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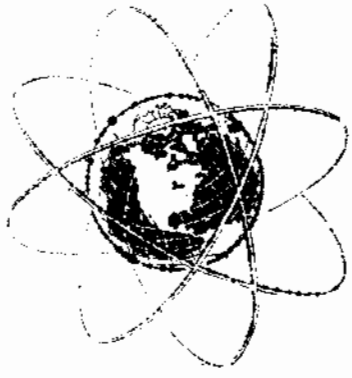
Sheep and Angora Goat, Wool and Mohair Research Report



Texas A&M University
Texas Agricultural Experiment Station
R. E. Patterson, Director, College Station, Texas

Contents

Foreword

Texas has approximately 20 percent of the sheep and 97 percent of the Angora goats in the United States. The research of the Texas Agricultural Experiment Station on sheep and goats has been expanding in a modest way for the past few years. We have come to realize that research results have, however, been inadequately reported to Texas sheep and goat producers. These consolidated progress reports are the culmination of a long-held ambition to make an annual report on the research done under the supervision of the Animal Science Department concerned with sheep and goats and wool and mohair.

This publication does not contain a complete report of all research done by Texas A&M University on these species. Some of the research of the Department of Agricultural Economics and Sociology, of the Range and Forestry Department, of the Soil and Crop Sciences Department, of the Biochemistry and Nutrition Department, of the Entomology Department and of the College of Veterinary Medicine would relate directly. Much other research of the Texas Agricultural Experiment Station would relate indirectly, such as water conservation.

We trust, however, that this complete report of the research supervised by the Animal Science Department, much of which is done at field stations at McGregor and Sonora, will provide useful information to Texas sheep and goat producers.

O. D. Butler, Head
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SHEEP AND ANGORA GOAT,
WOOL AND MOHAIR
RESEARCH REPORT

PR-2332

Determinants of Quality and Cutability of Lamb Carcasses

Z. L. Carpenter, G. T. King, J. M. Shelton and N. L. Cunningham *

Of paramount importance to the industry is the development of methods for accurately identifying and propagating the production of desirable lamb carcasses. It has been the purpose of this project to delve into all of the various considerations which are necessary to describe and accurately identify the most "desirable" carcasses for the producer, packer, retailer and the consumer. Objectives of this study are (1) to determine the yields of closely trimmed cuts as affected by various quantitative and qualitative factors and (2) to determine the tenderness of lamb and those factors of paramount importance in their affects on this palatability characteristic. The following results are preliminary in nature and have been completed during the first 2 years of this study.

LINEAR MEASUREMENTS AS INDICATORS OF CARCASS YIELD

Ninety-nine lambs were subjected to 18 bone-to-bone measurements before slaughter. After chilling for 48 hours, the carcasses were weighed and seven additional linear measurements were taken. The carcasses were separated into standard retail cuts, and subcutaneous fat was trimmed to 0.25 inch.

Simple correlation coefficients between variables showed that significant live measurement relationships to retail value per cwt. of carcass existed with thigh circumference (0.27) and the pin to hock measurement (-.28). Of the seven carcass measurements the only significant relationships to carcass value per cwt. were shoulder width (0.23), forearm length (—.31), loineye area per cwt. (0.38) and fat thickness per cwt. (--.26). Percent retail leg and loin was related significantly to forearm length, shoulder width, carcass width at the last rib, loineye area per cwt. and fat thickness per cwt. of chilled carcass.

This work suggests the difficulty of obtaining accurate and uniform live measurements of lambs. Work will be continued with emphasis on measurements of rams as related to comparable measurements on their progeny.

FACTORS INFLUENCING RETAIL CARCASS VALUE

Quantitative and qualitative data were obtained on 169 wether lambs representing four breed groups. The percent of retail leg was highly associated with the retail value of carcasses. Excessive subcutaneous fat was found to exert a highly significant negative effect on the retail carcass value. The fat thicknesses over the loineye and loineye area were found to be useful objective measures for estimating the cutout value of the carcasses.

Tenderness differed among breed groups with the fine-wool x medium-wool lambs producing the most tender rib chops. The means and standard deviations of certain carcass characteristics are presented in Table 1. These data indicate that selection of trim, muscular carcasses does not affect tenderness, which is one of the most important palatability characteristics.

COOKING METHOD, MARBLING AND COLOR AS RELATED TO TENDERNESS

Loin chops from 280 lamb carcasses of known history were used for a study of the influence of cooking method, marbling score, color score and core position on tenderness as determined by the Warner-Bratzler shear. The marbling score was significantly associated with the shear values when chops were cooked by oven-broiling, microwave oven cookery and deep-fat frying. The muscle color score was not significantly related to tenderness or cooking loss except for the deep-fat-fried chops. The percentage of ether extractable fat was significantly related to the shear when prepared by microwave and deep-fat meth-

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ods of cookery. The marbling score was related positively to the percentage of extractable fat with a correlation coefficient of 0.641. The core from the lateral position of the *longissimus dorsi* muscle or the position the greatest distance from the vertebral column was the most tender of the three positions by all methods of cookery. Microwave cookery produced the least tender chops with deep-fat frying only slightly more tender than the oven-broiling method. These results indicate that cooking methods, sample positions and muscle composition influence the tenderness and yield of the cooked product.

INFLUENCE OF CONFORMATION, FATNESS AND CARCASS WEIGHT ON YIELD OF EDIBLE MEAT

In another phase of the study, conducted in cooperation with the Standardization Branch, Livestock Division, U. S. Department of Agriculture, 150 lamb carcasses varying in carcass weight, fatness and conformation were completely evaluated and reduced to boneless, closely trimmed retail cuts to determine those characteristics of use in production of total edible meat from lamb carcasses. It is obvious that fatness is the characteristic that can be most valuable in prediction of the edible portion. Excess fat covering greatly reduces the yield of edible meat and consequently reduces the retail value of the carcass. These data currently are being analyzed.

TABLE 1. MEANS AND STANDARD DEVIATIONS OF LAMB CARCASS YIELDS AND MEASUREMENTS[1]

Variables	Breed group			
	Fine-wool	Finewool x medium-wool	Medium-wool	South-down
Number	58	70	24	17
Chilled carcass weight, lb.[2]	46.1[3]	46.6	49.3	43.1
	5.2[4]	5.4	5.6	7.2
Retail loin, percent[2]	15.8	15.9	15.7	15.1
	1.2	0.9	1.1	1.5
Retail leg, percent[2]	20.3	21.2	20.2	19.7
	1.5	1.3	1.0	1.7
Retail leg, loin rack and shoulder, percent[2]	64.9	66.7	65.8	65.7
	3.3	2.6	3.2	4.0
Retail carcass value, $/cwt.	53.34	55.20	52.69	50.63
	2.87	2.78	2.62	2.82
Kidney fat, percent[2]	2.93	1.70	1.88	2.25
	1.37	1.13	0.68	1.29
Fat trim less kidney fat, percent[2]	5.22	4.06	6.24	9.16
	2.68	2.09	3.07	4.21
Av. fat thickness, in./cwt.[2] [5]	0.41	0.34	0.53	0.77
	0.19	0.14	0.17	0.29
Loineye area, sq. in./cwt.[5]	4.07	4.44	4.10	4.76
	0.59	0.50	0.44	0.72
Tenderness, lbs./sq. in.[6]	9.03	6.61	7.68	7.32
	3.31	2.79	2.64	2.97

[1]From J. Animal Science 23:741, (1964).
[2]Yield and values calculated on chilled carcass weight basis.
[3]Mean.
[4]Standard deviation.
[5]Average of three measurements over each loineye muscle, based on chilled carcass weight.
[6]Warner-Bratzler shear values on broiled rib chops.

Improvement of Sheep Through Selection of Performance-Tested and Progeny-Tested Breeding Animals

James W. Menzies *

EXPERIMENT I

We are entering an age where there is little margin between profit and loss in the ranching business. In order to survive, the rancher must either purchase more land or improve production on the land he has. Most of the time it is more economical to improve one's production per acre or per head. One method of accomplishing greater production is through selection of superior producing animals. Selection has been done for centuries through visual observation. Is this the most desirable way to improve one's herd or is there a faster, more practical way?

Procedure

This project was designed to compare visual selection to production-record selection and to measure the improvements made by each. A control group is maintained at the same level of productivity as the three groups were originally (1961). Comparisons should be made on a within-year basis. The three groups have been run together and handled alike.

Visual selections are made each year in the normal ranching procedure by two competent and well known breeders.

Performance-group selections are made using weaning weight, wool weight, staple length and other production traits. Ram lambs are performance tested each year and ram selections are made using these records.

Results

Table 2 shows the production in pounds of lamb per ewe bred and shows that the production-selected group has outproduced the visually selected group each year. The first column shows the productivity of the groups before selection was applied. Note that the visual group was capable of producing 4.8 pounds more meat per head than the production group, originally. Row 4 gives the difference in pounds between the two groups for each year.

