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METHODS OF ESTIMATING CLEAN-FLEECE PRODUCTION

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INTRODUCTION

THE DETERMINATION of clean content of fleeces is subject to a number of sources of error. Among them, in addition to the method of assessment used, are differences in shrinkage, fiber length, grade, defect, and the climate in the area where the fleece was grown.

The Neale squeeze machine (Neale et al., 1956) has been reported to give accurate estimates of clean-wool content of fleeces. It was felt that it would be desirable to test its accuracy on fleeces showing a wider variation in shrinkage and foreign-matter content than those on which the machine had previously been tested, and to compare its accuracy with that of grease weight and the side-sample method. This report contains the results of tests on wool from California and Texas, each state being represented by several widely varying locations.

MATERIALS AND METHODS

Fleeces from five flocks in five locations in California and from seven flocks in two locations in Texas were used in the study. Two of the California flocks were represented two years, 1958 and 1959. A total of 728 fleeces was involved. Data on lot size, origin, growth period and climatic information on the locations where the fleeces were grown are presented in table 1.

Three different squeeze machines were used. Six lots were tested on a second machine following the initial test on the first. Both freshly shorn and conditioned wools were tested.

Grease-weight and squeeze readings were recorded for all fleeces. Fleeces from two flocks in California were side sampled during both 1958 and 1959. This sampling procedure consisted of the removal of approximately 100 gm of grease wool from the mid-side of the animal as it was shorn and before the remainder of the fleece was weighed or squeezed. The samples were placed in plastic bags, weighed, scoured and adjusted to standard A.S.T.M. conditions for reweighing. Yield figures based on these samples

TABLE 1

NUMBER, GROWTH PERIOD AND SOURCE FLOCK LOCATION
OF FLEECES USED

Group	Fleeces	Year	Time grown		Rainfall	Type of weather	
	Number		Months	Season	Inches	Summer	Winter
Substation #23, yearling ewes, McGregor, Texas......................	23	1958	6½	Winter	24.1	Warm	Cold
Substation #23, summer ram test, McGregor, Texas......................	46	1959	4¼	Summer	14.9	Warm	Cold
Substation #23, yearling ewes, McGregor, Texas......................	37	1959	7⅔	Winter	16.2	Warm	Cold
Sonora ram test.........................	120	1958	7	Winter	21.6	Moderate	Warm
Sonora ram test.........................	133	1959	7	Winter	11.6	Moderate	Warm
Sonora Station, yearling ewes............	66	1958	14	..	34.2	Moderate	Moderate
Sonora Station, yearling ewes............	78	1959	14	..	34.5	Moderate	Moderate
Davis..................................	36	1958	12	..	27.4	Hot	Moderate
Davis..................................	39	1959	12	..	15.6	Hot	Moderate
Hopland................................	40	1958	12	..	60.4	Hot	Moderate
Hopland................................	40	1959	12	..	25.8	Hot	Moderate
Sacramento County.....................	50	1959	12	..	15.7	Hot	Moderate
Bakersfield............................	10	1959	7½	Winter	1.2	Hot	Mild
Fresno.................................	10	1959	4½	Winter	3.8	Hot	Mild
	728						

were applied to the grease weight of the remainder of the fleece to give a
yield estimate of the entire fleece not including the sample.

All fleeces were scoured in the Wool and Mohair Laboratory, College Sta-
tion, Texas, where actual clean-fiber content was determined. Side samples
were scoured at the University of California, Davis, wool laboratory.

RESULTS AND DISCUSSION

The means for the items studied, the correlations between these measures
and actual clean-fleece weight, and standard errors of estimates are pre-
sented in tables 2 and 3.

Where pertinent comparisons are available (Davis and Hopland clips,
table 2) the side-sample estimate was more accurate than other methods for
estimating clean-fleece weight. This is shown by higher correlation values
and generally lower standard errors for this measure. Correlation values
for the squeeze-machine estimate with actual clean content of fleeces, over
all lots, ranged closer to 0.8 than the 0.9 reported by Neale *et al.* (1956).

Squeeze reading was more accurate at Davis and less accurate for the pre-
diction of clean weight at Hopland than was grease weight. These differ-
ences were relatively small, but were consistent over both years. Squeeze
reading was much more accurate than grease weight in the fleeces from
Bakersfield and Fresno. A study of these results suggests that correlations
involving grease weight are subject to wide variations apparently attrib-
utable to variation in shrinkage. This might be expected. Correlations in-
volving squeeze reading, however, do not appear subject to this source of
variation.

Results from the Texas wools (table 3) show no clear-cut trend in relative accuracy of grease-weight and squeeze reading in predicting clean weight. In four lots, grease weight yielded a higher correlation, and in three, squeeze reading was superior. The standard errors likewise show no consistent trend. As in the California wools, correlations involving squeeze reading were less variable, ranging from –0.76 to –0.88, whereas the grease-weight correlations ranged from 0.63 to 0.92. Again low correlations in the latter group were associated with higher shrinkage.

