groups had perhaps gone past the period of maximum muscle growth and, hence, were laying down more fat. If this be true, the question of the most desirable mature size and growth characteristics in feedlot cattle becomes an important consideration (insofar as muscling is concerned).

Analysis of a Breed Herd Classification Program[1]

James E. Tanner, Joe V. Whiteman, Richard L. Willham and Dwight F. Stephens

Story in Brief

Official breed classifiers scored the same cows during the spring and fall for two years. There was a general trend for increased agreement between different classifiers from the first to fourth classification. Classifiers agreed more closely with each other on scores for older cows than for scores on cows which were 2 years old when first classified.

Individual classifiers were able to repeat scores at different times on older cows with more accuracy than on younger cows. Correlations between scores at different times on younger cows were generally low. Differences in the correlations between scores at different times indicated differences in individual classifiers' abilities to repeat scores on the same animals. Interactions between cows, seasons and classifiers were more important in younger cows.

Correlations of spring scores near the time the cows were calving with calf weaning weights and grades were near zero for 2 and 3 year old cows but were positive for older cows. Correlations of fall scores after weaning with calf weaning weights and grades were essentially zero for 3 and 4 year old cows but were negative for 2 year old cows. Correlations between scores of slaughter cattle and hot carcass weight, fat

[1] This study was supported by a grant from the American Angus Association, headquarters, St. Joseph, Missouri.

thickness per cwt., percent retail cuts and percent trimmed round indicated classifiers scored heavier, fatter slaughter animals higher.

Introduction

Visual scores have been used extensively in classifying or evaluating and comparing animals for many years. This study was conducted to determine how well different classifiers agreed with each other on scores given the same animals at the same time and to measure the agreement between the same classifiers scores on the same animals at different times. Also the association between scores and certain measures of production were investigated.

Materials and Methods

Five official Angus classifiers scored cattle at the Ft. Reno Livestock Research Station during 1964 and 1965. Cattle were scored during the spring and fall of each year, making a total of four classifications over an eighteen month period. The majority of this report involves 76 cows which were classified each time by the same four classifiers. These cows consisted of three age groups, 2, 3, and 4 years and older based on their age at the first classification in the spring of 1964. The older cows will be referred to as 4 year olds in the remainder of this report. The cows either had calved or were about to calve in the spring and all had weaned a calf before being classified in the fall.

The score card was based on the following nine items with their respective maximum points in parenthesis; conformation (20), size (10), head and breed character (8), feet and legs (12), shoulder and foreribs (8), rib and back (10), loin (10), rump (10), and round (12). The first four were grouped as general appearance (50) and the last five as beef character (50). A slightly different score card was used during the first three classifications with conformation being divided into type and quality scores but with a total score of 100 points possible in each case.

The majority of this study involves correlations between scores. Correlations can be used to measure the degree of association between variables. Correlations range in magnitude from —1.0 to +1.0, with a correlation of —1.0 indicating a perfect negative association between the variables and +1.0 a perfect positive association. A correlation of zero would indicate no association between the variables. Many of the correlations reported in this study are average (pooled) correlations obtained by using a Z transformation. Before there is good agreement between scores, the correlation should probably be at least +0.8 or higher.

Results and Discussion

Correlations Between Scores at the Same Time and at Different Times

If classification scores are to be meaningful, a classifier must be able to repeat scores given the same animal with a reasonable degree of accuracy. Ideally there should also be close agreement between classifiers if different classifiers score animals and any comparison is made on the basis of such scores.

Table 1 contains pooled correlations between total scores given by each classifier and scores given by the other classifiers at the same time. This was done separately for each of the three age of cow groups and only scores of the four classifiers participating in all four classifications were used. The correlations in this table are a measure of the agreement between classifiers for total score. In general, the correlations became higher from the first classification in the spring of 1964 to the last classification in the fall of 1965. This indicates that classifiers were scoring more alike during the latter periods. There were distinct differences between cow groups during the first classification but little difference in the fall of 1965. This trend toward closer agreement during the latter classifications was generally true for all items making up total score.