Table 3 gives the average pounds of grease wool produced per ewe. Performance/visual, row 4, shows the differences in wool weights between performance selection and visual selection groups. For example, in 1964 the performance group sheared 0.5 pound more grease wool per head than the visual group and 1.0 pound more per head than the control group.

Conclusions

This experiment shows the progress which has been made through two different selection programs, visual vs. performance, during 4 years' work. Visual selection was made in the normal ranching procedure. Performance selection was made on both the ewe and ram side of the flock, using weights and measurements of actual performance.

In 1964 the performance group produced 8.2 pounds more meat per head and 0.5 pound more wool per head than the visual group. Transposing this into dollars:

8.2 lbs. meat × 0.17 per lb. = $1.39
0.5 lb. wool × 0.56 per lb. = 0.28

$1.67 more per head

The performance group netted $1.67 more than the visual group. The prices per pound are relative figures and should not be taken literally. However, they do show the relative difference in dollars between the two groups.

EXPERIMENT II

A program was initiated to determine what rams with different gain capabilities, as measured by performance tests, will produce under normal

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TABLE 2. POUNDS OF LAMB PRODUCED PER EWE BRED

Group	Before experiment 1960	1961	1962	1963	1964
Control	75.8	60.2	76.7	43.3	38.3
Visual selection	75.3	56.1	64.3	37.5	49.0
Performance selection	70.5	64.0	75.6	50.5	57.2
Performance/visual	Before selection	+ 7.9	+11.3	+13.0	+ 8.2

TABLE 3. POUNDS OF GREASE WOOL PRODUCED PER EWE

Group	Before experiment 1960	1961	1962	1963	1964
Control	9.1	9.7	10.3	8.9	9.0
Visual selection	8.9	9.3	10.1	9.1	9.5
Performance selection	9.3	9.9	10.4	8.9	10.0
Performance/visual	Before selection	+ .6	+ .3	− .2	+ .5

TABLE 4. COMPARING MEAT PRODUCTION FROM HIGH, MEDIUM AND MODERATE GAINING RAMS

Year	Rams' daily gain on performance test		Lambs' weaning weight	Pounds difference between high and moderate rams per 33 lambs	Increase based on 17¢ per pound
	High	.71	86.9	178.2	$30.26
1959	Medium	.63	80.6		
	Moderate	.57	81.5		
	High	.60	92.4	161.7	$27.49
1960	Medium	.47	90.2		
	Moderate	.40	87.5		
	High	.60	75.0	151.8	$25.80
1961	Medium	.52	66.4		
	Moderate	.42	70.4		
	High	.60	70.4	132.0	$22.44
1962	Medium	.52	75.0		
	Moderate	.45	66.4		
	High	.63	81.2	155.1	$26.37
4-year	Medium	.54	78.1		
average	Moderate	.46	76.5		

range conditions. The results of this test give a producer or buyer of performance-tested animals an indication of the direct production he would obtain with different gaining rams.

Procedure

Each year, three rams representing high, medium and moderate rates of gain were selected and placed with an average group of ewes. The flocks were managed under similar conditions so that the results should be comparable.

Results

The results presented in Table 4 represent a direct monetary gain in weaning weight which one could obtain by using a high gaining instead of a moderate gaining ram. The price of $.17 per pound is an arbitrary one and should not be used literally. However, it does give the relative difference in dollars between the rams.

Table 4 shows that there is an average advantage, using 4 years' data, of 4.7 pounds per lamb between the high and moderate-gaining rams. Transposing this into dollars would mean between $22 and $30 increase per 33 lambs theoretically produced by one ram.

A simple performance test program follows by which breeders who raise their own replacement rams can performance test.

1. Shear the lambs in the fall, and weigh and place them all on the same pasture. Record weight and weight date.

2. Handle the lambs normally during winter, but keep all the lambs on the same feed.

3. Weigh and shear the lambs in spring. Weight increase ÷ days on test = average daily gain.

4. Weigh the fleece and measure the staple length. Obtain additional fleece information by visual observation, from the wool testing laboratory, squeeze machine or Extension Service personnel.

5. Use this information to supplement visual selection.

Physical Factors Affecting Feedlot Production of Market Lambs

James W. Menzies*

The feeding of market lambs is a growing enterprise in Texas. Coupled with this is a shift to high-concentrate rations. The feeding facilities for these lambs, however, has remained about the same. This study was initiated to determine the effects of certain improvements in the physical facilities for the lambs. These included night-lighting systems, shades and watering systems. It was designed to define which of these improvements are economically feasible to the producer.

TEST I. WATERING SYSTEMS TRIAL

The first test was conducted during August 1964 to duplicate feeding situations in the summer. Ewe lambs were alloted at random to one of three groups. The control group, (Group 1), received normal feedlot treatment on a high-concentrate (70 percent milo) ration with access to a regular water trough. Group 2 received the same treatment as Group 1 with the exception of a shade over a regular water trough. Group 3 was treated the same as Groups 1 and 2 but had access to a running water system, the flow of which was approximately ⅓ gallon per minute.

Results

Table 5 shows the results of a 30-day test using the preceding treatments.

The running water system shows a decrease of 6.3 cents in cost per pound of gain compared to the regular-water group and 4.7 cents less than the shaded-water group. The shaded water showed a decrease in cost of gain of 1.6 cents compared to the control group. The running water system had an advantage of 0.10 pound increase in daily gain over the control group. It appears from this trial that both shaded water and running water systems are an economical advantage during the summer.

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TABLE 5. 1964 RESULTS COMPARING THREE WATER SYSTEMS FOR MARKET LAMBS

Treatment	Number of lambs[1]	Pounds feed per pound gain	Average daily gain	Cost per pound gain
Group 1 Regular water	8	8.63	.33	27.2 cents
Group 2 Shaded water	8	8.13	.30	25.6 cents
Group 3 Running water	8	6.62	.43	20.9 cents

[1]Ewe lambs.

TEST II. SHADE, SUN TRIAL

This trial was conducted during August 1964 to determine if sheep shades or night lighting are beneficial during the summer. Ram lambs were randomly allotted to three groups. Each of the three groups was fed a high concentrate (70 percent milo) ration and was handled the same.

Group 1 (control group) received no shade. Group 2 received 4 square feet of shade per lamb. Group 3 received no shade but did receive night lighting.

Results

It appears from this trial, as summarized in Table 6, that the shaded group had an advantage of 1.8 cents in cost per pound of gain over the control group and gained at a rate of 0.05 pound faster per day. The trial indicates that light 24 hours per day is a detriment to the productivity of lambs during the summer. They gained 0.16 pound a day less and cost 1.0 cent more per pound of gain than the control group.

TEST III. COMPARING PRODUCTIVENESS OF EWE LAMBS TO RAM LAMBS

Comparisons were made between the control group of Table 5, ewe lambs, and the control group of Table 6, ram lambs. These two groups were handled and fed in the same manner. Table 7 shows the results of this comparison.

Results

Ram lambs gained an average of 0.30 pound per day more than ewe lambs at a cost of 9.6 cents per pound of gain less than the cost for ewe lambs. When considering the differentials in buying and selling prices, the ram lambs showed an advantage of $3.42 per head over the ewe lambs.

TABLE 6. EFFECT OF SHADE OR NIGHT LIGHTING ON LAMBS DURING SUMMER

Treatment	Number of lambs[1]	Pounds of feed per pound gain	Average daily gain	Cost per pound of gain
Group 1 Control (sun)	9	5.6	.63	17.6 cents
Group 2 Shaded area	9	5.0	.68	15.8 cents
Group 3 Sun and night lights all night	9	5.9	.47	18.6 cents

[1]Ram lambs.

TABLE 7. COMPARING EWE LAMBS TO RAM LAMBS IN FEEDLOT

Treatment	Pounds of feed per pound gain	Average daily gain, pounds	Cost per pound gain, cents	July buying price per pound	September selling price per pound	Net profit per lamb, wool added
Ewe lambs	8.63	.33	27.2¢	13¢	19.5¢	$1.03
Ram lambs	5.60	.63	17.6¢	8¢	14.5¢	$4.45

TEST IV. NIGHT LIGHTING DURING FALL

This trial was conducted during October and November to see if artificial light is beneficial during short-light days. The lambs were fed the same high concentrate (70 percent milo) ration. The lambs were allotted at random to one of three groups. Group 1 (control) received no night lighting. Group 2 received continuous light 24 hours per day. Group 3 received 4 hours of night light from 10 p.m. to 2 a.m. each 24 hours.

Results

Table 8 indicates that Group 3, receiving light from 10 p.m. to 2 a.m., had the least cost per pound of gain. The cost was 3.2 cents less than the control group. These lambs also gained .07 pound faster per day than the controls. Group 2, receiving continuous light, gained faster than both the other groups but also consumed a greater portion of feed. These lambs cost more per pound of gain than either of the other groups.