Only one comparison can be made of the results of squeezing freshly shorn and conditioned wools by the same machine. This was the case with the Sonora rams, 1958, where fleeces were squeezed freshly shorn and later, as conditioned wools, by the Texas Wool Laboratory machine. The difference between the two correlations was very small.

Comparison of different machines with different operators on the same wools squeezed in the conditioned state is provided by the Fresno and Bakersfield fleeces (table 2) on which both the California and Texas Wool Laboratory machines were used. The correlations are nearly identical. The 1959 Davis and Hopland clips were squeezed freshly shorn by the California machine and conditioned by the Texas machine. The former was more accurate on Davis wools and the latter more accurate on Hopland wools. The differences are not, however, large enough to provide evidence for a real interaction between these variables.

Correlations and standard errors of estimates indicate no consistent difference in favor of use of the estimated weight from the conversion table of Stauder and Neale (1958) over the actual squeeze reading in either Texas or California wools. Where ranking of animals as to production is the only objective of testing, a conversion table is not necessary. If shrinkage is to be estimated on single fleeces or by sampling large lots of wool, a conversion table will furnish values of actual pounds of clean fiber present. However, accuracy of the squeeze method does not appear to be high enough under many conditions to allow its use in shrinkage determination for sales purposes.

The conversion table given by Stauder and Neale (1958) is based on a nonlinear regression of clean-fleece weight on squeeze reading, with greater change in clean weight per machine unit at lower readings. This table also gives different clean-fleece values, for the same machine readings, for coarser and for finer wools.

The data obtained in this study were examined for curvilinearity of regression of clean-fleece weight on squeeze reading. The regressions from flocks with low clean weights (high squeeze readings) tended to be slightly lower than those from flocks with lower squeeze readings, although to a much lesser degree than found by Stauder and Neale. However, fitting a second order regression to the data, either within flocks or to the total data, resulted in a nonsignificant and extremely small reduction in variation from that remaining after linear regression. Further, the regression values for different grades (grouped by individual spinning counts, or into two groups—58's and coarser, and 60's and finer) did not differ significantly from each other or show a consistent trend, within flocks or over-all.

TABLE 2

CORRELATIONS BETWEEN ESTIMATED AND ACTUAL CLEAN WEIGHT FROM CALIFORNIA WOOLS

Flock	Year	Number	Range in grade	Staple length	Clean yield (per cent)	Mean act. cl. wt. (lb.)	Grease weight Mean (lb.)	Grease r	Grease s_yx	Side-sample Mean (lb.)	Side r	Side s_yx	Fresh shorn Calif. squeeze — Actual reading Mean (lb.)	FS Actual r	FS Actual s_yx	Fresh shorn — Estimated weight Mean (lb.)	FS Est r	FS Est s_yx	Conditioned Texas — Actual reading Mean (lb.)	Cond Actual r	Cond Actual s_yx	Conditioned — Estimated weight Mean (lb.)	Cond Est r	Cond Est s_yx
Davis	1958	36	48's–64's	Staple	55.3	6.61																		
Within grade*							11.95	.72	.54	6.96	.92	.39	65.6	−.84	.60	5.50	.84	.47						
Gross								.63	.81		.92	.42		−.75	.69		.79	.65						
Davis	1959	39	48's–64's	Staple	53.4	6.75																		
Within grade							12.65	.59	.63	7.02	.73	.58	61.6	−.71	.58	6.23	.69	.63	66.2	−.61	.66	5.10	.49	.81
Gross								.80	.83		.89	.64		−.76	.89		.82	.78		−.66	1.03		.73	.94
Hopland	1958	40	46's–64's	Staple	67.0	5.01																		
Within grade							7.48	.90	.34	5.13	.93	.28	74.0	−.81	.51	4.20	.80	.41						
Gross								.90	.38		.93	.32		−.74	.57		.77	.54						
Hopland	1959	40	46's–64's	Staple	59.0	4.23																		
Within grade							7.17	.86	.38	4.10	.87	.36	77.5	−.87	.36	3.76	.87	.35	88.2	−.89	.34	3.06	.87	.34
Gross								.88	.40		.91	.35		−.84	.46		.84	.46		−.90	.38		.90	.36
Bakersfield	1959	10	60's–62's	Baby combing	42.2	3.04																		
Within grade							7.20	.63	.48				77.6	−.89	.28	3.32	.84	.34	83.4	−.88	.29	2.80	.82	.34
Fresno	1959	10	64's–70's	Clothing	30.7	2.24																		
Within grade							7.29	.10	.45				84.8	−.89	.20	2.60	.90	.20	88.7	−.87	.23	2.29	.98	.23
Sacramento	1959	50	44's–70's	Staple	51.6	4.84																		
Within grade							9.37	.78	.60				72.7	−.82	.56	3.90	.82	.56	75.9	−.85	.52	3.49	.85	.49
Gross								.80	.60					−.81	.58		.82	.58		−.84	.54		.85	.52

(The Fresh shorn section for Bakersfield, Fresno, and Sacramento flocks is labeled "Conditioned wools.")

