

# Performance Testing of Rams as an Aid in the Improvement of Fine-wool Sheep



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## DIGEST

Lamb and wool producers face a challenge to maintain their position in a competitive economy. Increased productive efficiency through continued improvement in breeding flocks is one way to meet this challenge. Accurate performance or production records probably will bring about the most improvement in a reasonable period of time. When time and facilities permit, breeders are encouraged to keep complete records of lamb and wool production on every animal in the flock, and to use this information in the breeding program.

Many breeders, especially range producers with large flocks, find it impractical and in many cases impossible to collect detailed records on every animal. Since most of the improvement in livestock breeding is made from proper selection of sires, considerable benefit results from a small amount of effort put into the collection and use of postweaning performance records on ram lambs.

This publication outlines suggested procedures for performance testing of ram lambs. These procedures follow:

1. Select the most promising ram lambs at weaning and put them on postweaning performance tests on the ranch or at established testing stations.
2. Identify each animal; shear and weigh.
3. Place the rams on good range or pasture or self-feed in drylot.
4. Weigh the rams periodically to determine the rate of gain.
5. Shear a second time at the next regular shearing or after approximately 6 months.
6. Measure or score animals for rate of gain, wool production, staple length, face covering and skin folds.
7. Select only the animals that rate high in all of these characteristics and which conform to acceptable standards in body type and wool quality.
8. Dispose of the low performers.

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## COVER PICTURE

Only performance tests show the difference. The two rams look alike, although the one on the left was a noted show ram. Performance tests at Substation No. 14, Sonora, showed that the offspring of the animal on the right markedly outperformed the get of the other. In staple length, 4.72 to 4.33 inches; in clean wool, 10 pounds to 8.3 pounds; in daily gain, .48 to .38 pounds.

# Performance Testing of Rams as an Aid in the Improvement of Fine-wool Sheep

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THE SHEEP INDUSTRY SHOULD CONTINUE to improve to maintain its position in a competitive economy. Outstanding changes in the sheep industry have been in the type of breeding animals used. If the past can be used as a guide, major progress in the future will be made in the field of breeding.

Selection is the only method yet demonstrated which will bring about this improvement. A new approach to the sheep breeding problem, which makes selection more effective, is required. Recent work has shown that this is done most effectively by production records, especially on rams, as a supplement to the current practice of selecting animals by visual appraisal. Visual selection is useful for length and quality of wool and for face covering and skin folds, but undue or excessive emphasis on these characteristics can result in the sacrifice of others. Simultaneous selection should be practiced for the most important traits in sheep breeding with emphasis on each in proportion to its contribution to income or to economy of production. As the general level of the flock improves, progress becomes more difficult, so newer, more effective selection procedures should be used. This especially is true of lamb and wool production.

Australian workers have reported that selection by visual appraisal is about 30 percent as efficient in increasing wool production as selection based on objective measurements.<sup>1</sup>

## REASONS FOR PERFORMANCE TESTING

Performance testing should be used because:

- (a) There are large, important differences in the performance of individual animals.
- (b) These differences cannot be predicted accurately by judging or visual appraisal.
- (c) These differences are controlled partially by inheritance. Thus, the collection and proper use of performance records will result in continued flock improvements.

The extent of differences in individual ram performance is presented in Table 1 and Figure 1. Some of the rams produced or gained at al-

most twice the rate of others. These production figures were obtained from rams tested under feedlot conditions at Substation No. 14, Sonora, Texas. Similar though less marked differences occur when animals are tested under pasture conditions. Some of these differences in individual ram performance are caused by uncontrolled environmental factors such as size and state of health, but a significant portion of the differences in individual animals is due to heredity. The degree of hereditary control over any characteristic may be measured or estimated by certain statistical procedures and is called heritability. Heritability can be translated roughly as that portion of the differences which are passed on to the offspring. Heritability estimates of ram performance records have been obtained from 45 tested rams in the flocks of the Sonora and Barnhart stations. These studies, as well as others, have shown that the heritability of staple length, face covering and skin folds are high, usually 40 to 50 percent. Heritability of body conformation usually is low. The growth rate and wool production usually are 20 to 30 percent, Table 2.