TABLE 8. 1964 RESULTS OF NIGHT-LIGHTING DURING SHORT-DAY FALL MONTHS

Treatment	Number of lambs	Pounds of feed per pound of gain	Average daily gain	Cost per pound of gain
Group 1 Control	8	8.79	.34	26.4 cents
Group 2 Continuous light	8	9.04	.45	27.1 cents
Group 3 Light 10 pm-2 am	8	7.72	.41	23.2 cents

GENERAL CONCLUSIONS

Summer Feeding

1. A running water system is highly beneficial to the productiveness of lambs during the summer.

2. Shaded water is also beneficial.

3. Shaded areas (4 square feet per lamb) are helpful during the summer.

4. All-night lighting during the summer was a detriment in this trial.

Fall Feeding

1. Night-lighting from 10 p.m. to 2 a.m. was an asset from both the cost per pound of gain and average daily gain standpoints.

2. Continuous light was beneficial only when average daily gain was considered.

Comparing Ewe Lambs to Ram Lambs

1. Ram lambs gain faster and more efficiently.

2. It takes a longer feeding period to fatten rams.

3. Calculi could become a serious problem when combining long feeding periods with ram lambs.

An Evaluation of Various Drug Additives to Rations for Lambs

Maurice Shelton and C. W. Livingston, Jr.*

In recent years, there has been a trend toward use of rations with much higher concentrate levels in lamb fattening. Some problems have been incurred which resulted in generally higher death losses from acute digestive disturbances. The use of aureomycin as an additive to these rations has become rather routine. Numerous feeding trials have been conducted at the McGregor Station to study the effect of including aureomycin and the desired level to use. The results have been erratic but have generally favored the use of aureomycin in high concentrate rations at levels somewhat above the usual rate of 12-15 mg. per pound of ration. The benefits obtained from these higher levels have not always offset their additional cost. In the summer of 1964 an organism resembling the Salmonella group was isolated from lambs on this station suffering from acute digestive disturbances. Since compounds of the nitrofuran group have been found of value in treatment of infections of this type in other species, it seemed desirable to evaluate the effect of this type of drug on lamb performance. The material chosen for this purpose was furazolidone in the formulation known as NF180 containing 50 grams of active ingredient per pound. It was fed at the rate of 2 pounds per ton or 50 mg. per pound of feed. Also, it seemed desirable to evaluate the effect of a combination of drugs. For this purpose, a product (SP250[1]) containing a mixture of aureomycin, penicillin and sulfamethazine was chosen. When fed at the rate of 2.5 pounds per ton, this provides 25 mg. aureomycin, 25 mg. sulfamethazine and 125 mg. penicillin per pound of feed. Aureomycin at the rate of 50 mg. per pound of feed was used as a control ration. A replicated experiment was conducted in the summer of 1964 using a mixed group of lightweight summer lambs produced in the flock of the McGregor Station. The ration used is shown below.

Ingredient	Percent
Ground sorghum grain	48.00
Ground alfalfa hay	20.00
Ground oats	15.00
Cottonseed meal	15.00
Urea	0.50
Calcium carbonate	0.50
Trace mineral salt	1.00

The results are shown in Table 9. Gains are low but are not out of line with expectations for lambs of this type at this season of the year. No death losses occurred in any lots although one lamb went off feed in each of lots 1 and 2. Highly significant differences in average daily gain were obtained. In each of the replicates, the lot receiving aureomycin alone gave the best results. The furazolidone markedly reduced gains. Since no great difference in the level of feed consumption was recorded, it appears that this drug actually interfered with feed utilization. In the absence of previous experience, the levels of drugs used were rather arbitrarily chosen, and in retrospect it appears the level of furazolidone may have been high for routine administration. Thus, it is not possible to suggest what the results may have been at a different level. Also, it should be pointed out that the acute digestive disturbances of the type mentioned earlier did not occur in any of the lots during the progress of this experiment.

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TABLE 9. INFLUENCE OF VARIOUS FEED ADDITIVES ON LAMB GAINS IN DRY LOT

Lot Number	Treatment	Number of lambs	Average daily gain	Average daily feed consumption	Feed per pound of gain
	FIRST EXPERIMENT (6/5/64 - 7/31/64)				
1	Aureomycin	10	.35	2.46	7.1
2	SP250	10	.32	2.43	7.7
3	Furazolidone	10	.25	2.34	9.5
	SECOND EXPERIMENT (6/30/64 - 8/21/64)				
4	Aureomycin	10	.40	2.06	5.1
5	SP250	10	.36	2.07	5.8
6	Furazolidone	10	.18	1.98	12.3

[1]This preparation is commercially available from American Cyanamid Co. under trade name Aureo SP250 and contains 20 gms. aureomycin and 10 gms. penicillin per pound and 4.4 percent sulfamethazine.

Effect of Physical Form of Ration on Performance of Lambs Receiving Rations Composed Largely of Sorghum Grain

Maurice Shelton*

Physical form is a problem in high-concentrate rations fed in drylot particularly if the ration is composed largely of sorghum grain. A feeding trial was conducted in the fall and winter of 1963-64 in which a single basic ration[1] was fed in five different forms. The ration used was as follows:

Ingredient	Percent
Ground sorghum grain	73.00
Ground alfalfa hay	12.00
Cottonseed meal	7.50
Urea	0.75
Molasses	6.00
Trace mineral salt	0.50
Di-calcium phosphate	0.25

15 mg. aureomycin per pound of feed.

The ration forms used were:

Lot 1—Ground form
Lot 2—Pelleted (complete ration)
Lot 3—Steam-rolled sorghum grain
Lot 4—Steam-rolled sorghum grain and pelleted supplement
Lot 5—Whole sorghum grain and pelleted supplement.

The sorghum grain and alfalfa hay had been ground through a hammer mill and, as is usually the case with these two feeds, were fine to dusty in nature. In the case of lots 4 and 5, all of the ingredients of the ration, except the sorghum grain and molasses, were put into a ¼-inch pellet. This supplement was then mixed with the appropriate amount of grain and molasses to equal the basal ration. The ¼-inch pellets were prepared in error in processing the feeds, as smaller size pellets were intended in planning. The molasses did not satisfactorily bind the supplement and grain, thus, these ingredients tended to separate out in the feed trough. Each lot or treatment group was sub-divided into A and B groups with the latter having access to long alfalfa hay free choice. At the outset there were 10 lambs in each sub-group, or a total of 100 in the entire experiment. The experiment was continued for 70 days. The results are shown in Table 10.

Several lambs were lost or removed for reasons not considered pertinent to the experiment except to point out that some increase in death losses are expected in self-feeding rations of this type.

As has been observed in previous experiences with rations of this type, animal gains were erratic because of a considerable amount of digestive disturbances among the lambs. However, significant differences were obtained and these appear to fit a trend or pattern. Those lots which received the ground ration, or the ration containing whole sorghum grain, performed less satisfactorily than the remainder. Although the poor performance of lot 4B receiving steam-rolled grain and pelleted supplement plus long hay cannot be explained, in general the lots receiving steam-rolled sorghum grain were distinctly superior in performance. Animals receiving the complete pelleted ration were intermediate in performance between those receiving the ground rations and the steam-rolled grain. In this series of studies, those lambs having access to long hay did not gain as fast or as efficently as those receiving only the basal ration. However, fewer lambs were lost from those lots receiving the long hay. In the B lots, long hay comprised 29.4 percent of the total feed intake.

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[1]The assistance of Texas Milling Company of Clifton, Texas in preparation of experimental rations is gratefully acknowledged.

TABLE 10. INFLUENCE OF RATION FORMS ON LAMB PERFORMANCE

Lot Number	Average daily gain	Feed per pound gain[1]	Lot Number	Average daily gain	Feed per pound gain[1]	Lots A and B combined: Average gain	Lots A and B combined: Feed per pound gain[1]
1A	.394	7.30	1B	.401	7.20	.398	7.25
2A	.421	5.68	2B	.400	7.16	.411	6.42
3A	.464	6.47	3B	.459	6.66	.462	6.56
4A	.456	7.09	4B	.383	8.23	.420	7.66
5A	.387	6.90	5B	.390	7.85	.389	7.37
Average	.424	6.69		.406	7.42	4.15	7.05

[1]Several lambs were lost or removed during the progress of the experiment, and feed efficiency figures do not account for feed consumed by animals which died.

SUMMARY

This work has shown that lamb performance can be improved by steam rolling sorghum grain, and that pellets are preferred over the finely

ground form. For best results, whole grain sorghum probably should not be used unless provision can be made to prevent its separation from the remainder of the feed mixture. Final decision on ration form would depend on availability and cost of processing which would be expected to vary widely under different conditions.

Two clinical cases of urinary calculi were observed at the termination of this experiment. Thus, the ration used here is potentially calculogenic in nature. Other work has shown that this may have been prevented by the addition of either ammonium chloride or potassium chloride to the ration.

