management schemes for the spring-born lambs, in terms of income to the industry and in terms of the potential to produce a larger and leaner type of lamb.

MATERIALS AND METHODS

Spring-born lambs from the Winters-Wall ranch at Brady were used for this study, which involved a total of 565 lambs from the 1975, '76, and '77 lamb crops (year of birth). The available wether lambs within each year were divided into the following treatment groups:

1. Placed directly into feedlot at fall weaning,
2. Placed on oat or grain-field grazing as soon as available and marketed for slaughter from grain fields or with a short period of feeding as required to produce choice carcasses,
3. Grazed on native range and placed in feedlot in mid-winter (February of each year),
4. Grazed until the following spring on native pasture and marketed (in May or June) for slaughter directly from pasture or following a short feeding period as necessary to produce choice grade slaughter lambs.

Lambs from treatment No. 2 (small grain grazing) required a period of feeding in two of the three years. The actual feeding periods for these lambs were: 1975-none, 1976-65 days, 1977-27 days. The animals on treatment Number 4 required a short period on feed in each of the three years. The feed periods ranged from 24 to 30 days.

All lambs were initially weighed and assigned to treatment groups in the early fall (September or October) of each year. Subsequently, they were weighed periodically while grazing on pasture or grain fields and at seven-day intervals while in drylot. Lambs were vaccinated for protection against enterotoxemia before being placed on feed in drylot.

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One lot in one year was erroneously placed on feed without prior vaccination with several losses from enterotoxemia. Since this represented a management error for the one year, these losses are not considered in the economic analyses. The diets used in the drylot feeding portions of each trial were complete, mixed rations based on dry-rolled sorghum grain with either cottonseed hulls or ground peanut hulls as the roughage source. The starter, intermediate, and finisher diets were comprised of 40, 25, and 10% roughage, respectively. In some years the lambs on pasture were fed a salt-limiting protein supplement to maintain them in strong condition.

All lambs were slaughtered either at a commercial plant in San Angelo (Armour & Co.) or at the Texas A&M Meats Laboratory in College Station. The carcass data collected included carcass weight, U.S.D.A. quality and yield grades, backfat thickness and estimated kidney fat. In San Angelo the quality grades and the scores necessary to calculate yield grade were assigned by the official U.S.D.A. grader while in College Station they were assigned by staff members of the Department of Animal Science. Other data were collected by project personnel. The various groups actually varied over the years in slaughter and carcass weights. In efforts to compare groups relative to carcass data, all carcass traits were adjusted for differences in carcass weight by appropriate statistical procedures.

RESULTS

The various measures of carcass traits are shown in Table 1. Statistically significant differences associated with treatment were observed for all traits studied. However, the results are not entirely consistent between years. In general, there appears to be a distinct tendency for those lambs which put on most of their gain in the feedlot to deposit more fat internally as kidney fat with less subcutaneous fat. This generally translates to those which were carried for a longer period of time on pasture to being leaner lambs at a given carcass weight. This suggests that packers should find less reason to discriminate against heavier lambs when these lambs have been run in pasture for a longer period of time relative to drylot feeding. However, the differences were small and could be negated for environmental or management variables. Those lambs which were grazed on oat pasture tend to be leaner lambs except for the unexplained reversal of this trend with the 1977 lambs.

Data relative to economic interpretation are shown in Table 2. In these analyses, feed has been included at actual costs. Small grain grazing was calculated at 7.5¢ per day. A charge of $2.50 per head was charged for native pasture for those lambs which were placed on feed in midwinter, and a charge of $5.00 per head for those carried on native pasture to the following spring. No labor or finance charges have been included. The lambs were not actually purchased, but an attempt was made to place a realistic value on the lamb at the initiation of the study. These data are calculated on a per head basis, and death losses are not included in the calculations. This appears to require some explanation. Most death losses tended to be associated with placing lambs on feed, and since essentially all lambs required a period of time on feed, those losses tend to be at random relative to treatment. As mentioned earlier, lambs in one year were erronously placed on feed without previous vaccination for enterotoxemia, and several losses were encountered due to causes not related to treatment. In the case of lambs which were wintered on pasture, some cases occurred where lambs were missing at working due to not gathering or straying from pasture, losing identity, or other cases not related to treatment. Thus, with the small numbers involved, inclusion of death losses tended to distort the economic interpretation.

It will be noted that each year a different treatment gave the most favorable results. In general the differences are of such magnitude that favorable price breaks or environmental conditions could place one treatment at an advantage over the other. In general the data suggest that grazing on grain fields would be the management system of choice when this option is available. This will scarcely be a surprise to producers, but the economic results could change depending on the value placed on field grazing. Placing lambs directly in the feedlot at weaning gave the poorest return in two of the three years. This suggests that the industry should consider holding the lambs for a period of time which could be greatly dependent on general forage availability. However, it should be noted that the most successful operator will be the one who predicts favorable environmental or economic conditions within a given year. The possibility or carrying feeder lambs for a period post weaning provides an opportunity to adjust stocking rates to forage availability. This practice also provides a potential opportunity to increase the market weight of lamb and wool from the basic ewe population.

TABLE 1. LEAST SQUARE MEANS FOR CARCASS DATA ADJUSTED FOR DIFFERENCES IN CARCASS WEIGHTS (all data adjusted to mean carcass weight of 53.9 pounds)

Year of Birth of Lamb	75				76				77				Overall			
Treatment	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
No. of Animals	60	60	60	60	49	49	50	50	35	29	30	33	144	138	140	143
Back Fat Thickness (in.)	.189	.211	.161	.214	.165	.183	.155	.147	.169	.242	.270	.222	.175	.212	.195	.194
% Kidney Fat	5.66	3.30	2.75	2.28	4.58	3.16	4.68	3.47	2.59	3.25	4.30	3.04	4.28	3.24	3.91	2.93
USDA Quality Grade	11.37	10.46	11.43	10.48	11.64	10.95	10.78	10.72	11.91	11.46	11.85	10.48	11.64	10.96	11.35	10.56
USDA Yield Grade	3.76	3.34	2.86	3.14	3.30	3.07	3.32	2.96	2.84	3.53	3.93	3.35	3.30	3.31	3.37	3.15

TABLE 2. EFFECTS OF MANAGEMENT SYSTEMS ON COSTS AND RETURNS PER ANIMAL

Year	1975				1976				1977[1]				Overall			
Treatment	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Animal Cost	$24.00	$24.00	$24.00	$24.00	$33.62	$32.09	$33.45	$34.20	$35.39	$37.50	$36.70	$34.44	$30.04	$30.62	$30.10	$30.88
Shearing	0.76	0.81	0.81	0.76	0.91	0.91	0.91	0.91	-	0.94	0.91	0.94	0.83	0.86	0.86	0.86
Medicine	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.13	0.19	0.13	0.13	0.21	0.14	0.14	0.14	0.15
Feed	18.35	7.59	17.66	19.61	20.58	15.60	25.04	7.51	9.45	15.48	18.79	11.09	16.53	12.89	20.50	12.74
Total Cost	43.24	32.53	42.60	44.51	55.24	48.73	59.53	42.75	45.03	54.05	56.53	46.68	47.54	45.10	52.88	44.65
Wool Income	2.74	2.66	3.60	5.48	5.32	6.38	4.20	6.10	-	2.69	3.96	4.37	2.95	4.25	3.62	5.45
Lamb Income	52.51	52.35	52.85	44.06	51.99	49.70	49.39	47.00	52.95	69.04	69.17	63.34	52.82	55.28	55.93	49.67
Total Sales	55.25	55.01	56.45	49.54	57.31	56.08	53.59	53.10	52.95	71.73	73.13	67.71	55.77	59.53	59.55	55.12
Return Over Cash Costs[2]	$12.01	$22.48	$13.85	$ 5.03	$ 2.07	$ 7.35	$-5.94	$10.35	$ 7.92	$17.68	$16.60	$21.03	$ 8.23	$15.84	$ 8.17	$12.14

[1]All lambs had been shorn prior to groupging this year.

[2]In this case, the estimated initial value of the lamb is considered a cash cost.

PR-3569

RATIONS FOR DRYLOT FEEDING OF EWES

Gary Snowder and Maurice Shelton *

INTRODUCTION

Traditionally ewes have been culled from Texas ranches at advanced ages based on chronological age or condition of mouth, body or udder. Removal from range flocks usually occurs between the ages of 5 and 8 years. In the past, they have often gone to the slaughter market at a sacrifice price. The current demand for breeding ewes and the recent favorable market for fat slaughter ewes suggests that efforts should be made to explore economical programs for drylot feeding of these aged ewes. Ewes might be temporarily fed in drylot to put fat on the ewes to improve their market value or to maintain them sufficiently long enough to obtain an additional lamb. For these reasons a feeding trial was undertaken to explore these possibilities.

EXPERIMENTAL PROCEDURES

One hundred and sixteen aged Rambouillet ewes were used for this experiment, which was conducted in the Fall of 1978. The ewes were from two different sources of which 57 were obtained at the local auction market and represented broken mouth shelly ewes. The remaining 59 ewes come from the San Angelo Research Center flock. The ewes were shorn, eartagged, weighed and drenched for internal parasites. Ten ewes from each group were slaughtered at the initiation of the experiment to obtain reference carcass data.

Four feed treatments were employed within each source of ewe. The treatments consisted of pelleted alfalfa, a mixed pelleted ration based on cottonseed hulls, pelleted cotton gin trash (cotton plant by-product) (with 10% molasses added) or pelleted cotton gin trash (10% molasses added) supplemented with a salt-limited concentrate. Composition of the diets is shown in Table 1. The basic diets were group fed for a 28-day period on an *ad libitum* basis. Supplemental concentrate with treatment four was fed 3 times weekly in controlled amounts.

Two rams were added to each group of ewes and rotated daily. Breeding data were collected daily by the use of marking pigment placed on the chest of the rams. At the end of the experiment all ewes were slaughtered through a local slaughter facility to obtain carcass data and reproductive performance.

RESULTS AND DISCUSSION

Performance and carcass data are summarized in Tables 2 and 3.

The ewes obtained at auction for this study adapted slowly to the new environment and had lower initial scores and weights than the ewes from the San Angelo Research Center. For this reason purchased ewes did not perform equally as well and had significantly lower gains within

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each treatment. However, though these gains and associated traits such as final and carcass weights were lower, they were consistent with the overall treatment effects.

Live weight gains were maximum in the alfalfa pellets and the cotton seed hull-based ration. These two treatments were not significantly different in overall performance. Gains were lower in ewes fed pelleted cotton gin trash. The ewes on an unsupplemented cotton gin trash diet lost weight. All ewes consuming pelleted cotton gin trash adjusted slowly to these treatments. A period of approximately 7 to 10 days was necessary for this adjustment since weight loss was greatest and feed consumption lowest during this period. Two ewes purchased at auction that were fed on unsupplemented cotton gin trash died during this period from diagnosed starvation. Possible contributing factors to the poor performance on the cotton gin trash pellets may have been the large size (½ inch pellet) and hardness of the pellet.

Initial and final body scores were based on a subjective visual appraisal on a scale of 1 to 10 and averaged for 3 or more judges. All treatments were similar in initial body scores. However, the final body scores were influenced by the treatments. Final body scores of ewes on the cotton gin trash diets were significantly lower than for the alfalfa and the cotton seed hull rations. The unsupplemented cotton gin trash treatment showed the only decrease in body condition scores. Carcass weight data reflect the changes in live weight and body score, showing a greater efficiency of cotton gin trash when supplemented with another protein and energy source to compensate for lower feed intake.

Comparison of treatment performance with slaughtered reference ewes for initial data show an increase with respect to origin in body condition, live weight and carcass weight in all but one treatment. The unsupplemented cotton gin trash treatment had lower performance in these characteristics than the initial reference ewes.

Reproductive data are summarized in Table 4. Surprisingly treatments had no significant effect on the ability of the ewe to show estrus and to ovulate as even those ewes losing weight cycled as well as the other lots. Although ovulation was not noticeably affected by the treatments employed, the ewes losing weight did have fewer embryos at slaughter. In earlier experiments (Shelton, 1978) an apparent adverse effect of alfalfa on fertility was noted. In this study it should be noted that the percent of ovulation points represented by embryos were lower for the alfalfa group than the other comparable fed group (cotton seed hull ration), but such differences would not approach statistical significance.

On a daily cost per ewe basis the treatments utilizing the cotton industry's by-products were considerably lower. In regards to maintaining a ewe and allowing her to breed and reproduce such feeds may be at an economical advantage to producers.

The costs of gain were calculated to economically compare the varied treatments (Table 3). Feed prices were adjusted to August 1978 costs. The feeding of cotton gin trash alone resulted in weight loss and associated deaths of 2 ewes; therefore, this treatment was not considered for economic comparison. Supplemented cotton gin trash showed the lowest cost of live and carcass weight gain; however, the gains within the treatment were significantly slower than other treatments, suggesting longer feeding periods with increased labor over time to attain equal gain with the other treatments. The cotton seed hull ration had a cost of 35 cents per pound of carcass weight gain with an average daily gain of live weight of .76 lb. The costs of live and carcass weight gains per pound in the alfalfa ration were 35% higher than the cotton seed hull ration with an approximately equal average daily gain of .61 lb. Based on current ewe carcass prices the economic return to be realized for feeding of ewes would be minimal or uneconomic based on weight gains alone, but may often be justified based on margin or increase in sale price over initial value.

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TABLE 1. PERCENT INGREDIENT COMPOSITION OF EXPERIMENT DIETS

Ration No.		Ingredient, %	Cost, $/Ton
1	Pelleted alfalfa[1/]	100.00 Alfalfa	$96.00
2	Pelleted cottonseed hull ration	60.00 Cottonseed hull	
		22.24 Sorghum grain	
		10.00 Cottonseed meal	
		6.00 Molasses	
		1.00 Sodium chloride	
		.75 Calcium carbonate	$76.86
3	Pelleted cotton gin trash[2/]	90.00 Cotton gin trash 10.00 Molasses	$28.00
4	Pelleted cotton gin trash plus suppliment	Suppliment Composition:	
		54.00 Sorghum grain	
		24.00 Cottonseed meal	
		15.00 Sodium chloride	
		4.00 Fat	
		2.00 Ammonium sulphate	
		1.00 Dicalcium phosphate	$86.00

1/ 1/4" pellet

2/ 1/2" pellet

Table 2. Mean Animal Performance and Carcass Data of Ewes from Different Sources

Treatment	Initial Reference Values		Alfalfa		Cotton Seed Hull Ration		Cotton Gin Trash + 10% Molasses		Supplemented Cotton Gin Trash	
Origin	Auction	TAES	Auction	TAES[a]	Auction	TAES	Auction	TAES	Auction	TAES
Ewes, no.			13	11	11	11	11	11	12	11
Initial Score[b]	2.1	3.1	2.6	2.8	2.3	3.0	2.6	3.2	2.3	3.3
Final Score[b]			4.3	6.4	3.2	5.8	1.6	2.5	2.6	4.5
Initial Wt., lbs.	90.3	106.8	92.0	104.5	83.4	104.8	100.4	109.5	96.8	101.5
Final Wt., lbs.			108.5	128.9	105.9	135.0	84.3	101.5	100.1	114.1
Live Wt. Gain, lbs.			16.5	24.5	12.5	30.2	-16.1	-7.9	3.3	12.5
Ave. Daily Gain lbs./day			.59	.88	.45	1.08	-.58	-.28	.12	.45
Carcass Wt. lbs.	36.3	48.8	48.0	62.3	51.1	60.1	32.0	44.6	47.1	55.1
Dressing %	40.2	45.7	44.24	48.33	48.25	44.52	37.96	43.94	47.05	48.29

[a] Texas A&M University Center, San Angelo.

[b] Fat condition was scored by three people on a 1 to 10 basis with the higher values for the fatter ewes.

Table 3. Mean Animal Performance and Carcass Data of Ewes

Treatment	Alfalfa	Cotton Seed Hull Rations	Cotton Gin Trash With 10% Molasses	Supplemented Cotton Gin Trash
No. Ewes Assigned	24	22	22	23
No. Ewes Completing Test	24	22	20	23
Initial Score	2.7	2.7	2.9	2.7
Final Score	5.3	4.5	2.1	3.6
Initial Wt., lbs.	100.6	99.1	104.9	99.2
Final Wt., lbs.	117.8	120.5	92.9	106.8
Live Wt. Gain, lbs.	17.2	21.4	-12.0	7.6
Ave. Daily Gain, lbs./day	.61	.76	-.43	.27
Feed Consumption, lbs./day	4.5	4.5	2.7	3.1
Carcass Wt., lbs.	55.1	56.3	39.2	51.1
Dressing % lbs.	46.77	46.72	42.20	47.85
Daily Feed Cost/Ewe	$.22	.17	.04	.06
Live Wt. Gain Cost/lbs.	$.35	.22	0[a]	.21
Carcass Wt. Gain Cost/lbs.	$.48	.35	0[a]	.20

[a]Not calculated since no gain in weight observed.

Table 4. Reproductive Performance

Treatment	Alfalfa	Cotton Seed Hull Rations	Cotton Gin Trash Ration	Supplemented Cotton Gin Trash
Ewes, no.	24	22	22	23
Ovulation rate corpora lutea per ewe	1.42	1.41	1.23	1.43
% Ovulating	.96	.95	.94	.95
% Pregnant	.70	.82	.65	.80
Total Embryos	22	25	15	23
% Total CL Represented by Embryos	.67	.81	.56	.70

EFFECT OF ABOMASAL CYSTEINE ADDITION ON RESPONSE TO SUBACUTE BITTERWEED (HYMENOXYS ODORATA) POISONING

M.C. Calhoun, B.C. Baldwin, Jr.
and C.W. Livingston, Jr.*

INTRODUCTION

A poisonous sesquiterpene lactone (hymenoxon) has been identified as the major toxic principle of bitterweed (8,9,10). The reported acute $IPLD_{50}$ [1/] of hymenoxon in sheep is about 3.2 mg/lb (9) and the acute $IPLD_{95}$ about 5.8 mg/lb (4). An amino acid, ℓ-cysteine, has been shown to be effective in reducing the toxicity of this lactone in acute studies with sheep (4), dogs (10), and hamsters (8). ℓ-Cysteine administered intravenously to sheep which received an $IPLD_{95}$ of hymenoxon was 80% protective at dosage levels of 44 mg/lb and 100% protective at dosage levels of 62 mg/lb (4). In dogs, ℓ-cysteine administered intravenously gave up to 80% protection against an intravenously administered LD_{90} of the poisonous lactone when both were given at the same time (10).

In order to provide protection, it was necessary to administer an excess of ℓ-cysteine simultaneously with the poisonous lactone (8,10). Protection against an acute $IPLD_{95}$ dose of hymenoxon in sheep required 25 molecules of ℓ-cysteine per molecule of hymenoxon. These results support the hypothesis that the toxic activity of hymenoxon is due, at least partly, to its ability to react with sulfhydryl (-SH) groups of key enzymes (7,8,10). However, the excessive amount of a model thiol compound (cysteine) required to provide protection against bitterweed poisoning, may be due to differences in the reactivity of sulfhydryl groups. Sulfhydryl groups at the active centers of enzymes often appear to have greatly heightened reactivity as compared to a simple thiol compound such as ℓ-cysteine (11).

Although other sulfhydryl containing compounds may be more reactive in complexing with hymenoxon, ℓ-cysteine has the advantages of being

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1/ $IPLD_{50}$ - The amount of hymenoxon, in mg/lb live weight, which will kill 50% of the sheep when administered into the peritonieal cavity in a single dose.

readily available and a normal component of sheep diets. Because of this and the reported benefits from administering ℓ-cysteine in conjunction with hymenoxon, it was decided to determine whether adding ℓ-cysteine to the gastrointestinal tract at the same time bitterweed was being fed would decrease its toxicity.

EXPERIMENTAL PROCEDURE

Sixteen lambs (Rambouillet and Rambouillet x black-faced crossbred), with an average initial weight of 79.6 ± 1.6 lb were used in this study. They were housed in individual stalls on raised, expanded metal floors in an enclosed building. Feed intake was restricted to 2.76 lb/day, a level adequate to insure some live weight gain but still low enough to reduce variation in voluntary feed intake [2/]. Feed was available for eight hours each day (8:00 a.m. to 4:00 p.m.), and water was offered (all they wanted to drink) at 8:00 a.m. and 4:00 p.m. Eight lambs were surgically fitted with an abomasal cannula at least 18 days prior to the start of ℓ-cysteine infusion.

The bitterweed used was collected on May 16, 1978, from an irrigated field located approximately two miles west of Garden City, Texas. The bitterweed was mature 12" to 18" tall and in full flower. It was dried at $\leq 150^{o}$ F and then ground to pass through a 1mm screen. Average hymenoxon concentration of the bitterweed in this collection was 0.87%.

Four experimental treatments (four lambs per treatment) were compared: (1) A control group which received neither bitterweed nor ℓ-cysteine; (2) An ℓ-cysteine infusion group which was administered ℓ-cysteine by constant infusion into the abomasum at the rate of 0.25g (ℓ-cysteine · HCl · H_2O) per pound body weight per day; (3) A bitterweed group in which bitterweed (air-dry basis) was administered by rumen tube (at the rate of 0.25% of live weight) as a single dose each morning for four consecutive days; and (4) A group which received both bitterweed and ℓ-cysteine.

The amount of ℓ-cysteine to be infused was determined in preliminary studies designed to measure the blood sulfhydryl response to various levels of abomasal ℓ-cysteine infusion. This response was linear over the range from 0 to 30g ℓ-cysteine per day and was described by the equation $Y = 1.12 + .021X$, $r = 0.92$, where X = grams of ℓ-cysteine · HCl · H_2O infused per day and Y = extracellular blood thiol concentration in milligrams of sulfhydryls (-SH) per 100 ml of blood.

On the first day of the experimental period, blood samples were collected, ℓ-cysteine infusion was started, and then bitterweed was given. Subsequently, bitterweed doses were continued for four days and ℓ-cysteine infusion for seven days. Additional blood samples were collected at two-day intervals for a 15-day period.

[2/]The percentage ingredient composition of the diet used was: 55.2% dry rolled, sorghum grain; 30.0% cottonseed hulls; 7.8% cottonseed meal; 4.0% molasses and 3.0% of a mineral and vitamin premix.

The following criteria were used to assess the effect of ℓ-cysteine on bitterweed toxicity: feed intake, rectal temperature, hematocrit, serum urea nitrogen (3), serum glutamic-oxalacetic transaminase (1), and serum γ-glutamyl transpeptidase (2). In addition, extracellular blood thiol concentrations (6) were measured to monitor the responses to abomasal ℓ-cysteine infusion.

In the statistical treatment of the data, the following sets of comparisons were tested: (1) bitterweed versus no bitterweed, (2) ℓ-cysteine versus no ℓ-cysteine, and (3) bitterweed with ℓ-cysteine versus bitterweed without ℓ-cysteine (13).

RESULTS

Two lambs were lost during the experiment. One lamb infused with ℓ-cysteine was found dead on the morning of the 13th day and one receiving bitterweed plus ℓ-cysteine was moribund and posted on the morning of the ninth day. In both cases, the abomasal cannulation sites were well-healed indicating infection due to surgery was not a contributing factor.

The effects of bitterweed and/or ℓ-cysteine administration on feed intake is presented in Figure 1. Bitterweed decreased feed intake on the first day ($P<.01$). By the second day, lambs were completely off feed, and they did not start to eat again until the sixth day (48 hours after the last bitterweed dose). Lambs receiving ℓ-cysteine and bitterweed went off feed as rapidly as those getting bitterweed alone; however, they did not come back on feed after bitterweed dosing ceased. ℓ-Cysteine alone also had a depressing effect on feed intake. Feed intake decreased daily until ℓ-cysteine infusion was stopped at the end of the seventh day, after which it gradually increased.