Studies that involve high-performing rams (Figure 2) indicate that they are capable of siring lambs of considerably greater value than those sired by low-performing rams. Weaning records were made in 1958 on four ranches where tested high-performing rams were compared with visually selected good quality rams. The lambs from the tested rams outweighed the others at weaning by 2.2 to 7.4 pounds. Staple length was longer in three of the four cases by 7 to 9 percent. Differences in other characteristics, such as conformation, face covering and skin folds, generally were small and unimportant. These data are condensed and shown in Table 3.

## TESTS RESTRICTED TO RAMS

Most sheep producers, especially commercial producers with large flocks, find it impossible or impractical to collect records on every animal. Fortunately this is not necessary because most of the progress in sheep breeding is in the proper selection of rams. Progress in animal breeding depends entirely on the selection differential (superiority of the selected animals over the average of the flock in general), which can be obtained. When the size of the ewe flock is to be maintained or increased, only a small amount of culling is possible. However, a greater selection differ-

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TABLE 1. VARIATION OF ECONOMICALLY IMPORTANT TRAITS IN PERFORMANCE TESTING OF RAMBOUILLET RAMS (1955-59)<sup>1</sup>

Daily gain	1955	1956	1957	1958	1959	Total
Below .3 lb.			0	0	1	1
.3 to .4 lb.	4	7	8	1	14	34
.4 to .5 lb.	45	37	49	13	57	201
.5 to .6 lb.	31	42	50	54	40	217
Above .6 lb.	4		6	56	12	78
<b>Grease wool</b>						
Below 14 lb.	8	1	2	7	25	43
14 to 16 lb.	12	3	13	20	47	95
16 to 18 lb.	23	13	30	28	32	126
18 to 20 lb.	21	31	36	37	10	135
20 to 22 lb.	18	20	19	14	8	79
22 to 24 lb.	1	12	8	12	1	34
Above 24 lb.	1	6	5	6	1	19
<b>Clean wool</b>						
Below 5 lb.			0	0	0	0
5 to 6 lb.	1		0	0	4	5
6 to 7 lb.	8	2	3	7	23	43
7 to 8 lb.	11	12	23	24	42	112
8 to 9 lb.	27	23	36	38	32	156
9 to 10 lb.	25	23	25	30	11	114
10 to 11 lb.	9	22	13	16	8	68
Above 11 lb.	3	4	13	9	4	33
<b>Staple length</b>						
Below 3.0 in.			0	0	0	0
3.0 - 3.5 in.	8	10	1	5	7	31
3.5 - 4.0 in.	28	44	59	37	33	201
4.0 - 4.5 in.	39	31	44	52	60	226
Above 4.5 in.	10		9	30	24	73

<sup>1</sup>Numbers of rams grouped according to performance and years.

ential is possible with rams. It also is possible to use only young rams, especially in a stud capacity, which results in a shorter generation interval. For these reasons, it is estimated that 75 to 90 percent of the progress will be made through ram selection.

Commercial producers logically can restrict the collection of performance records to rams where major improvements can be obtained with relatively little effort. However, producers maintaining stud flocks, and especially those producing rams for sale, should consider a more intensive form of record keeping on the entire stud flock. Next to rams, the greatest gain from records probably can be obtained by using objective measures when selecting replacement yearling ewes.

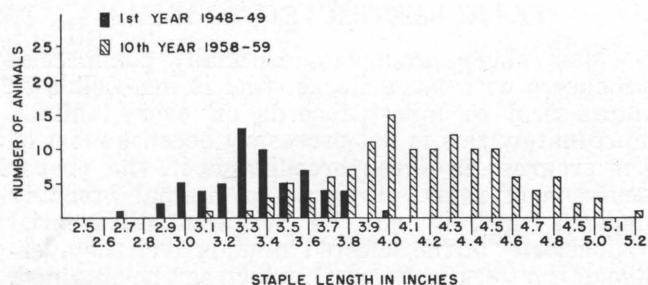


Figure 1. Distribution of rams according to staple length showing the progress made by breeders in 10 years of performance testing at the Sonora station.