An Interaction of Temperature, Shade and Shearing Treatment on Heat Stress of Sheep

Maurice Shelton*

The detrimental effect of high environmental temperatures is one of the major obstacles to efficient livestock production in Texas. Artificial modification of the environment at present seems to be impractical for an enterprise conducted on an extensive basis, as is much of the sheep industry. Thus, a major effort should be directed toward a choice of management practices which minimizes the effect of high temperatures. This is particularly true at critical or important phases such as several stages of the reproductive process or in lamb fattening. The desirability of providing shade or of shearing during hot weather is no doubt recognized by most producers. However, the importance of and possible interaction of these variables apparently are not fully understood by many producers, and no research data has been previously reported in Texas relating to these questions.

PROCEDURE

In the summer of 1962, a series of measures was taken of body temperature (rectal temperature), respiration rate, skin temperature and temperature of wool tips on 32 well-developed ewe lambs from June 1 to September 1. Fifteen observations were made on each characteristic for each animal over a range of environmental temperatures from 93° to 112° F. Thus, 480 observations were taken for each variable except in the case of wool-tip temperatures where only half this number was involved. All temperatures were recorded using tele-thermometers with thermister probes. The 32 lambs were subdivided into four groups of eight each as follows: shade-freshly shorn, shade-unshorn, sun-freshly shorn and sun-unshorn. Freshly shorn animals had a maximum of 2 weeks wool growth and unshorn animals always had a minimum of 10 weeks growth. By means of rotation or reversal, every animal appeared in each of the four treatment groups.

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RESULTS AND DISCUSSION

Major results are summarized in Table 11 and Figure 1. The results are reported for temperature ranges above and below 100° F. based on measures obtained in the sun at approximately 5 feet above ground surface. All measures were taken on days or at times of the day when environmental temperatures were between 93° and 112° F. The average of those days below 100° F. was 95.5° F., and of those above 100° F. 104.7° F. was average. Shade temperatures averaged 4.8° F. below that of similar measures taken in the sun.

Significant and important differences were obtained between treatment groups in each of the variables studied, and shearing treatment appeared to interact with environmental temperature and shade versus sun comparisons. Of the various measures taken, respiration rate is most indicative of the degree of heat stress as this is the primary means of dissipating heat from the body in sheep. Skin and wool tip temperatures, when above body temperature, primarily indicate the effect of direct and reflected radiation. Internal body temperatures rise only when the animal is unable to maintain normal ranges (approximately 100°-104° F.) by the various mechanisms available. When internal body temperatures remain above normal for extended periods of time, death of the animal is likely to result.

As would be expected, shade was greatly beneficial in eliminating heat stress. Apparently, the degree of this effect would hold the primary interest. In resting sheep not exposed to thermal stress, the respiration rate usually is on the order

TABLE 11. AVERAGES FOR FOUR TREATMENT GROUPS FOR THE FOUR VARIABLES STUDIED

Treatment	Respiration rate		Body temperature		Skin temperature		Wool temperature	
	Environmental temperature							
	Above 100° F.	Below 100° F.	Above 100° F.	Below 100° F.	Above 100° F.	Below 100° F.	Above 100° F.	Below 100° F.
Sun-shorn	210.6	162.3	105.0	103.9	119.3	114.3		
Sun-unshorn	161.7	144.6	104.3	103.8	116.9	111.5	136.1	144.9
Shade-shorn	116.0	90.8	103.6	102.9	109.3	104.0		
Shade-unshorn	118.4	100.9	103.6	103.2	109.7	105.1	109.7	104.6

of 20, and when this is compared to the values in Table 11 the seriousness of heat stress is apparent. On five occasions, the average respiration rate of those animals exposed to sunshine was above 200 compared to much lower values in the shade. The animals in the shade essentially were able to maintain their temperature within normal range on all days except the one in which environmental temperatures reached 112° F.

The question of shearing does not provide the clear-cut results as does provision of shade. Within the temperature ranges used in this study, shorn animals were at a distinct disadvantage when exposed to direct sunlight. The differences favoring the unshorn animals were quite marked and serious at temperatures above 100° F. but were comparatively minor at temperatures below 100° F. In the case of animals in the shade, shearing provided no advantage at temperatures above 100° F. but did have some advantage at temperatures below 100° F. These results can be rationalized when we consider the function the fleece might serve, that of insulation. In most cases, this would be a disadvantage to the animal since it must dispose of body heat. However, when environmental temperatures approach or exceed body temperature, this insulating effect can aid in preventing or reducing the amount of heat the animal absorbs from its environment. This then seems to explain the interaction of shearing treatment and environmental temperature. The second function of the fleece might be to protect the animal from the heat obtained from direct and reflected sunlight. Thus, each sheep with a fleece would have its own private shade. This then explains the differential reaction to shearing among the animals in the shade and sun. The importance of this effect of radiation can be ascertained from the fact that on numerous occasions the temperature of the wool tips on animals in the sun reached as high as 170° F., whereas wool tip temperatures on animals maintained in the shade never exceeded 114° F. The slight inverse relationship between environmental temperatures and wool tip temperature cannot be explained at the present time.

RECOMMENDATION

The desirability of providing shade would seem to be well established. However, certain recent developments may make this more important than previously recognized. It has recently been shown that heat stress at or shortly after mating can result in complete embryo loss. The degree of heat stress observed in certain groups of this experiment would seem to be more than enough to bring about this loss. Also, there is a well known observation that sheep graze into the wind in the early part of the day and this often will lead them away from the shade available in the pasture. Some researchers have put these two factors together and have demonstrated an advantage in holding animals in sheds or barns during the day in hot weather. The desirability of shearing in summer also would seem well established. However, this work has suggested that such procedure may be undesirable in midsummer, particularly if adequate shade is not available.

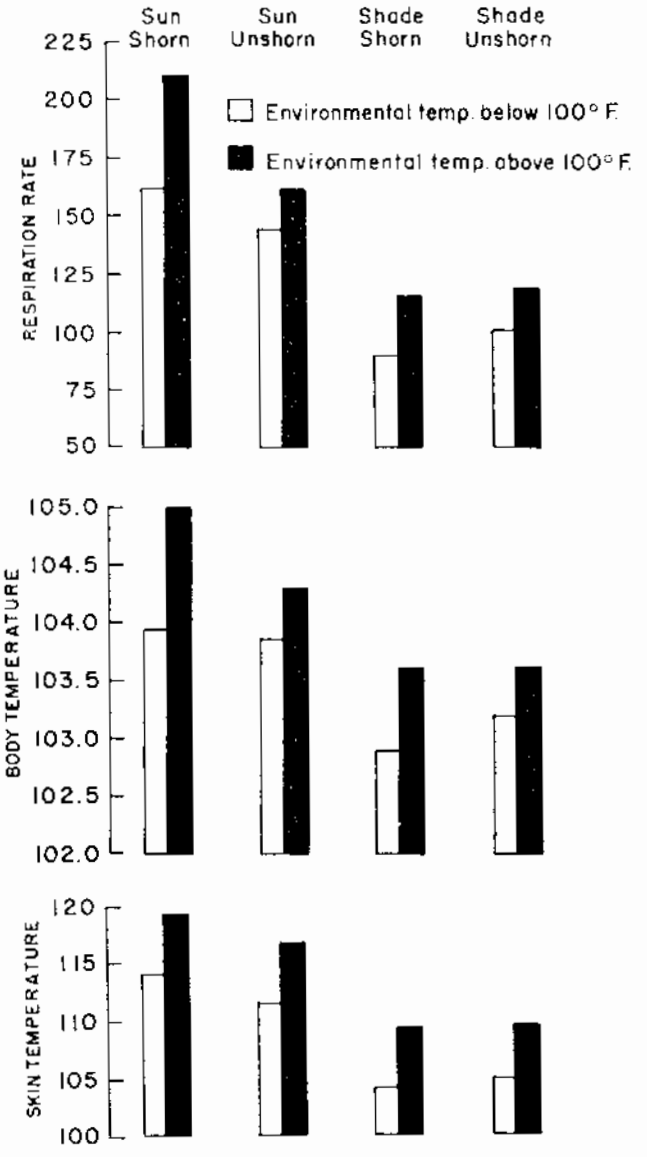

Figure 1. Effect of temperature range, shade and shearing treatment on heat stress in sheep.

Influence of Level of Energy and Shearing on Reproductive Performance of Aged Finewool Ewes

Maurice Shelton*

Number of lambs raised is a major factor contributing to income from a sheep enterprise. Thus, any management practice which might potentially increase fertility should hold the interest of both research workers and producers. Shearing of the ewes and increasing feed level at the time of mating are two practices of interest in this connection.

PROCEDURE

For the last 2 years, groups of aged finewool ewes of predominantly Rambouillet breeding have been used to study the effect of season on various aspects of reproduction. By means of split block design, shearing and energy-level treatments have been superimposed on these studies. The effect of season will be reported in a separate publication and the present report concerns only the two secondary questions involved.