Dosing with bitterweed caused rectal temperatures to increase. However, the pattern of response was different for bitterweed alone as compared to bitterweed and ℓ-cysteine infusion. After the initial rise in temperature, which occurred by day three, ℓ-cysteine infusion appeared to maintain a slightly lower temperature when compared to bitterweed alone (Figure 2). However, after bitterweed administration and ℓ-cysteine infusion were stopped (days four and seven, respectively), lambs given this combination of treatments exhibited another rise in temperature, which persisted through day 15, whereas, the rectal temperatures of those lambs receiving only the four bitterweed doses were similar to the control lambs after the sixth day.

There was a general downward trend in hematocrit values as the experiment progressed (Figure 3). This was particularly apparent with the control lambs, where the hematocrit value on day one was 44.2 and then decreased to 35.9 on day 15. Lambs infused with ℓ-cysteine exhibited a similar trend. Bitterweed increased hematocrit values on days three ($P<.05$) and five ($P<.05$). ℓ-Cysteine infused in combination with bitterweed dosing did not alter the hematocrit response during the first seven days of the experiment. However, subsequently, there was a tendency for higher hematocrit values in the lambs receiving the combination of ℓ-cysteine and bitterweed when compared to those getting bitterweed only. These differences approached significance on the 15th day ($P<.10$).

There was a general upward trend in extracellular blood thiols (expressed as milligrams of sulfhydryls per 100 milliliters of blood) for the control group as the experiment progressed (Figure 4). Abomasal ℓ-cysteine infusion increased blood thiols, and they remained elevated until infusion was stopped at the end of the seventh day. The pattern of response was similar for ℓ-cysteine infusion alone and the combination of ℓ-cysteine and bitterweed. However, in the absence of ℓ-cysteine, bitterweed dosing decreased blood thiol levels. The lowest level was reached on day seven; thereafter, blood thiol levels gradually increased and were back to normal by the 15th day.

Serum urea nitrogen was increased by bitterweed dosing; however, ℓ-cysteine infusion reduced the response to bitterweed ($P<.01$ and $P<.05$ for days three and five, respectively). After day seven, the response was reversed. Those lambs receiving only bitterweed returned to normal, whereas those which had received the combination of bitterweed and ℓ-cysteine continued to increase. Also, ℓ-cysteine infusion alone caused an increase in serum urea nitrogen values which peaked on the 11th day (Figure 5).

Serum glutamic-oxalacetic transaminase activity (expressed as Sigma-Frankel units per milliliter of serum) were elevated by dosing with bitterweed and then gradually returned to normal (Figure 6). ℓ-Cysteine infusion, along with bitterweed, at first reduced the serum glutamic-oxalacetic transaminase response to bitterweed. However, in those lambs which had received both ℓ-cysteine and bitterweed, serum glutamic-oxalacetic transaminase activity increased to values of 306 and 402 SF U/ml on days 11 and 15, respectively.

The average initial value for serum γ-glutamyl transpeptidase activity was 49.8 ± 4.4 units/ml. Bitterweed dosing increased γ-glutamyl transpeptidase activity to 299.2 U/ml on day five, whereas in lambs infused with ℓ-cysteine, bitterweed increased γ-glutamyl transpeptidase activity to 181.7 U/ml on the fifth day. Activity decreased thereafter but did not return to pre-treatment levels during this 15-day study (Figure 7).

DISCUSSION

A number of physiological and biochemical changes have been reported associated with subacute administration of bitterweed to sheep (5,6). The criteria selected for use in this study were chosen because they have been found to be consistently responsive to bitterweed dose. Additionally, they are relatively easy to measure and provide some insight into the degree of bitterweed poisoning. Overall, the results of this study tend to support the observation that ℓ-cysteine reduces the effects of poisoning. This is shown by the lowered values for rectal temperature ($P<.05$), serum urea nitrogen ($P<.05$), serum glutamic-oxalacetic transaminase ($P<.01$), and serum γ-glutamyl transpeptidase ($P<.10$) for day five with bitterweed plus ℓ-cysteine, as compared to bitterweed alone.

It is also apparent that the level of ℓ-cysteine used in this study was slightly toxic. As a result, the combination of ℓ-cysteine and bitterweed had a greater detrimental effect, as the experiment progressed, than either one by itself. This effect is evident in the feed intake data (Figure 1), and further supported by observed changes in rectal temperature (Figure 2), serum urea nitrogen (Figure 5), and serum glutamic-oxalacetic transaminase (Figure 6). Also, the two lambs that were lost from the experiment were infused with ℓ-cysteine, whereas, none of the lambs getting only bitterweed died.

Since the amount of ℓ-cysteine selected for abomasal infusion was intentionally set at a fairly high level (0.25 g/lb live weight/day), the decrease in voluntary feed consumption as a result of abomasal ℓ-cysteine infusion was expected. However, this level was selected on the basis of preliminary studies designed to define the blood thiol response to various levels of ℓ-cysteine infused into the abomasum and was felt to be adequate to overcome the rapid metabolism of ℓ-cysteine in the body and provide a circulating level of -SH, considerably in excess of absorbed hymenoxon.

Based on previous experience, the bitterweed level used (0.25% live weight/day) was expected to cause the sheep to go completely off feed on the second day (5). The fact the ℓ-cysteine infusion also decreased feed intake effectively negates use of feed intake information in this study for evaluating the effect of ℓ-cysteine infusion on subacute bitterweed toxicity. This is unfortunate since experience indicates feed intake is the most sensitive criterion for assessing response to bitterweed treatments (5).

An unexpected result was the failure of sheep getting the combined bitterweed and ℓ-cysteine treatment to start eating after the treatment ceased. It is quite obvious that the combination of bitterweed and ℓ-cysteine, at the levels used in this study, was more detrimental than either alone.

Administration of bitterweed into the rumen produced a marked febrile response (Figure 2). Maximum response occurred by the third day, and temperatures remained elevated for about 24 hours after the last bitterweed dose. The cause of this temperature rise is unknown at present. Microbiological examination of blood samples from six lambs were essentially negative. Thus, a bacteremia does not appear to be involved. It is possible that some constituent of bitterweed (maybe hymenoxon) is pyrogenic. Another possibility is that the temperature rise is due to an effect of bitterweed on release of endotoxin from enteric gram-negative bacteria (7,12).

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Figure 1

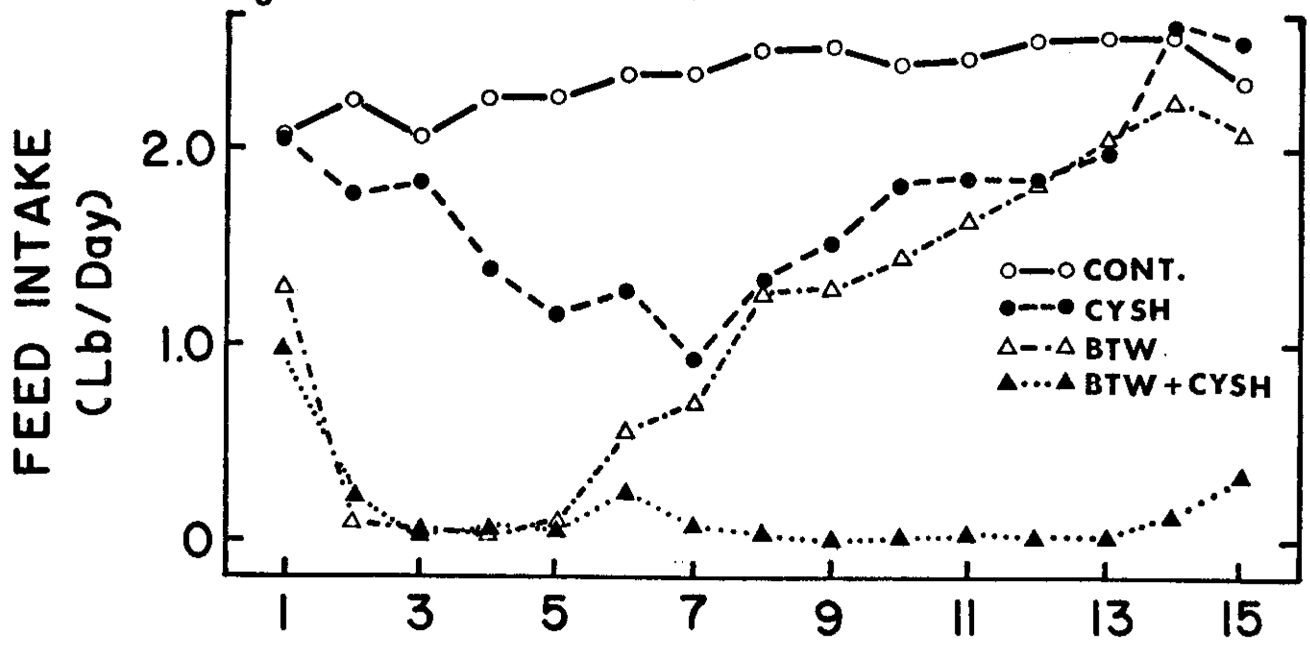


Figure 2

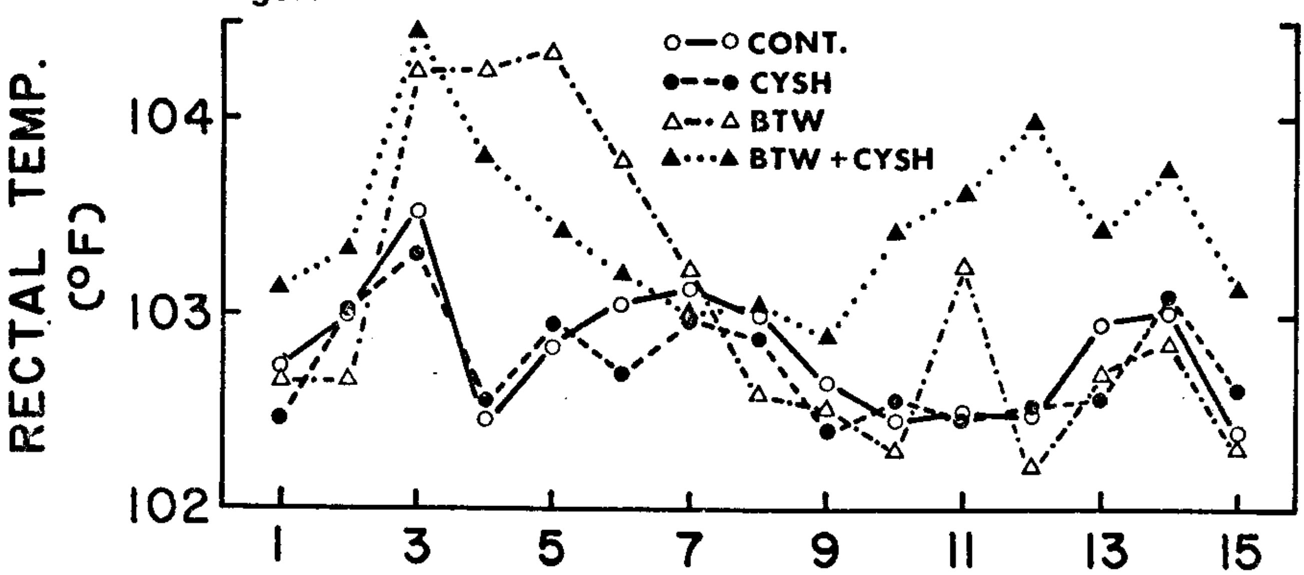


Figure 3

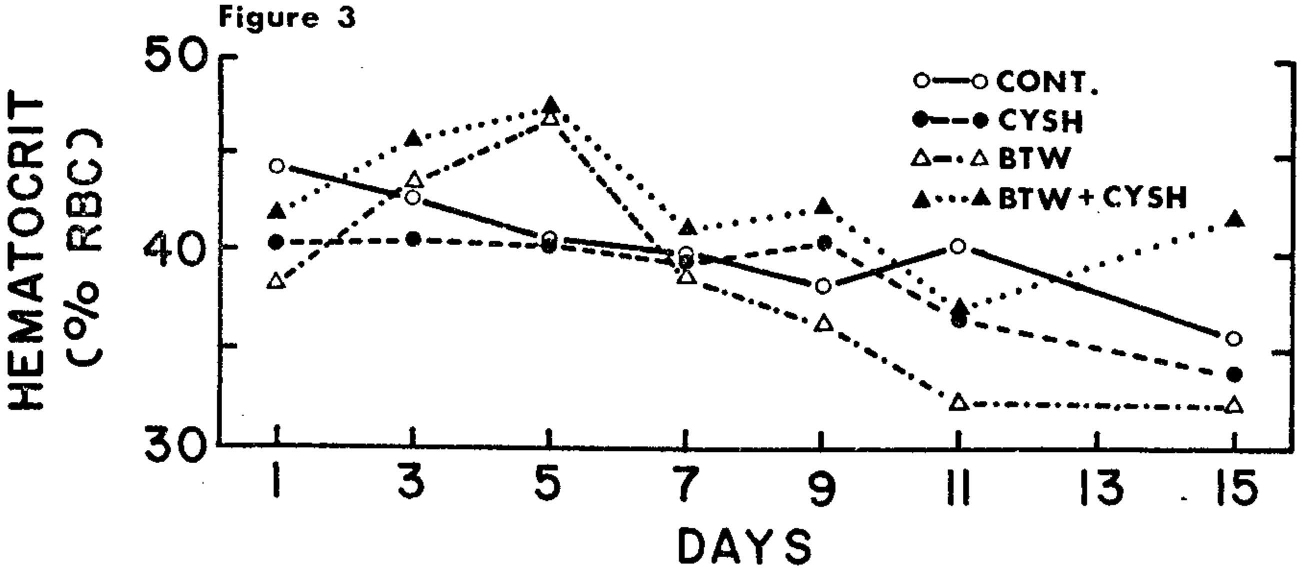


Figure 4

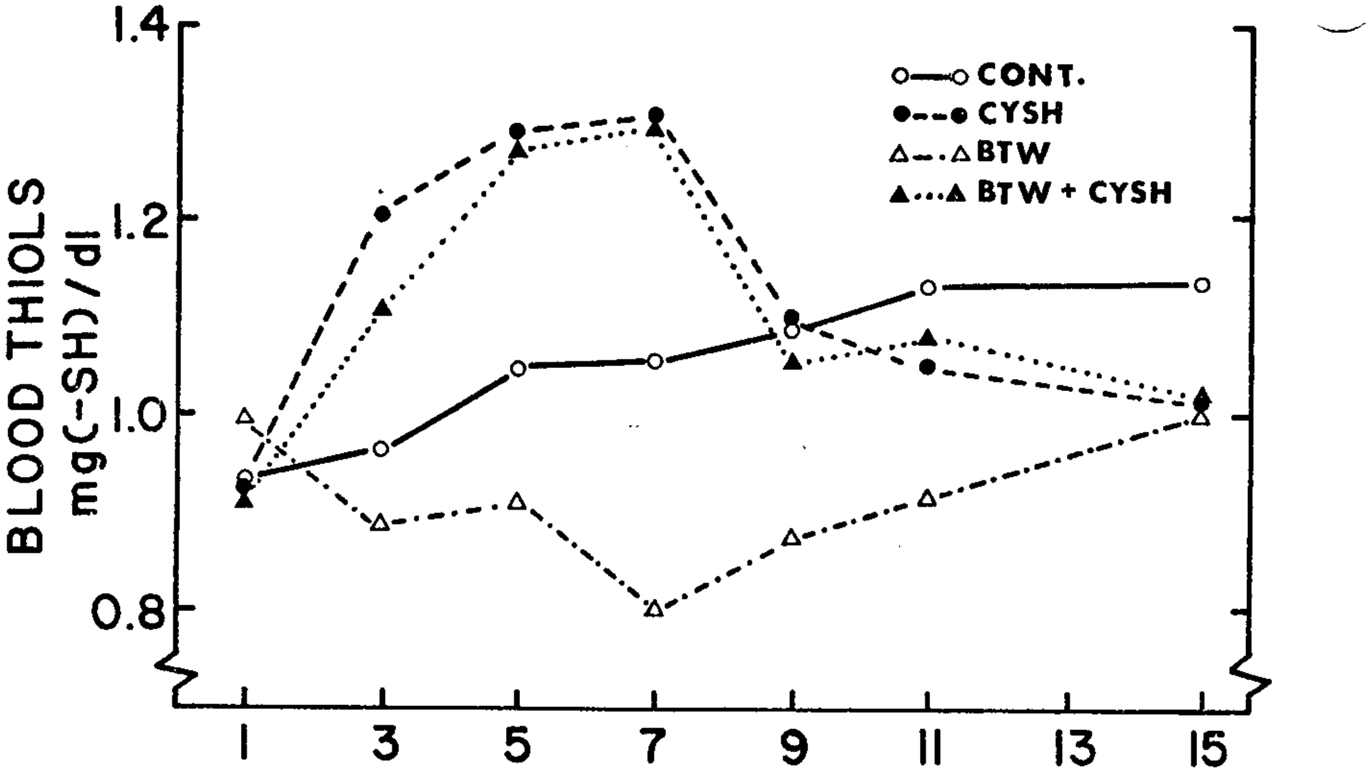


Figure 5

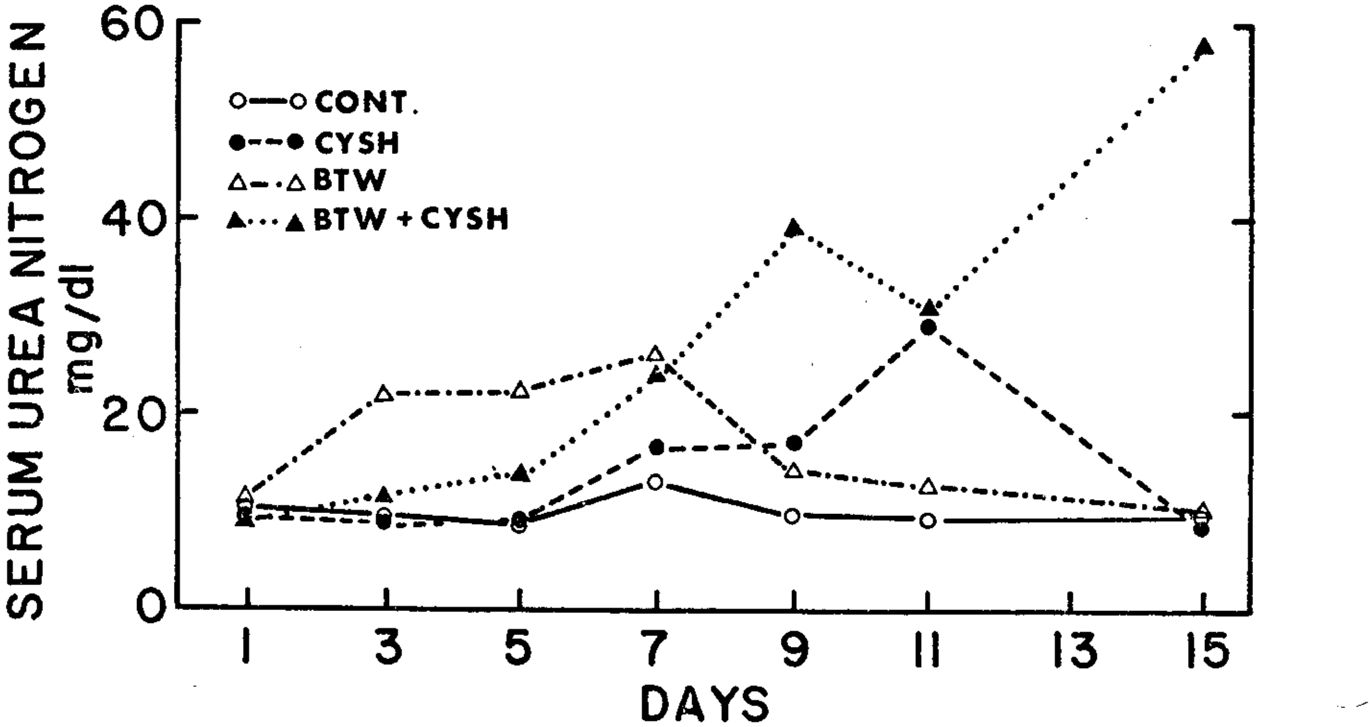


Figure 6

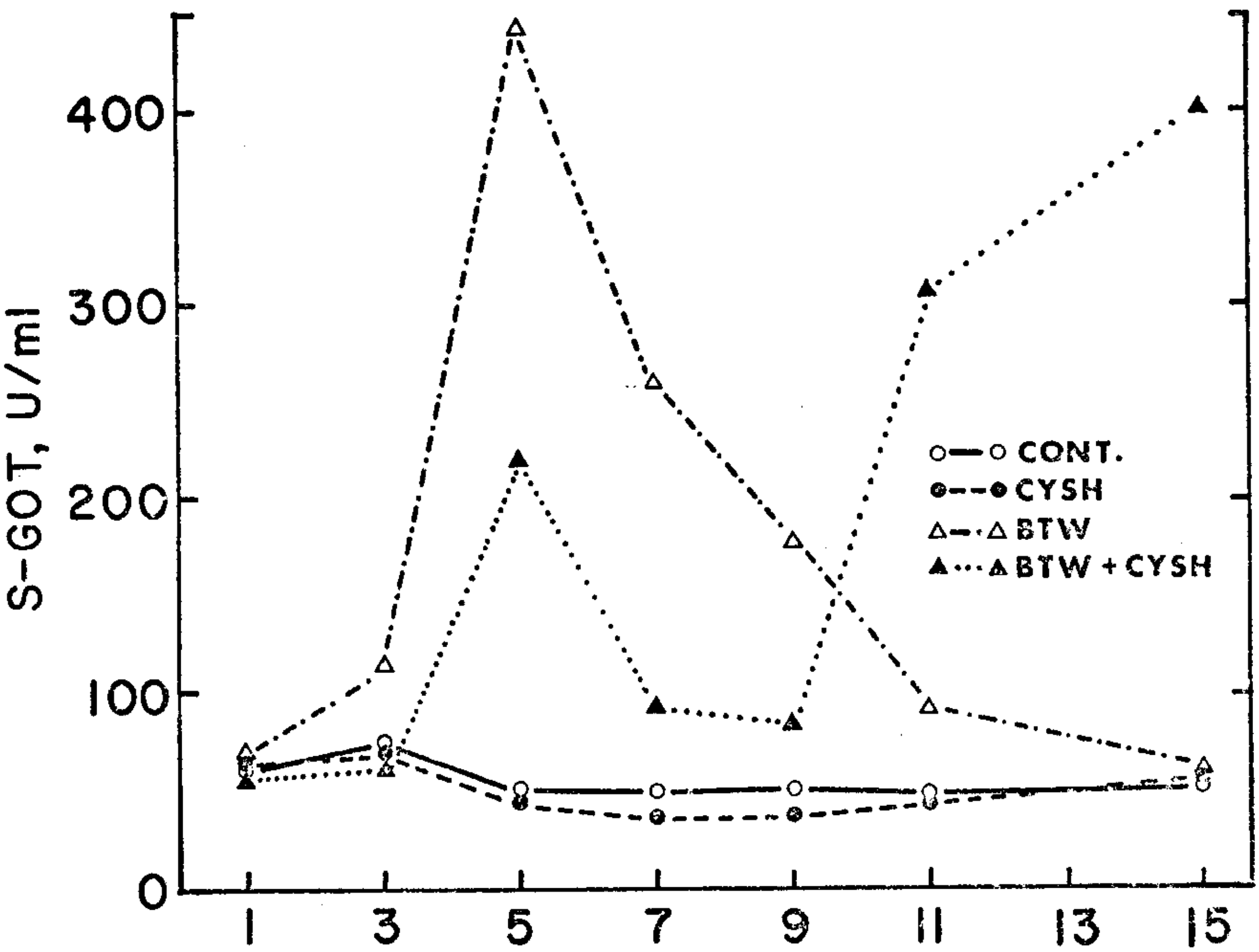
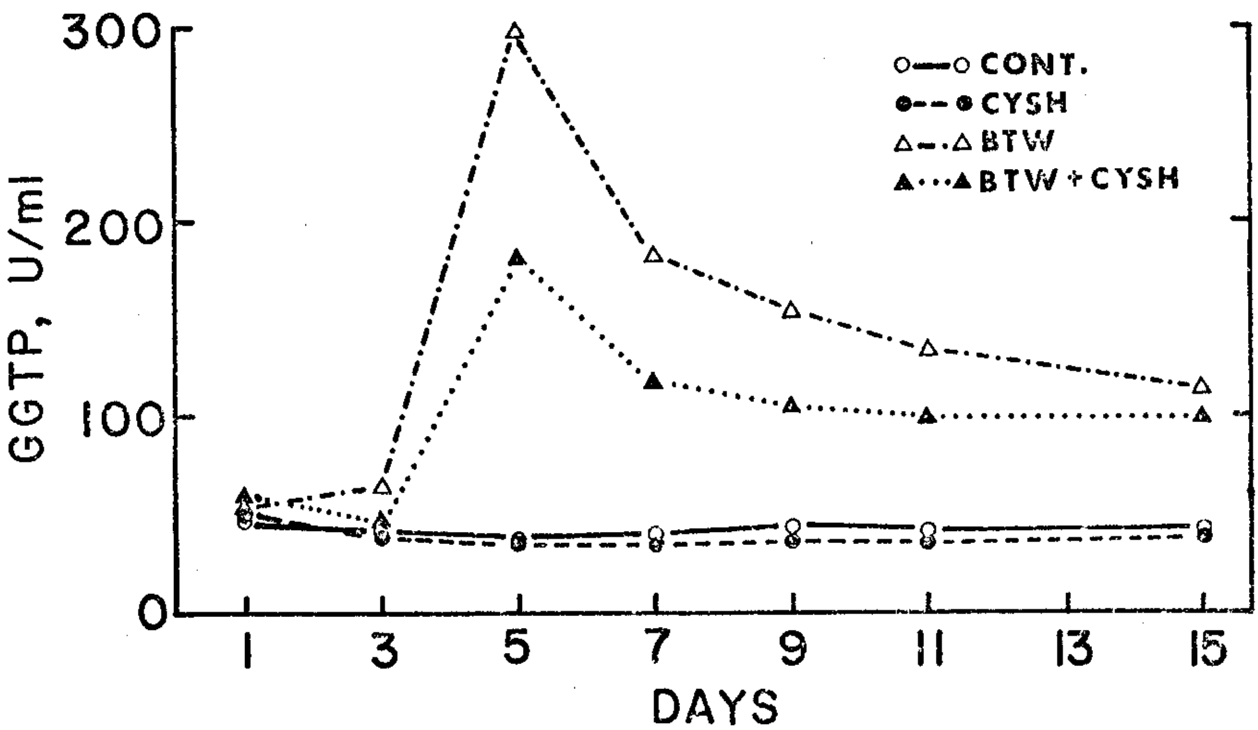


Figure 7



DIETARY PROTEIN AND SUBACUTE BITTERWEED POISONING IN SHEEP

B.C. Baldwin, Jr. and M.C. Calhoun*

The role of dietary protein in bitterweed (*Hymenoxys odorata*) poisoning in sheep is unclear. Ranchers have observed that supplementation with high protein feeds tended to aggravate the problem in sheep grazing bitterweed infested pastures, whereas researchers have reported a reduction in toxicity in acute studies when the crude protein level of the diet was raised from 10 to 20 percent (1).