## TESTING PROCEDURE

Ideally every ram placed in service should be selected with some objective information in addition to appearance. Rams should be selected on performance records collected as a necessary function of the ranch management program. Weaning data (weaning weight, staple length, face covering and skin folds) should be collected on all ram lambs whenever possible. The two types of postweaning performance testing programs that currently are in use are range testing conducted on the ranch of the producer or user of the rams; and tests conducted at centralized testing stations by colleges, breed associations or other agencies.<sup>2</sup>

The first type is potentially more important since a larger number of rams are involved and

<sup>2</sup>The American Rambouillet Sheep Breeders' Association recently established a "Registry of Merit" program of recognizing superior animals based on performance records.

TABLE 2. HERITABILITIES OF CHARACTERS IN FINE-WOOL SHEEP

Highly heritable (above 30 percent)	Moderately heritable (15-30 percent)	Low heritability
Face covering	Rate of gain	Conformation
Skin folds	Body weight	Condition
Staple length	Clean wool	
Fiber diameter		

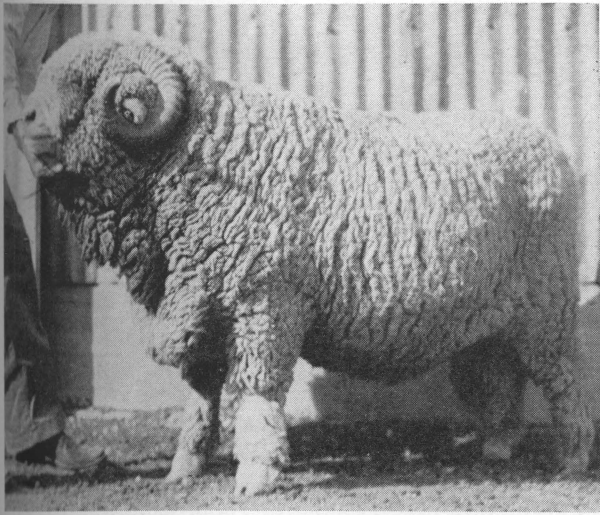


Figure 2. This ram was one of the first superior performing rams to be identified in the performance testing work. In actual range tests his lambs were 5.0 percent heavier at weaning, gained 8.2 percent faster in the feedlot and produced 8.9 percent more clean wool than the offspring of the seven other rams used for comparison.

are tested under environmental conditions similar to those of the flock in general. However, the second type of program is necessary for proper selection of stud rams which often should be obtained outside the owner's flock, and also to provide a service to producers or users of a small number of rams and to those who do not want to conduct their own testing program.

### Selecting Ram Lambs for Testing

Since ram tests involve time and effort, it is a waste of both to test obviously undesirable animals (Figure 3). At weaning time, ram lambs should be selected carefully and only those with desirable qualities placed on test. Rams with defects such as wool blindness, anatomical weakness, hairy britch, coarse fleeces, black spots, short staple and small or "doggied" lambs, should be disposed of. Unless lambing records are available, heavy culling on weaning weights should not be practiced since the result will be the culling of twin lambs or those out of young ewes.

In flocks with available records, preliminary culling should be done at weaning, using the available information. Weaning weight and staple length are important characteristics which may be considered. However, both require some environmental corrections before they can be

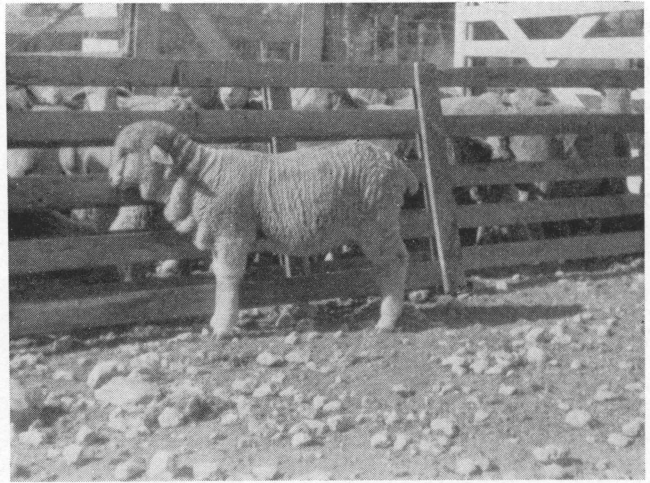


Figure 3. Ram lambs with an excessive amount of skin-folds, face covering or other undesirable features should be culled at weaning.

used accurately for culling or selection. The major environmental factor influencing staple length is the age of the lamb. If the age is known, the staple length may be corrected to 160 days by use of the nomograph, Figure 4.