For 60 days prior to mating, all ewes were maintained in drylot on a ration of 80 percent sorghum hay, 5 percent sorghum grain, 5 percent cottonseed meal and 10 percent alfalfa hay. This proved to be better than a maintenance ration as the ewes gained a small amount of weight. The high energy level consisted of raising the sorghum grain to 30 percent with a coincident reduction of sorghum hay at the time the rams were placed with the ewes. This treatment was applied to each of the four seasons in the first year (June 1962 to March 1963). The shearing treatments consisted of shearing half of each group of ewes at the time of joining the rams. This treatment was applied at June and September matings for 2 years. Unshorn animals had a minimum of 6 weeks and a maximum of 9 months of wool growth. Unshorn animals on the low energy ration served as controls for both groups in June and September 1962; otherwise, there is no duplication of animals involved in the two studies reported.

The rams were marked with lamp black in oil, and estrus was recorded as the ewes came into heat. Half of each group of ewes were laparotomized 4 days after estrus to determine ovulation rate. The other half were allowed to lamb to determine lambing rate.

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TABLE 12. INFLUENCE OF SHEARING PRIOR TO MATING ON REPRODUCTIVE PERFORMANCE OF AGED FINEWOOL EWES

Treatment	Number ewes	Average ewe weight	Percent showing estrus	Ovulation rate	Percent ewes lambing	Number of lambs born	
						Per 100 ewes bred	Per 100 ewes lambing
Shorn	111	121.9	94.6	1.65	77.2	107.0	138.6
Unshorn	111	126.2	99.1	1.59	79.3	105.7	133.3

RESULTS AND DISCUSSION

Shearing Treatment

The effect of shearing prior to mating on various aspects of reproductive performance is shown in Table 12. The weights given represent weights taken at the time of joining with rams and do not represent trends which may have occurred after this date. The significant differences in weights represent only the approximate weight of wool on the unshorn group. No significant differences were observed in any of the various measures of reproductive performance. There appeared to be a slight, but non-significant, tendency for more of the unshorn ewes to exhibit estrus but for the shorn ewes to have a higher ovulation or lambing rate.

These results were somewhat surprising in that work at other locations had suggested an advantage for shearing. Thus, the exact conditions under which this experiment was run should hold some interest. Rams were put out on June 21 and September 21. Thus, most of the matings occurred in July, late September and October. On the latter dates, temperature stress would not be expected to be a problem, but some temperature stress would have been expected in July. Other observations reported indicate that the reaction to shearing depends largely on environmental conditions involved. In this study, ewes were maintained in an open lot with access to an ammunition storage igloo structure which would not permit free air movement. Thus, facilities were not the best in terms of eliminating heat stress. In addition, this study involves only aged finewool ewes which would be expected to be most resistant to heat stress. The effect of shearing will be investigated further under other conditions.

Level of Energy

The effect of level of energy at mating on various aspects of reproduction is shown in Table 13. No statistically significant differences were

TABLE 13. INFLUENCE OF ENERGY LEVEL DURING BREEDING ON REPRODUCTIVE PERFORMANCE OF AGED FINEWOOL EWES

Treatment	Number ewes	Average ewe weight	Percent showing estrus	Ovulation rate	Percent ewes lambing	Number of lambs born	
						Per 100 ewes bred	Per 100 ewes lambing
Low	115	125.4	91.3	1.41	84.3	123.5	146.5
High	110	126.9	91.8	1.48	77.2	121.1	156.8

observed. However, there appeared to be a distinct trend for the group on high energy to have a higher ovulation and lambing rate, but also to have a larger number of dry ewes. These two opposing trends cancelled each other with the result that the realized lamb crop essentially was the same. Again the conditions under which this experiment was conducted should be kept in mind. The basal or low energy treatment was an adequate or maintenance-plus ration. The ewes involved averaged 126 pounds at the start of the test. Previous analyses have shown this weight to be an approximately normal physiological weight for animals of this breed. The results obtained tend to support the numerous experiments in flushing sheep which indicate that feed level, or an increase in feed level, at the time of mating generally is without great value in increasing lamb crop. In order to be most effective, flushing should be started before mating to gain a weight response by the animals involved prior to exposure to rams.

The Relation of Size to Breeding Performance of Angora Does

Maurice Shelton*

A low reproductive rate, as expressed in terms of kid crop weaned, remains a problem with the Texas Angora goat industry. Previous research work has suggested several possible ways in which this might be improved, and several of these revolve around the lack of adequate size and development of breeding does. Since the relationship between these factors and fertility is based either on observation or on the extensive analysis of data collected several years ago on the Ranch Experiment Station at Sonora, it appeared that a more recent analysis based on data collected on the Livestock and Forage Research Center, McGregor, might shed further light on this relationship.

PROCEDURE

Since 1957, all Angora does on the Livestock and Forage Research Center, McGregor, have been weighed when they were put into the breeding flock. These represent shorn body weights taken early in September. Results were analyzed separately for yearling and mature does and for grade and registered does. However, the latter two groups performed similarly and were combined for purposes of reporting.

RESULTS AND DISCUSSION

Yearling Does

The yearling does were divided into groups with a 10-pound weight range, Table 14. These represent shorn body weights at the start of the fall breeding season in early September. Thus, they represent approximately 18-month body weights. The relation of this breeding weight to breeding performance for their first breeding season is shown in Table 14 and Figure 2. The 12-month fleece weights reported represent the two shearings in the calendar year in which the kids were born. In line with earlier work, these data show an important relationship of size to kid production, but a nonsignificant relationship of size to fleece weight. The percent of does kidding increases directly with size up to 60 pounds, but above this figure no further increase in this variable is noted. The kidding rate, or number of kids born per doe kidding, continues to increase even with the upper limits of size. Because of this increase in kidding rate, the percent of kids dropped and kids raised continues to increase. A substantial number of the yearling does drop and raise twins when the weight range is above 70 pounds. However, this is an unusual weight for yearling does under Texas range conditions. Although mortality of kids is a serious problem in this flock, unusually heavy mortality of kids was experienced only among kidding does weighing less than 50 pounds (57.1 percent) or among twin-born kids out of does weighing less than 70 pounds (40 percent).

Mature Does

The mature does (3 years of age or older) were divided into groups within a 10-pound weight range, Table 15 and Figure 3.

Again fleece weights were not greatly affected by size of doe, but all measures of fertility on kid production show a direct linear increase with increasing body weight up to 90 pounds. Above this weight, the number of does kidding decreases slightly, but the number of kids born continues to increase due to an increased kidding rate. In terms of kids weaned, there is no advantage to increasing body weight above 100 pounds and only slight advantage to any increase above 90 pounds. However, a very important increase in all aspects of fertility occurred up to

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TABLE 14. THE RELATION OF YEARLING BREEDING WEIGHT TO FIRST-SEASON PERFORMANCE

Weight range, pounds	Average weight, pounds	Percent does kidding	Percent kids		Kidding rate[1]	Average 120 day weight of kid, pounds	12 months' fleece weight, pounds[2]
			Born	Raised			
Below 50	46.4	53.8	53.8	23.1	1.00	29.3	10.8
50-60	56.5	67.6	72.0	55.9	1.07	37.9	11.0
60-70	66.3	82.1	97.9	70.5	1.19	41.0	11.0
70-80	75.3	82.3	117.8	89.9	1.43	38.8	10.7
80+	85.9	80.0	130.0	103.3	1.63	43.9	10.9
Summary	67.6	77.2	98.6	73.7	1.28	39.9	10.9

[1]Average number of kids dropped per doe kidding.
[2]Only purebred goats included in fleece weights.

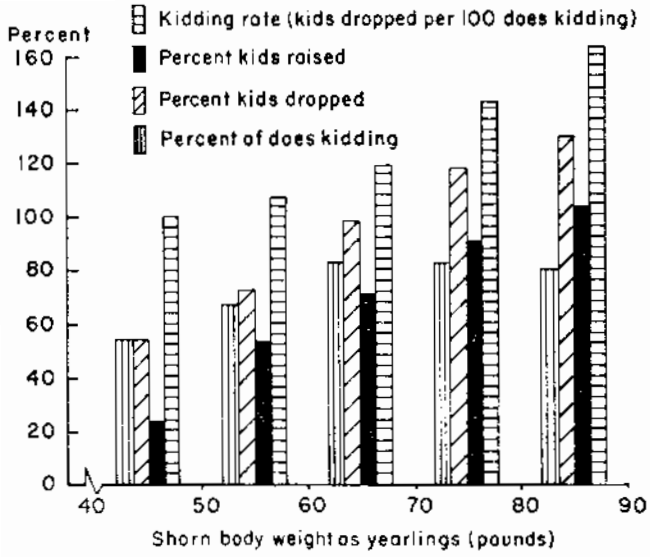

Figure 2. Shorn body weight as yearlings.

