No important differences were observed in rectal temperature of steers on the various rations, however, all steers were under rather severe heat stress as indicated by rectal temperatures as high as 105°F.

Summary

The influence of fat additions as an alternative energy source in conventional and high concentrate rations was studied. Also the influence of bulk **per se** added to a high concentrate ration was evaluated by using polyethylene fluff as a source of inert bulk.

Rate of gain was superior for all rations containing bulk whether in the form of cottonseed hulls or polyethylene.

Feed efficiency favored the high concentrate rations and fat additions to either high concentrate or conventional rations improved feed efficiency by 8 and 7 percent respectively. The addition of inert bulk to a high concentrate ration resulted in a marked improvement in efficiency with which the concentrate portion of the ration was utilized. Some possible reasons for this improvement are discussed, however, these results are considered preliminary at this time. The cost of the source of inert bulk used prohibits the commercial use of the material at the level reported.

The feed cost per pound of gain favored the conventional ration but these results are subject to relative prices of cottonseed hulls and concentrate ingredients in the ration. Fat additions did not reduce cost of gain at the prevailing price at the time the test was conducted.

Cutability score of carcasses tended to favor the high concentrate rations. Average carcass grade was the same for all treatments used in the study.

Genetic Relationships Between Growth and Carcass Traits

L. V. Cundiff, R. L. Willham, and D. F. Stephens

Numerous studies have shown that measures of growth rate in beef cattle are highly heritable. Thus, selection of breeding stock with superior gaining ability will result in genetic improvement in growth rate. When devising breeding programs which include selection for growth rate, it is important to consider the effect of genetic change resulting from this selection on other traits of economic importance.

Data were presented by Chambers *et al.* (1956) which indicated that selection for rapid growth on a five month post weaning feed would lead to genetic improvement in efficient use of feed. Further, no antagonism was indicated between growth and conformation appraisal at the end of the feeding period.

The purpose of this study was to investigate the genetic relationships between growth as measured by carcass weight per day of age and several carcass traits.

Materials and Methods

The data were 265 Hereford and Angus steers from 47 sires that were dropped in the spring of 1961 and 1962 and placed on a 5 month feed test after weaning. The calves were group self-fed a complete mixed ration containing approximately 9 percent digestible protein and 63 percent total digestible nutrients. Table 1 gives a description of the five groups. The data were studied on an intra-group basis to remove the effects of year, breed, herd and management differences. Table 1 also gives the average performance for the traits studied.

Carcass weight per day of age was the measure of growth rate used. Rib-eye area per hundred pounds of carcass was used as the measure of muscular development and average fat thickness was used as the measure of fatness. Federal carcass grade (⅓ of grades) was used as the measure of carcass quality and percent retail cuts the indicator of carcass cutability. Percentage retail cuts; the percent of boneless retail trimmed cuts from the round, loin, rib and chuck; was calculated by the following formula:

$$\%RC = 52.66 - 5.33X_1 - .979X_2 + .665X_3 - .0065X_4$$

Table 1. Performance of the Five Groups of Steers

Item	Groups				
	1	2	3	4	5
Number	63	60	74	32	36
Breed[1]	H	A	H	A	A
Age on test	211	211	254	210	211
Weight on test	478	501	477	484	450
Days on test	196	168	168	168	168
A.D.G. on test	2.48	2.38	2.69	2.48	2.45
Carcass wt./day of age	1.40	1.46	1.34	1.47	1.35
Carcass grade[2]	9.70	11.20	9.74	10.84	10.36
Rib eye/CWT	1.84	1.82	1.75	1.73	1.91
Fat thickness inches	0.79	0.86	0.70	0.86	0.72
% Retail cuts	48.05	47.00	48.61	46.83	48.08

[1] Hereford = H; Angus = A.
[2] High good = 9; Low choice = 10; Avg. choice = 11, etc.

In this formula X_1 is average fat thickness in inches, X_2 is kidney fat as a percentage of carcass weight, X_3 is rib-eye area in square inches and X_4 is carcass weight in pounds (Murphy *et al.*, 1960). Intra-group paternal half-rib analyses of variance and covariance were used to estimate the heritabilities and genetic correlations.