The weaning weight of lambs is subject to great variation due to nongenetic causes, such as the age, sex, and type of birth (single or twin) of the lamb and the age of the dam. It is necessary to consider these factors in using weaning weights in selection. Two approaches to this problem are suggested. The first is to compare lambs only with others raised under similar conditions; second, an adjustment may be made for these factors. In the latter case, 10 pounds should be added to twin lambs to make them approximately equal to singles. Approximately 5 pounds should be added to the weight of lambs out of yearling ewes and to lambs out of ewes 8 years old or older. A suggested method of adjusting for age is shown in Figure 5. These adjustment factors are based on studies made at the Sonora station, and apply only to range flocks under similar conditions. An alternative method that may be applied under any condition is to divide the weight at weaning by the age in days to obtain average growth which is multiplied by a constant such as 160 days.

### Age

Performance records should be collected at a relatively early age to be of value in selecting replacement rams. Records on the growth rate

TABLE 3. COMPARISON OF WEANING WEIGHT AND STAPLE LENGTH MEASUREMENTS OF LAMBS Sired BY TESTED HIGH-PERFORMING RAMS AND BREEDER-SELECTED UNTESTED RAMS ON FOUR RANCHES

Item	Flock A		Flock B		Flock C		Flock D	
	Tested sires	Untested sires	Tested sires	Untested sires	Tested sires	Untested sires	Tested sires	Untested sires
Weaning weight, lb.	84.3	78.3	76.7	74.5	77.8	72.6	64.4	57.0
Staple length, in.	2.14	2.26	1.55	1.42	1.58	1.48	1.84	1.69

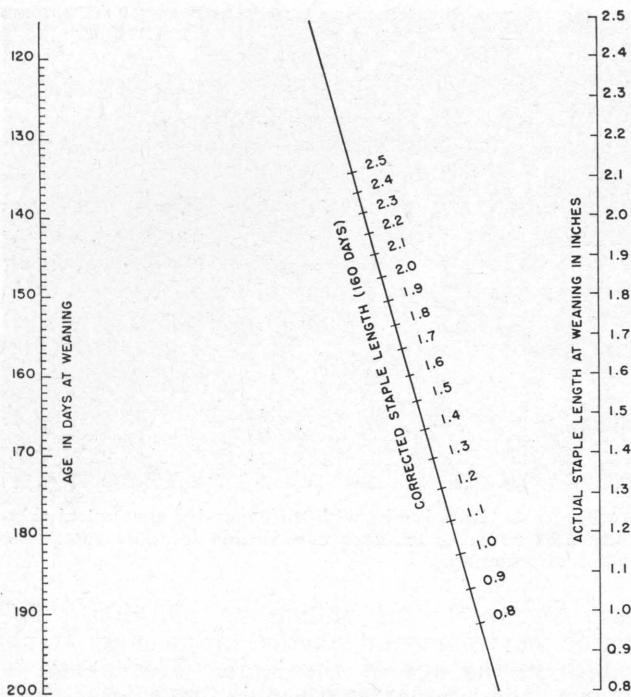


Figure 4. Scale to adjust staple length to 160 days of age. Use a straight edge to connect actual age in days (left) and actual staple length (right). Read the estimated staple length at 160 days on the center scale.

should be collected during the growing period, and preferably over a period comparable to commercial practice. The time from weaning to regular spring shearing is excellent to collect performance records. The testing period may cover this entire interval, if conducted under range conditions, or a shorter period, if conducted under feedlot conditions. These tests should start as soon after weaning as possible, since the earlier period is most similar to commercial application in slaughter lamb production. The testing period should last at least 4 months to provide an adequate test of wool growth.