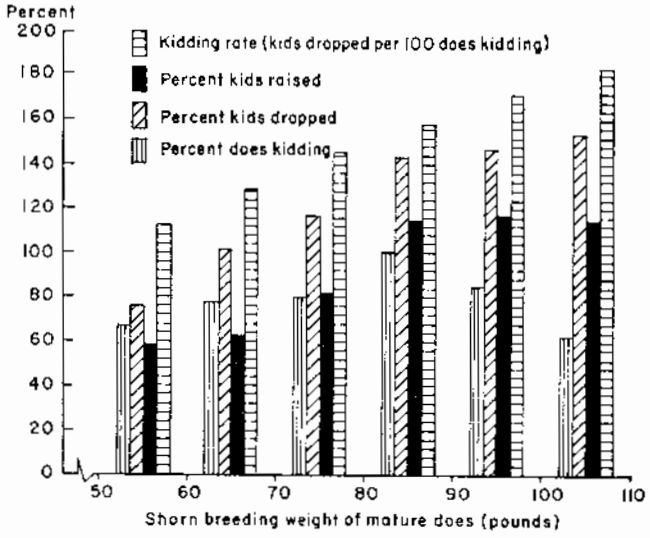

Figure 3. Shorn breeding weight of mature does.

the range of 80 to 90 pounds on the group which averaged 85.4 pounds. Some twinning occurred with all sizes of does and this increased in a direct linear manner as body size increased. Thus, there seems no way to avoid twinning as it will increase automatically with any efforts to improve environmental conditions. Although not a part of this study, it is obvious that the death rate is higher among twins, but not sufficiently high to prevent this having a favorable effect on percent kids raised. Thus, in cases of reasonably good environmental conditions, twinning should be looked on with favor.

These studies agree with earlier analysis made on data collected on the Ranch Experiment Station, Sonora, in that realized fertilty is markedly improved with increase in body size. The percentage of does which kid did not improve above the average weights of 65 and 85 pounds for yearlings and mature does, respectively, and these values may be looked upon as approximate physiologic weights for this breed. Above these weights, the amount of twinning, and thus possibly total realized fertility, may continue to increase. However, the degree of increase above the suggested weights, particularly for mature does, may not be sufficient to suggest these higher weights as goals.

The failure of fleece weights to improve with increases in size is somewhat surprising and appears to require explanation. It is known that kid production adversely affects fleece growth, but the degree of this effect is minor compared to the value of kids produced. It also is obvious that a negative genetic correlation exists between efficiency of mohair production and body weight increases. In the case of analyses made within a given flock treated alike these two factors appear to have compensated for any expected increase in fleece weight. However, when contrasting different flocks or different management schemes in which environmental variations are more important as a source of variation in size, it would seem obvious that some increase in fleece weights are to be expected with increased body weight.

TABLE 15. RELATION OF MATURE BREEDING WEIGHT TO PERFORMANCE THE FOLLOWING SEASON

Weight range, pounds	Average weight, pounds	Percent does kidding	Percent Kids		Kidding rate[1]	Average 120 day weight of kid, pounds	12 months' fleece weight, pounds[2]
			Born	Raised			
Below 60	56.1	67.6	76.5	58.8	1.13	36.5	11.3
60-70	65.9	78.6	101.9	62.1	1.30	39.3	10.5
70-80	75.7	80.6	117.3	81.2	1.46	41.5	10.4
80-90	85.4	90.7	143.2	114.8	1.58	42.4	10.3
90-100	95.1	85.6	147.4	116.9	1.72	44.8	10.0
100+	107.2	83.3	155.4	113.8	1.84	46.7	10.7
Summary	82.0	83.2	128.1	94.6	1.54	42.7	10.4

[1]Number of kids dropped per doe kidding.
[2]Fleece weights on purebred Angoras only, calculated in a manner as to remove age of doe.

A Study of the Mechanism of Male Stimulation in Angora Goats

Maurice Shelton and Tom Morrow*

INTRODUCTION

Previous research work has shown that the male normally acts as an exterioceptive stimulus to terminate anestrus in Angora does and that the does are highly synchronized as a result. Since the Angora does normally do not exhibit a first silent or nonreceptive heat period as is characteristic of many other species, they are routinely bred on the first ovulation of the season. Previous research also has shown that an increased kid crop can be expected from mating at the second as contrasted to the first estrus period. These facts seem to offer opportunities for alternative management procedures contributing to substantial improvement in reproductive efficiency. Scientific curiosity, as well as more practical matters, suggests that the mechanism of this male stimulation should be understood insofar as possible. Specifically, it seems desirable to know what degree of contact or isolation is necessary to encourage or prevent the expression of this male stimulation.

PROCEDURE

Two years work has been conducted in which Angora does have been afforded various degrees of contact with males and slaughtered at periods of 14 to 17 days after initiation of the experiment. The condition of the ovaries were then observed for evidence of ovulation or the amount of follicular development on the ovaries. The number of does which had ovulated was considered to be the critical measure, but an ovarian activity score also was assigned according to the following schedule:

0—No activity (inactive, senile or juvenile type ovaries)

1—Presence of one or more small follicles on ovaries.

2—Presence of one or more medium follices on ovaries.

4—Presence of one or more large follicles on ovaries.

8—Presence of one or more corpus luteum or corpus hemorrhagicum on ovaries.

1963 Experiment

On September 2, 1963, a group of Angora does were randomized into five treatments, as listed below and shown in Table 16. The number shown are those completing the experiment and on which data were obtained. For reasons not pertinent to this experiment, a few additional does were put into lot 5. The variability in numbers in the remaining lots is due to an irregular number at assignment, death losses or a failure to recover ovaries for examination. The does were slaughtered at a commercial abattoir on September 16, the 14th day of the experiment.

All does were maintained on the same ration in drylot at widely separate locations from September 2 to 16. The various treatments were designed with the following intent:

Lot 1—Control—no contact with male.

Lot 2—Odor of male—this was accomplished by placing the experimental group in a structure previously occupied by several active males and by suspending in a sack near the feed trough mohair recently shorn from rutting males.

Lot 3—Adjacent to a secluded male—in this way the does were expected to be exposed to odor and sound of the male, but not sight or physical contact.

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TABLE 16. THE EFFECT OF MALE STIMULATION ON INITIATION OF ESTRUS IN ANGORA DOES

Lot number	Treatment	1963 Results				1964 Results				Summary			
		Number, does	Ovulating		Ovarian activity rating	Number, does	Ovulating		Ovarian activity rating	Number, does	Ovulating		Ovarian activity rating
			Number	Percent			Number	Percent			Number	Percent	
1	Control—No contact with male	17	1	5.9	2.76	19	6	31.7	3.74	36	7	19.4	3.28
2	Odor of male	19	3	15.8	3.05	19	7	36.8	4.47	38	10	26.3	3.76
3	Adjacent to secluded male	18	2	11.1	1.83	19	5	26.3	3.63	37	7	18.9	2.75
4	Adjacent to male (separated by wire fence)	20	6	30.0	3.65	19	13	68.4	6.26	39	19	48.7	4.92
5	With male	24	21	87.5	7.29	18	17	94.4	7.72	42	38	90.5	7.47

Lot 4—Adjacent to male—(separated by wire fence) in this treatment it was anticipated that the does would be exposed to sight, sound and odor but not physical contact beyond that permitted by fine-mesh wire fence.

Lot 5—Complete contact with male.

1964 Experiment

The 1964 experiment followed essentially the same plan as that employed in 1963. The experiment continued for 17 days from September 11 to 29. Different males, and in certain instances different pen locations, were involved as contrasted to 1963.

The results of both experiments are shown in Table 16.

RESULTS AND DISCUSSION

Significant differences were noted between both treatments and years in respect to number of does ovulating and ovarian activity rating. These data again substantiate that the presence of the male is a major factor in the initiation of estrus cycling in Angora does. The large number of does showing estrus in the second year, even in the absence of a male, substantiates an observation previously made that confining does together in pens, especially if they are handled or worked, frequently will serve to initiate estrus in a significant number of females.

No attempt was made to determine significance between individual treatment means. It appears that the male odor had only a slight effect in initiating estrus in the doe. It should be noted that it was not possible in these experiments to cause a strong odor to remain throughout this experiment.

The presence of an active male across the fence from the does did serve to initiate estrus in approximately 50 percent of the does. A noticeable difference occurred in the effectiveness of this treatment between the 2 years. It appears that this can be explained because the male used for this purpose in 1963 was an aged male showing much less libido than the male used in 1964. In general, it appears that the presence of one or more rutting males across the fence would have the effect of initiating estrus in the majority of Angora does, although it appears that more time would be required than in the case of complete contact with the male. This experiment did not consider distance of the male from the female as a factor in doe stimulation. Work with sheep has suggested that males as much as 60 or more feet removed from the females may have an effect on their cycling activity.