Current knowledge of the identity of the principal toxin (hymenoxon) in bitterweed and its effects in the body provides an explanation as to how dietary protein may be both beneficial and detrimental, depending on circumstances. Hymenoxon is reported to react with sulfhydryl (-SH) groups in the body (5,6). These -SH groups are essential components of the body chemistry, playing an important role in cell membrane integrity and enzyme function. When enough -SH groups are tied up by hymenoxon, important body systems (liver, kidney) are affected. When this occurs, there are dramatic increases in serum urea nitrogen and activities of several serum enzymes, such as glutamic-oxalacetic transaminase, γ-glutamyl transpeptidase and lactic dehydrogenase. Introduction of a high protein feed after sheep exhibit signs of bitterweed poisoning would be expected to accentuate this problem, particularly if a portion of the protein in the supplement was derived from a non-protein nitrogen source, such as urea (7). However, since natural proteins contain the sulfur amino acids methionine, cysteine and cystine, providing a high protein feed (all natural protein) prior to the time sheep are consuming bitterweed would increase sulfhydryl levels in the rumen and possibly the abomasum and small intestine as well. The -SH containing amino acid, ℓ-cysteine, has been demonstrated to provide protection against bitterweed poisoning (2,5,6).

This study was designed to provide a preliminary assessment of the value of protein in reducing subacute bitterweed poisoning in sheep.

EXPERIMENTAL PROCEDURE

Eight lambs maintained in individual stanchion stalls on raised expanded metal floors in an enclosed building were used for this study.

Four were assigned to a 10% crude protein diet; the remaining four to a 20% crude protein diet. Lambs were started on these diets seven days

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*Respectively, technician I and associate professor, The Texas Agricultural Experiment Station, San Angelo. This research was supported in part by the Natural Fibers and Food Protein Commission of Texas. Appreciation is expressed to Dr. Bennie J. Camp (Professor, Department of Veterinary Physiology and Pharmacology, College Station, Texas) for determination of the hymenoxon concentration of bitterweed. The cooperation of Jerry Murphy, Garden City, Texas in allowing collection of bitterweed plants on his property is also appreciated.

before dosing with bitterweed was initiated, and they were continued for seven days after the last bitterweed dose. The diets used were based on dry rolled sorghum grain and cottonseed hulls (30%) with cottonseed meal as the protein source used to adjust crude protein levels. Feed intake was restricted to 2.76 lb/day, a level adequate to insure some live weight gain but still low enough to reduce variation in voluntary feed intake. Feed was available for eight hours each day (8:00 a.m.to 4:00 p.m.) and water was offered (all they wanted to drink) at 8:00 a.m. and 4:00 p.m.

Dried, ground bitterweed was administered directly into the rumen (via rumen tube in a water suspension) at 4:00 p.m. each day for four days. The daily dose was 0.25% of the sheep's live weight on an air-dry basis. This approach was followed because in preliminary studies with rumen fistulated sheep, it was found that rumen sulfhydryl (-SH) levels were highest at about 4:00 p.m. when lambs were fed as described. Blood samples were collected, initially (on the morning of the day the first bitterweed dose was given, i.e., day one) and again at three and five days.

The following measurements were used to assess the effects of protein level in the diet on response to bitterweed: feed intake, water intake, rectal temperature, extracellular blood thiols (-SH), icteric index, hematocrit, serum urea nitrogen, serum-glutamic oxalacetic transaminase and serum γ-glutamyl transpeptidase. All of these measurements have been shown to be consistently responsive to bitterweed dose (2,3,4).

Following a 7-day recovery period, the dietary treatments were reversed. Those lambs previously getting 10% crude protein were switched to 20% and *vice versa*. The new protein levels were fed for a 7-day period and then all lambs were given bitterweed for another 4-day period, using the same levels as for Trial 1. Blood samples, observations and analyses were also the same as for Trial 1. This approach was used to obtain additional information on protein effects with the limited numbers of lambs available and to provide some ideas as to the variability in susceptibility of individual sheep to bitterweed poisoning, as well as the repeatability of these measurements.

RESULTS

One lamb was lost from the 20% crude protein treatment during bitterweed dosing in Trial 1. A small amount of bitterweed was accidently introduced into the lungs, and subsequently, the lamb died from foreign body pneumonia. All data from this lamb were excluded from the summary. Thus, in Trial 1, there were only three lambs on the 20% crude protein treatment, and in Trial 2, only three lambs on the 10% crude protein diet.

A summary of the data from this study is presented in figures 1 through 8. In general, there appears to be a slight beneficial effect from increasing the protein level in the diet from 10 to 20%. Although this tended to be the situation in both trials, the effect of protein was certainly not consistent across all criteria examined.

Bitterweed decreased feed and water intake. Additional protein increased feed and water consumption in both trials. However, the effect of protein was greater in Trial 2 (figure 2); that is, lambs went off feed and water slower and recovered faster in Trial 2, as a result of increasing crude protein to 20%, whereas, in Trial 1, they stopped eating and drinking at the same rate, regardless of protein level but recovered faster on the 20% crude protein treatment (figure 1).

Bitterweed increased rectal temperature on days three, four and five. The effect of dietary protein on temperature response to bitterweed was inconsistent between trials. In Trial 1, lambs fed the 20% crude protein diet tended to have slightly higher temperatures with the reverse true in the second trial. Actually, this may merely be due to the fact that the lambs getting the 20% crude protein diet in Trial 1 were switched to the 10% crude protein diet for Trial 2 (figures 1 and 2).

Icteric index was increased by bitterweed administration but the response was less for those lambs getting the 20% protein diet. The effect of protein was similar for both trials (figure 3).

Hematocrit (% red blood cells) was increased as a result of bitterweed, but the effect of protein varied. In Trial 1, additional protein prevented the rise in hematocrit values, whereas, in Trial 2, the response to bitterweed was less dramatic and similar, regardless of protein level in the diet (figure 4).

In Trial 1, extracellular blood thiol concentrations (mg -SH/dl blood) decreased as a result of bitterweed treatment. However, on day five, the decrease was slightly greater with the 20% crude protein diet. In contrast, there was little decrease with time in Trial 2, and the sheep on the 20% crude protein diet had consistently higher values (figure 5).

Urea nitrogen values were significantly higher, initially, in serum from lambs fed the 20% crude protein diet. The average initial urea nitrogen values were 9.8 and 18.5 mg/dl (Trial 1) and 7.6 and 21.9 mg/dl (Trial 2) for the 10 and 20% crude protein diets, respectively. Bitterweed treatment increased urea nitrogen in both trials with the 10% crude protein diet, whereas, there was little change from the initial values for lambs on 20% crude protein (figure 6).

Bitterweed increased serum glutamic-oxalacetic transaminase activity from 58 to 499 Sigma-Frankel units/ml in Trial 1 and from 63 to 260 Sigma-Frankel units/ml in Trial 2. Protein level in the diet was without effect on the response to bitterweed (figure 7).

Gamma-glutamyl transpeptidase activity increased in the serum when bitterweed was administered in Trials 1 and 2. There was no effect of protein level on bitterweed response in Trial 1, but the sheep fed 20% crude protein had slightly lower enzyme activity on days three and five in Trial 2 (figure 8).

DISCUSSION

The slight reduction in bitterweed toxicity resulting from increasing the crude protein content of the diet in lambs given a subacute dose of bitterweed is consistent with previous research in which feeding a 20% crude protein diet raised the acute LD_{50} of a bitterweed collection from 2.8 gm/kg to 4.0 gm/kg in sheep (1). The fact that subacutely poisoned sheep appeared to benefit from additional protein as they began to eat again (figures 1 and 2) and the common practice of feeding alfalfa hay to range sheep recovering from bitterweed poisoning makes it difficult to understand the rancher's field observation that protein aggravates the problem. In the two trials reported, minimal permanent effects on liver and kidney functions were anticipated. With the exception of gamma-glutamyl transpeptidase, all values would be expected to return to normal within 10 days after the last bitterweed dose (2). It might be that in chronically poisoned sheep with severely impaired liver and/or kidney functions, additional dietary protein would aggravate the situation. However, a more likely explanation could be the failure of researchers and ranchers to consider the amount of non-protein nitrogen in a protein supplement. An increased susceptibility to dietary urea toxicity has been reported in sheep with a progressive liver dysfunction (7). Another possibility is the effect of supplemental feeding on the consumption of bitterweed by grazing sheep. If a supplement increased the amount of bitterweed eaten, an adverse response would result.

An interesting observation is the generally diminished bitterweed response in Trial 2, as compared to Trial 1, particularly since the 2-weeks allowed for recovery between the bitterweed dosing periods is similar to the procedure followed by ranchers grazing bitterweed pastures. In this case, the same bitterweed source was fed in both trials at a constant percentage of live weight. The response the second time was less severe, regardless of crude protein level in the diet. The major exception was that the serum enzyme, gamma-glutamyl transpeptidase, was still slightly elevated at the beginning of Trial 2, and the response to bitterweed was greater the second time, particularly with the 10% crude protein diet.

A considerable variation in the susceptibility of individual sheep to bitterweed poisoning was observed. Also, there was a tendency for those sheep which were tolerant of bitterweed in Trial 1 to be tolerant in Trial 2. Although all sheep appeared to be less responsive to bitterweed poisoning the second time, the response of one lamb in particular was quite different. This individual was quite susceptible in Trial 1 but gave little response when challenged with bitterweed the second time. It would be valuable to know the factors determining individual sheep susceptibility to bitterweed poisoning, as well as the heritability of this trait. Research efforts to confirm adaptation to bitterweed are also desirable.

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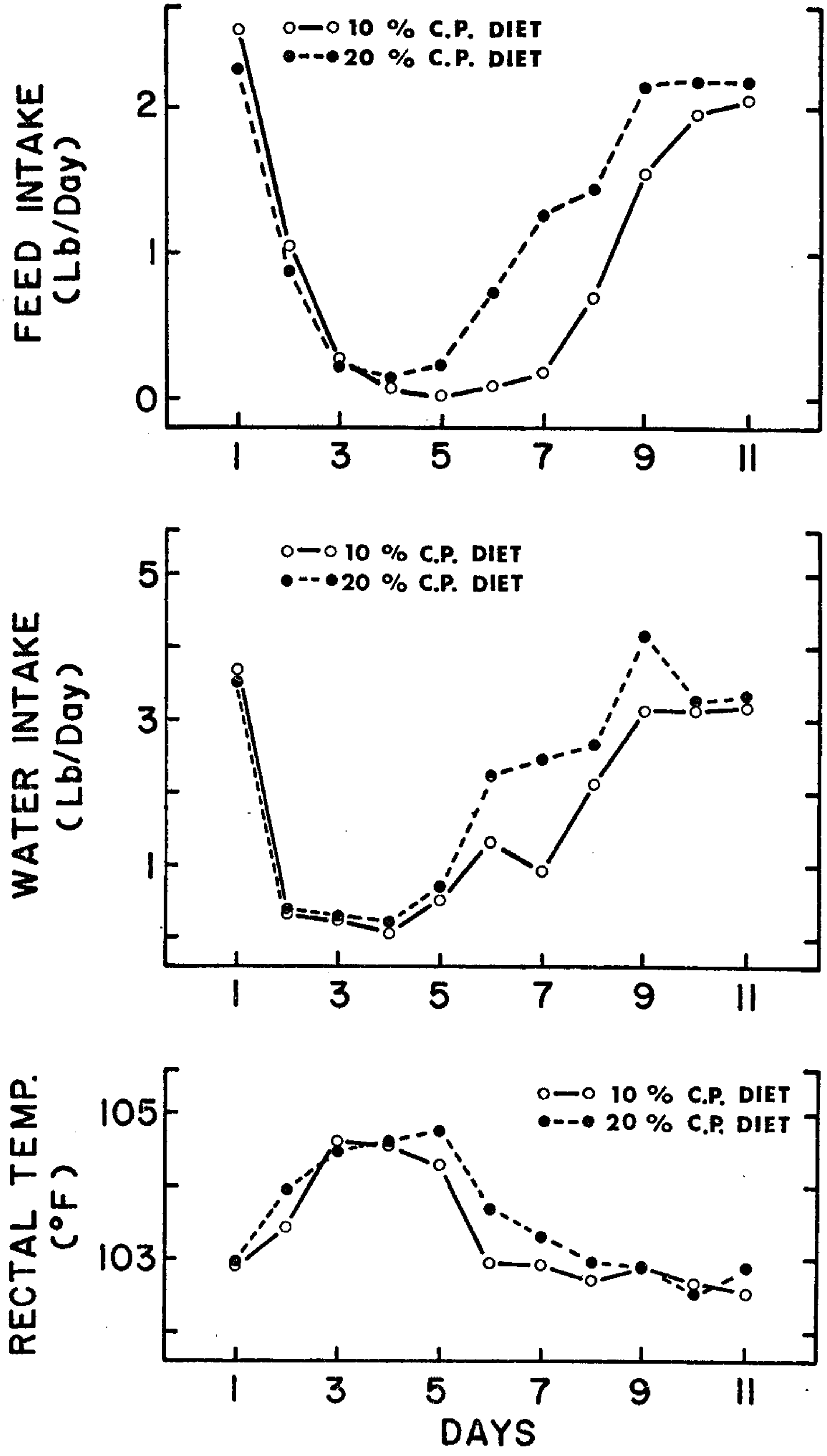
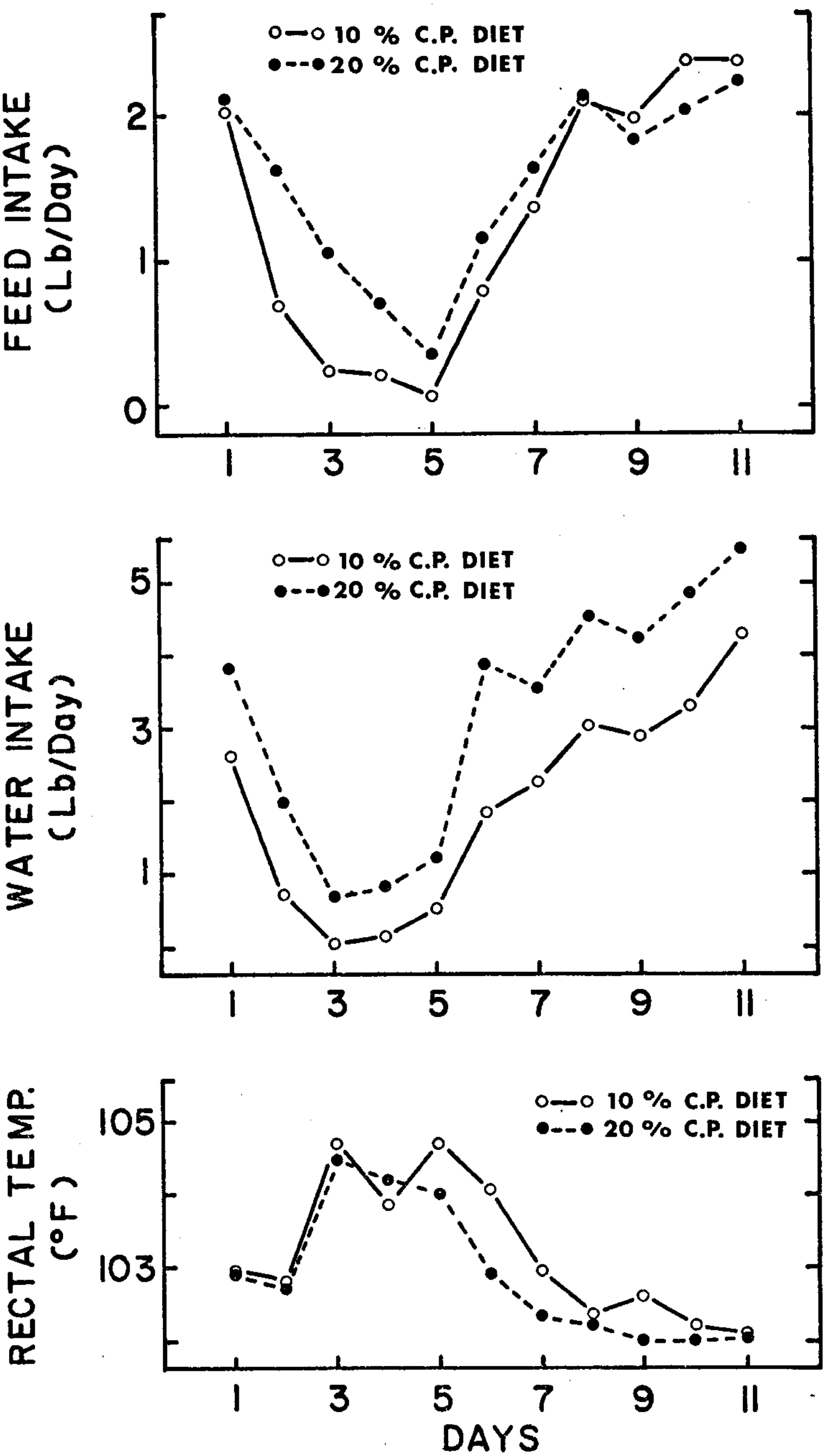
Figure 1



10 % C.P. DIET
20 % C.P. DIET
FEED INTAKE (Lb/Day)
0
1
2
1
3
5
7
9
11
10 % C.P. DIET
20 % C.P. DIET
WATER INTAKE (Lb/Day)
1
3
5
1
3
5
7
9
11
10 % C.P. DIET
20 % C.P. DIET
RECTAL TEMP. (°F)
103
105
1
3
5
7
9
11
DAYS

Figure 2


10 % C.P. DIET
20 % C.P. DIET
FEED INTAKE (Lb/Day)
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WATER INTAKE (Lb/Day)
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11
10 % C.P. DIET
20 % C.P. DIET
RECTAL TEMP. (°F)
103
105
1
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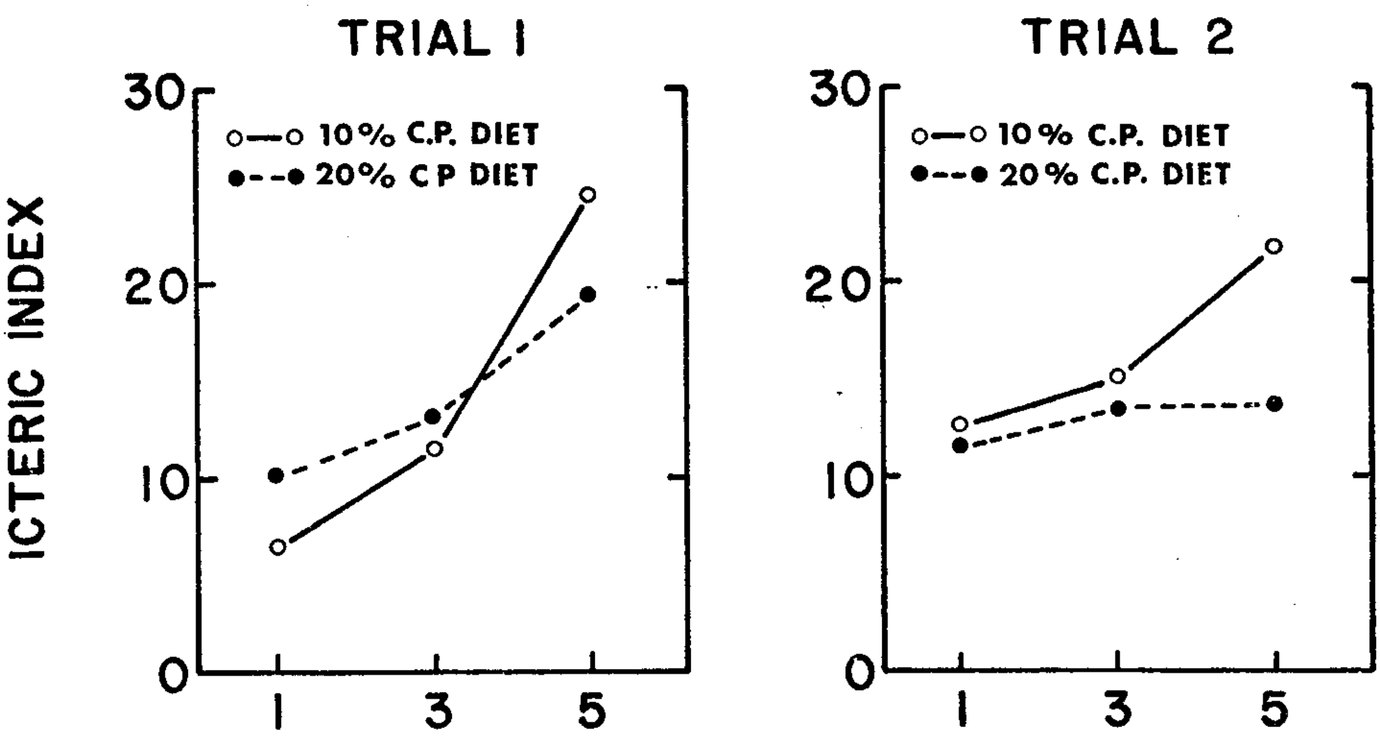
11
DAYS