Results and Discussion

The relatively high heritabilities shown in Table 2 indicate that offspring from selected parents will have a higher average performance than those from unselected parents for any one of the traits. Measurement of these traits requires slaughter making it necessary to select individuals on the basis of their progeny or other close relatives. This increases the generation interval and reduces the progress by selection per unit of time. Other measures of growth rate exist such as live weight per day of age. Although not as accurate a measure of growth rate of the end product—beef, live animal growth rates compensate for this deficiency since they can be measured on the individual thus reducing the generation interval when compared with traits requiring slaughter. Carcass weight per day of age was used as the measure of growth rate since it was highly correlated with live measures of growth.

The primary purpose of this study was to study the expected genetic change in carcass traits if selection were based on some measure of growth rate only. The expected genetic change in one trait when selection is for another depends on several factors. However, the principle one is the genetic correlation between the two traits. Table 3 gives the gentic

Table 2. Heritabilities

Traits	Heritabilities (%)
Carcass wt./day of age	39
Rib-eye area/CWT	29
Fat thickness	43
Carcass grade	62
%Retail cuts	40

Table 3. Genetic Correlations Between Growth Rate and Several Carcass Traits.

Trait	Correlation
Rib-Eye Area/CWT	—.02
% Retail cuts	+.02
Fat thickness	+.15
Carcass grade	+.47

correlations between carcass weight per day of age and the various carcass traits. Both rib-eye area per hundred weight of carcass and percentage retail cuts have essentially no genetic relationship with growth rate. Although rib-eye area and retail cut percentage are not perfect indicators of proportion of lean, these results suggest that selection for growth rate would lead to no genetic change in percentage of lean meat. Selection for growth rate appears to lead to proportionate changes in fat, lean and bone, resulting in heavier carcasses leaving percentage of lean roughly the same.

The small gentic correlation between growth and fat thickness suggests that selection for increased growth rate would result in a slight increase in carcass fatness. Carcass grade, which in these data is primarily a measure of marbling or quality, and carcass weight per day of age had a moderate genetic correlation.

These data suggest that as growth rate is increased both outside fat deposition and intra-muscular fat deposition would be increased. The genetic correlation between outside fat thickness and marbling was high indicating that the genes responsible for fat deposition are probably general in their effect. That is, the same genes are responsible for fat deposition wherever it occurs. These particular results may not be applicable in other groups of cattle since there seem to be large differences between cattle in size at maturity. In this particular study the level of maturity at 12 to 13 months might have been such that this relationship between increased fatness and growth exists where in other data it might not. More work needs to be done in this area.

Ideally, cattle with rapid and efficient growth coupled with a high percentage of lean and enough marbling to grade choice would be most desirable. These data suggest that selection for increased growth rate is not antagonistic to the production of desirable carcasses since it would result in a slight increase in carcass grade and would have no effect on percentage of retail cuts. Consequently, some selection effort must be directed toward increased percentage of retail cuts for it to be improved.

One problem may arise with selection for percent retail cuts. In this study carcass grade or quality had a high negative genetic correlation with percentage of retail cuts, probably because of their high genetic relationship with fat thickness. Thus, there is an indication that carcass grade could be reduced by selection for increased percentage of retail cuts. With present marketing standards this is not good. Since the sampling errors of genetic correlations are quite high, the values found in this study really indicate the direction either positive or negative and either large or small in magnitude. Therefore, selection for growth rate and percent retail cuts is probably possible while maintaining carcass grade or quality.

Summary

Data from 265 Hereford and Angus steers representing 47 sire groups were studied. The heritabilities obtained for carcass weight per day of age, rib-eye area per hundred weight, fat thickness, carcass grade and percentage retail cuts indicated that selection for any one would be effective. The genetic correlations between the traits suggested that selection for growth rate is compatable with the production of desirable carcasses.

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Preliminary Studies on the Performance of Lambs Weaned at 30 - 45 Days of Age

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There is currently a lot of interest in management programs for sheep that involve weaning lambs at 30-45 days of age and carrying them to market weight under confinement conditions. Such a program might allow earlier rebreeding of the ewe, require less pasture per animal unit, and virtually eliminate internal parasites and adverse weather as problems in finishing lambs.

Studies are currently being conducted at this station to determine the feasibility of this type of program with ewes under Oklahoma conditions. However, before any program of this nature is successful, much information is needed on the nutrient requirements of this very young lamb. Morrison (1956) and N. R. C. (1957) do not list the nutrient requirements for lambs lighter than 50 lb. The purpose of these preliminary studies was to determine the response of lambs when weaned at 30-45 days of age.