Correlations between a classifier's score each season with his score every other season are presented in Table 2. Six between season correlations were obtained, three between scores at six month intervals, two at twelve month intervals and one with an eighteen month interval. There was no general tendency for the totals at six month intervals to be more

Table 1. Within Season Correlations for Total Score Between Each Classifier and the Other Three Classifiers[1]

Age of Cow	Season	Classifiers			
		1	2	3	4
2	Spring '64	0.49	0.55	0.44	0.53
	Fall '64	0.63	0.62	0.73	0.68
	Spring '65	0.80	0.80	0.83	0.83
	Fall '65	0.91	0.86	0.91	0.90
3	Spring '64	0.59	0.54	0.56	0.62
	Fall '64	0.64	0.74	0.80	0.77
	Spring '65	0.70	0.66	0.77	0.76
	Fall '65	0.72	0.51	0.68	0.69
4	Spring '64	0.71	0.66	0.70	0.75
	Fall '64	0.76	0.67	0.76	0.77
	Spring '65	0.84	0.81	0.84	0.81
	Fall '65	0.72	0.83	0.85	0.85

All correlations were significant ($P < .01$)

Table 2. Pooled Correlations Between Scores Given by Each Classifier and His Scores at Following Classifications[1]

Variable	Age of Cow	Classifier 1	2	3	4
Total Score	2	0.42	0.62	0.38	0.41
	3	0.53	0.71	0.57	0.47
	4	0.73	0.83	0.75	0.72

[1] All correlations were significant ($P < .01$)

highly correlated than those at twelve and eighteen months and correlations were therefore pooled for each classifier. The correlations between a classifier's total score at different times were in general low, particularly between scores even at six month intervals in the younger cows. While actual changes in the cows during these periods, particularly in the younger cows, can account for some of the lack of agreement it is probably due in part to the inability of even experienced classifiers to repeat subjective scores.

The correlations tend to be higher between scores for the older cows for each classifier. This may be partly the result of a smaller, more select group of cows but to some extent probably reflects more extensive changes in the younger cows. Younger cows are likely to be more drastically affected by stage of lactation and other environmental influences. The higher correlations for classifier 2 indicate that he scored cows more nearly the same from time to time than did the other classifiers.

Table 3 contains pooled correlations between a classifier's score with the other three classifiers within each season (W) and the pooled correlations of an individual classifier's scores between each season (B). These correlations reveal that the agreement is higher among different classifiers at the same time (W) than between the same classifier at different times (B). This difference is much more pronounced in the younger cows and probably indicates actual changes in younger cows.

Table 3. Pooled Correlations for Classifiers with Themselves Between Seasons and with Other Classifiers Within Seasons[1]

Age of Cow	2		3		4	
Variable	W[2]	B[3]	W	B	W	B
Total—Beef Character	0.72	0.44	0.56	0.53	0.70	0.71
Total Score	0.76	0.47	0.68	0.58	0.79	0.77

[1] All correlations were significant ($P < .01$)
[2] Classifiers with others within seasons
[3] Classifiers with themselves between seasons

While there is little difference in the respective correlations for beef character and total score, the correlations between totals tended to be consistently higher than for individual items. This would be expected since differences in the separate variables have a chance to be cancelled out in the totals and would indicate that comparisons between animals would probably be more meaningful based on totals rather than individual items.

Scores of Variation in Scores of Cows Classified Four Times

In another part of this study scores given cows classified all four times were analyzed to determine the importance of cows, seasons, and classifiers and the interactions of these factors as sources of variation. Seasons in this case correspond to the four times of classification. It would be desirable if cow differences accounted for most of the variation in scores. If scores are to be consistent from one time to another, the interactions must make up only a relatively small part of the variation.

The interactions were significant for most of the items and totals analyzed. The percentage of total variation in total score accounted for by each of the factors and interactions are listed in Table 4. Cow and season differences were important sources of variation in total score for all age groups. However classifiers contributed only a small portion of the total variation. Interactions generally accounted for a larger portion of the variation in scores of younger cows, indicating scores were least consistent for younger cows.