Figure 3



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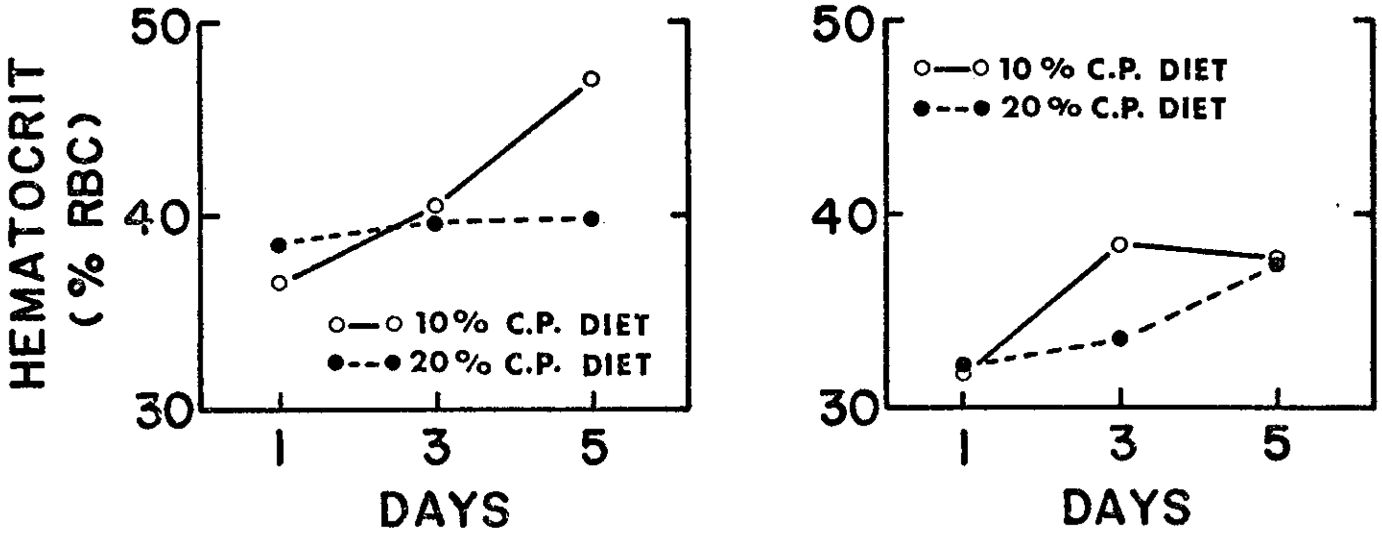

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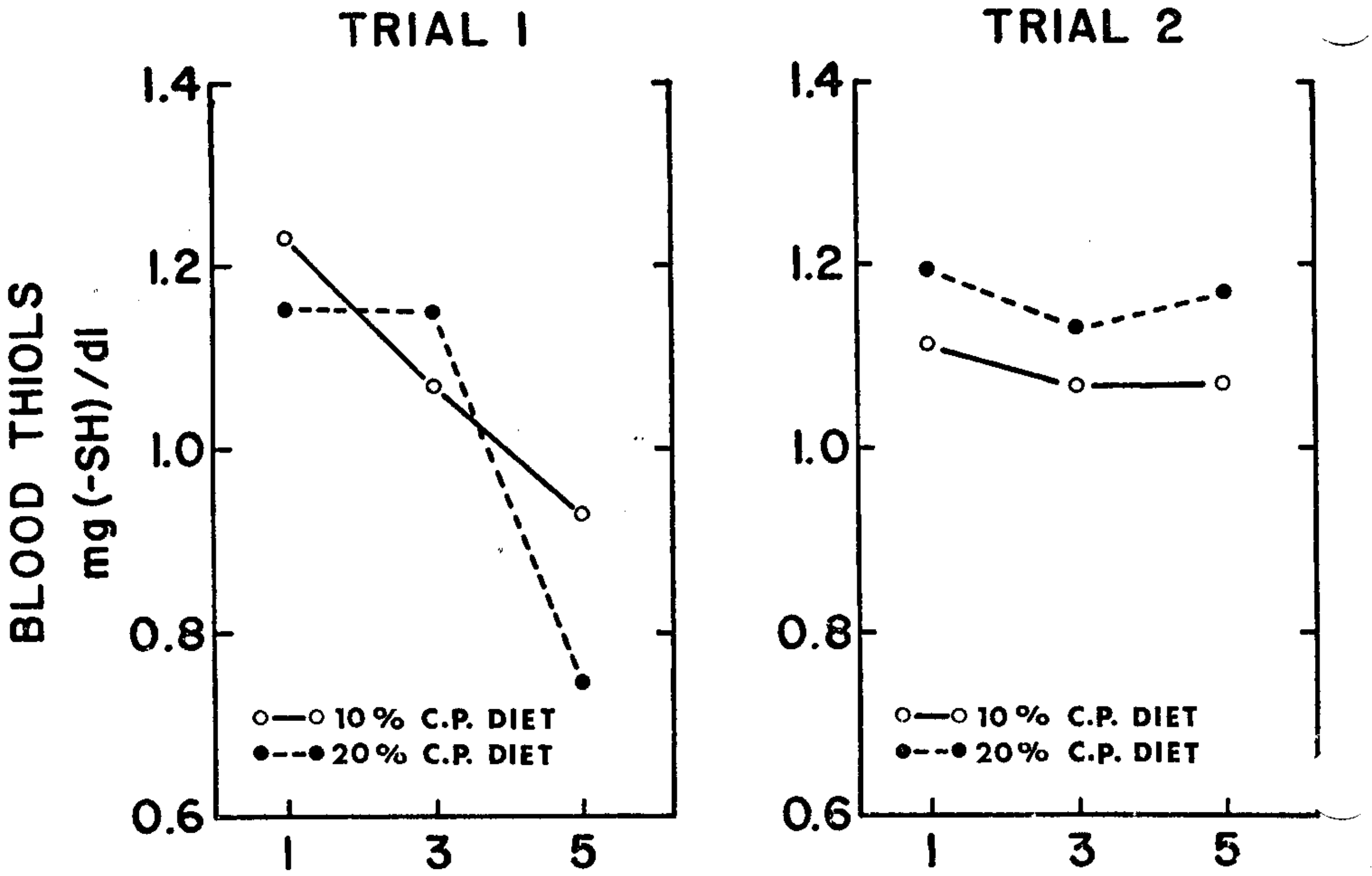

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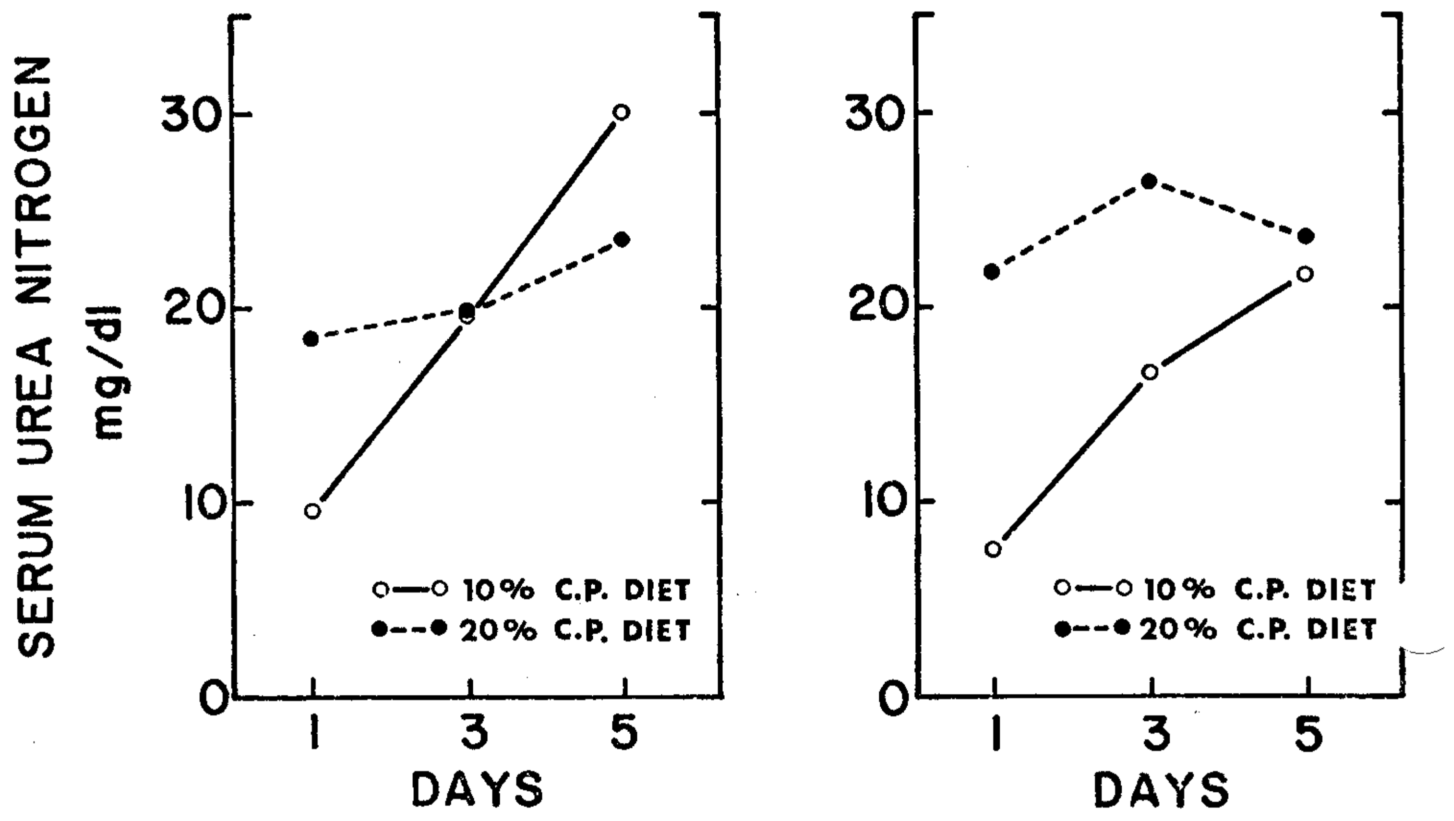


Figure 7

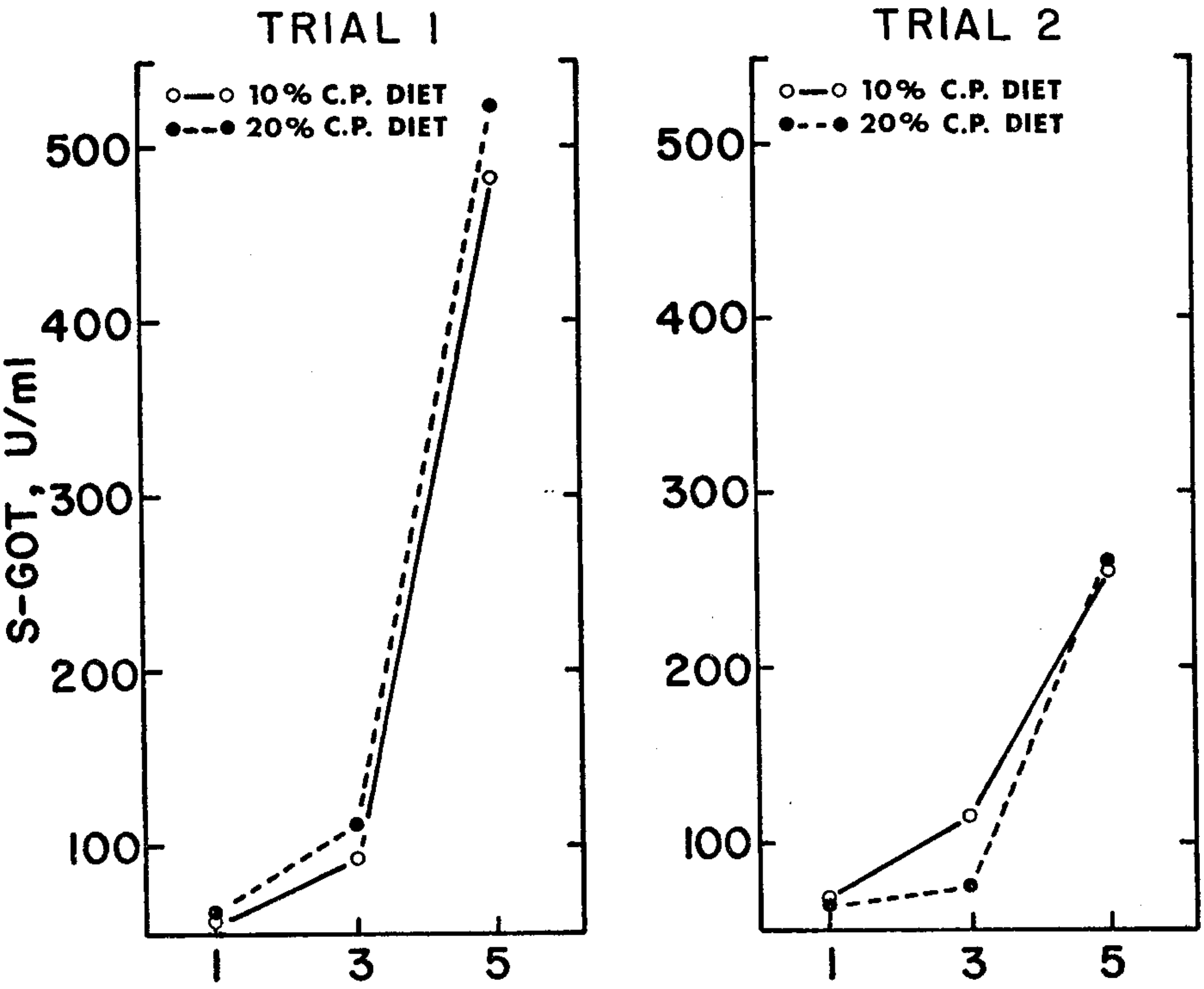
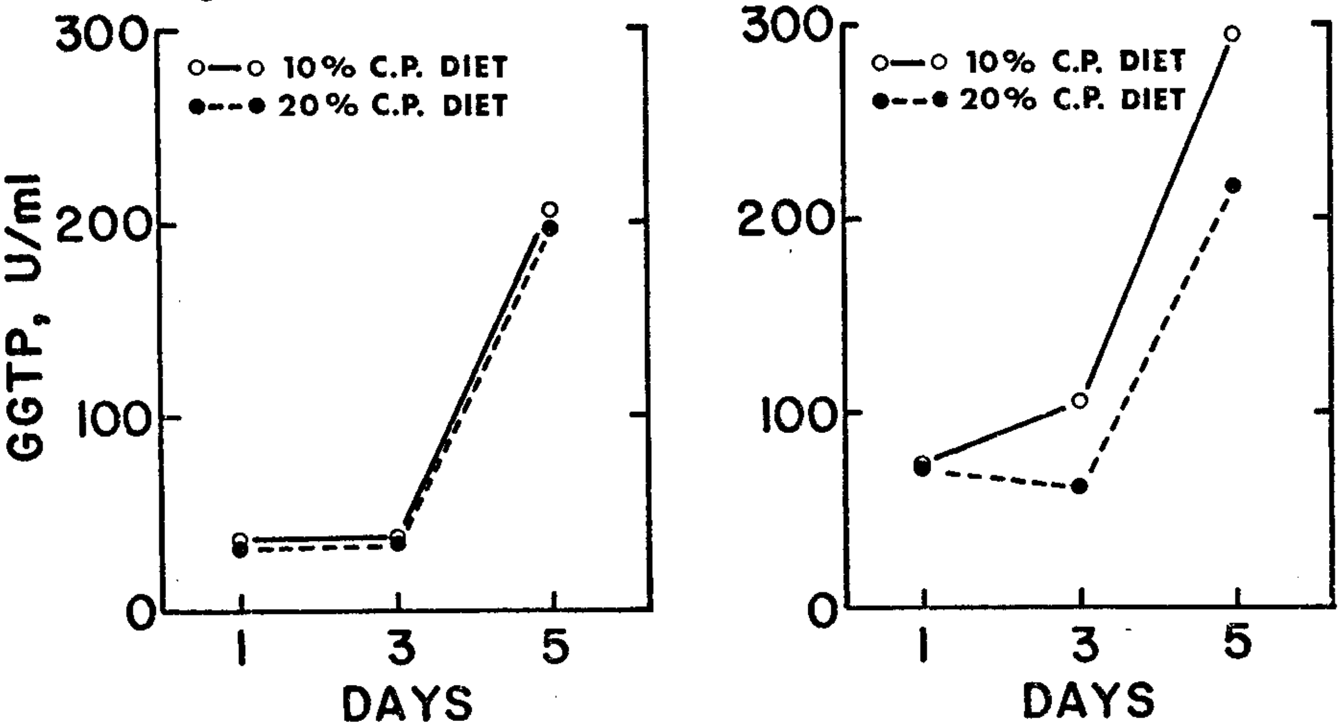


Figure 8



PR-3572

FIELD STUDIES WITH BLUETONGUE MODIFIED LIVE VIRUS VACCINES

S. McConnell and C. W. Livingston*

Bluetongue infections continue to occur in Texas ruminant populations. With increased awareness of the economic consequences of bluetongue disease in sheep and cattle, requests for effective vaccines have increased. In response to this problem, TAES initiated a study to produce the needed biologics. In 1977 the authors published on the proposed preparation of bluetongue virus vaccine(s) in the TAES Research Reports on Sheep and Goat-Wool, Mohair. A follow-up of the study was published in 1978 at which time it was noted that if progress continued, a vaccine should be ready for field evaluation in 1979. This report summarized the continued efforts with this program.

Pilot lots of vaccine for two distinct serotypes of BT virus found in Texas were prepared and tested under stringent experimental conditions. Each candidate vaccine was shown to be safe and efficacious, providing complete protection to challenge with specific unattenuated virus. Subsequently, experimental field testing of these two vaccines was initiated. The products are being tested for sterility, safety and efficacy. The tests are designed to determine 1) an effective immunizing dose level, 2) serological responses of vaccinated sheep and 3) the protective index of each virus dose given.

To date, 700 sheep have been included in each of the two vaccine test trials. A total of 525 sheep were vaccinated with each of the vaccine serotypes and these studies are now underway. Prevaccination serum samples, post-vaccination and post-challenge serum samples have been collected and are now under test. In addition, challenge of immunity in vaccinated sheep is done in either 50% of each unit, or in smaller herds 100% of the animals are challenged. These studies are incomplete; however, preliminary data suggest that the amount of virus in each challenge dose was below that needed to effect a serological response by the agar gel immunodiffusion (AGID) test.

Although no untoward responses were obtained from vaccination, the AGID test shows a relatively high index of positive sheep in the study sets. These yearling ewes were selected because the herd history was good and illness not observed in the flocks. However, serological evidence suggests exposure to at least 1 and probably 2 serotypes of BTV. Definitive typing has not been completed.

The study is still in progress and all parameters to be measured have not been tested. Data collected have not been tabulated or analyzed, but field evidence shows the pilot lots of vaccine to be safe and of marginal efficacy. Unfortunately, the high percentage of seropositive animals included in the study makes interpretation of the data difficult. Additional sheep are being sought, and field evaluation of these vaccines will continue.

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PR-3573

DIETS OF SHEEP DURING A WET YEAR AND A DRY YEAR IN RELATION TO HARD YELLOW LIVER DISEASE

D. N. Ueckert, S. G. Whisenant, E. M. Bailey, Jr. and L. G. Adams*

Sheep, cattle, goats and antelope are affected by hard yellow liver disease (hepatic fatty cirrhosis) in parts of five to seven counties of the western Edwards Plateau resource area. Deer are also reported affected in La Salle County and portions of adjacent counties in the South Texas Plains resource area. The disease, believed to be of toxic origin, has not been reproduced by feeding various amounts of 80 different plants common in the western Edwards Plateau (1). Ohlenbusch (3) speculated that a toxic substance or substances in the forages forming the animals' diets during wet winter and dry spring seasons caused hard yellow liver disease. According to Ohlenbusch, factors appearing to be correlated with occurrence of the disease included: (i) a dominance of Reagan silty clay loam soil; (ii) above-normal rainfall in August-October and a wet winter followed by a dry spring; (iii) relatively light grazing pressure; and (iv) fluctuating nutritional levels in animal diets.

This study was initiated, as part of a multidisciplinary research effort, to determine the diet of sheep grazing native rangeland in the "hard yellow liver area" and to document the vegetation present in an area in which the disease frequently occurs.

METHODS

A 137-acre pasture on the E.G. Cauble Ranch in central Reagan County was stocked with a flock of pregnant ewes from November 1976 through October 1977 and with a different flock from January 1978 through October 1978. Vegetation surveys were made at approximately monthly intervals on ten permanently marked sampling transects to determine cover and frequency of plants within all range sites in the experimental pasture. Major range sites in the pasture, their percentage of the total acreage, and soil types included: loamy range site, 71.4%, Reagan silty clay loam; shallow range site, 19.4%, Conger loam, undulating; clay flat range site, 5.6%, Tobosa clay; and lakebed range site, 3.5%, Lipan clay.

Fecal samples were collected from all the sheep at approximately monthly intervals and approximate dry weight composition of plants in the sheep diets were determined by microscopic examination of plant epidermal tissues in the samples[1/]. Soil moisture and precipitation were

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1/ Diet determinations were conducted on a contract basis by Dr. Richard M. Hansen's Composition Analysis Laboratory at Colorado State University, Fort Collins, Colorado 80523.

above-normal for most of the first year of the study (November 1976 through October 1977) and below the long-term average for the second year (January 1978 through October 1978).

RESULTS

All sheep in the flock grazing the pasture from November 1976 through October 1977 contracted hard yellow liver, but no symptoms appeared in any of the flock grazed on the same pasture from January 1978 through October 1978.

During the "hard yellow liver year" (November 1976 through October 1977), 33 different plants were identified in sheep fecal samples. Diet diversity was highest in February 1977 (18 different foods) and lowest in September and October 1977 (11 different foods). In contrast, only 25 different plants were identified in sheep diets during the second year (January 1978 through October 1978). Diet diversity in the second year was highest during July (13 different foods) and lowest during June and October (8 different foods).

Grasses contributed 53% of the average yearlong diet during the "hard yellow liver year" while forbs contributed 47% (Table 1). Grasses were most important in sheep diets in December 1976, February, July, August, and October 1977, whereas forbs were most important in March, April, May, June, and September 1977. Grasses and forbs were eaten in equal amounts in November 1976. During the drier second year, grasses contributed 60% of the average yearlong diet while forbs and other items contributed 40% (Table 2). In the second year, grasses were most important in sheep diets during January, March, April, June, July, and August while forbs were most important in February, May, September, and October.