### Feeding Methods

Two facts should be considered when choosing a feeding method. First, the level of feed intake should be high enough to permit normal growth and development; i.e. it is impossible to performance test an animal unless he is given a chance to perform. Second, the amount of feed consumed should be left up to the appetite and vigor of the animal. In other words, restricted hand feeding should be ruled out as a feeding method during a test period. The nature of the feed also should be as similar as possible to that of natural conditions under which the sheep are produced. In general, animals should be grazed under normal range conditions with supplemental feeding as necessary to insure normal development, or they should be self-fed a bulky roughage type ration in drylot. It is important that all animals have equal access to an available feed supply.

### Beginning Tests

The essential requirements to start a test are to identify, shear and weigh the rams individually. Identification may be by ear tag, ear notch, tattoo or paint brand. Preferably, a combination of ear tags, tattoo or ear notches for permanent identification and paint branding to facilitate immediate identification should be used. If the animals do not have ear tags and the test is started during the screwworm season, paint brands may be used until ear tagging is possible. Shearing and weighing the lambs is necessary so that all will be started on an even basis. Many of the differences between individual animals previous to weaning are due to the birth type and the age and milking ability of the dam, so it is necessary to eliminate as many of these differences as possible. All of the animals then should undergo the same conditions until the testing period ends. They may be weighed monthly (Figure 6) or at other desirable times, but generally, only initial and final weights are essential.

### Terminating Tests

Data should be collected on all of the important characteristics by which the sheep are to be selected, when the test ends. These include growth rate, staple length, wool production, face covering and skin folds. Before shearing, the rams should be inspected for objectionable wool

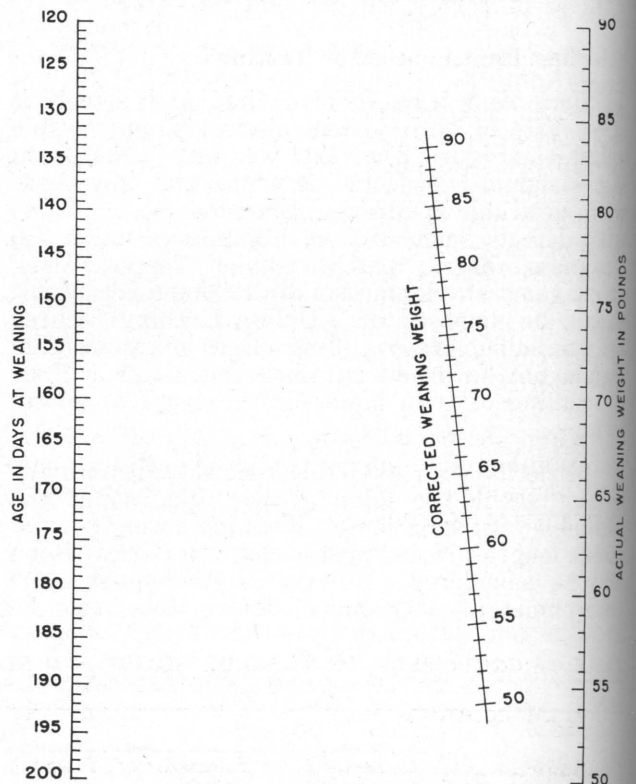


Figure 5. Scale to adjust weaning weight to 160 days of age. Use a straight edge to connect actual age in days (left) and actual weaning weight (right). Read the estimated weaning weight at 160 days on the center scale.

qualities such as coarse wool, hairy britch or belly-type wool extending on the side of the fleece. If spinning count determinations will be made, samples should be taken from the same site on each animal, with shoulder or midside areas preferable. Notes or measures also should be obtained on wool quality and objectionable points of the fleece.

Staple length should be measured before the animal is sheared by taking an average of the shoulder, side and thigh measurements (Figure 7). To obtain an accurate measure of wool-growth rate, subtract one-eighth of an inch to account for the wool left on the animal from a previous shearing. This is not necessary for an accurate comparison between individual animals, but should be used when the estimated 12-month growth is to be calculated from short test periods. The approximate 12-month wool growth may be calculated based on the number of days' growth since the last shearing.

Face covering scores also should be assigned before the animal is sheared. For accuracy, the average scores of three observers may be used. Photographic standards for these scores are shown in Figure 8.

The rams should be weighed individually immediately after being taken off the range or out of feedlot. Selection may be based on the total or on daily gain calculated by considering the number of days since the first weighing.