Correlations Between Classification Scores and Measures of Production

It would be desirable if classification scores, particularly total score, were positively related to such performance traits as weaning weight and grade. If not positively related, they should not be antagonistic to per-

Table 4. Components of Variance as a Percent of Total Variance of Total Score

Source of Variation	Age Group		
	2	3	4
Cows	23.1	32.1	41.6
Seasons	27.0	35.3	32.3
Classifiers	0.4	0.1	0.4
Cows x Seasons	15.6	14.0	6.7
Cows x Classifiers	6.9	5.0	6.0
Seasons x Classifiers	13.7	6.2	5.7
Cows x Seas. x Class.	13.3	7.3	7.3

formance. Each score given a cow was correlated with the average weaning weight and grade (feeder grade) of her calf. There were no large differences among correlations obtained for different classifiers during the spring and fall classifications. These correlations were pooled within seasons and age of cow groups.

Table 5 contains correlations between average weaning weight and grade with total score. The correlations between spring scores were essentially zero for 2 and 3 year old cows, but were positive and significantly greater than zero for 4 year old cows. This pattern was generally the same for most of the items making up total score. The larger correlations for the smaller number of older cows may have been due in part to a few high scoring cows that had heavy calves or low scoring cows with light calves and probably are not truly this high.

Correlations between fall scores and weaning weight and grade present a different picture. Correlations between fall scores and average weaning weight and grade were close to zero for 3 and 4 year old cows. Significant negative correlations were obtained for 2 year old cows, the correlation of —0.3 between total score and average weaning weight would suggest that the beter producing younger cows were being penalized. This was probably a result of the better milking cows being thinner in the fall and consequently receiving a lower score. It would therefore seem advisable to score younger cows during the spring rather than following weaning.

Yearling slaughter cattle consisting of 36 bulls, 35 steers, and 44 heifers were scored in the spring of 1965. Classification scores were correlated with hot carcass weight, rib eye area per cwt., fat thickness per cwt., percent retail cuts and percent trimmed round. The correlations did not differ appreciably between the sexes and were therefore combined. Table 6 contains correlations of beef character and total score with carcass measures. While many of the correlations are significantly dif-

Table 5. Correlations Between Total Scores of Cows of Different Ages and Average Weaning Weights and Grades of Their Calves

	Spring			Fall		
Age of Cow	2	3	4	2	3	4
Weaning Weight	—.06	—.06	.59	—.30	—.10	.07
Weaning Grade	.05	.14	.39	—.19	.14	—.13

Correlations equal to, less than or greater than ± 0.13, ± 0.18, and ± 0.25 for two, three, and four year old cows, respectively, were significant ($P < .01$).

Table 6. Pooled Correlations Between Classification Scores of Yearling Bulls, Steers, and Heifers and Carcass Measurements

	Beef Character	Total Score
Hot Carcass Weight	.24	.28
Rib Eye Area Per Cwt.	—.26	—.04
Fat Thickness Per Cwt.	.20	.20
% Retail Cuts	—.26	—.29
% Trimmed Round	—.12	—.12

Correlations equal to or greater than 0.12 or equal to or less than −0.12 are significant ($P < .01$).

ferent from zero they were generally small. All significant correlations between hot carcass weight and fat thickness per cwt. were positive indicating that heavier, fatter animals were scored higher. All significant correlations between percent retail cuts and percent trimmed round were negative. This is probably a further reflection of the tendency to give fatter animals higher scores.

Methods of Processing Milo for Fattening Cattle*

James R. Newsom, Robert Totusek, Robert Renbarger, E. C. Nelson, Larry Franks, Vincent Neuhaus, and Willie Basler

Story in Brief

Six methods of processing milo—coarse grinding, fine grinding, dry rolling, reconstituting-rolling, reconstituting-grinding, and steam-process-flaking—were compared in a high concentrate ration. All processing methods significantly improved feed efficiency compared to coarse grinding, with greatest improvements noted for reconstituting-rolling and steam-process-flaking. Steam-process-flaking resulted in the fastest rate of gain; gains on the other processed grains were similar. Feed intake was significantly lower on reconstituted-rolled milo, reflecting more efficient utilization since rate of gain was not depressed. Carcass merit and dressing percentage were not affected by processing method.

* Appreciation is extended to Farmland Industries, Kansas City, Missouri, for partial financial support of this research.

The cooperation of Wilson and Company, Oklahoma City, Oklahoma, in obtaining slaughter and carcass data is gratefully acknowledged.

Thanks are also extended to personnel at Ft. Reno for valuable assistance in the conduct of the experiment and collection of data.