Buffalograss (*Buchloe dactyloides*) was the most important sheep food both years, contributing 33.8% of the annual diet the first year and 42.5% the second year. During the "hard yellow liver year" buffalograss was most important in sheep diets in August (70.9%) and least important in April (3.9%). In the second year, buffalograss was most important in July, March, and June (66%, 64.4% and 61.6% of the diet, respectively) and least important in February (23.7%). Threeawns (*Aristida* spp.) contributed 5.1% of the annual diet during the "hard yellow liver year" (range: 21% in February 1977 to 0.7% in October 1977) while burrograss (*Scleropogon brevifolius*) contributed 3.4% (range: 14% in February 1977 to 0% in April through October 1977). Sand dropseed (*Sporobolus cryptandrus*) contributed 7.6% of the annual diet during the second year of the study (range: 22.1% in January 1978 to 3.1% in October 1978), compared to only 2.7% of the annual diet during the 1976-77 period. During the second year threeawns contributed 2.9% of the annual diet and burrograss contributed only 0.6%. Sixteen species of grasses were identified in sheep diets during 1976-77, compared to 15 species in 1978.

Forbs were much more abundant during the "hard yellow liver year" (1976-77) than during 1978 due to differences in effective precipitation. A total of 15 forb species were identified in sheep diets in 1976-77, compared to 8 species in 1978.

Croton (*Croton* spp.) was the most important forb in sheep diets during both years, contributing 20.2% of the annual diet in 1976-77 (Table 1) and 39.9% in 1978 (Table 2). Croton was a major food of sheep during November, March, June, July, September, and October of the "hard yellow liver year" and during every month of the second year. Filaree (*Erodium texanum* and *E.*

cicutarium) was highly important in sheep diets in April, May and June of 1977 but only contributed a trace amount to sheep diets during July 1978 of the second year. Filaree contributed 86.3% of the sheep diets in May 1977. Bladderpods (Lesquerella spp.) and Nuttall milkvetch (Astragalus nuttallianus) contributed 3.3% and 2.7% of the annual diet in 1976-77, but these plants were either not detected or were very minor diet components in 1978.

Plant species present in the experimental pasture which are known to cause livestock losses or which are closely related to plants known to cause livestock losses in other parts of the United States include croton, Nuttall milkvetch, tansymustard (Descurainia pinnata), silverleaf nightshade (Solanum elaeagnifolium), threadleaf groundsel (Senecio longilobus), locoweed (Astragalus mollissimus), bitterweed (Hymenoxys odorata), trecul queensdelight (Stillingia treculiana), and honey mesquite (Prosopis glandulosa Torr. var. glandulosa) (2,4). Tobosagrass (Hilaria mutica) is a dominant plant on the clay flat range sites and tobosagrass ergot (Claviceps cinerea), a fungus, is known to be toxic to cattle (4). Several of the plant species eaten by sheep are commonly infected with fungus. Since many plants are toxic only when infected with fungus (2), plants known to be eaten by sheep are sampled monthly and sent to Dr. Charles Bridges (Department of Veterinary Pathology) for identification and evaluation. During 1976-77 microscopic examination of plants in sheep fecal samples revealed heavy infestations of fungus in epidermal tissues of croton, buffalograss, threeawns, bladderpods, and tobosagrass.

A similar study is being conducted on the 137-acre pasture in 1979 to further elucidate the interrelationships of forage, fungus, sheep diets, weather and hard yellow liver disease in sheep.

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TABLE 1. DRY WEIGHT COMPOSITION (%) OF SHEEP DIETS NOV., 1976 THROUGH OCT., 1977 IN REAGAN COUNTY, TEXAS

	Month											
Plants	Nov.	Dec.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Mean
Grasses and grass-like plants												
Threeawns	5.8	6.0	21.0	8.7	1.7	1.3	2.7	3.8	1.7	2.2	0.7	5.1
Silver bluestem	0.9	2.2	2.0	0.4	-	-	-	2.5	-	-	-	0.7
Sideoats grama	0.2	0.7	0.3	0.6	-	-	2.1	2.1	9.0	0.9	0.9	1.5
Rescuegrass	0.2	-	0.9	-	-	0.8	-	0.2	1.2	-	0.1	0.3
Buffalograss	25.5	69.3	26.6	14.6	3.9	6.1	6.9	55.6	70.9	29.8	62.4	33.8
Sedge	-	-	-	-	-	0.2	0.6	0.2	-	-	-	0.1
Inland saltgrass	0.9	0.2	6.0	0.4	0.3	-	-	-	1.0	0.1	-	0.8
Tobosagrass	1.8	1.8	0.6	8.0	-	0.8	3.0	2.1	0.2	0.6	0.3	1.8
Sand muhly & ear muhly	0.9	2.9	2.6	2.7	-	-	-	5.4	0.7	1.0	2.7	1.7
Vine mesquite & Hall's panicum	-	-	3.2	-	0.3	-	-	-	3.1	0.2	-	0.6
Burrograss	11.3	3.4	14.0	9.0	-	-	-	-	-	-	0.1	3.4
Foxtail barley	-	-	0.3	-	3.2	1.1	-	0.4	-	-	-	0.5
Sand dropseed	0.7	2.7	6.3	-	0.6	-	4.3	4.2	4.2	3.0	3.4	2.7
Texas wintergrass	-	-	-	-	-	-	0.3	-	-	-	-	t*
Slim tridens & white tridens	1.6	1.1	1.1	-	-	-	-	-	0.5	0.5	0.1	0.5
Unknown grass	-	-	-	-	-	-	-	-	-	0.1	-	t
Forbs and other items												
Nuttall milkvetch	-	-	9.5	1.2	18.6	0.8	-	-	-	-	-	2.7
Thistles	-	-	-	-	-	-	-	-	0.3	-	-	t
Croton	46.4	6.3	3.5	22.6	0.9	0.2	26.8	18.2	6.9	61.5	29.1	20.2
Tansymustard	-	-	-	0.8	-	-	-	-	-	-	-	0.1
Filaree	0.5	-	-	2.9	54.4	86.3	33.2	1.8	-	-	-	16.3
Slender janusia	-	-	-	-	-	0.2	0.6	0.6	-	-	-	0.1
Prairie pepperweed	-	-	-	-	0.5	-	-	-	-	-	-	0.1
Bladderpods	1.6	3.6	-	27.0	3.2	-	-	0.4	-	-	0.1	3.3
Common horehound	-	-	-	-	-	0.2	-	-	-	-	-	t
Pricklypear	-	-	0.3	-	-	-	-	-	-	-	-	t
Redseed plantain	-	-	-	-	-	0.2	3.7	-	-	-	-	0.4
Prairie coneflower	1.4	-	-	-	-	-	-	1.8	-	-	-	0.3
Clubmoss	-	-	0.9	0.4	-	-	-	-	-	-	-	0.1
Silverleaf nightshade	-	-	1.1	-	-	-	-	0.6	-	-	-	0.2
Globemallow	-	-	-	0.6	2.7	1.9	-	-	-	-	-	0.5
Crownbeard	-	-	-	-	9.7	-	8.6	-	-	-	-	1.7
Unknown forb	-	-	-	-	-	-	-	-	0.5	-	-	0.1
Seeds	0.2	-	-	-	-	-	7.2	0.2	-	-	-	0.7

*t=trace

TABLE 2. DRY WEIGHT COMPOSITION (%) OF SHEEP DIETS JAN., 1978 THROUGH OCT., 1978 IN REGAN COUNTY, TEXAS

	Month										
Plants	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Mean
Grasses and grass-like plants											
Threeawns	3.1	3.9	1.6	6.7	3.1	2.2	0.4	2.1	2.5	3.1	2.9
Silver bluestem	0.9	1.9	-	-	-	-	-	0.9	-	-	0.4
Sideoats grama	-	0.3	1.4	5.8	4.3	3.9	5.3	1.5	0.7	0.2	2.3
Rescuegrass	-	-	-	-	-	-	-	-	0.2	0.1	t*
Buffalograss	34.0	23.7	64.4	34.9	23.7	61.6	66.0	52.0	30.7	33.8	42.5
Sedge	0.3	1.2	0.2	0.2	-	-	-	-	-	-	0.2
Inland saltgrass	0.6	-	-	0.2	0.1	0.4	-	0.3	0.5	-	0.2
Spikesedge	0.3	-	-	-	0.1	-	0.1	-	-	-	0.1
Tobosagrass	10.4	-	0.6	1.0	1.7	2.5	1.4	4.8	1.6	1.1	2.5
Foxtail barley	-	-	-	-	0.3	0.1	-	-	-	-	t
Sand muhly & ear muhly	-	-	0.4	2.0	-	-	0.3	0.3	-	0.1	0.3
Tumblegrass	-	-	-	-	0.1	-	-	-	0.1	-	t
Burrograss	1.5	1.4	0.6	1.8	0.5	-	0.1	-	-	-	0.6
Sand dropseed	22.1	4.1	8.2	7.0	5.6	5.7	9.2	7.0	3.8	3.1	7.6
Slim tridens & white tridens	0.3	1.6	-	-	0.1	-	-	-	-	-	0.2
Forbs and other items											
Nuttall milkvetch	-	-	-	-	-	-	0.1	-	-	-	t
Thistles	-	0.2	-	-	-	-	-	-	-	-	t
Croton	26.6	61.6	22.5	40.5	60.4	23.6	16.4	29.4	59.7	58.5	39.9
Filaree	-	-	-	-	-	-	0.1	-	-	-	t
Slender janusia	-	-	-	-	-	-	0.3	0.3	-	-	0.1
Alfalfa	-	-	-	-	-	-	-	0.9	-	-	0.1
Pricklypear	-	-	-	-	-	-	0.1	-	-	-	t
Clubmoss	-	0.2	-	-	-	-	-	-	-	-	t
Yucca	-	-	-	-	-	-	-	0.3	-	-	t
Lichen	-	-	-	-	-	-	-	0.3	-	-	t

* t=trace

PR-3574

AN ANALYTICAL METHOD FOR THE ANALYSIS OF A MYCOTOXIN, SPORIDESMIN, FROM PITHOMYCES CHARTARUM

Clive Halder,* Ruth Taber, ** and Bennie J. Camp*

Sporidesmin, a mycotoxin produced by the fungus *Pithomyces chartarum* has been incriminated as the toxic principle in the mycotoxicosis of sheep and cattle, commonly called facial eczema (1,2,3). This disease is a major economic problem in the sheep and cattle industry of New Zealand. A similar syndrome in sheep has been observed in Texas where sheep graze Kleingrass. Taber *et al.* (4) reported the isolation of *P. chartarum* from pastures growing in the Gulf Coast Plain of Texas, but these workers did not detect sporidesmin in cultures isolated from these pastures. Taber (5) isolated *Pithomyces chartarum* from pastures of Kleingrass during periods of photosensitization in sheep that were grazing Kleingrass.

EXPERIMENTAL

Cultures of *Pithomyces chartarum* obtained from diMenna *et al.* (Ruakura Soil Research Station, Hamilton, New Zealand) were grown on kleingrass and ryecorn for four weeks at ambient temperatures. The fungal material was harvested from the plant material by a wet flotation and filtration technique. The sporidesmin was extracted from the isolated fungal material by extraction into acetonitrile and benzene. The solvent mixture was evaporated to dryness, and the residue was dissolved in a mixture of methanol and water. The aqueous phase was extracted with hexane and then extracted with benzene. The benzene extract was evaporated to dryness and the residue was dissolved in acetonitrile.

The acetonitrile sample was injected into a high performance liquid chromatograph equipped with a reverse phase μ-Bondapak C_{18} column and ultraviolet detector (254 mm). The mobile phase consisted of methanol-water (47:53) at a flow rate of 2.0 ml/min and a column pressure of 2000 p.s.i. The sensitivity of the detector was set at 0.01 absorbance units at full scale with a recorder speed of 5.0 in/hr.

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RESULTS

Based on 12 parallel extractions on fungal material spiked with standard sporidesmin at the 0.98 to 2.45 µg range, the recoveries were 91 ± 3%. With standard curves plotting the peak height ratios versus sporidesmin concentration, the plot exhibited a linear relationship between 100 to 500 µg with a correlation coefficient averaging 0.9982.

CONCLUSION

A rapid and accurate analytical technique has been developed for the analysis of fungal and plant material with the presence of sporidesmin.

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PR-3575

STRATEGIC USE OF ANTHELMINTICS IN SHEEP IN THE EDWARDS PLATEAU OF TEXAS

Tom Craig*

Several studies indicate that a significant reduction in the magnitude of parasitism in ewes and lambs can be achieved by the strategic use of anthelmintics in ewes in the early lactation[1,2]. Parasitic disease in sheep in the Edwards Plateau will vary from year to year largely based on the weather conditions which larval parasites encounter and the amount of resistance which the sheep develop to combat them. Except for a clairvoyant few, most producers cannot accurately anticipate weather conditions far enough in advance to plan rational worming programs, so the strategic use of anthelmintics is based on a phenomenon which occurs year after year, despite the weather: lambing. The ewe loses her ability to rid herself of parasite infections during lactation 1, and lambs are unable to mount effective resistance to certain worms until they are at least 5 to 6 months of age[3,4]. It would seem reasonable that treatment of ewes when they have a relatively low parasite burden in the spring[5], even though they are unable to mount an immune response, will interfere with the usual escalation of parasite numbers that leads to disease in the summer. The effect of a strategic treatment given to ewes at the time the lambs were docked is depicted. Figures 1 and 2 compare treatment and the effects of placing ewes in contaminated or "clean" (not grazed by helminth-infected ewes for 4 months) pastures (Fig 1), and treatment at the time of docking, March, with that at shearing, early May, during a dry summer (Fig 2). As can be seen, the ewes not treated in either case (Group 3) had a much heavier parasite burden, expressed as the numbers of worm eggs produced. Likewise the lambs pastured with these ewes developed greater parasite burdens if their mothers were not given a strategic treatment (Figs 3 and 4). Not only did the number of parasites increase significantly in untreated controls, these ewes showed signs of parasitic disease manifested by anemia and decreased serum protein levels.

This study is being continued to compare the economic value of strategic treatment with that of tactical treatment[6,7] (that treatment given when helminth burdens start to increase due to favorable weather conditions, but before clinical signs of parasitism are seen). The results of data gathered thus far indicate that, at least as far as spring lambing in the Edwards Plateau is concerned, strategic treatment is a reasonable practice in preventing parasitic disease in ewes and lambs.

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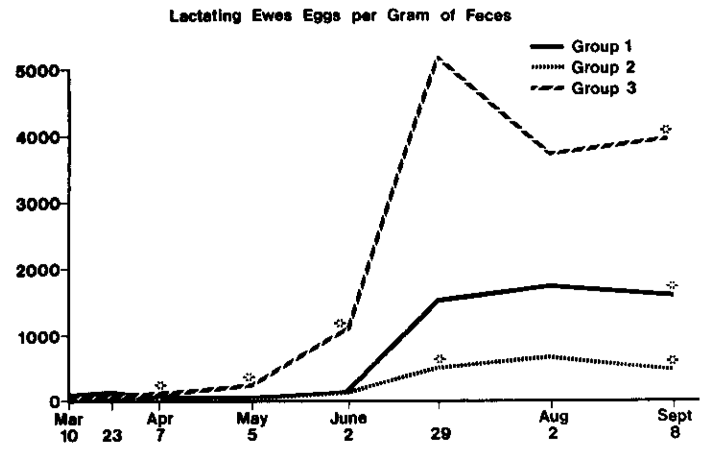

Figure 1 Value of strategic anthelmintic treatment of ewes treated at the time of lamb docking
Group 1: Strategic treatment and "clean" pasture
Group 2: Strategic treatment and contaminated pasture
Group 3: No treatment and "clean" pasture
Asterisk indicates significant ($P < 0.05$) differences from expected values.

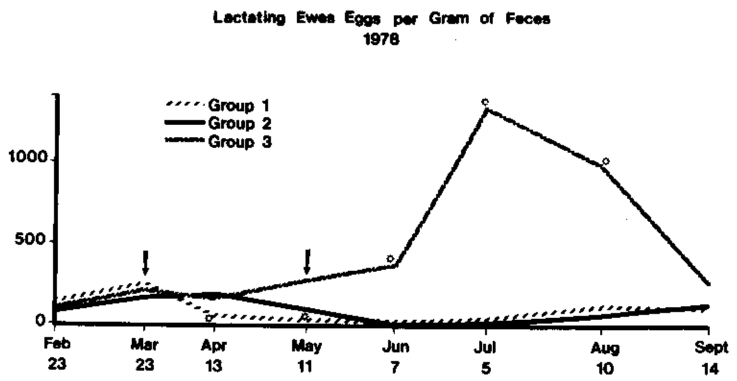

Figure 2 Value of strategic anthelmintic treatment of ewes at docking and shearing.
Group 1: Strategic treatment at docking 23 Mar
Group 2: Strategic treatment at shearing 10 May
Group 3: Untreated controls
Asterisk indicates significant ($P < 0.05$) differences from expected values.

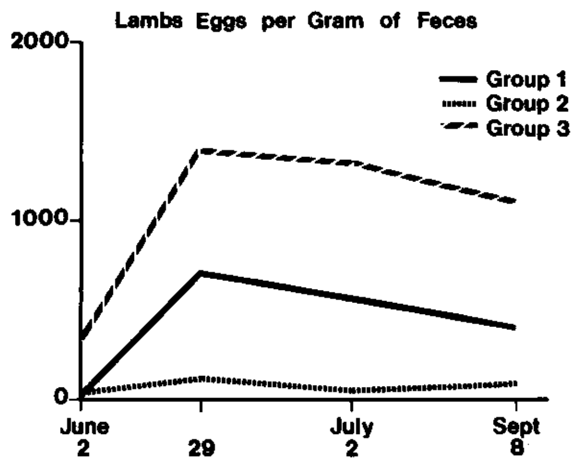

Figure 3 Reflection of parasite levels of lambs suckling ewes depicted in figure 1

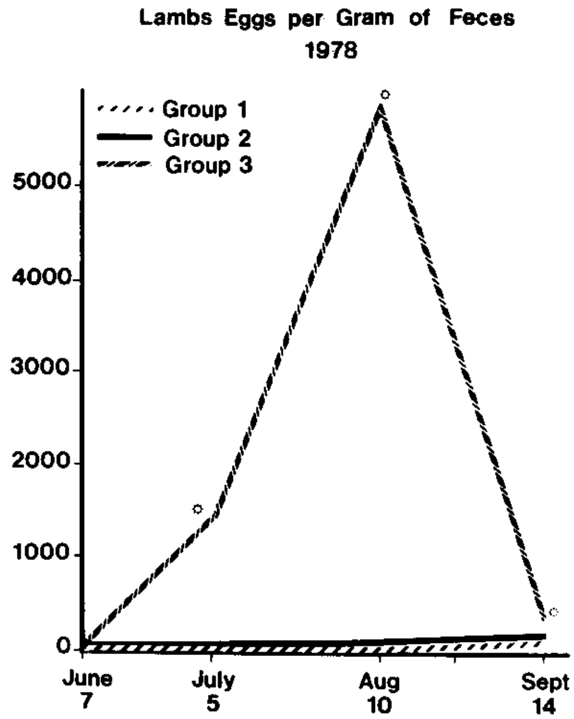

Figure 4 Reflection of parasite levels of lambs suckling ewes depicted in figure 2
Asterisk indicates significant ($P < 0.05$) differences from expected values.

PR-3576

EFFECT OF VARIOUS DRENCHING PRODUCTS ON THE CONTROL OF STOMACH WORMS IN YEARLING EWES

N.J. Adams[1/], Billy Reagor[2/], and R.R. Bell[3/]

INTRODUCTION

Sheep producers on the western edge of the Edwards Plateau are uncertain as to the value of treating developing yearlings for the control of stomach worms. Failing to control stomach worms can delay growth and even result in death losses. Yet drenching when not necessary is expensive and time consuming.

This field investigation was conducted to determine if treating for stomach worms was beneficial and to compare drenching products.

EXPERIMENTAL PROCEDURES

One-hundred yearling Rambouillet ewes were selected at random from 250 running on the same range in Crockett county on the western edge of the Edwards Plateau. This area receives an average annual rainfall of 16 to 18 inches. Twenty-five ewes were assigned at random to each of four treatment groups as shown in Table 1.

Each ewe was individually identified by a paint brand number. Fecal samples were taken from each ewe and placed in individual sample bags and stored in an ice filled chest. These were transported to the Veterinary Parasitology Laboratory at College Station and egg counts determined by the McMaster's fecal counting procedure. The ewes were weighed and each treated with its assigned drench or left untreated to serve as controls. The ewes were then returned to the original flock which were grazing on native range. The 150 ewes not used in this evaluation, but running with the test ewes, were not drenched when the test ewes were treated. Growing conditions during this evaluation were poor and native feed was short.

After seven days, the ewes were again gathered and individual fecal samples were taken and processed in the same manner as the original samples. After the 75-day grazing season from July 21 to October 5, the ewes were again gathered and individual weights and fecal samples taken. Weighing conditions were similar to those used to obtain the initial weights. Only one ewe was missing from the original group.

RESULTS AND DISCUSSION

Table 2 provides mean values for the number of eggs found by treatment group for each collection date. As can be seen, drenching with any

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of the products greatly reduced the number of parasite eggs at the seven day post-treatment count. Egg counts remained at a relatively low level for the three drench treatment groups after 75 days on native range. The control or non-drench group stayed relatively unchanged in number of parasite eggs. The egg number in the control group is not considered high enough to be damaging under most conditions.

The performance of these ewes by treatment group is given in Table 3. Considerable variation existed in gain among ewes within groups. Individual gain over the 75-day grazing period ranged from a loss of four pounds to a gain of 21 pounds. There were no significant differences among treatment groups.

Based on the results of this trial any of the three drench products evaluated reduced parasite egg count. All treated groups remained relatively clean through the grazing period of the test. There were no differences in gain between ewes which had been drenched and those which had not been drenched.

Under the conditions which prevailed during this evaluation, there was no value in treating yearling ewes for stomach worms.

"The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied."

TABLE 1. FIELD TRIAL DESIGN

Treatment No.	No. of Ewes	Treatment Description
1	25	Oxfendazole
2	25	Controls
3	25	Tramisol
4	25	Thibenzole (TBZ)

TABLE 2. FECAL EGG COUNT BY TREATMENT GROUP

	Egg Count (eggs per gram)		
Treatment	Initial Count 7/21	7 Day Post Treatment 7/28	Final Count 10/5
Oxfendazole	236	14	15
Control	208	200	166
Tramisol	229	25	73
Thibenzole	240	17	40

TABLE 3. EWE PERFORMANCE BY TREATMENT GROUP

			Oxfendazole	Control	Tramisol	Thibenzole
No. of ewes			25	25	24	25
Initial wt.	7/21	lbs.	89.4	87.0	87.7	89.2
Final wt.	10/5	lbs.	94.3	92.0	93.5	95.4
Average 75 day gain		lbs.	4.9	5.0	5.8	6.2
Average daily gain		lbs.	.065[a]	.067[a]	.077[a]	.082[a]

[a] means on the same line carrying a common superscript are not statistically different

PR-3577

STOMACH WORM CONTROL IN FEEDER LAMBS ON IRRIGATED PECAN ORCHARDS

N.J. Adams[1/], John Menzies[2/], and R.R. Bell[3/]

INTRODUCTION

The profitability of a feeder lamb operation depends on the ability of the lambs to gain weight. Internal parasites can seriously affect the performance of sheep, particularly lambs. The control of internal parasites in feeder lambs is a vital part of management. The decisions facing producers are when to drench, what product to use and how frequent to treat under their environmental conditions.

Large acreages of pecan trees have been established in West Texas in recent years. Some operations use feeder lambs in a dual role to keep vegetation down in the developing orchards and to produce weight gain on lambs from this vegetation. A heavy concentration of lambs is often required to keep vegetation down to a level which will not be competitive for water use. The pecan orchards are flood and/or drip irrigated. This water, plus summer showers, provides ample moisture for good vegetative growth and may create favorable conditions for internal parasite development. This environment plus heavy concentrations of lambs can lead to heavy infestation of stomach worms in feeder lambs.

This field evaluation was conducted to develop information on the effectiveness of drenching feeder lambs under these conditions and to compare a new product with two products currently on the market.