Shearing should be done by a one or two-man crew. The rams should be sheared as close to the skin as possible. The fleeces should be weighed individually and may be placed in clean burlap or paper bags and labeled according to the animal number for later reference or study. In most cases, the fleeces will be too short to tie with ordinary fleece string. For this reason, the most practical manner of weighing is to place the fleeces in a washtub and weigh on a spring-type or platform balance scale. Satisfactory scales can be purchased at most hardware or feed stores.

After the animals are sheared, they should be examined for body conformation and soundness and scored for skin folds on neck and body. A suggested scoring system follows:

1. Smooth.
2. Few folds on neck.
3. Folds on neck, few folds on body.
4. Moderate to heavy folds on neck and body.

Suggested photographic standards for these scores are shown in Figure 9.

Several methods can be used in selecting fleece weight. The individual fleece may be

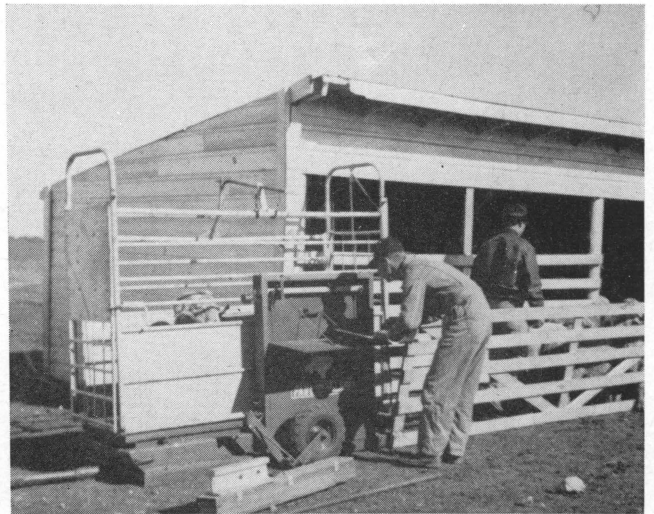


Figure 6. Weighing rams for performance testing.

scoured at the Wool and Mohair Research Laboratory, the Department of Animal Husbandry, the A&M College of Texas, on a partial-cost basis. If the work constitutes an official test, these fleeces should be scoured by a recognized procedure to determine clean wool and spinning count. However, if the work is a ranch test conducted by an individual breeder, scouring of each fleece individually may not be justified. Consideration should be given to scouring the fleeces of a few top individual rams if they are being considered for use as stud rams. For commercial or range rams, selections may be based on grease fleece weight or estimated clean fleece weight. If all stud ram selections are based on clean wool estimates, grease wool values may be used satisfactorily to selected range or commercial grade rams. However, the entire selection program should not be based on grease



Figure 7. Staple length should represent the average of shoulder, side and thigh measurements taken before the ram is sheared.

wool values without giving consideration to the production of clean wool.

### FINAL SELECTION

In any group of rams, the top 1 to 5 percent should be considered for use as stud rams. The required number of commercial or range rams should be selected from the top performers of the remaining group. The low performers of the group should be disposed of as culls. The number of rams selected for each group depends on the number of replacement rams needed. One of the most important aspects of the sheep improvement program is the basis on which these selections or classifications are made.

The best procedure in livestock improvement is to select for all of the characteristics that are economically important for a given class of animals. However, since progress in overall improvement or in any single trait is reduced proportionately as the number of traits are increased, only those that contribute directly to income or economy of production should be considered, and each should be weighted to contribute

to maximum overall progress. This weighting should be determined by the relative economic importance and heritability of each characteristic and the interrelationships between these traits. These objectives can be accomplished best by an index which uses measures of the most important characteristics combined with culling levels (minimum acceptable standards) for those characteristics that are not well-adapted to an index, Figure 10.

