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Project 286: Improvement of Beef Cattle
Through Breeding Methods

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Two inbred lines of purebred Shorthorn cattle were established and progressively developed, to study production traits and effects of inbreeding. Inbreeding was initiated in the Wernace Premier Line in 1949 and in the Mercury line in 1952. Both lines have remained closed to outside breeding since. Inbreeding has progressively increased as the result of successive generations of half sibbing.

All cows in the study were pasture bred for spring and early summer calving. Birth weights, birth dates, sires and dams for all calves were recorded. Calves were not creep-fed. All calves were weaned at approximately 180 days of age and weaning weights and conformation scores were taken. Approximately three weeks after weaning, the calves were weighed and placed on individual feeding trials for 182 days (196 in 1950). Individual feed consumption data were taken. Until 1957 about half the bull calves were castrated at weaning and fed as steers. All male calves were left as bulls thereafter. The full-feed ration for heifers was 55 percent cracked corn and 45 percent chopped alfalfa hay; for the bulls and steers, 75 percent cracked corn and 25 percent chopped alfalfa hay. Final weights and conformation scores were recorded for all animals at the termination of the feeding period.

Post weaning data for all cattle produced during the first 16 years were summarized and analyzed during 1967. Seven sires used in the Weracre Premier line had sired 126 calves. Coefficients of inbreeding for these sires varied from 0 to 32 percent. The calves were produced by 49 cows with an average coefficient of inbreeding of 10 percent. The Wernacre Premier calves had an average coefficient of inbreeding of 20.4 percent, an average birth weight of 71 pounds, average starting weight of 401 pounds, average weaning score of low choice and average weight of 783 pounds at the end of the feeding period.

Nine sires used in the Mercury line sired 300 calves. The coefficients of inbreeding for these sires varied from 0 to 14 percent. The calves were produced by cows with an average coefficient of inbreeding of 7 per cent. The Mercury calves had an average coefficient of inbreeding of 14 percent, an average birth weight of 65 pounds, average starting weight of 360 pounds, average weaning score of choice, and average weight of 729 pounds at the end of the feeding period.

Feed efficiency was determined by computing pounds of total digestible nutrients required per pound of live body weight gained during the feeding period. Average daily gain was the average increase per day in body weight.

from beginning to end of the feeding period. Gain on test was the difference between initial and final feed-lot weight. In data analyses, the performance traits considered as dependent variables were feed efficiency, gain on test, average daily gain, and final type score. The factors considered independent variables were age of dam, inbred line, weaning type score, sex of calf, initial weight, birth weight and age at start of the feeding period.

The data were analyzed by the fitting of least squares analysis, using a multiple classification model with regressions and unequal subclass numbers. It was assumed on the basis of previous analyses that none of the main effects would interact significantly, so interaction terms were excluded from the model. The normal least squares equations were solved to obtain estimates of constants and regression coefficients by inversion of matrix on IBM 360. Standard errors were calculated and LSD tests performed.

The effect of age of dam was significant on calf average daily gain on feed but not significant with regard to other production traits. Calf average daily gains were lowest for 2-year-old cows; highest for 3-year old cows. Gains of calves from cows 4 to 10 years old were similar but were lower for cows 11 years or older.

Weaning type score was significantly related to average daily gain on test and to final type score. Calves with higher type scores at weaning tended to be scored higher at the end of the feeding period. Calves scored higher at weaning also tended to make higher average daily gains on feed.

Sex of calf had a highly significant effect on all performance traits studied. Bulls gained 45 pounds more on test than steers and steers gained 87 pounds more than heifers. Bulls and steers did not differ significantly in rate of gain but gained significantly faster than heifers. Steers required significantly less total digestible nutrients per pound of gain than bulls and bulls significantly less than heifers. Heifers were scored highest at the end of the feeding period and steers lowest.

The effect of year (weather and environment) was significant on all performance traits.

Inbreeding significantly affected average daily gain and final type score but not feed efficiency. Average daily gain and type score tended to decline as inbreeding increased. No physical abnormalities attributable to inbreeding have been observed.

Calves heavier at birth tended to gain significantly faster after weaning and required less total digestible nutrients per pound of gain than calves lighter at birth.

Initial weight of calf significantly affected feed efficiency and final type score, but not average daily gain. Calves higher initial weights tended to require more total digestible nutrients per pound of gain and to have high final type scores.

Initial age at the start of feeding was significantly related to average daily gain on test and to feed efficiency. The older calves tended to gain more rapidly and make more efficient gains on test.

Environmental effect appeared to be the major component of year-to-year changes in calf performance traits. There has been essentially no detectable genetic change in any of the production traits during the 16 years of the study. It is speculated that selection has offset effects of inbreeding.

The study will be continued according to the general project plan.