SELECTION RESPONSE AND GENETIC PARAMETER ESTIMATION FOR FEED INTAKE, GAIN, AND FEED CONVERSION

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Summary

Performance records of 1459 Polled Hereford cattle born from 1967 through 1979 were analyzed to estimate genetic parameters and the direct and correlated responses that were due to selection for feed conversion. Heritabilities were .24 for intake, .25 for gain, and .14 for feed conversion. The genetic correlation between average daily gain and feed conversion was -.82; correlation between average daily gain and feed intake was .42. Faster-gaining cattle have greater feed intakes and are more efficient. Feed conversion was improved by direct selection. However, it is more economically feasible for breeders to improve feed conversion by selecting for faster rates of gain, rather than selecting for the trait directly.

(Key Words: Selection, Genetic Parameters, Feed Intake, Average Daily Gain, Feed Conversion.)

Introduction

In beef cattle production, both growth rate and feed efficiency are economically important. Even though beef producers have traditionally emphasized improving growth traits, many are unaware of how that influences feed efficiency. Our purpose was to estimate the genetic parameters for feed intake, average daily gain, and feed conversion, and to provide basic information about the direct and correlated responses caused by selection for feed conversion.

Experimental Procedures

Performance data were collected on 486 bull calves produced in a Polled Hereford herd at Kansas State University, from 1967 through 1979. Animals were donated by breeders from several states and were representative of the Polled Hereford breed. Animals from the original herd were used to establish a selection herd. Following establishment of the selection herd, the original animals were used as unselected controls. Replacements were selected from within each herd. Two bulls were selected based on individual feed conversion and used for 2 consecutive years in the selected herd. The first bull born, sired by the oldest herd sire in the control herd, was selected to replace his sire each year. These bulls were used in the control herd for approximately 6 years. Cows representing the selected and control herds were maintained on native pasture throughout the year and were supplemented in the winter. Cows were bred to calve in March and April, with calves being weaned in the fall at an average age of 196 days. Bull calves were fed individually for 140 days postweaning, which allowed selection for feed conversion (feed/gain). The ration consisted of 25% prairie hay, 15% dehydrated alfalfa, 43% corn, 12.5% soybean meal, 4% molasses, and .5% salt. Heifers were group-fed and were not selected on the basis of feed conversion. Cows were culled according to the following: 1) open at the end of the breeding season, 2) severe structural problems, and 3) horned. Average feed intake was 16.68 ± 2.36 (std dev) lb/day, average daily gain was 2.81±.42 lb, and average feed/gain was 5.92±.83 lb. A multiple-trait, derivative-free, restricted maximum likelihood (MTDFREML) procedure, with a full numerator relationship matrix, was used to analyze the data. The mixed linear animal model included the fixed effects of age of dam (2, 3, 4, 5-10, and >10 yr) and contemporary group (sex and year of birth), as well as calf age as a covariate. Average weight maintained over the 140-day

test period was used as a covariate for feed intake and feed conversion. Individual animal effect was included as a random effect. Best linear unbiased prediction (BLUP) procedures were used to calculate breeding values, for each animal, in each of the traits. Selection response was examined by regressing trait breeding values on year within the selection and control lines.

Results and Discussion

Heritabilities and genetic correlations for feed intake, average daily gain, and feed conversion are presented in Table 1 . The heritabilities for intake (.24) and gain (.25) are similar in magnitude to estimates found in the literature. The heritability for feed conversion (.14) is lower than most previously reported estimates. The genetic correlation between feed intake and average daily gain (.42) indicates that as calves eat more, they in turn gain more. The genetic correlation between average daily gain and feed conversion (-.82) shows that faster-gaining cattle are more efficient. Direct response to selection for improved feed conversion is presented in Figure 1. Most of the progress from selecting for feed conversion was made in 1974, with slow but steady improvement made thereafter. On the average, a .01 lb improvement in feed conversion occurred each year. Bulls from the selection herd consumed more feed and gained faster than those in the control herd. When the cost of measuring individual feed intake is considered, as well as the large negative genetic correlation between gain and feed conversion, selecting cattle based on feed conversion appears to be uneconomical. Rather, breeders can improve feed conversion by selecting for faster rates of gain.

Table 1. Heritabilities and Genetic Correlations[a] for Each Trait Analyzed

Trait[b]	INT	ADG	FC
INT	.24		
ADG	.42	.25	
FC	.27	-.82	.14

[a]Heritabilities are on the diagonal; genetic correlations are below the diagonal.
[b]INT = feed intake; ADG = average daily gain; FC = feed conversion.

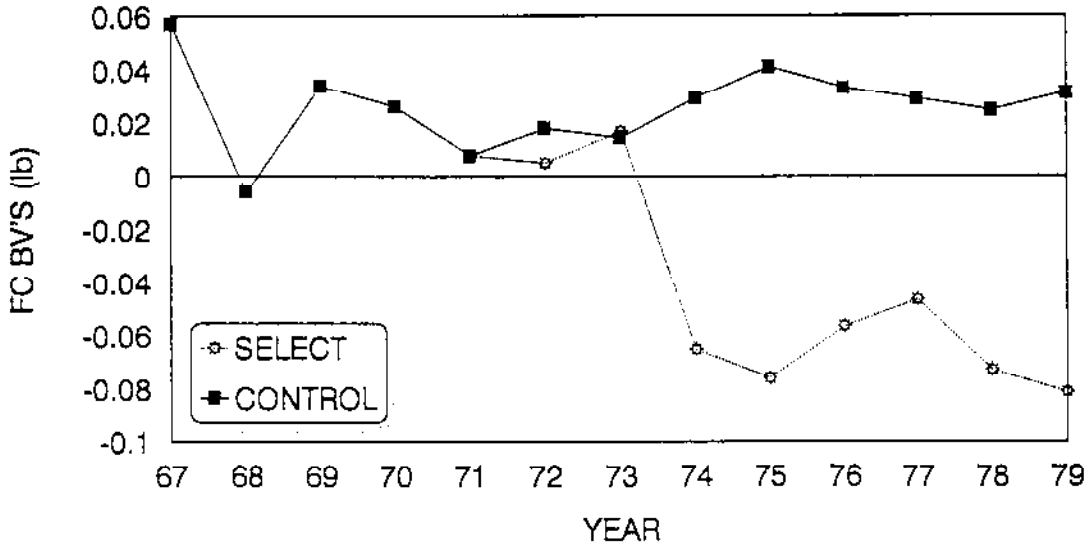

Figure 1. Response to Selection for Feed Conversion. FCBV is Feed Conversion Breeding Value