* Pooled within following grades: 64's–70's, 58's–62's, 56's, 46's–54's.

TABLE 3

CORRELATIONS BETWEEN ESTIMATED AND ACTUAL CLEAN WEIGHT FROM TEXAS WOOLS

Flock	Year	Number	Range in grade	Staple length	Clean yield	Mean actual cl. wt.	Grease weight			Fresh shorn, Wool Laboratory machine					
										Actual reading			Estimated weight		
							Mean	r	Syx	Mean	r	Syx	Mean	r	Syx
					per cent	lb.	lb.						lb.		
Sonora, yearling ewes	1958	66	62's-70's	Staple	55.5	5.69	10.25	.92	.46	72.4	-.84	.65	4.43	.84	.47
McGregor, yearling ewes	1958	23	60's-70's	French to staple	57.0	4.24	7.44	.92	.25	81.2	-.81	.38	3.28	.80	.38
Sonora, rams	1958	120	62's-70's	French combing	48.4	4.13	8.53	.63	.50	78.4	-.82	.37	3.64	.82	.36
													Conditioned wools		
Sonora, rams	1958	120	62's-70's	French combing	48.4	4.13	8.53	.63	.50	78.7	-.80	.38	3.15	.80	.38
McGregor, yearling ewes	1959	37	62's-70's	French to staple	51.5	5.19	10.07	.81	.43	72.4	-.76	.48	3.88	.74	.50
McGregor, rams	1959	46	64's-80's	Baby combing to Big French	47.2	2.31	4.89	.66	.32	91.9	-.86	.22	2.04	.86	.22
Sonora, yearling ewes	1959	78	62's-80's	Staple	54.4	4.65	8.54	.87	.39	77.1	-.81	.47	3.36	.80	.48
													Extension machine—fresh shorn		
Sonora, rams	1959	133	62's-70's	French combing	50.9	3.76	7.39	.73	.44	79.3	-.88	.30	3.53	.88	.30

It therefore appears that a linear regression equation based on all the data from this test would be the most satisfactory to use in estimating clean weight from machine readings. The equation obtained in this study, based on data from all fleeces squeezed freshly shorn (497 fleeces) is:

  $Y = 16.23 - .153X$

  Where Y = estimated clean weight

  X = squeeze reading

Sidwell *et al.* (1958) compared a number of methods of estimating clean-fleece weight. While all methods reported gave reasonably accurate estimates, the squeeze machine method gave a correlation with actual clean-fleece weight of 0.87 and the side-sample method 0.92.

Price *et al.* (1960) also compared a number of methods of estimation, including grease weight, side-sample and squeeze reading. These gave correlations ranging from $0.84 - 0.93$, $0.88 - 0.95$, and $0.82 - 0.87$, respectively. The fleeces graded fine through quarter blood. In the presence of grease-fleece weight these workers found that the contribution of machine reading to their prediction equations was significant only for fine $(P < 0.01)$, ½ blood $(P < 0.05)$ and ⅜ blood $(P < 0.10)$ wools. Staple length made a significant contribution only for the fine-wool equation.

Under practical field conditions, where ease and speed of assessment are important for ranking animals in a flock for selection purposes, the side-sample method is too slow and in most cases cannot be used by the breeder himself. Either grease-weight or squeeze-machine reading are far superior in this regard, and assessment can be made by untrained personnel.

The results of this study indicate little difference in accuracy between these two methods on wools yielding 50 per cent or higher but that the squeeze machine is more accurate on lower-yielding wools.

SUMMARY AND CONCLUSIONS

A total of 728 fleeces from 12 flocks representing seven locations in California and Texas were used in the evaluation of different methods for assessment of clean-fiber content.

Methods compared with actual clean-fleece weight include side-sample estimate, grease-weight, squeeze-machine reading and estimated weight from squeeze reading.

Side-sample estimate was the most accurate of the methods used. It is also the most laborious. The squeeze-machine reading and estimated weight from squeeze reading were more accurate than grease weight where clean yield was low.

The squeeze machine is a practical tool for use in ranking animals in order of clean-fiber production except with high-yielding wools where the machine may be equaled or surpassed in accuracy by grease weight.

There was little difference in accuracy due to squeezing freshly shorn or conditioned wools, or between different machines and operators.

For obtaining clean-fleece weight from squeeze reading for freshly shorn fleeces, the equation $Y = 16.23 - .153X$, where X is squeeze reading and Y estimated clean-fleece weight in pounds was found to give the best prediction.

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