Analyses of variance indicated that the within-year level of inbreeding of the calves did not affect calf weaning weight significantly in either breed line. Examination of the year of calf weaning weights for both lines, however, reveals a general trend of decreasing weaning weight with increased level of inbreeding of calves. Level of inbreeding of calves is confounded with year effects, so an accurate evaluation of inbreeding is not possible with these data. The analyses of variance indicated that both the effect of years on calf weaning weight was highly significant in both breeds lines.

The following within-year simple correlations were calculated for the Hereford Premier line and Merino line, respectively: birth weight of calf and average daily gain to weaning, 35 and 41; birth weight and weaning weight (adjusted for age of calf), 51 and 57; actual weaning weight and weaning score, 49 and 57. All of these correlation coefficients are highly significant.

The analyses reported on this crossbred Shorthorn cattle breeding program are not conclusive and additional data are needed to be forthcoming. The preliminary findings discussed here indicate the problems involved in evaluating animal performance data. None of the correlations used in this study for adjustment of calf weaning weight procedures are recommended for use by cattle breeders at this time.

The growth rate and feed consumption data for the project cattle are undergoing analyses currently. The results of these studies will be reported in the future.

Record of Performance Testing Program for Beef Cattle

Walter Smith and W. K. McAdams

Introduction

Performance in beef cattle includes all traits that contribute to the efficient production of beef with quality appeal to the consumer. The major factors influencing the efficient production of a cow are: the environment and the use of each procedure comprises what is known as Record of Performance. The goal of these procedures is to identify the genetically superior individuals within a herd so that maximum genetic improvement can be made through their selection and breeding. Performance should be a guide to herd improvement in Kansas.

Principles of Record of Performance

Differences between individual animals are due to two major causes, genetic and environmental. The observed performance of an individual animal for each trait is the result of the herd's quality that it receives from both parents and the environment in which it is produced.

Inbreeding differences with regard to the ability of cattle to grow rapidly, mature early, convert feed to meat efficiently, reproduce efficiently, and to produce desirable carcasses provide the basis for selecting for improvement through breeding methods.

Record of Performance is useful primarily to provide a basis for comparisons among cattle raised alike within a herd and not for comparing differences between breeds. Genetic differences between breeds do exist; however, uncontrolled environmental effects eliminate the possibility of an evaluation of these genetic differences in most instances. Minimum standards for level of performance with regard to the various production traits have been advanced in some broad-scale Record of Performance programs. Because of the tremendous variation in environmental conditions and production standards, standards of performance involving comparisons between herds are likely to be erroneous. Performance records are useful for selecting the high producers and for culling undesirable animals. Maintaining production records on cattle produced in a herd helps to identify the best performing individuals and gives information about the breeding value of the sire and dam that produced them. The performance of all individuals should be measured in order to identify those that are above average in total merit.

The impact of the Record of Performance program on the beef cattle industry will depend mainly on its adoption by producers and breeders in the production of hard data. Commercial beef breeders can make the most effective use of (record of performance) in selecting the selection of hard data on the basis of records from within parent herds that are on a systematic Record of Performance program. Commercial breeders may use production records as a guide to calving ease or bull and to select replacement heifers.

Attention That Each Trait Should Receive

Beef cattle breeders are concerned with the important problem of determining the emphasis placed on each trait in selection procedures. Generally speaking, the heritability, the relative economic importance, and the genetic association with other traits determine the attention which should be devoted to a given trait in a selection program. The number of traits entering selection limits the emphasis which may be placed on a given trait; therefore, the greater the number of traits selected for, the less intensity can be placed for any single trait. Beef cattle production trends vary with regard to their individual and economic value. Traits of high economic value respond more to selection than those of low heritability, and greater attention should be given to traits of higher economic value.

Rate of Improvement from Selection

The factors that determine the rate of breeding improvement as a result of selection are: (1) Heritability, (2) selection differential, (3) genetic association among traits, and (4) generation interval.