The superiority of fine-wool sheep is determined by the quantity and quality of both lamb and wool as well as face covering and skin folds, which are important to the management program. The quantity of meat is expressed best in pounds of weight or the rate of gain under controlled conditions. There is no adequate basis at present to appraise the meat quality of the live animal. Wool is well expressed in pounds of clean wool produced under controlled conditions. The price of clean wool is determined largely by staple length and quality. Thus, the five traits—rate of gain, staple length, clean wool production, face covering and skin folds—are important and



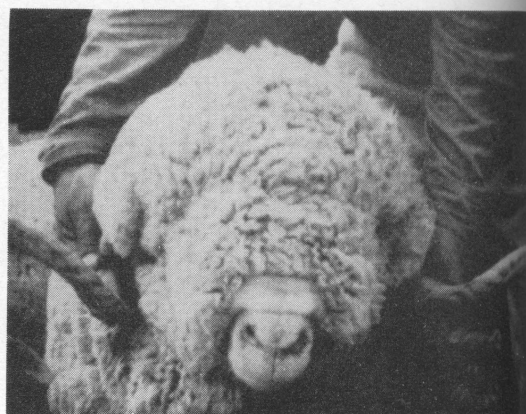
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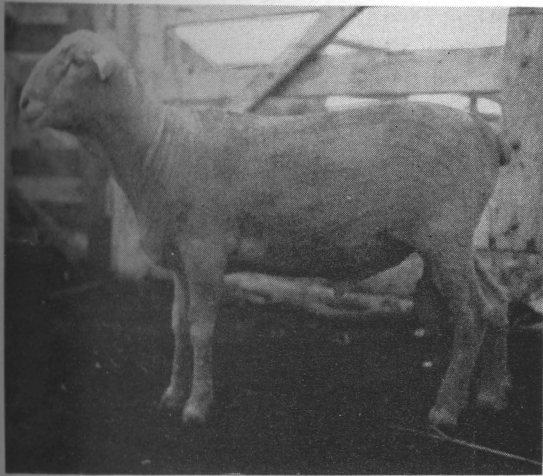
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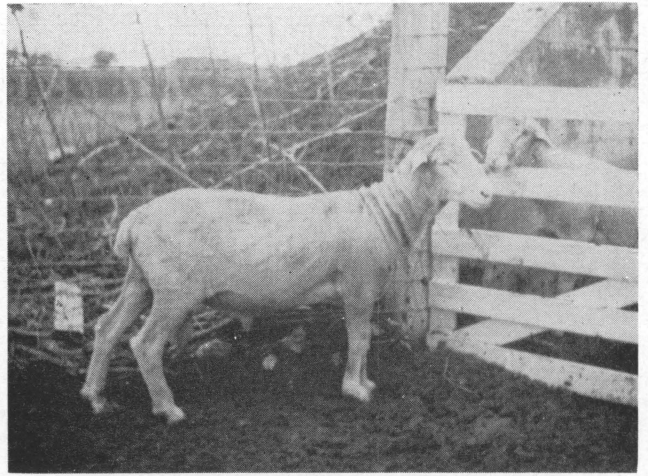
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Figure 8. Face covering scores: 1. Open from eyes and below. 2. Partially covered. 3. Covered with circle or channel at eye. 4. Wool blind or capable of becoming wool blind.

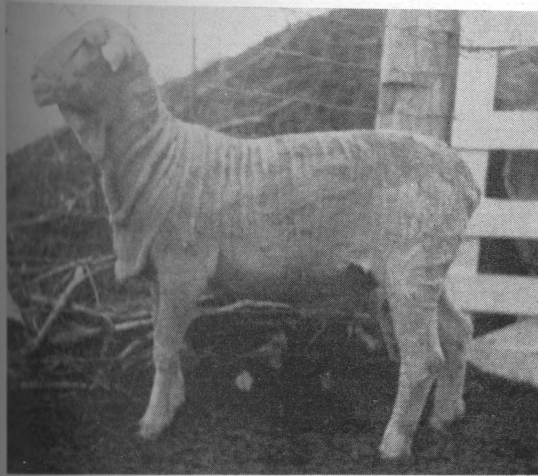




1



2



3



4

Figure 9. Skin fold scores: 1. Smooth. 2. Few folds on neck. 3. Folds on neck, few folds on body. 4. Moderate to heavy folds on neck and body.

should be included in an index. The following index is recommended:  $I = 60 \times (\text{daily gain in pounds}) - 5.2 \times (\text{face covering score}) - 2.0 \times (\text{skin fold score}) + 6.0 \times (\text{staple length in inches}) + 4.0^3 \times (\text{clean wool in pounds})$ .