EXPERIMENTAL PROCEDURES

One hundred-twenty feeder lambs were randomly sorted from a larger band of 2,000 grazing on Johnson grass and annual weeds under young trees in a pecan orchard. Lambs were stratified by breed and sex so that only crossbred (Rambouillet X Blackface) wether lambs were used. The lambs were allotted at random to four treatment groups as shown in Table 1. They were individually numbered and weights recorded at the beginning and at the conclusion of the test. A fecal sample was taken from each lamb prior to administering any treatments. These samples were placed in a numbered plastic bag and transported in a chilled container to the Veterinary Parasitology Laboratory in College Station for parasite egg counts. The three treated groups received the desiginated dosage indicated in Table 1 as an oral drench. The remaining lambs in the band were also drenched.

Seven days after the initial treatment the lambs were gathered and fecal samples were again taken. Sampling procedures were the same as for the initial collection. All egg counts were determined by the McMaster's fecal counting procedure. At the conclusion of the 62-day trial the lambs were weighed and a final fecal sample taken. Eleven lambs were not accounted for at the final weighing date.

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RESULTS AND DISCUSSION

Data on the number of parasite eggs found by treatment group are provided in Table 2. Each drench material substantially reduced egg counts at the seven-day post-treatment count. There was a gradual increase over the remaining 55-day grazing period for each treated group. Final egg count figures are considered very low, and no treatment would be recommended. The control or non-drenched group had substantually higher egg count numbers, but this number is not considered high and drenching may not be recommended. Egg counts below 300 are normally associated with performance levels which would not warrant treating for internal parasites. However, animal condition and feed supply would dictate recommendation with egg counts at the levels of the control group in this evaluation.

A comparison of the performance between drenched and untreated lambs is provided in Table 3. As the figures show, there was no difference in weight gains of the lambs whether they were drenched for stomach worms or not.

The performance of these lambs by treatment group is given in Table 4. There was no difference among treatment groups in weight gain during the 62-day evaluation period.

Under the conditions of this evaluation there was no apparent benefit from drenching lambs for stomach worms. The three products compared gave equal results in reducing parasite egg counts and no difference existed in weight gain of lambs among the products evaluated.

The control lambs in this evaluation had not been drenched for over 92 days. They did not show excessive egg counts nor did they gain less than lambs receiving a drench. They were, however, running with a band which had all been treated. Due to seasonal variations a treatment program based on monitored egg count data and good judgement would be advisable. This information indicated that under the conditions which existed during this test period lambs would not require drenching for satisfactory performance.

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TABLE 1. PROJECT TREATMENT DESIGN

Treatment Group No.	No. of Lambs	Treatment Description	Dosage
1	27	Oxfendazole	5 mg/kg
2	30	Controls	None
3	26	Tramisol	1 oz./lamb
4	26	Thibenzole	1 oz./lamb

TABLE 2. FECAL EGG COUNT BY TREATMENT GROUP

Treatment Compound	Initial Count (7/20)	7-day Post-treatment (7/27)	Final Count (9/21)
Oxfendazole	306	19	30
Control	248	253	208
Tramisol	202	22	60
Thibenzole	263	20	90

TABLE 3. COMPARISON OF PERFORMANCE FOR TREATED VS UNTREATED LAMBS

		Controls	Treated
No. of lambs		30	79
Initial wt.	lbs.	69.3	69.7
Final wt.	lbs.	77.8	78.3
Average 62 day gain		8.5	8.6
Average daily gain		.137	.138

TABLE 4. MEAN VALUES OF LAMB PERFORMANCE BY TREATMENT

		Oxfendazole	Control	Tramisol	Thibenzole
No. of lambs		27	30	26	26
Initial wt.	lbs.	69.6	69.3	70.1	69.6
Final wt.	lbs.	78.2	77.8	78.0	78.8
Average 62 day gain	lbs.	8.6[a]	8.5[a]	7.9[a]	9.2[a]
Average daily gain	lbs.	.138[a]	.137[a]	.127[a]	.148[a]

[a] means on the same line carrying a common superscript are not statistically different.

PR-3578

LAMB AND KID NECROPSIES AND MORTALITY FACTORS FOUND IN OPERATION DEAD LAMB - 1978-79

Dale A. Wade and Charles W. Livingston, Jr.*

Necropsies to determine the cause of death were completed on 159 lamb and kid goat carcasses submitted for examination from 22 counties in the Edwards Plateau area to the Texas A&M University Research and Extension Center at San Angelo during the periods January - July 1978 and January - May 1979.

Dr. Bart W. O'Gara, University of Montana, Missoula, performed the necropsies on the first group of carcasses on February 27, 1978. Dr. Charles W. Livingston, Jr., Research Veterinarian, and Dr. Dale A. Wade, Area Wildlife Specialist, both stationed at the Texas A&M University Research and Extension Center, assisted Dr. O'Gara.

Livingston and Wade have since examined additional groups of carcasses delivered to the Center. Table I summarizes the results of necropsies on 80 animals examined from February through July 1978 and on 79 animals examined from January through May 4, 1979.

TABLE I. CAUSE OF DEATH OF LAMB AND KID CARCASSES SUBMITTED FOR NECROPSY BETWEEN JANUARY 1978 AND MAY 1979.

Cause of Death	Lambs 1978	Lambs 1979	Kids 1978	Kids 1979	Total 1978	Total 1979
Killed by mammals	15	22	3	1	18	23
Killed by eagles	9	14	15	5	24	19
Probable eagle kills	11	1	10	-	21	1
**Predation (moribund animals)	-	6	-	3	-	9
Misc. Causes, predation undetermined (disease, starvation, etc.)	9	21	8	6	17	27
Total confirmed predator kills:	1978 42	1979 42			80	79
Total probable predator kills:	21	1				
**Total predation (moribund animals)	-	9				

**Animals, dying from other causes, which would not have survived.

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The cause of death was determined, in most instances, for each animal by detailed examination of carcass remains. In some instances, there were insufficient remains to permit an accurate diagnosis, or the evidence was not conclusive. For these animals, death was ascribed to unknown causes, or where appropriate, to a probable cause.

Some of the animals necropsied had been almost entirely consumed and in others, the entire viscera were missing; thus, their nutritional status could not be determined. For those of which sufficient remains existed to evaluate their condition, there was no apparent selection by predators for sick, weak, or starving animals. This is consistent with the results of numerous other investigations in recent years.

Depredation as the cause of death was determined by the presence of tooth or talon punctures accompanied by extensive hemorrhage of the skin and surrounding tissue, since such hemorrhage does not occur after the heart stops and blood flow ceases. Likewise, bruises do not occur after death. In some cases, there was insufficient evidence of hemorrhage remaining to confirm depredation or other factors as the cause of death, even though there were multiple puncture wounds of the skin, or other injuries. Characteristics used to distinguish kills by eagles and mammals include location, size, shape, spacing, and depth of puncture wounds through the skin and underlying tissue, and into the skull, other bones, and body cavities.

Punctures caused by the canine teeth of mammals are typically rounded and occur in double pairs from the opposing pairs of teeth. Crushing of intervening soft tissue and bone, including the skull, is common on smaller prey such as lamb and kids. Crushing of the trachea and larynx is frequently found on larger prey, such as adult sheep, killed by the characteristic throat attack by coyotes. Multiple puncture wounds caused by repeated biting may obscure the characteristic paired tooth wounds but does not alter the shape of the punctures.

Eagles have three toes opposing the hallux (rear toe) on each foot. The front talons leave wounds one to three inches apart with the wound from the hallux four to six inches from the wound caused by the middle front talon. On animals the size of small lambs and kids, fewer than four talon wounds may be round, one made by the hallux and one or two by the opposing toes. Talon puncutres are typically deeper than those caused by canine teeth and tend to be triangular in shape. Crushing between the wounds is not usually found, although compression fractures of the skull of small animsl may occur from an eagle's grip. Small lambs and kids may be seized anywhere on the head, neck, or body, with lambs frequently being grasped by the head from the front or side. Eagles usually kill lambs and kids weighing 25 pounds or more by multiple talon stabs into the back and upper ribs. The talons commonly puncture large arteries, causing massive internal hemorrhage. From the evidence found during these examinations, there are also indications that small kids may tend to struggle more than small lambs before being subdued by eagles, and thus receive more talon stabs to the body than lambs. Additional investigations may help to clarify this point.

From the dates reported for some of these animal deaths and the dates on which carcasses of others were found, depredation by eagles appears to be more frequent and widespread from December through March in these 22 counties from which carcasses were submitted. From the limited number of carcasses reported found during those months and examined at the Texas A&M University Research and Extension Center, depredation by mammals appears to predominate from March through May.

PR-3579

QUALITY, APPEARANCE AND TENDERNESS OF ELECTRICALLY STIMULATED LAMB

R.R. Riley[1], J.W. Savell[2], G.C. Smith[1] and Maurice Shelton[3]

INTRODUCTION

Interest in the incorporation of electrical stimulation in the slaughter-dressing sequence of U.S. beef packing plants has been due to the multiple benefits realized by the packer--increased tenderness and improved quality-indicating characteristics. Research has not been conducted to ascertain whether some of the improvements in the quality-indicating characteristics observed in beef (such as lean color) would also be found in lamb. Brighter lean color and more attractive lamb chops in the retail case, in addition to the benefits of increased tenderness, could make the use of electrical stimulation for lamb in the United States a reality.

This study was conducted to investigate the effects of electrical stimulation on some of the quality-indicating characteristics of lamb. Also, evaluations were made of loin chops displayed under retail conditions in order to determine the possible effects of electrical stimulation on muscle color, surface discoloration and overall appearance. Finally, shear force determinations were obtained for cooked loin chops from electrically stimulated and control sides to further document tenderness improvement due to electrical stimulation.

EXPERIMENTAL

Fourteen wether lambs were exsanguinated, dressed, split longitudinally and the left side of each carcass was electrically stimulated within 30 min postmortem and before chilling. The source of electrical stimulation was an experimental "Lectro-Tender™" unit manufactured by the LeFiell Company, San Francisco, California, USA. The single probe of the unit was inserted in the muscles between the first rib and blade-bone of each side with the rail serving as the ground for the completion of the circuit. The stimulator setting was 550 volts (AC), 5 amps and 17 impulses were given during a period of 1 minute (1.8 sec duration, 1.8 sec interval between impulses).

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Quality and yield grade measurements. Approximately 24 hr following slaughter, quality and yield grade factors were assigned by T.A.E.S. personnel. The factors evaluated were adjusted fat thickness, 12th rib; USDA leg conformation; kidney and pelvic fat percentage; USDA skeletal lean and overall maturity; intercostal feathering; flank streaking; and ribeye muscle area.

Fabrication. The ribeye muscle was removed from the wholesale loin and cut into four chops (3.8 cm in thickness) on the fifth day postmortem. Loin chops were cut using strict sanitation procedures which consisted of continuous cleansing of hands and equipment as well as knife sterilization between fabrication of loins.

Retail display. Two boneless loin chops from each side were placed on foam trays, overwrapped with polyvinyl chloride film and displayed in a standard retail display case at 1-3° C under 883 lux of incandescent light for four days. At 24-hr intervals, a nine-member trained panel evaluated the chops for muscle color (9=very light cherry red, 1=very dark purple), surface discoloration (7=no surface discoloration, 1=total surface discoloration), and overall appearance (8=extremely desirable, 1=extremely undesirable). Chops were weighed at the beginning and end of retail display in order to determine shrink loss.

Bacterial counts. Samples for bacterial counts were taken from the lean surface of the retail cuts at the beginning and end of retail display by the use of a moist sterile dacron swab, a 9 cm^2 sterile template and buffered rinse solution technique. After swabbing, samples were diluted in phosphate buffer, plated (within 30 min of swabbing) and incubated at 22° C for 5 days to obtain psychrotrophic counts.

Shear force determinations. On the fifth day postmortem two chops from each side were wrapped with polyethylene-coated paper, frozen and stored (-23° C) for two weeks. Each chop was removed from the freezer, thawed and cooked to 70° C internally in a 190° C gas oven. Chops were weighed before and after thawing and after cooking in order to determine thawing and cooking loss percentages. After chops were cooled to room temperature, two cores (1.3 cm in diameter) were removed from each chop (four cores per side) and shear force measurements were obtained by the use of the Warner-Bratzler shear force machine.

Statistical analysis. The data were analyzed by the use of paired-t distribution analysis to determine significance of difference between treatments.

RESULTS

Comparisons of untreated (control) and electrically stimulated sides for muscle color, cooking characteristics and shear force values are reported in Table 1. Electrically stimulated sides had significantly more youthful ribeye muscle color ($P<.001$) and internal (primary and secondary flank and intercostal) lean color ($P<.10$) and lower Warner-

Bratzler shear force values ($P<.01$) than did samples from the untreated sides. Cooking loss did not differ ($P>.10$) between samples from electrically stimulated and untreated sides.

Presented in Table 2 are comparisons of retail caselife for boneless loin chops from electrically stimulated and untreated sides. No significant differences ($P>.10$) were observed between retail cuts from electrically stimulated and untreated sides for muscle color, surface discoloration and overall appearance after 3 days of retail display; however, loin chops from the electrically stimulated sides were more desirable ($P<.10$) in appearance on Day 4 than were the chops from the untreated sides. Initial bacteria counts and final bacteria counts from samples of electrically stimulated lamb were substantially lower numerically than were those from samples of untreated sides after 0 and 4 days of retail case display.

DISCUSSION

Since color is undoubtedly related to decisions on purchasing, production of young slaughter animals might help alleviate a color problem in lamb since physiological maturity is closely related to color (Carpenter, 1966). Electrical stimulation has been shown to improve lean color of beef (Savell et al., 1978a, b; 1979); improved lean color in retail cuts of lamb may greatly enhance their attractiveness to retail customers. In the present study, lean color (longissimus muscle and body cavity muscle surfaces) was significantly improved by the use of electrical stimulation, but muscle color of chops from electrically stimulated sides displayed under retail conditions was not different from that of chops from sides in the control group. The color advantage for chops from electrically stimulated sides at 24 hr may be negated by chilling and storage for five days before fabrication. It is possible that use of differing voltages, impulses, etc. for electrical stimulation could prevent deterioration in lean color associated with additional postmortem chilling time.

Extending the retail caselife of lamb is important because lamb is a slow-moving item at retail in many parts of the U.S. In this study, overall appearance of chops from electrically stimulated lambs was significantly improved in comparison to that for chops from control lambs after four days of display. Bacterial counts (initial and final) were substantially lower for chops that were from electrically stimulated sides. It is possible that electrical stimulation may have a deleterious effect on either bacteria or on their growth medium.

In conclusion, it is possible that electrical stimulation can be utilized to improve the lean maturity of certain lean surfaces of the lamb carcass, to increase tenderness, to improve appearance of chops during retail display and to reduce bacterial growth on retail cuts. Such advantages for electrically stimulated lamb may lead to utilization of the electrical stimulation process by lamb slaughterers in the United States.

SUMMARY

Fourteen wether lambs were slaughtered, split longitudinally and the left sides were electrically stimulated (ES) with 17 impulses (1.8 sec duration) of 550 volts for one minute prior to chilling. Ribeye muscles from electrically stimulated sides were more youthful (P<.001) in color, and body cavity muscles (primary flank, secondary flank, intercostal) were brighter (P<.05) in color at 24 hr postmortem. There were no significant differences between chops from electrically stimulated and control sides for muscle color, surface discoloration and overall appearance after 3 days of retail display; however, loin chops from the electrically stimulated sides were more desirable (P<.10) in appearance on the fourth day of retail display than were the chops from the control (unstimulated) sides. Shear force measurements revealed that samples from electrically stimulated sides were significantly (P<.01) more tender than were samples from the control sides. These data suggest that lamb lean color can be made brighter and more youthful in appearance by use of electrical stimulation. Other advantages associated with use of electrical stimulation are extended retail caselife and markedly improved tenderness of loin chops.

ACKNOWLEDGMENTS

This study was partially supported by King Ranch, Inc., Kingsville, TX; the Natural Fibers and Food Protein Commission of Texas, Austin, TX and by the LeFiell Company, Inc., San Francisco, CA.

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Table 1. Comparison of muscle color, cooking characteristics and shear force values for samples from electrically stimulated and untreated sides

Trait	Electrically stimulated		Untreated (control)		Level of probability[a]
	Mean	S.D.	Mean	S.D.	
Ribeye muscle color[b]	A^{51}	18.8	A^{67}	23.1	P<.001
Primary and secondary flank and intercostal muscle color[b]	A^{59}	11.7	A^{65}	13.5	P<.05
Thawing loss, (%)	0.83	0.3	1.23	0.8	P<.10
Cooking loss, (%)	24.90	5.3	25.19	3.9	N.S.
Warner-Bratzler shear force, kg	3.24	1.1	4.63	1.9	P<.01

[a]Probability that the difference between treatments is statistically significant based on the paired-t analysis P.>.10 was reported as nonsignificant (N.S.).

[b]Lambs slaughtered at chronological ages of 3 to 8 months generally produce carcasses with physiological maturity indicators described as A^{00} to A^{100}, respectively, in USDA (1960) grade standards for lamb carcasses.

Table 2. Comparison of certain traits for boneless loin chops subjected to retail display for four days

Trait	Day of retail display	Electrically stimulated		Untreated (control)		Level of probability[a]
		Mean	S.D.	Mean	S.D.	
Muscle color[b]	0	5.1	1.03	5.2	0.93	N.S.
	1	5.0	0.64	5.0	0.86	N.S.
	2	5.0	0.61	5.0	0.77	N.S.
	3	4.7	0.61	4.6	0.80	N.S.
	4	4.5	0.64	4.3	0.77	N.S.
Surface discoloration[c]	0	6.9	0.17	7.0	0.07	N.S.
	1	6.3	0.42	6.4	0.34	N.S.
	2	5.9	0.48	5.8	0.43	N.S.
	3	5.6	0.46	5.6	0.43	N.S.
	4	5.0	0.45	4.9	0.53	N.S.
Overall appearance[d]	0	6.9	0.65	6.7	0.58	N.S.
	1	5.9	0.72	5.7	0.66	N.S.
	2	5.2	0.79	4.9	0.68	N.S.
	3	4.9	0.73	4.6	0.79	N.S.
	4	4.4	0.72	4.0	0.69	$P<.10$
Bacterial count, $\log_{10}$	0	1.11	--	1.23	--	--
	4	1.83	--	3.06	--	--
Shrink loss, (%)	4	3.53	0.67	3.56	0.68	N.S.

[a]Probability that the difference between treatments is statistically significant based on the paired-t analysis. $P>.10$ was reported as nonsignificant (N.S.).

[b]9 = very light cherry red; 1 = very dark purple.

[c]7 = no surface discoloration; 1 = complete surface discoloration.

[d]8 = extremely desirable; 1 = extremely undesirable.

PR-3580

EVALUATION OF RETAIL CASELIFE AND SHRINKAGE OF CUTS FROM ELECTRICALLY STIMULATED LAMB

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INTRODUCTION

A major factor determining the demand for lamb carcasses involves the length of time subsequent retail cuts will remain acceptable to the consumer (Jeremiah et al., 1971). It has been reported that lean color and appearance are two of the top ten criteria for selecting retail lamb and that color is the most important factor to the low income group (Carpenter, 1966). Electrical stimulation of beef has been shown to improve lean color and retail caselife of beef steaks over steaks not electrically stimulated (Savell and Smith, 1979).

This study was conducted to evaluate the effects of electrical stimulation on muscle color, surface discoloration and overall appearance of boneless loin chops from old crop and spring lambs. Also, this study was conducted to investigate the effects of electrical stimulation on vacuum packaged wholesale cuts (leg, loin, rack and shoulder) from old crop and spring lambs.

EXPERIMENTAL

One hundred and forty lambs consisting of old crop and spring lambs were slaughtered and assigned to one of four treatments: (1) electrical stimulation (ES) immediately following bleeding, (2) ES immediately following pelt removal, (3) ES immediately upon entering the cooler, and (4) not electrically stimulated (untreated controls).

Electrical stimulation was administered in 18 impulses (1.8 second duration) of 550 volts (total time of 64 seconds). At approximately 24 hr postmortem, lambs were selected and fabricated for vacuum packaging or for retail case display.

Twenty-five old crop lambs and twenty-five spring lambs were fabricated into wholesale cuts of leg, loin, rack and shoulder. Each wholesale cut was weighed, vacuum packaged, and then stored at refrigeration temperatures. After six days of storage, the cuts were removed from vacuum and weighed in order to determine weight loss percentages.

Boneless loin chops were removed from the wholesale loin of 30 old crop lambs and 60 spring lambs. Two chops (1.5 in) were placed on foam trays and wrapped with polyvinyl chloride film on the 1st day postmortem

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and were displayed for 4 days. Every 24 hr a four-member trained panel evaluated the chops for muscle color (15 = pinkish red, 1 = very dark brown or green), surface discoloration (15 = no surface discoloration, 1 = total surface discoloration), and overall appearance (15 = very desirable, 1 = very undesirable).

RESULTS AND DISCUSSION

Comparison between electrically stimulated and untreated (control) old crop and spring lambs for vacuum packaged leg, loin, rack and shoulder are reported in Table 1. Among the eight comparisons only vacuum packaged legs from electrically stimulated old crop lambs had a significantly ($P<0.10$) greater weight loss percentage than the controls. The remaining seven comparisons between electrically stimulated and control wholesale cuts were nonsignificant. This suggests that weight loss in vacuum packaged wholesale cuts from electrically stimulated lamb is minimal when compared to vacuum packaged wholesale cuts from control carcasses.

Presented in Table 2 are comparisons of retail caselife of boneless loin chops from electrically stimulated and control spring lambs. No significant differences ($P>0.10$) were observed between retail cuts from electrically stimulated and control lambs for muscle color, surface discoloration and overall appearance after 4 days of retail display; however, in Table 3 significant differences were observed between electrically stimulated and control retail cuts from old crop lambs. These data suggest that electrical stimulation may not improve retail caselife characteristics in young lambs (spring lambs) but may have a greater impact on these characteristics in older lambs (old crop lambs).

These data indicate that electrical stimulation does not seriously affect the weight loss percentage of vacuum packaged wholesale cuts (leg, loin, rack and shoulder) from old crop and spring lambs. Also, these data show that electrical stimulation has no significant effect on retail caselife of boneless loin chops from spring lambs; however, retail caselife of boneless loin chops from old crop lambs may be extended by the use of electrical stimulation.

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Table 1. Comparison of mean values for percent weight loss of vacuum packaged wholesale cuts from spring and old crop lambs

Item	Spring lambs			Old crop lambs		
	Electrically stimulated	Control	Level of probability[a]	Electrically stimulated	Control	Level of probability[a]
Leg	0.93	1.18	N.S.	1.67	1.23	P<0.10
Loin	1.33	1.56	N.S.	1.11	1.12	N.S.
Rack	0.86	0.45	N.S.	0.62	0.56	N.S.
Shoulder	1.16	0.96	N.S.	0.60	1.07	N.S.

[a]Probability that the difference between treatments is statistically significant. P>0.10 was reported as N.S.

Table 2. Comparison of mean values for retail caselife of boneless loin chops from spring lambs

Trait	Day	Electrically stimulated	Control	Level of probability[a]
Muscle color[b]	0	11.3	10.9	N.S.
	1	10.8	10.5	N.S.
	2	10.3	10.2	N.S.
	3	9.3	9.2	N.S.
	4	8.5	8.4	N.S.
Surface discoloration[c]	0	15.0	15.0	N.S.
	1	12.2	11.8	N.S.
	2	10.6	10.0	N.S.
	3	7.2	6.8	N.S.
	4	5.8	4.9	N.S.
Overall appearance[d]	0	12.4	12.2	N.S.
	1	11.3	10.9	N.S.
	2	9.4	8.9	N.S.
	3	7.2	7.0	N.S.
	4	6.3	5.8	N.S.

[a]Probability that the difference between treatments is statistically significant. P>0.10 was reported as N.S.