Heritability is generally defined as the proportion of the differences measured between animals that is due to genetic differences. Thus, heritability for a trait may vary from 0 to 100%. Heritability estimates are obtained under carefully controlled environmental conditions with adjustment being made for environmental sources of variation. The heritability value for a given trait may be expected to vary among limited extent in different breeds or in different environments. There have been many heritability estimates reported from studies made on data obtained on numerous different traits in beef cattle. The estimates presented in Table 1 probably represent average expectations for many traits, provided the general environment is similar for all cattle within the herd. These estimates are recommended for reference to Kansas beef cattle breeders pursuing Record of Performance programs.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability</th>
</tr>
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<tbody>
<tr>
<td>Calving interval</td>
<td>10</td>
</tr>
<tr>
<td>Birth weight</td>
<td>10</td>
</tr>
<tr>
<td>Weaning weight</td>
<td>10</td>
</tr>
<tr>
<td>Cow weight</td>
<td>10</td>
</tr>
<tr>
<td>Efficiency of gain</td>
<td>10</td>
</tr>
<tr>
<td>Fat score</td>
<td>10</td>
</tr>
<tr>
<td>Cooper score</td>
<td>10</td>
</tr>
<tr>
<td>Weaning</td>
<td>25</td>
</tr>
<tr>
<td>Slaughter</td>
<td>40</td>
</tr>
<tr>
<td>Carcass traits</td>
<td>30</td>
</tr>
<tr>
<td>Carcass grade</td>
<td>30</td>
</tr>
<tr>
<td>Rib eye area</td>
<td>30</td>
</tr>
<tr>
<td>Marbling</td>
<td>60</td>
</tr>
<tr>
<td>Cancer eye susceptibility</td>
<td>30</td>
</tr>
</tbody>
</table>

(81)
Selection differential is the difference between the selected individual and the average of all the animals in a herd from which they were actually selected. It is influenced by the proportion of the total selected, the number of traits selected for, and the prevailing variation present in the initial or total group. Selection differentials having high values can usually be obtained in sire selection because of the relatively low proportion of males selected for breeding purposes.

Genetic associations may or may not exist among traits. In the event of no association between two or more traits, the traits are inherited independently. On the other hand, a genetic association between traits may be either positive or negative. If positive, the rate of overall improvement is facilitated as the positive associations lead to a better average improvement of those traits as selection is practiced for a larger proportion of them. Negative genetic association decreases or decreases improvement rates under selection because selection in the desired direction for one or more traits results in a degree of selection in an undesired direction for one or more other traits. In a sense, genetically associated traits are antagonistic in selection procedures. Current beef cattle breeding research findings do not indicate major negative genetic associations among various traits; however, more conclusive evidence regarding genetic associations among traits will become available in the future from results of extensive beef cattle selection experiments now in progress.

Generation interval is long in beef cattle. It averages nearly five years in most herds. Beef cattle, also possess lower reproductive rates as evidenced by the prevailing natural single birth, with percentage of calf crop weaned approximately lower than 100%, in most breeding herds. Long generation interval, low reproductive rate, and the relatively large numbers of traits involved in beef cattle limit the opportunity for selection that can be practiced in the near future. This means that the expected rate of genetic improvement in beef cattle is relatively slow. The primary factor in improving a trait that can be measured is the change in the mean of the population from which the population is selected. This change is facilitated by the selection of the best individuals from the population. If no selection is practiced for a given generation interval, for example, the selected bull and heifer calves were 20 pounds heavier than the herd average in weaning weight, the mean weight would be expected to average nine pounds heavier than if no selection had been practiced for that trait. (Heritability = selection differential of 40% x 50% = -5)

Economically Important Traits

Traits important in the profitable production of desirable beef stock should be evaluated and considered in a Record of Performance Program. The traits generally included are:

1. Fertility or reproductive performance.
2. Mothering or nursing ability.
3. Calf production as related to ease of estrus and structural soundness.
4. Rate of growth.
5. Efficiency of growth.

Fertility or Reproductive Performance

The heritability of fertility is high in cattle. It is high. Fertility is a complex trait with both environmental and genetic influences as measured or observed in breeding herds. Improved measures of both female and male fertility are needed to evaluate fertility in breeding herds. Research is under way on this problem; however, immediate exploitation is unlikely.

Because of the importance of reproductive performance in efficient production, attention must be given to it in breeding programs. The selection of open cows on some systematic basis is a usual practice which also provides some genetic fertility: however, it certainly does not appear to be a complete, or even a satisfactory solution.

If it is not possible, herd bulls should be selected from parents which have known good fertility records. This procedure has a major handicap in that fertility is not completely expressed until maturity, which limits this selection to the many of older cows a rule.

Mothering or Nursing Ability

There has been an increasing tendency for some period of years to slaughter beef cattle at younger ages. Weaning weight or pre-weaning growth has become more important because it now comprises a higher percentage of total growth.

Nursing or mothering ability of cows is reflected and evaluated in the weaning weight of calves.

The responsibility of the weaning weight of calves as a characteristic of cows is high. Research findings that select sows on the basis of single or limited calf production records. Although a single production record may be the basis for selecting a sow with high productivity, it will not likely be average or better on the basis of lifetime production.