The one surprising result of these studies is the apparent detrimental effect observed in lot 3. In both years the amount of reproductivity appeared to be below that of the controls. This effect was very noticeable in 1963 when a number of large, well-developed does had ovaries that appeared to be completely inactive. The following observations suggest a possibility of the lack of ovarian activity in this group. In each of the 2 years, a single male was penned in complete isolation in a corner of the building where the does were maintained. These males, especially the one used in 1963, were very distressed and made this evident frequently and repeatedly by vocal means. Apparently, this communicable form of stress is the explanation for the low level of ovarian activity of this group. However, it is not clear if this was a direct effect on reproduction or if it may have been through the medium of reduced fed intake. The does had *ad lib* access to feed located close to the male in question. Data on feed consumption and body weight gains were not recorded, but in the first year it was evident that the does in question had lost weight. The possible implications of this finding requires further examination, but for the time being it appears desirable that producers be aware of possible adverse effects of this type.

An Analysis of Some Factors Affecting Weaning Weight of Angora Kids

Walter Davis and Maurice Shelton*

Numerous observations and available research data indicate strongly that lack of size and development are two of the major problems in the Angora goat industry.

Lack of size has been shown to contribute to a low reproductive rate, abortion, increased freeze losses and reduced resistance to external and internal parasites.

Improvement in size or growth rate theoretically may be obtained from changes in management or selection programs or a combination of both.

In order to arrive at the proper decision in respect to these matters, producers should have some knowledge of the various genetic parameters relating to size. In order to properly calculate estimates of the various genetic parameters, it is necessary to have an extensive body of data collected under conditions closely approximating those in which the goats are to be raised. No data are available which exactly meet these requirements. However, a rather extensive body of data is available from records collected on the flock maintained at Ranch Experiment Station, Sonora, prior to the time this flock was moved to McGregor. The primary limitations are that the types of goats have changed somewhat since that time, and that the animals in question were maintained under adverse conditions with only a limited amount of supplemental feeding.

One of the more critical periods in the life of the animal and the first opportunity to exercise selection for size would be at weaning time.

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TABLE 17. EFFECTS OF ENVIRONMENTAL FACTORS ON ANGORA KID WEANING WEIGHTS

Factor	Weaning weight, pounds	Increase or decrease from standard, percent
Sex		
Female	0	0
Male	+2.86	+ 9.02
Type of birth		
Single	0	0
Twin	−4.06	−12.81
Age of dam, years		
2	0	0
3	+0.36	+ 1.14
4	+2.70	+ 8.52
5	+2.88	+ 9.09
6	+3.63	+11.45
7	+3.06	+ 9.65
8	+2.96	+ 9.34
9+	+0.60	+ 1.89
Years		
Range from average		
Lightest	−7.41	−23.40
Heaviest	+6.31	+19.90
Age of kid		
Continuous variable, increase per day of age	0.081	

MATERIALS AND METHODS

An analysis of some of the factors affecting weaning weight was made utilizing the least squares procedure. The data used were collected on animals born in the Sonora station flock which had completed their lifetime records when they were moved to McGregor in 1948. A period of 13 years was involved in which 911 kids were sired by 41 sires. These kids were born in February or early March and weaned in late August. The average weaning age was 174 days.

The factors studied were sex, type of birth, age of dam, year of birth, age of kid and inheritance. Some of the results are shown in Table 17, with a single female kid born in an average year out of a 2-year-old doe considered as a standard. This average kid weighed 31.7 pounds. Other types are shown in both pounds and percent and as plus or minus values from this base.

For reasons indicated earlier, the weaning weights on these kids are light, ranging from approximately 32 pounds for an average female kid out of a 2-year-old doe in an average year, to 45 pounds for male kids out of 6-year-old does in one of the better years. These data show male kids weighed 2.86 pounds or 9.02 percent more than females, and twin kids weighed 4.06 pounds or 12.81 percent less than singles. Both these factors followed the expected pattern. The maximum weights of kids were obtained from 6-year-old does. However, only small differences were observed between the ages of 4 and 8 years. Does 2 and 3 years old and those older than 8 years produced light-weight kids.

Variation in age of kid at weaning was associated with an increase of 0.081 pound in weight per day of age. This may be roughly interpreted to indicate that, on the average, the kids were gaining only 0.08 pound daily at weaning time. This rate of growth would not permit adequate development in this species and would suggest some improvement in the management schemes used in this flock.

These data provide a basis for adjustment factors, if these are desired in a selection or research program. Either pounds or percent may be used, but it would appear that the latter would be more applicable under environmental or management conditions differing from those under which the animals were raised.

Attempts were made to estimate the heritability of weaning weight by half-sib analysis and by intra-sire regression of offspring on dam, Table 18.

TABLE 18. HERITABILITY ESTIMATES OF ANGORA KID WEANING WEIGHTS

Method	Heritability estimate of weaning weight
Half-sib analysis	
All least squares constants fitted	.00
All constants except years fitted	.48
No least squares constants fitted	.33
Intra-sire regression of offspring on dam	
All least squares constants fitted to both dam and offspring	.55

The results of this analysis are difficult to interpret. Of the two procedures used, the intra-sire regression is considered the more valid with the half-sib method tending to overestimate heritability. Since different sires were used most years, any analysis which does not consider the important year effect is meaningless. Thus, these data indicate that in this case the sire had no effect on the weaning weight of the kids. By contrast, there was an important relationship between the weaning weight of the dam and the weaning weight of her offspring. Since it is known from other analyses that lack of size and development were characteristic of many of the does in this flock, it would appear that an environmental correlation exists between the dam and her offspring. This would tend to discount the relatively high heritability estimate obtained by this procedure. These data seem to suggest that heritability of weaning weight under these conditions is low, and that the first effort should be in the direction of improved management or environmental conditions. Other attempts to estimate heritability of body weight in goats indicate that it is low to moderate except in the case of yearling weight where the true genetic potential is more likely to be expressed.

Effect of Two Levels of Protein and of Supplemental Methionine in Rations for Kid Goats

Maurice Shelton*

Hair fibers of various types, such as wool and mohair, have been shown to contain large amounts of the sulfur-containing amino acids such as methionine and cystine. Considerable work has been done with sheep to investigate a possible beneficial effect on wool production from the addition of one or more of these amino acids to the ration. Results have been variable, but generally have failed to show a consistent favorable response except in those cases where non-protein nitrogen made up a large part of the protein potential available. Since Angora goats have a much higher level of fiber production per unit of body weight than sheep, it appears that this matter should be investigated concerning goats.

PROCEDURE

Angora male kids, approximately 6 months old, were shorn and started on feeding tests. Vitamin A was added to all rations, and trace mineral salt was provided free choice. Three rations were used as shown in Table 19. The rations were designed to contain approximately 12 or 14 percent digestible protein. Analyses were made for nitrogen and sulfur and were used in making the calculations in Table 19.

The test was continued for 132 days, from August 21 to December 31. A total of 24 kids, or 8 per lot, was involved. Initially, half of these were individually fed, but the kids did not perform satisfactorily in isolation, and after 20 days, all kids were fed in groups.

The results shown in Table 20 generally fail to show a response to the treatments used. The differences between rations were not significant.

There seemed to be a trend for the lot receiving the methionine to perform less satisfactorily than the other two lots. It would appear that this is a palatability factor, and may be caused by settling out of the methionine since the ration was not pelleted or treated with a binding agent. By analogy with sheep in which the requirements for sulfur are known, indications are that this ration represents a borderline deficiency of sulfur. Further work on this element in the ration for goats is needed.

In this case, the ration containing approximately 12 percent digestible protein appeared to be adequate, as a further increase of 2.5 percent did not improve performance. However, the type of ration used here did not give desired performance either in mohair production or body weight gains. Low palatability of the sorghum-type forage appeared to be a distinct factor, but perhaps others are involved.

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TABLE 19. COMPOSITION OF RATIONS

Lot number	Ration	Crude protein, percent	Estimated digestible protein, percent	Sulfur, percent
1	60 percent Johnson-grass hay 15 percent Ground oats 25 percent Cottonseed meal	17.5	12.0	.422
2	60 percent Johnson-grass hay 5 percent Ground oats 35 percent Cottonseed meal	20.8	14.6	.436
3	Same as Ration 1 with 0.5 percent DL-Methionine added	17.5	12.0	.529

TABLE 20. BODY WEIGHT CHANGES AND MOHAIR PRODUCTION AS RELATED TO RATION TREATMENTS

Ration	Number kids	Initial weight (shorn)	Final weight (in hair)	Body weight gain	Daily feed consumption	Mohair production		
						Stretched fiber inches	Grease weight pounds	6-month basis
		Pounds						
1	8	37.6	46.1	8.5	2.0	4.11	2.92	3.98
2	7	38.9	46.4	7.5	2.0	4.42	2.91	3.97
3	8	41.6	47.9	6.3	1.9	4.30	2.76	3.77

A Preliminary Study of the Importance of Staple Length in Selecting Angora Goats

Maurice Shelton, S. P. Davis and J. W. Bassett*

INTRODUCTION

The importance of staple length in selecting Angora goats is a somewhat controversial issue. In the absence of detailed studies on this factor, many producers have tended to equate staple length in goats with the importance attached to this characteristic in sheep. In sheep, length of wool contributes to price received and is highly correlated with fleece weight (both clean and grease weight) and yield as well as other valuable characteristics. In addition to these, staple length of sheep also is high in heritability. It is the purpose of this report to examine some of these relationships as they apply to the Angora goat.