[b]15 = Pinkish red, 1 = very dark brown or green

[c]15 = No surface discoloration, 1 = total surface discoloration

[d]15 = Very desirable, 1 = very undesirable

Table 3. Comparison of mean values for retail caselife of boneless loin chops from old crop lambs

Trait	Day	Electrically stimulated	Control	Level of probability[a]
Muscle color[b]	0	12.5	11.6	N.S.
	1	12.4	11.1	P<0.10
	2	12.2	9.9	P<0.01
	3	11.3	8.7	P<0.05
	4	11.2	8.5	P<0.05
Surface discoloration[c]	0	15.0	14.9	P<0.05
	1	13.8	12.1	P<0.01
	2	11.5	9.1	P<0.05
	3	9.0	6.4	P<0.10
	4	7.9	5.2	P<0.10
Overall appearance[d]	0	13.4	12.5	P<0.10
	1	12.6	10.9	P<0.05
	2	11.1	8.5	P<0.01
	3	9.5	6.9	P<0.05
	4	9.2	6.4	P<0.10

[a] Probability that the difference between treatments is statistically significant. P>0.10 was reported as N.S.

[b] 15 = Pinkish red, 1 = very dark brown or green

[c] 15 = No surface discoloration, 1 = total surface discoloration

[d] 15 = Very desirable, 1 = very undesirable

PR-3581

EVALUATION OF A MECHANICAL PELT PULLER

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INTRODUCTION

Among meat animal species, the slaughter and dressing of sheep and goats requires the greatest manipulative skill, the greatest manual dexterity, and the most precise hand-work and knife-work. Great care must be exercised: (1) to assure that the carcass does not become soiled with fleece contaminants or manure, (2) to prevent rupture of the fell membrane (a thin layer of connective tissue between the pelt and the external fat cover), and (3) to facilitate pelt removal from the upper portion of the legs, from the rump-dock region and over the shoulder, rack and loin without also removing the fell membrane and external fat from these regions. In spite of the very considerable technology applied to slaughter and dressing of beef, few of the advancements have been applied to sheep or goat slaughter-dressing. Correspondingly, the operational efficiency of lamb slaughter and the procedures utilized to remove the pelt have remained essentially unchanged during the last 50 years (Smith et al., 1975). The draft proposal to form Regional Sheep Marketing Project W-174 (1973) includes the statement "Methods of slaughtering sheep have changed very little in the past century; sheep are still being pelted by hand in most plants". The economic feasibility of mechanical methods for depelting sheep and lambs needs further investigation (Regional Sheep Marketing Project W-174, 1973). The present study represents the first attempt by T.A.E.S. to investigate the usefulness of a mechanical depelting device under industry conditions.

MATERIALS AND METHODS

A mechanical depelting machine has been developed by P.C. Development Company in Hermiston, Oregon. For purposes of the present study, this machine was installed in a commercial lamb slaughtering plant (Superior Packing Company; Ellensburg, Washington) and data were collected in March, 1979.

The normal dressing operation used in the test plant consists of removal of the head, pelt, forefeet, hindfeet, pluck and viscera. These operations are performed via line (on-the-rail) dressing using a double-rail system (two adjacent rails, parallel to each other, 30 inches apart). Briefly stated, the procedure is as follows: (a) the animal is stunned, shackled, hoisted, stuck and bled, (b) the hindlegs, forelegs, neck and breast are skinned with handknives, (c) the pelt is "fisted", by hand, away from the legs, abdomen, flanks, breast and sides, and (d) the pelt is "pulled", by hand, away from the head, neck, shoulder, rack, loin and sirloin. As these operations are performed, certain errors are

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made by the workmen which result in defects in the carcasses; the number and severity of these "dressing defects" vary quite markedly from plant to plant, between dressing stations within the same plant, between individual workmen and across time--within a work-day--for a given dressing station and/or for a given workman. Documentation of the number and severity of dressing defects has not previously been achieved; the present study does offer data of this kind collected on 700 lambs in a single plant and on a single day of slaughter.

To our knowledge, data do not exist which would allow judgments to be made regarding the usefulness of attempts to develop a mechanical depelting machine. A prototype depelting machine (PCDC-Depelter) was installed in a packing plant and used to remove the pelt from 45 lambs at the end of a normal work-day. Data were obtained for the number and severity of dressing defects on lamb carcasses following use of the PCDC-Depelter.

RESULTS AND DISCUSSION

Data from 700 lambs, collected in groups of 100 lambs each, are presented in Table 1. Slaughter and dressing of lambs in this plant consisted of activities performed by several workmen, only five of which are of consequence to the present study. Workman A fisted over the legs of the first 600 lambs; Workman B fisted over the legs of lambs 601 to 700. Workman C pulled the pelts (over the sirloin, loin, rack and shoulder) of the first 600 lambs; Workman D pulled the pelts from lambs 601 to 700. Workman E pulled the pelts from the neck and head of all 700 of the lambs.

Fatigue appeared to be a factor contributing to incidence of dressing defects during the morning shift (lambs 1 through 400) for Workmen A, C and E as evidenced by the following increases with time: (a) Major defect incidence on the leg and sirloin, (b) total (Major plus Average plus Minor) defect incidence on the rack, shoulder, neck and entire carcass, and (c) severity of defects (ratio of Major defect to total defect incidence) on the leg and sirloin. After lunch: (a) Workman A caused more defects on the leg, (b) Workman C caused more defects on the sirloin and loin, and (c) Workman E caused more defects on the neck, than had been the case prior to lunch, yet (d) the percentage of "perfectly dressed" (entire carcass with no dressing defect) lambs increased.

At lamb 601, Workman B replaced Workman A; dressing defects on legs decreased by 10 percentage points, compared to that for the previous 100 lambs. At lamb 601, Workman D replaced Workman C; Workman D was obviously less skilled than his predecessor at the pelt pulling station. Workman D increased the incidence of defects on the sirloin, loin, rack and shoulder by 21, 5, 37 and 20 percentage points, respectively, over that for the previous 100 lambs. Dressing defects on the neck increased by 22 percentage points, over that for the previous 100 lambs, for lambs 601 to 700; this increase was attributed to a combination of poor workmanship by Workman D and fatigue on the part of Workman E. The data of Table 1 suggest that: (a) dressing defects on lamb carcasses are likely to increase during the work-day because of worker fatigue, and (b) there are wide differences between workmen in their abilities to remove the pelt; a change of one workman at a critical work-station increased the number of lamb carcasses with at least one dressing defect by 7 to 14 lambs per 100 lambs slaughtered.

Data comparing the incidence of dressing defects on lamb carcasses dressed via hand-work and by use of the PCDC-Depelter are presented in Table 2. Use of the PCDC-Depelter, compared to dressing of lambs by use of hand-work, was associated with: (a) a 20 to 21 percentage point increase in total dressing defects on legs, (b) decreases in total defect incidence of 7 to 11 percentage points on the sirloin, 7 to 9 percentage points on the shoulder, 2 to 6 percentage points on the neck, and 10 to 12 percentage points on the entire carcass, but (c) increased severity of dressing defects--incidence of Major defects on PCDC-Depelter dressed lambs was twice (neck), three times (sirloin, loin) or four times (leg) as high as that for lambs dressed via hand-work.

Time-motion studies would be needed to accurately assess the labor savings that might accrue from industry implementation and use of a mechanical depelting machine, but the following general observations are presented: (a) carcasses dressed by use of the PCDC-Depelter had less grease, spots and soil on exterior surfaces than did lambs dressed via hand-work, (b) pulling of the pelt caudally (toward the tail) as with the PCDC-Depelter, rather than cranially (toward the head) as with hand-work, produces a pulling force that is more efficacious in removing the pelt while leaving intact the fell membrane and external fat covering, (c) less extensive hand-work is required in preparing a lamb for pelt pulling if a mechanical depelter is to be used--reduced labor for this operation would reduce the work-force by at least one workman, (d) the PCDC-Depelter removes the skin from the hindlegs, the back (from sirloin to shoulder) and from the neck and head; three workmen are required to accomplish these functions in conventional slaughter-dressing, while only two workmen are required when the PCDC-Depelter is used, but (e) the PCDC-Depelter left patches of wool on the heads of 20% of lambs and on the body (usually around the dock) of 30% of lambs; pelts were torn into at least two pieces on 15% of lambs depelted with the mechanical device.

In conclusion, use of the specific mechanical depelting machine involved in this study would decrease work-force requirements by at least two men and would produce 10 to 12 more "perfectly dressed" lambs per 100 lambs slaughtered; however, when dressing defects occur they are much more severe than are those created via hand-work dressing and pelt-credits per lamb would be markedly reduced because of the high incidence of damaged skins. Development of the PCDC-Depelter in its present form is a remarkable achievement; further development of its potential is important, and solutions to its most serious shortcomings must be researched.

SUMMARY

Studies were made of a mechanical pelt-puller in a commercial plant. When lambs are dressed via hand-work, the number of carcass defects are likely to increase during the work-day because of worker fatigue and there are wide differences between workmen in their abilities to remove the pelt. The mechanical pelt-puller tested (the PCDC-Depelter) would, of course, not be subject to fatigue and all such machines would have reliable and repeatable performance. Major advantages, in comparison to hand-work dressing, associated with use of the PCDC-Depelter were a decrease in work-force requirements of at least two men, 10 to 12 percentage points increase in the number of "perfectly dressed" carcasses and visibly cleaner carcasses. Major disadvantages, in comparison to hand-work dressing, with use of the PCDC-Depelter were increased severity of dressing defects when defects occurred and a high incidence (15%) of damaged pelts. The machine tested has tremendous potential for depelting sheep and goats; further research and development are essential prior to recommending its implementation by industry.

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Table 1. Dressing defect data collected during a single work-day at a commercial lamb slaughter plant.

Area of carcass	Severity[a] of dressing defect	Sequence of slaughter-dressing; percentage defect incidence.						
		Lambs 1 to 100	Lambs 101 to 200	Lambs 201 to 300	Lambs 301 to 400	Lambs 401 to 500	Lambs 501 to 600	Lambs 601 to 700
Leg	Major	2	7	3	7	8	4	6
	Average	9	7	11	11	14	18	11
	Minor	11	11	10	8	11	10	5
Sirloin	Major	2	4	1	5	4	4	12
	Average	11	15	14	9	16	17	28
	Minor	8	5	6	5	6	11	13
Loin	Major	8	5	9	4	6	6	13
	Average	14	16	22	15	22	22	25
	Minor	5	3	2	4	1	8	3
Rack	Major	13	12	16	4	12	5	23
	Average	13	25	27	29	28	20	40
	Minor	8	1	4	9	3	11	10
Shoulder	Major	14	9	10	4	6	5	15
	Average	7	15	14	25	26	13	31
	Minor	11	5	12	15	7	13	5
Neck	Major	0	0	0	0	3	2	4
	Average	4	9	13	16	26	12	33
	Minor	5	6	9	9	8	13	12
Entire carcass	Some	68	67	72	70	65	65	79
	None	32	33	28	30	35	35	21

[a]Major=area of fat and/or muscle larger than 2 sq in pulled loose or removed from the external surface of the carcass; Average=area of fat and/or muscle of less than 2 sq in but more than 1 sq in pulled loose or removed from the external surface of the carcass; Minor=area of fat and/or muscle of less than 1 sq in pulled loose or removed from the external surface of the carcass.

Table 2. Comparison of dressing defects on lamb carcasses dressed via hand-work and by use of the PCDC-depelter.

Area of carcass	Severity[a] of dressing defect	Sequence of slaughter-dressing; percentage defect incidence		
		Hand-work		PCDC-Depelter
		Lambs 1 to 600	Lambs 1 to 700	Lambs 701 to 745
Leg	Major	5.2	5.3	22.5
	Average	11.7	11.6	15.0
	Minor	10.2	9.4	10.0
Sirloin	Major	3.3	4.6	12.5
	Average	13.7	15.7	5.0
	Minor	6.8	7.7	0.0
Loin	Major	6.3	7.3	20.0
	Average	18.5	19.4	10.0
	Minor	3.8	3.7	0.0
Rack	Major	10.3	12.1	12.5
	Average	23.7	26.0	10.0
	Minor	6.0	6.6	0.0
Shoulder	Major	8.0	9.0	10.0
	Average	16.7	18.7	17.5
	Minor	10.5	9.7	0.0
Neck	Major	0.8	1.3	2.5
	Average	13.3	16.1	12.5
	Minor	8.3	8.9	5.0
Entire carcass	Some	67.8	69.4	57.5
	None	32.2	30.6	42.5

[a]Major=area of fat and/or muscle larger than 2 sq in pulled loose or removed from the external surface of the carcass; Average=area of fat and/or muscle of less than 2 sq in but more than 1 sq in pulled loose or removed from the external surface of the carcass; Minor=area of fat and/or muscle of less than 1 sq in pulled loose or removed from the external surface of the carcass.

PR-3582

TRAPPING OF SHEEP OR GOATS

Maurice Shelton, Gary Snowder and W.H. Aldred*

High labor costs are often mentioned as a serious problem for sheep and goat producers. Gathering of sheep or goats from the large and often brushy pastures of this state represents one of the practices which requires a high input of labor. In addition, instances occur in which it is impossible to gather some animals due to their wild nature or to rough terrain. For these reasons attempts have been made to develop or evaluate methods of trapping these animals. These efforts have met with modest success. It is not envisioned that trapping is likely to replace the routine practice of gathering or mustering, but it does appear that over a period of time instances will occur in which this practice can be utilized to advantage.

In this work trapping has been practiced at feed or water sources or both. Trapping at salt sources provides another alternative. Each of these presents some disadvantages. For instance, if running water or more than one water source exists in the pasture of if several species (cattle, sheep or goats) utilize the same water source, trapping at water is made difficult. Another difficulty is that during the season when green forage is available some species such as goats do not require water daily and may avoid drinking entirely if their normal routine is interfered with. The use of feed as an attractant, of course, requires that the animals are receiving feed. Thus trapping at salt should be considered a viable alternative.

The first type of trap utilized was that shown in Figure 1. This type of device may be utilized with both sheep and goats, but has proved more successful with sheep. Note that the device is easily portable and may be set in place between gates or between a gate and post in a few minutes. However, a period of prior training is required for it to work successfully. Note that the device consists of two small swinging gates which may swing either direction or may be locked in an open position. They may be locked to swing in only one direction. The overall width of the device may be adjusted to leave a variable width opening between the gates. In operation the gates are set with an opening between the gates or with the gates locked open to encourage the animals to pass. After a brief period of time the gates are left free swinging in a manner that the animals can force their way through, going in either direction. When animals are routinely using the device in this manner, they can be easily trapped by placing a pin to make the device swing in only one direction so that the animals are trapped inside an enclosure. The device has been successfully

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used under test conditions to trap both sheep and goats. It has not been extensively tested under field conditions. Gentle sheep which feed or water frequently are easily trapped. Wild goats, which are the species most likely to be difficult to gather, are more difficult. The primary problem is that they may be more reluctant to use a device of this type and may more readily go without feed and water. However, even difficult animals have been successfully trapped.

If goats alone are to be trapped, the device shown in Figure 2 may be used. This procedure takes advantage of the goat's capricious nature and appears to work better than the device discussed previously. In this procedure, walk-up ramps are placed on each side of the fence. The goats walk up and down the ramps or walk up one side and jump down. When goats have been trained to use the ramps, they can be successfully trapped by simple removal of the ramp which leads out of the pen. Some potential disadvantages of this approach are that small or weak animals may be reluctant to use it or that it may contribute to training the animal to jump.

Both systems are relatively inexpensive and may be evaluated under producer conditions with only minimal costs in time or money. If attempts are to be made to use them in routine practice it would be desirable to use them in a manner in which the animals are trapped within or with access to an enclosure with a few acres or a small amount of feed available in order that trapping could start one or more days prior to the need to gather. A detailed drawing plan of the trapping gate is shown in Table 3.

Figure 1. Sheep and Goat Trapping Gate

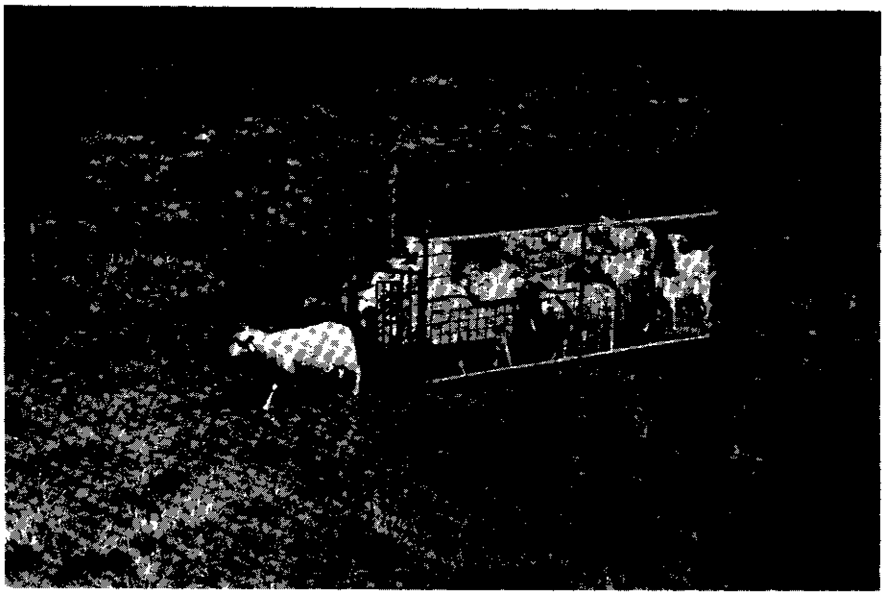
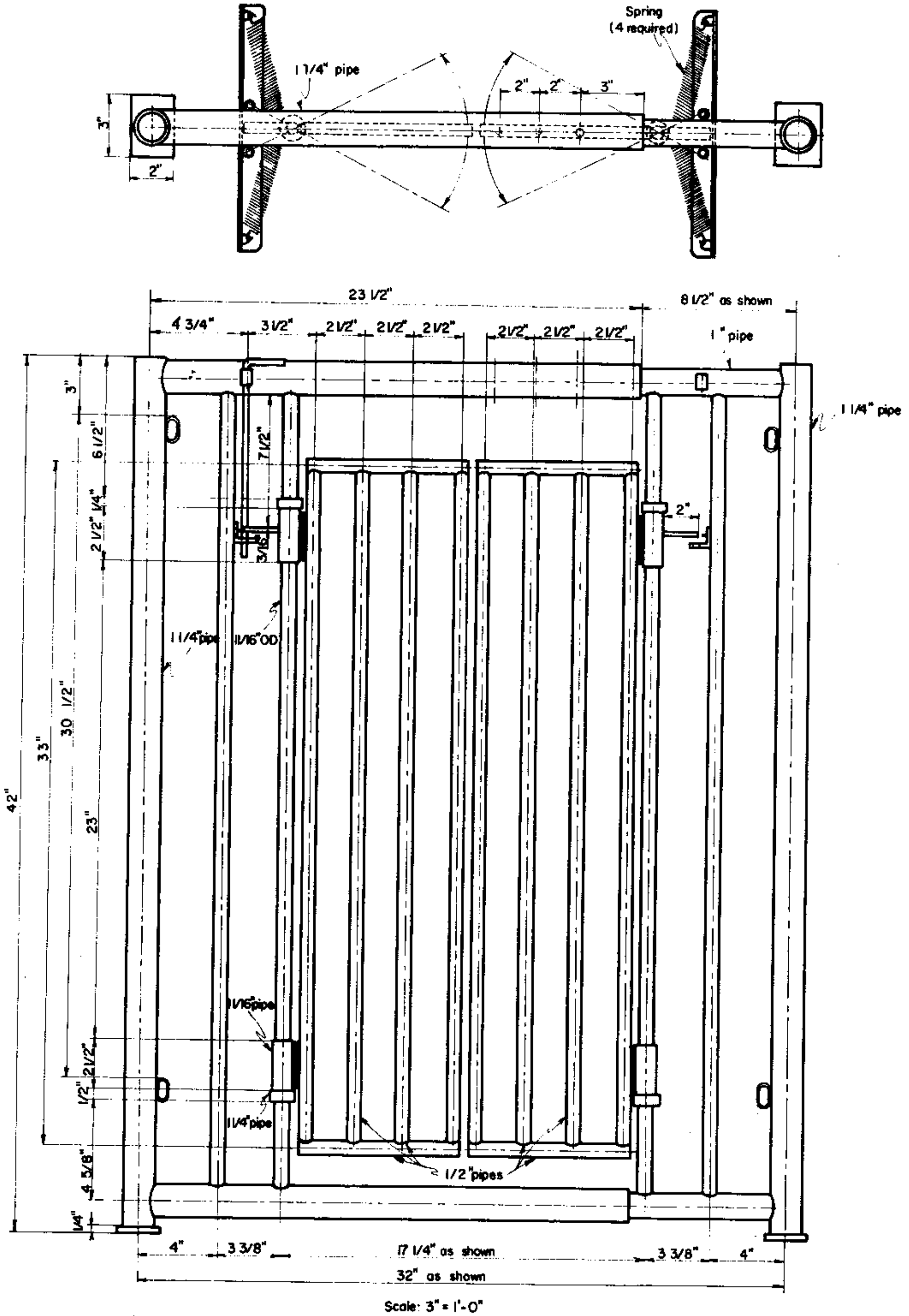


Figure 2. Goat Trapping Ramps



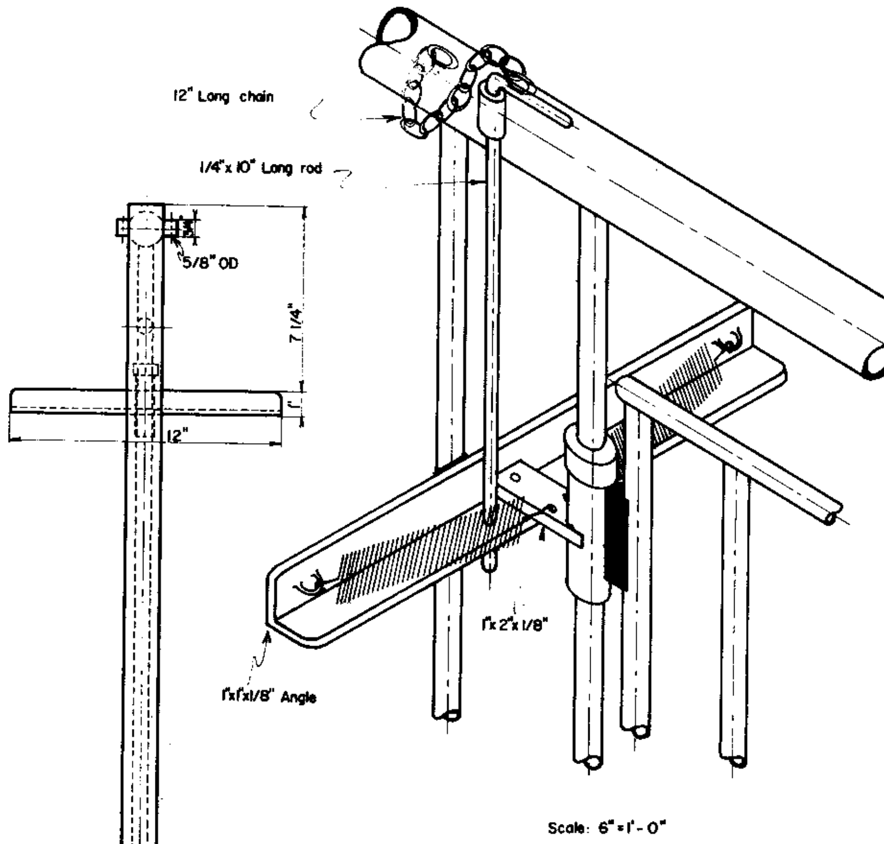


Figure 3. Trapping Gate Plan

PR-3583

SELECTIVE FEEDING OF GOATS IN PASTURES WITH MIXED STOCKING

Maurice Shelton, Phil Thompson and Donald Spiller*

Most ranches in the Edwards Plateau which are stocked with goats also have other classes of livestock, including sheep. It may be desirable to selectively feed goats in pastures containing other types of livestock, and this can present problems, especially if sheep are present.