Differences in mothering ability may be evaluated quite accurately at the age of 12 months. The best practice is to evaluate the mothering ability of a cow at the age of 12 months.

Several environmental factors affect calf weaning weight: age of calf, age of dam, sex of dam, sex of calf, and management of herd. Calf weaning weight is affected by the age of the dam and management practices. The weight of calf at birth is the product of the influences of the dam and the sire. The weight of calf at birth is the sum of the weight of its dam and the weight of its sire. The weight of calf at birth is the product of the influences of the dam and the sire.

The adjustment of calf weaning weights requires that each animal's weight must be identified and that essential records be maintained.

Individual cows must be identified by some permanent method. The following are satisfactory:

1. Brand numbers (applied according to State Brand Laws)
2. Ear tags
3. Brand numbers (as used in purebred herds)
4. Neck chains
5. Sire identification

Cow identification is necessary to maintain individual cow production records and to provide information relative to the age of dam, sex of dam, sex of calf, and age of calf. Calf identification must be maintained. Both the dam's and the sire's identification numbers must be maintained.

New-born calves may also be identified with ear tags or, in addition, to identify them to facilitate identification, all sutures are usually made to read easily.

It is not necessary to weight calves at birth, although actual birth weight is included in the average daily gain of the calf.

Sire identification of calves is generally not available under pasture breeding conditions in large commercial cow herds. Sire identification...
Adjustment values follow:

<table>
<thead>
<tr>
<th>Age of dam</th>
<th>Calves (pounds)</th>
<th>Cows (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 and older</td>
<td>+30</td>
<td>-20</td>
</tr>
<tr>
<td>2</td>
<td>+24</td>
<td>-13</td>
</tr>
<tr>
<td>1</td>
<td>+16</td>
<td>-15</td>
</tr>
</tbody>
</table>

These correction values are based on adjustment of calf weaning weight to "mature dam" equivalent and are recommended for use where individual herd adjustments are not available.

Correcting Weaning Weight for Age of Calf

Calf ages are easily computed with a calendar chart. The standardized ages most commonly used are 209 days, 245 days, and 216 days. If the actual age deviates more than 50 days from the standardized age, there is little justification for attempting to adjust for age. In most herds it will be necessary to weigh the calves to more than one group according to age on separate dates to avoid large deviations between actual and standardized weaning ages.

The adjustment of weaning weight for age of calf may be made by using each calf's average daily gain from birth to weaning, multiplied by the calf's actual age deviation from standard. This correction value is then added to or subtracted from the calf's actual weaning weight, depending on whether the calf is younger or older than the standard age. This method of adjustment is probably the most acceptable recommendation for all herds that have not had herd age corrections developed for them.

Pre-weaning average daily gain is computed by subtracting the actual age of calf from the weaning weight and dividing the remainder by the actual age. Average birth weight is nearly 70 pounds for heifer calves and 74 for bull calves. Constant or assumed birth weight should be near these if they are used. The main objection to using daily pre-weaning gain to correct for age is that it necessitates individual computations, and they are not convenient when corrections are made while calves are being sold.

Weaning weight for age of calf may also be adjusted by use of herd regression coefficients (regression of weight of calf on age of calf). These coefficients indicate the average effect of one day of age on weaning weight within the range of age of calves existing among the animals that are used. Regression coefficients have been computed on a large volume of data provided by the Kansas Commercial Angus breed at the Rush Ranch, Kansas. These data involved calves not creep-fed and those creep-fed.

The average effect on one day of age for calves nonexistent was 1.36 pounds, and for creep-fed calves, 1.42 pounds. Adjustments for age of calf may be computed by multiplying the above weight values appropriate for the management by age deviations from standard.

Correcting Weaning Weight for Age of Dam

Age of dams influence weaning weights of beef calves. Weaning weight tends to increase with age of dam until production is mature in 18 to 20 months, and the weight of calves declines with advancing age. The effects of age of dams must be corrected to compare weaning weights of calves from dams of different ages.

The influence of age of dam was studied in data provided by the Kansas Commercial Angus breed at the Rush Ranch under both noncreep-feeding and creep-feeding conditions. A procedure was approved to be quite different, so it is recommended that the appropriate adjustment value be used for each method of calf management.
growth rate

Size in beef cattle, which is a function of growth rate, is an economically important trait because of its association with feed efficiency or economy of gain and with feed costs that are regulated on a per head basis. In some instances, basal feed costs dominate the cost of gain in terms of the entire enterprise. In general, the rate of gain may be measured in terms of live weight change, average daily gain, or corrected average daily gain, or any other selective trait that is associated with an objective measurement of growth rate. The rate of gain is also best measured by the differences in the growth rate of a given animal when fed different feedstuffs or fed different nutritional levels.