MATERIALS AND METHODS

Since the fall of 1958, a small number of doe fleeces from the flock of registered Angora goats maintained at the Livestock and Forage Research Center, McGregor, have been sent to the Wool and Mohair Research Laboratory at College Station for yield and quality determinations. These have been of variable ages up to 6 years. Since the fall of 1960, similar studies were made on all purebred kids (both sexes) utilizing the fleeces obtained at the second shearing in early February. All data collected to date were used in the present analysis. Thus, these results are based primarily on the second kid fleece.

Before shearing, a single lock-length measurement was made on the shoulder area of each animal and recorded in centimeters. One or more locks also were collected and taken to the laboratory. From these an attempt was made to determine actual fiber length in a manner which might be used by producers. Two small bundles of 10 to 15 fibers each were stretched adequately to straighten the fibers, but not to cause any elongation of individual fibers. An average of two such measurements taken in centimeters was recorded as fiber length. This appeared to be a satisfactory way of obtaining a good approximation of the actual fiber length. The values obtained were correlated with measures of other fleece characters. Heritability estimates also were obtained on both lock and fiber length utilizing the procedure of half-sib analysis.

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TABLE 21. PHENOTYPIC CORRELATIONS AND HERITABILITY ESTIMATES INVOLVING STAPLE LENGTH AND FLEECE CHARACTERS OF ANGORA GOATS

	Correlation coefficients				Heritability
	Grease weight	Clean weight	Yield, percent	Fiber diameter	estimate, percent[1]
Lock length	.044	.174*	.350**	.174*	.593**
Fiber length	.178*	.328**	.283**	.234**	.216**

* Probability equal to or less than .05%.
**Probability equal to or less than .01%.
[1]In the case of the heritability estimates, tests of significance apply to sire effects in the variance analysis on which these are based.

RESULTS

Correlations and heritability estimates obtained are shown in Table 21. Correlations involving lock lengths are based on 221 animals, whereas data on fiber lengths are available on only 177 animals. In some cases, correlation values are based on numbers smaller than these where both items of data are not complete. The correlation of lock length and fiber length measurements was .400. Although this value was highly significant, it should be considered very low if these are looked upon as alternative measures of the same character. Under conditions of this study, lock length appeared to be high in heritability but seemed to have only a low relationship to other fleece characters. Lock length apparently was almost completely unrelated to grease fleece weight; however, a low but significant positive correlation with fiber diameter and clean fleece weight was obtained. The latter appears to be explained by the highly significant correlation with yield. Fiber length measurements were low to moderate in heritability, but showed a higher correlation with both grease and clean-fleece weights. In general, all of the correlation values reported are of low magnitude, and although they may be statistically significant, they would be of only slight economic significance. It is generally stated that the square of the correlation coefficient will give the approximate percentage of the variation in one characteristic which is associated with variation in co-variable. When considered in this light, most of the values reported become unimportant.

DISCUSSION

Earlier attempts to estimate the various genetic parameters associated with fleece characters of Angora goats have proved very erratic.

Thus, these values based on small numbers should be considered very preliminary, but these tend to substantiate other suggestions that staple length is of only secondary or minor importance as a component of fleece weight. Breeder or producer attitude should be somewhat influenced by a personal estimate of the future importance of lock or fiber length in respect to market demands or acceptance. Current marketing practices do not provide a premium for longer hair, although there is good reason to believe that some increase in staple length of Texas mohair would be to the long-term advantage of the industry. The much higher estimate obtained for heritability of lock length would indicate that lock type or configuration is higher in heritability than actual rate of hair growth. These data also would indicate that if measures of staple length are to be used in selection schemes such as performance testing of males, some measure of actual fiber length should be recorded in place of or in addition to lock length.

The Influence of Age on Fiber Diameter, Staple Length and Yield of Mohair

S. P. Davis and J. W. Bassett*

Mohair generally is classified into two categories in Texas markets on the basis of the age of the animal shorn; that is, kid and adult. The real basis for the two categories is a difference in fiber diameter since an Angora goat under normal feed conditions will produce a coarser fleece with each shearing. Market classifications based solely on age do not present an equitable market classification system for either the buyer or the seller. Market value of mohair is determined not only by fiber diameter, which is related to but not entirely determined by age of the animal, but also fiber length, yield, strength, vegetable matter defect, kemp and other factors. This study was initiated to study some of these quality factors to determine their relationship to age and location and to study the feasibility of developing a mohair marketing classification system.

PROCEDURE

The study was started with the fall shearing in 1964. Five Angora goat producers in three areas of Texas agreed to cooperate in the study. A minimum of ten does from each of four age groups were randomly selected from each producer's flock. The goats were sheared and weighed. The fleeces were weighed and physical measurements of fiber diameter, staple length and clean yield were obtained at the Wool and Mohair Laboratory. The goats were individually identified and the fleeces from these same goats will be measured for the next five shearings.

The age groups at the first shearing were 6 months, 1½ years, 2½ years and 3½ years.

RESULTS AND DISCUSSION

The results obtained from the first shearing and weighing are shown in Table 22.

Grease and clean fleece weights show a marked increase between 6 months of age and 1½ years, but little difference afterwards. Clean yield varies a little with age with the highest average yield coming at 1½ years of age and the lowest at 2½ years. Staple length shows some variation as the younger does had a longer average staple length than the older ones. It will be

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TABLE 22. ANGORA DOE FLEECES, FALL 1964, ADJUSTED TO 6-MONTH BASIS

Age, years	Owner	Number head	Laboratory fleece weight, pounds		Clean yield, percent	Length, inches	Fineness		Body weight at shearing, pounds
			Grease	Clean			Microns	Count	
	A	10	2.57	2.05	79.77	5.59	24.6	40s	30.4
	B	10	3.10	2.26	72.90	5.33	23.6	40s	37.8
1½	C	10	3.07	2.36	76.87	5.80	23.5	40s	40.0
	D	12	1.73	1.44	83.24	5.49	21.6	40s	30.5
	E	10	2.93	2.23	76.11	5.16	24.8	40s	*
Average		(52)	2.68	2.07	77.78	5.47	23.6	40s	34.5
	A	10	6.07	4.63	76.28	5.34	31.0	28s	47.8
	B	10	6.71	5.27	78.54	5.75	30.9	28s	52.0
1½	C	10	5.27	4.16	78.94	5.62	29.0	32s	48.6
	D	12	4.75	3.89	81.89	5.54	29.6	28s	47.3
	E	10	8.11	6.40	78.91	5.52	34.5	24s	*
Average		(52)	6.18	4.87	78.91	5.55	31.0	28s	48.8
	A	10	6.19	4.70	75.93	5.34	32.1	24s	56.2
	B	10	5.97	4.73	79.23	5.45	32.2	24s	53.6
2½	C	10	6.41	4.85	75.66	5.07	32.6	24s	67.2
	D	12	4.43	3.64	82.17	5.04	29.2	28s	50.9
	E	10	8.21	6.10	74.30	4.84	37.1	20s	*
Average		(52)	6.24	4.80	77.46	5.15	32.6	24s	56.7
	A	10	5.89	4.37	74.27	5.60	36.7	20s	61.2
	B	3	5.53	4.41	79.75	5.59	31.5	28s	63.0
3½	C	10	7.10	5.56	78.31	5.36	36.2	20s	70.7
	D	12	5.02	4.15	82.67	5.06	32.8	24s	58.3
	E	10	7.21	5.46	75.73	4.64	38.0	20s	*
Average		(45)	6.15	4.79	78.15	5.25	35.0	24s	63.1

*Not available.

necessary to wait until more data are available before deciding if this staple length difference is a real one.

Average fineness as indicated by fiber diameter in microns shows a very distinct increase from 6 months to 1½ years with smaller increases at later ages. This of course points out the primary reason for price differentials between "kid" and "adult" hair.

Average body weights increase with each year of age. One reason why fleece weights do not show a corresponding increase may be because the 2½ and 3½-year-old does had raised kids.

Consideration of data from individual producers within age groups indicates some of the inequities within the present two-class market price system. Within the kid group, differences in fiber diameter are not too great as all producers averaged a 40s spinning count, although there was a difference of over 3 microns between the finest and coarsest. A more important difference is that found in clean yield where there was more than 10 percent difference between the highest and the lowest yielding groups. Average length varied over .6 of an inch.

It is within the "adult" classification that we find the largest differences in the market quality factors which are considered here. Fiber diameter varies from 29.0 to 38.0 microns and from a 32s to a 20s spinning count. Staple length varies from 5.75 to 4.64 inches for a difference of over 1 inch and clean yield varies from 82.67 percent to 72.27 percent. All of these factors are important in determining the value of the mohair to the manufacturers.

A more complete understanding of the relationships being studied will be available as additional information is obtained.