Some of the possible reasons for selective feeding of goats include:

(a) Angora goats have a higher nutrient requirement than other classes of livestock and thus may be in need of feeding a higher percentage of the time,

(b) At present higher prices for mohair and replacement stock Angora goats will provide an economic response to feeding throughout much of the year,

(c) Goats do not consume, as readily as sheep, feedstuffs to which limiters such as salt have been added,

(d) It may be desirable to selectively feed goats in order to administer specific nutrients or drugs (coccidiostats) to this species.

In attempting to devise a means of trapping goats or of selectively trapping goats it was observed that they readily utilized walk up ramps to go over panels placed around feed or water. Thus this practice has been adapted for selective feeding of goats when sheep and/or cattle are present in the pasture (see figure 1a & b). Assuming the animals know how to eat dry feed and recognize feed troughs.essentially no training is required. The animals may actually be found playing on the ramps even when no feed is present. The ramps have been made of two 2" x 6" x 10' nailed together with cross pieces to provide footing. The ramps may be placed in opposition as in figure 1a or at right angles as in figure 1b. If they are placed at right angles an additional board should be used in an upright position alongside the panel to prevent injuries to the goat by the foot getting caught in the panel.

This method of selective feeding has been successfully utilized with three flocks of goats.

It has been suggested that it can be made selective for creep feeding of kids by placing crossbars over the ramp which the kids can go under, but adult goats cannot.

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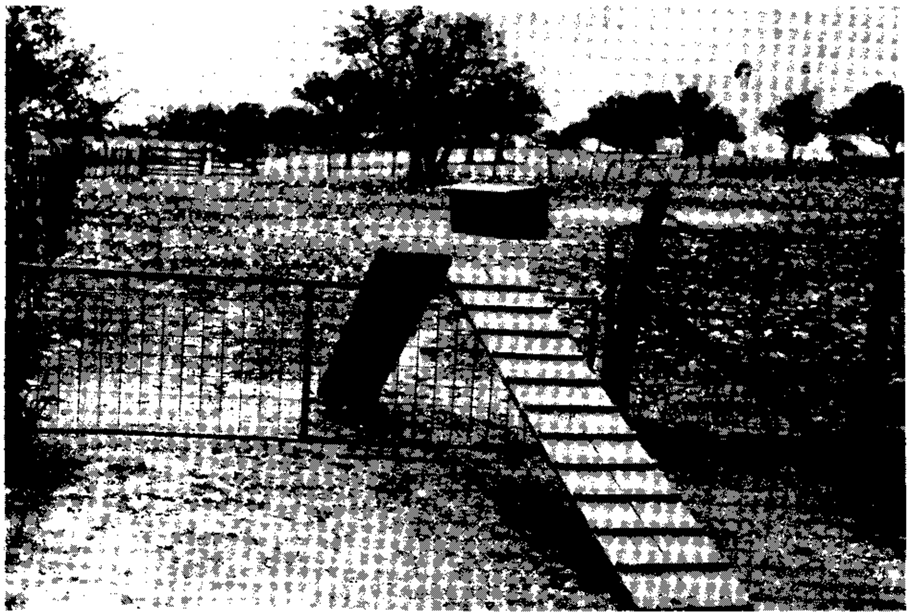
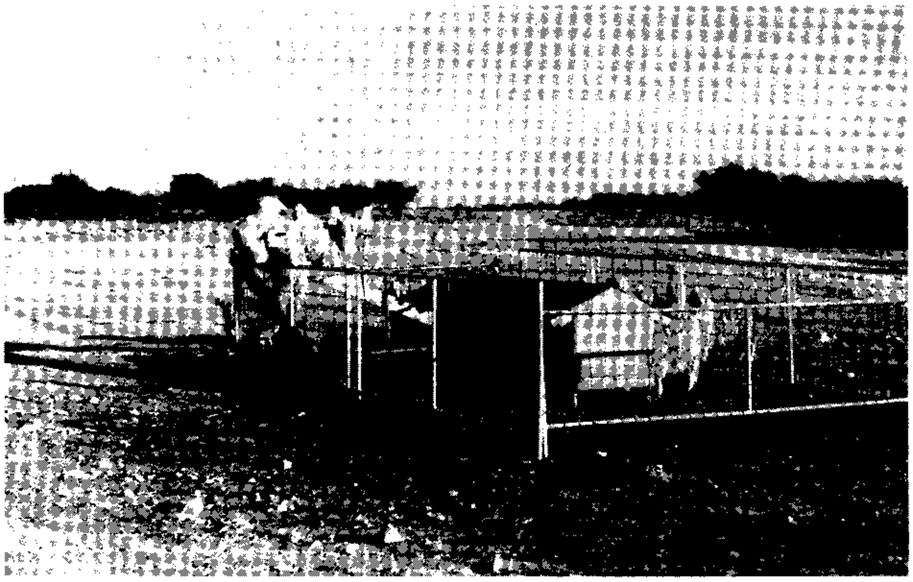


Figures 1a and 1b. Goat trapping for selective feeding.



PR-3584

EFFECT OF BREEDING FREQUENCY AND WINTER FEEDING ON WOOL PRODUCTION IN FINEWOOL EWES

J.E. Huston*

Both nutrient consumption and alternate nutrient use affect wool growth. That is, sheep usually produce heavier fleeces in good years due to greater consumption of high quality forage. Also, ewes nursing lambs tend to shear lighter fleeces than dry ewes.

Fleece weights were recorded over a four-year period for 156 finewool ewes that were divided between two breeding groups (conventional versus accelerated breeding) and among five feed sub-groups. The experimental design is described in detail in PR-3564 (Huston, 1979).

RESULTS AND DISCUSSION

Wool production did not differ greatly between groups and among sub-groups in this study (table 1). The average fleece weights for the conventional and accelerated breeding groups were almost identical. Fed sub-groups consistently produced heavier fleeces than the control; but, the differences were rather small and variable among individual ewes (P>.05). On the average, fed groups produced fleeces only 6.4% heavier than the control. The higher protein feed (tables 1 and 2 in Huston, 1979) appeared to promote a slightly linear response. However, a greater amount of additional energy supplied to sub-group 4 did not result in a further increase in wool.

LITERATURE CITED

1. Huston, J.E. 1979. Effects of breeding frequency and winter feeding on attrition rate in finewool ewes. Texas Agr. Exp. Sta. PR-3564, p. 11.

TABLE 1. WOOL PRODUCTION IN EWES DURING A FOUR-YEAR STUDY COMPARING BREEDING FREQUENCY AND WINTER FEEDING IN FINEWOOL EWES

	Feed Treatment Groups					
	1 Control	2 Low	3 Medium	4 High	5 Low-High	Total
Conventional Group						
Number of ewes	16	17	17	15	16	81
Average grease fleece weight	8.2	8.6	8.6	8.6	8.7	8.54
Accelerated group						
Number of ewes	15	15	15	15	15	75
Average grease fleece weight	8.1	8.6	9.1	8.8	8.4	8.60
Total flock						
Number of ewes	31	32	32	30	31	156
Average grease fleece weight	8.2	8.6	8.8	8.7	8.6	8.57

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PR-3585

ALTERNATIVE METHODS FOR DETERMINING CLEAN FLEECE WEIGHTS

James W. Bassett and B. F. Craddock[1]

Clean fleece weight is an important trait to be considered in most Texas sheep selection programs. The most common method used to select for clean fleece weight in ranch selection programs is to select for grease fleece weight, since the correlation between grease fleece weight and clean fleece weight is quite high. Clean fleece weight has always been an important element in the ram performance test program conducted at the Texas A&M University Agricultural Research Station at Sonora. The method used for determining clean fleece weight for the ram performance test has been to individually scour each fleece in the 4-bowl scouring train at the Wool and Mohair Laboratory, College Station. This method is both expensive and time consuming and is subject to lengthy delays due to equipment malfunctions. Efforts have been directed for several years towards developing faster, more economical methods of determining clean fleece weights.

EXPERIMENTAL PROCEDURE

Prior to shearing performance test rams at Sonora for the years 1976-77 and 1977-78, side samples were sheared to obtain estimates of fleece clean yields. These small samples were scoured in the laboratory at College Station and the resulting clean yields, corrected to 12% moisture, were used to estimate clean fleece weights. After shearing, each fleece was placed in the Neale squeeze machine (2) to obtain the relative volume of each fleece under uniform pressure. The resulting squeeze machine readings were utilized in regression equations which had been obtained from earlier efforts (1) to predict clean fleece weights. The squeeze machine readings were used in different combinations with grease weight, staple length and clean fleece weight estimated by side sample clean yield as follows:

Equation number:	Equation
1	Y_1 = grease fleece weight X side sample clean yield.
2	Y_2 = 9.245 + .248 grease fleece weight + 0.9 staple length -0.108 squeeze reading.
3	Y_3 = 12.85 + 0.4 staple length -0.13 squeeze reading + $0.54Y_1$.
4	Y_4 = 9.26 + .01 grease fleece weight + 0.41 staple length -0.10 squeeze reading + $0.52Y_1$.

where: Y_i = clean fleece estimate, i = 1,4.

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[1]Respectively, professor and former research associate, Texas Agricultural Experiment Station.

In addition to the rams at the Sonora Station, there were 108 Rambouillet rams on a private performance test program at Sterling City in 1977-78[2]. The same sampling and testing procedure were used for these rams as at Sonora. After shearing, however, the fleeces were shipped to the Yocum-McColl Testing Laboratory, Denver, Colorado, where the fleeces were core-sampled and two sub-samples were obtained for laboratory scouring. The fleeces and core samples were then shipped to the Wool and Mohair Laboratory at College Station where fleece and sample scouring took place. Clean fleece weights were estimated from both of the core sub-samples and from an average of the two.

Clean fleece weight is important in itself, but it is also a major part of a selection index which has been used to rank the fine-wool rams at the Sonora performance test and which was used in the Sterling City test. Index value rankings receive high priority in ram evaluation since they consider several important selection criteria. The index which is used is as follows:

Index = 60(average daily gain) + 4(staple length) + 4(clean fleece weight) -3(face cover score) -4(skin fold score).

Differences between methods of estimating clean fleece weights are thus reflected in changes in index values. Changes in absolute values are of less importance than changes in relative position within the rankings. Correlations were determined both for the various methods of estimating clean fleece weight and for relative index ranking when using the different fleece estimates.

RESULT AND DISCUSSION

Clean fleece weights as determined by scouring individual fleeces and as estimated by the differing methods are shown in table 1. These weights are shorn weights adjusted to 365 days and 12% moisture standard conditions. The clean fleece weight estimates determined from side sample clean yields were consistently higher than actual clean fleece weights (0.82 to 1.34 lbs), while all other estimates were consistently lower. Regression equation 4 gave consistently the lowest estimate of clean fleece weight (0.65 to 1.44 lbs lower than actual). Regression equation 3 which included staple length, squeeze machine reading and clean fleece weight using side sample yield, came the closest of the equations to actual values (0.13 to 0.51).

The core test results, which were available for only the one group of fleeces gave the closest estimates to actual clean fleeces, within 0.18 to 0.21 lbs.

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[2]Appreciation is expressed to Clinton Hodges, Fred Campbell and Joe Freeman for their support in obtaining the core test samples from individual fleeces and to the Yokum-McColl Testing Laboratory for their assistance.

Correlations of actual values with the various methods of estimating are shown in table 2. All of these correlations indicate a high degree of predictability but show year and location differenences. There is a consistency though, in looking at the four methods common to both years and locations. Equation 3, which came the closest to actual average clean fleece weight also has the highest correlation, closely followed by equation 4, which gave the least close average estimate. Using side sample clean yield to estimate clean fleece weight showed the lowest correlations in all three data sets, indicating a greater variation in predictability using this trait by itself. The core test results gave the highest correlations between estimated and actual clean fleece weights.

Since index values are a major consideration in evaluating and comparing rams and are used as a criterion in determining rams eligible for certification or Register of Merit classification by the American Rambouillet Sheep Breeders Association, it is desirable to determine how estimated clean fleece values influence index values and ranking. Correlations of rankings based on index values with rankings based on estimated values are shown in table 3. These indicate that both equations 3 and 4 give similar index rankings, even though equation 4 estimated clean fleece weights about one pound lighter than equation 3. For some reason, which is not readily apparent, the results using core test measurements were not higher than those using other methods of estimation. While yearly variations appear to exist, these values indicate that the estimated clean fleece weights did not materially change index value rankings, and that equation 3 did the best job.

LITERATURE CITED

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2. Neale, P. E., G. M. Sidwell and W. D. McFadden. 1956. Clean fleece yield in two minutes. Proc. West. Sec., Am. Soc. Anim. Prod. 7:LXXIV.

TABLE 1. CLEAN FLEECE WEIGHTS

Method	Clean fleece weight, lbs: Sonora 1976-77	Sonora 1977-78	Sterling City 1977-78	Overall
Number of fleeces	188	212	108	508
Actual scoured weight, avg.	11.10	10.12	9.63	10.37
Estimated clean fleece weights based on side sample yield	11.92	11.10	10.97	11.38
Regression equation 2	9.65	9.58	8.88	9.45
Regression equation 3	10.60	9.99	9.12	10.03
Regression equation 4	9.45	8.90	8.19	8.95
Core test sample 1	-----	-----	9.42	-----
Core test sample 2	-----	-----	9.45	-----
Average of 2 core test samples	-----	-----	9.44	-----

TABLE 2. CORRELATIONS OF ESTIMATED CLEAN FLEECE WEIGHTS WITH ACTUAL CLEAN FLEECE WEIGHTS

Method	Actual clean fleece weight: Sonora 1976-77	Sonora 1977-78	Sterling City 1977-78
Side sample clean yield	.909	.813	.836
Regression equation 2	.915	.844	.879
Regression equation 3	.936	.884	.912
Regression equation 4	.935	.877	.909
Core test sample 1	----	----	.948
Core test sample 2	----	----	.930
Avg. of 2 core test samples	----	----	.954

TABLE 3. CORRELATIONS OF INDEX RANKINGS

Method	Actual index rank: Sonora 1976-77	Sonora 1977-78	Sterling City 1977-78
Side sample clean yield	.969	.917	.846
Regression equation 2	.974	.936	.866
Regression equation 3	.981	.951	.868
Regression equation 4	.981	.950	.867
Core test sample 1	----	----	.868
Core test sample 2	----	----	.862
Avg. of 2 core test samples	----	----	.868

PR-3586

TEXAS MOHAIR MEASUREMENTS, FALL 1978

James W. Bassett and R. H. Stobart*

Most of the mohair produced in Texas is exported to Great Britain and Europe where it is in direct competition primarily with mohair produced in South Africa and to a lesser extent the mohair from Turkey, Lesotho and Argentina. Manufacturers and processors indicate the need for specific requirements of fiber diameter, length, freedom from kemp and colored fiber and other fiber attributes. They may criticize Texas mohair for lacking in certain of these attributes, and imply that South Africa mohair is superior, but in general, there are no measurement figures available to either define the Texas mohair clip or to serve as a basis for comparison of Texas mohair with that from other countries.

An effort was initiated in late fall 1978 to obtain mohair samples from warehouses located within the major Angora goat production areas to provide objective measurements of certain mohair fiber traits.

PROCEDURE

The project was initiated late in the fall season after the major portion of the clip had been sold and shipped. Warehouses in Del Rio, Ingram, Rocksprings, Sonora and Uvalde were visited, and core samples were taken from mohair which was still available. Core samples were taken with a 1/2" pressure coring device, with a minimum of 20 cores per lot. Bags sampled were selected at random from each of the lines indicated. Lines in general were original bag lots of kid, yearling or adult mohair, although in some instances the goats had been chute cut into more uniform groups. A total of 6 lines of kid mohair, 8 yearling and 12 adults were sampled. These samples were measured for fiber diameter and uniformity, kemp fibers, clean yield and vegetable matter content. Data from South Africa were available for fiber diameter and clean yield to provide some basis of comparison.

RESULTS AND DISCUSSION

The clean yields for all lots are shown in table 1, along with similar data from South Africa. These data indicate what has generally been considered as factual, that South Africa mohair is in general higher yielding than Texas mohair. This is probably true even though at this point there is not a basis for assuming that the Texas samples are a good representation of the fall clip, since they were very late in the season. Nor is there any basis for knowing to what extent the South Africa samples are representative. The samples were from the summer 1972 clip. A report of clip composition in 1977 (1) indicates that these reported types represented 22.7% of the total summer mohair

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marketed. South African mohair producers have selected breeding stock which is higher in clean yield and adopted management practices to improve on clean yield since it is believed that their marketing methods will recognize the improved value.

Another difference in the two sources of data which makes comparisons difficult to evaluate is that each South African measurement represents a single bale while the Texas measurements were a sample taken from a large number of sacks representing, in most cases, several different ranches.

Fiber diameters are given in table 2. Again, the South African measurements are from single, highly classed bales from the finer classes within the kid and adult categories. The first letter incates average length as follows:

A = over 6 inches

B = 5 to 6 inches

C = 4 to 5 inches

D = under 4 inches

The "S" when present indicates super style and character and its absence indicates average style and character. The last 1 or 2 letters indicate fiber diameter as follows:

FK = fine kid, under 30 microns

K = kid, under 33 microns

YG = young goat, under 36 microns

FH = fine hair, mature goats, under 39 microns

H = hair, mature goats, under 43 microns

Fiber diameters of the Texas mohair tended to be consistently finer than the South African mohair. Using the South African diameter designations, 6 of the 8 Texas yearling lots would have qualified for kid classification and 8 of 12 adult lots would have been young goat. In those instances where two values are listed for a South African designation, these represent the high and low values for two to eight lots.

Except for one lot of adult mohair, the Texas lots were not subject to fleece classing in which individual fleeces are separated on the basis of fiber differences within the fleeces. This results in higher than desirable coefficients of variation. Townend (3) indicated a desirable C.V. of 25% or less for wool top, but reported the C.V. for a group of mohair tops from 26.0 to 32.4%. It will be necessary to carry mohair into top to determine the influence of combing on coefficient of variation of fiber diameter. The South African diameter measurements were made with air-flow instrumentation which did not permit a measure of coefficient of variation.

Measures of kemp, med fibers and vegetable matter for the Texas mohair are reported in table 3. Both kemp and med fibers have hollow centers with classification being based on the amount of hollow area (2). A kemp fiber has over 65% of the fiber diameter as a hollow area, with a med fiber being less than 65%. Kemp fibers can be detected visually as the hollow area causes a different light refraction in both the natural and dyed states. This fact, plus the facts that the fibers are less strong and have less stretch and flexibility make them undesirable for manufacturing purposes. Med fibers can be readily identified under a microscopic examination but are not as apparent to visual detection and are thus less objectionable. Standards are set for the number of kemp fibers which will be acceptable for a lot of wool or mohair top, but thus far there is no indication as to a specific level of kemp in grease mohair. It will be necessary to determine the extent to which they may be removed during processing. Needless to say, the fewer there are at the beginning, the better it is. The same can be said for vegetable matter. In general, quantities under 2% are probably not objectionable, but the critical question is the amount that is not removed during mechanical processing, which is usually determined by the type of vegetable matter present. Two percent burr clover or needle grass may be much worse than 5% cockle burr or grass burr. The data in table 3 indicate that the fall clip 1978 did not present problems of vegetable matter defect in those areas which were sampled. Climatic conditions can of course make large differences in the extent of the problem between areas, shearing seasons and years.

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2. A.S.T.M. 1978. Standard method of test for med and kemp fibers in wool and other animal fibers by microprojection. D 2968 -75, Part 33:606.

3. Townend, P.P. 1979. An evaluation of the wool and mohair research being conducted in Texas. Mimeo report.

TABLE 1. MOHAIR CLEAN YIELDS

Texas		South Africa	
Designation	Clean yield, %	Designation	Clean yield, %
Kid		Kid	
Kid	76.5	ASFK	84.2
Kid	78.1	BSFK	83.1
Kid	79.3		92.2
Kid	78.0	CSFK	86.2
Kid	80.9	BFK	85.8
Kid	80.2		90.8
		CFK	77.9
Yearling		Young goat	
Yearling	73.0	ASYG	85.4
Graded yearling	73.4	BSYG	82.9
Original bag yearling	74.4		89.6
Best yearling	76.6	AYG	85.8
Yearling	78.1		89.5
Yearling	78.2	BYG	88.0
Average yearling	78.8		91.3
Best yearling	80.6		
Adult		Adult	
Adult	74.7	BSFH	78.0
Low adult	76.5		87.1
Fine adult	77.8	BSH	81.4
Original bag adult	77.9		85.8
Average adult	78.5	BFH	88.3
Original bag adult	78.6	DSFIT	84.8
Coarse adult	78.8		
Adult	78.9		
Average adult	79.9		
Sorted 26's	81.0		
Fine adult	81.5		

TABLE 2. FIBER DIAMETER

Texas				South Africa		
DIAMETER				DIAMETER		
Designation	Microns	C.V.,%	U.S.D.A. spinning count	Designation	Microns	U.S.D.A. spinning count
Kid				Kid		
Kid	25.2	26.0	36's	ASFK	28.4	36's
Kid	25.2	28.2	36's	BSFK	26.2	36's
Kid	25.9	29.7	36's		27.7	32's
Kid	26.0	30.3	36's	CSFK	28.5	32's
Kid	26.6	24.3	36's	BFK	25.7	36's
Kid	27.0	26.8	36's		28.7	32's
				CFK	26.3	36's
Yearling				Young goat		
Best Yrl.	29.6	29.3	30's	ASYG	35.1	24's
Graded Yrl.	31.1	25.1	28's	BSYG	31.4	28's
Yearling	31.2	27.2	28's		38.6	22's
Best Yrl.	31.3	27.7	28's	AYG	34.0	26's
Yearling	31.4	26.7	28's		35.3	24's
Yearling	32.0	24.0	28's	BYG	32.0	28's
Original bag Yrl.	33.2	24.8	28's		35.8	24's
Avg. Yrl.	33.7	26.0	26's			
Adult				Adult		
Sorted 26's	32.4	27.7	28's	BSFH	35.7	24's
Adult	35.0	28.1	26's		38.7	22's
Adult	35.1	27.7	24's	BSH	36.8	24's
Fine adult	35.2	26.9	24's		36.9	24's
Fine adult	35.6	28.4	24's	BFH	37.5	22's
Adult	35.7	27.0	24's	DSFH	34.8	26's
Original bag adult	35.8	25.6	24's			
Coarse adult	36.0	26.0	24's			
Avg. adult	36.2	25.8	24's			
Original bag adult	36.2	26.9	24's			
Avg. adult	36.4	28.8	24's			
Low adult	371.	26.7	22's			

TABLE 3. KEMP AND MED FIBERS AND VEGETABLE MATTER CONTENTS, TEXAS MOHAIR

Designation	Kemp, %	Med fibers, %	Vegetable matter, %
Kid	1.69	0.75	1.10
	.58	1.09	.45
	.37	.37	.64
	.37	.37	.74
	.45	.64	.48
	.44	1.06	.50
Yearling	.75	.68	.47
	1.97	.70	1.53
	.75	.19	.48
	.55	.12	.52
	1.78	.25	.84
	.57	.13	1.28
	.06	.39	.48
	.50	.19	.84
Adult	.52	.43	.32
	.80	.92	.50
	.62	.62	.10
	.49	.43	.40
	.31	.44	.42
	.58	.26	.58
	.49	.18	.68
	.06	.54	.37
	.40	.40	.22
	.50	.25	1.21
	.72	.39	.24
	.42	.67	.61