Staple length and clean wool values are reported on a 12-month basis. Desirable animals will have a higher index value. Actual index values should be calculated for each animal being considered for breeding. When this is not possible or desirable, the principles used in the construction of an index should be considered in making selections. The animals also should be anatomically sound, should produce a desirable type of fine-wool (wool grading 62s may be tolerated for highly fed rams) and should be an acceptable commercial type from the standpoint of body conformation. Animals that do not meet



Figure 10. Ewe with hairy britch. When adequate safeguards are not taken, this undesirable characteristic can show up in the ewe flock.

<sup>3</sup>If grease wool is used instead of clean wool, this factor should be reduced to 2.0.

these requirements should be culled before the test is started or at the end of the test.

Breeding experience has shown that the most important consideration in ram selection should be individual performance. There is some advantage in consideration of the performance of collateral relatives, such as the sire or brother.

A high-performing ram out of a high-performing sire or sire group is more likely to be a good breeder than a high-performing animal out of an average or mediocre-sire group. In 10 years of performing testing at the Sonora station, several breeding lines have been identified which consistently produce high-performing rams.

RECORD FORM—RAM PERFORMANCE TEST

Date started 10-1-58

Date ended 3-18-59

Animal ear tag	Number paint brand	Sire	Initial weight	Final weight	Daily gain	Staple length	Grease wool	Yield	Clean wool	Spinn. count	Face cover score	Skin folds score	Index value	Remarks
5699	3	4722	94	195	.60	4.39	17.1	53.8	9.2	62 $\frac{2}{3}$	2.3	2	83.1	PROSPECTIVE STUD
5719	4	4722	87	178	.54	4.01	14.8	52.0	7.7	70 $\frac{2}{3}$	1.5	2	75.5	RANGE RAM
5741	5	4722	83	151	.40	4.01	12.5	48.8	6.1	70 $\frac{2}{3}$	3.7	2	49.3	CULL
5810	6	4722	76	148	.43	3.93	12.7	55.9	7.1	64 $\frac{2}{3}$	3.7	3	52.6	CULL
5668	7	5157	93	172	.47	4.70	14.8	48.0	7.1	70 $\frac{2}{3}$	3.3	1	65.6	RANGE RAM
5731	8	5157	93	179	.51	4.39	13.6	52.2	7.1	70 $\frac{2}{3}$	3.7	1	64.1	CULL WOOL BLIND
5773	9	5157	86	171	.50	4.03	16.9	49.7	8.4	60 $\frac{2}{3}$	3.0	4	64.2	CULL EXCESS FOLDS
5818	10	5157	81	170	.53	4.56	16.1	46.6	7.5	70 $\frac{2}{3}$	2.8	4	66.6	" " "
5677	11	4776	80	175	.57	4.08	15.0	47.0	7.1	64 $\frac{2}{3}$	3.2	3	64.5	RANGE RAM
5734	12	4776	80	164	.50	3.82	11.9	51.2	6.1	70 $\frac{2}{3}$	2.5	2	60.3	CULL
5749	13	4776	68	140	.43	4.49	13.8	51.4	7.1	64 $\frac{2}{3}$	2.0	2	66.7	RANGE RAM
5799	14	4776	72	161	.53	4.22	15.0	54.7	8.2	64 $\frac{2}{3}$	3.2	3	67.3	" "
5736	17	5157	74	170	.57	3.91	21.7	40.6	8.8	64 $\frac{2}{3}$	2.7	4	70.9	" "
5751	18	5157	79	174	.56	4.49	19.0	46.3	8.8	64 $\frac{2}{3}$	2.2	1	82.3	PROSPECTIVE STUD
5760	21	4722	73	183	.65	4.01	17.8	49.4	8.8	64 $\frac{2}{3}$	3.0	3	76.7	RANGE RAM
5721	24	5926	90	192	.60	4.87	19.2	53.1	10.2	70 $\frac{2}{3}$	3.3	2	78.8	PROSPECTIVE STUD
Average all rams tested			81.8	170.2	.52	4.24	15.7	50.0	7.8		2.9	2.4	68.0	