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Research work indicates that the more rapidly gaining individual among cattle in a feedlot tend to make the most economical gains; however, there is not conclusive information relating to variable nature itself of cattle to justify recommendations with regard to total production merit.

The details of the techniques employed in a program that entails monitoring and evaluating growth rate in beef cattle are not of great importance; however, they should be standardized on a farm or ranch location, preferably in a single herd where individuals are compared. The restrictions or justifiable comparisons are practically the same for production records and recording ability in beef cattle. The standardization of methods does not remove a large portion of the environmental factors due to location, season, years, and differences in feed composition.

Conformation

Conformation in beef cattle is related to increased desirability, structural soundness, and longevity. Production records other than these, which have a direct relationship with conformation, should be considered by the industry previously discussed rather than by items of conformation. Basically, maximum attention is given to longevity, and feed efficiency or meat carcasses, in regard to conformation.

Considerable research is in progress to develop new techniques in measuring differences in proportions of fat and muscle in beef cattle. Research may present some new tools that will result in improved techniques for conformation; however, at this time it is recommended that cattlemen and feeders use the best current procedures to appraise the major items of conformation.

It is recommended that conformation scores be used. Skeletal structure, body proportions, bone thickness, and muscle thickness should be considered for conformation grades. Scores for conformation should be obtained at the time of weaning and repeated at 8 to 12 months of age.

A scoring system may be simple or include considerable detail. Simple scoring systems tend to group individuals in equal desirability without individuality of superiority or inferiority. The system used indicated individual conformation merit better. A breeder should use a systematic scoring system. Choosing a method which best effectively serves him in evaluating conformation in his herd.

Scores can be done by an individual person or a committee consisting of several. In the event that a committee is used, its average score should be considered the final measurement and it is important that it be done independently during the scoring process.

Records of carcass traits can be measured only through observation. It appears that progeny test data must be relied on to select these traits. Comparing bulls with progeny to sonic transmitting ability on the basis of the number of superior carcass traits among their sire progeny is the only reliable technique available at present.

Record of Performance as an Additional Tool

Record of Performance procedures can lead to more economical production and improved consumer desirability of beef through the breeding improvement of beef cattle. Progress should not be expected to be rapid because of biological principles involved. Some traits are not available or others are not willing to participate in the adoption of systematic programs. Record of Performance, as a technique for the industry, will establish its position and functional status through its trial adoption and observed usefulness by both the producer and commercial cattle interests.

The basic goals of Record of Performance are not necessarily different from those that have long been sought by the breeding industry. The techniques involved are not to be regarded as "revolutionary," but rather as an additional tool to facilitate the progress of production objectives. The principal features of a desirable Record of Performance program follow:

1. All individual animals to be given equal opportunity to demonstrate their genetic merit.

2. Systematic, recorded information to be maintained on all animals in a herd.

3. Records to be adjusted for major environmental influences, such as management, so that individuals can be directly compared.

4. Production records to be used to select replacement breeding stock and to call on the basis of performance.

5. Nutritional and other managerial practices to be both practical and comparable with those of commercial beef producers.

This discussion does not involve extensive or numerous specific recommendations. It has been prepared to illustrate principles and to describe basic limitations of the principles. Maintaining records on animals does not alter their breeding value as far as environmental advantage is transmitted. Records must identify genetically superior individuals if breeding improvement is to be accomplished.

An Orally Active Progesterone in Estrus Control in Beef Heifers

H. G. Spies, G. R. Mavoni, F. W. Roesen, J. S. Newwood, and E. P. Colby

An orally active progestin (propionate) was fed to 45 feeder heifers for 26 days. The seven lots (10 per lot in five lots and 5 per lot in two lots) were assigned to treatments of no-hormones (10 heifers), 150 mg. per heifer per day (20 heifers), or 210 mg. per heifer per day (20 heifers). The hormone was fed until day 20 of pregnancy was confirmed.

Grain was kept before the heifers at all times. For 70 days before, during, and after the breeding season, the heifers were observed twice daily for estrus and their ovaries were examined once weekly by rectal palpation for follicular development and ovulation. Progesterone inhibited ovulation completely in 96% (40/42) of the heifers. There was no difference in the number of heifers ovulating between those to which progesterone was fed and those that received no hormone. In 39.9% of the heifers that ovulated during treatment did so before the sixth day of treatment, and in 53.6% of the heifers that ovulated during treatment did so after the sixth day of treatment. In 100.0% of the heifers that ovulated during treatment did so after the sixth day of treatment.

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