Using Crossbreeding Systems to Produce Beef

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Introduction

Crossbreeding provides an opportunity to improve performance by beef cattle. Breed differences are inheritable and can be used to produce superior crossbred cattle. Heterosis results from bringing together unlike genes from different breeds to produce an animal with a level of performance that exceeds the average of the parent breeds. We develop crossbreeding systems to make the greatest improvement in performance possible consistent with a sustainable breeding program. Heterosis and differences among breeds are tools of the trade. In this paper, we combine the results from earlier studies to investigate their practical applications.

Procedure

Angus, Hereford and Shorthorn cows produced straightbred and two-breed cross calves. Resulting straightbred heifers were bred to bulls of the other breeds to produce additional two-breed cross calves. Two-breed cross heifers resulting from the original matings produced three-breed cross and backcross progeny at the same time. The three-breed cross and backcross heifers formed the foundation for two- and three-breed rotation systems. These rotation systems continued for two more generations. Straightbred calves were produced along with backcross, three-breed cross, and rotation calves. All calves grazed with their dams until weaning and had no access to creep feed.

Steer calves were fed a growing-finishing ration containing 1.18 Mcal metabolizable energy per lb for 252 days after weaning. Then they were slaughtered and carcass data collected.

Breed group differences resulted from breed effects of the individual, its dam, or its maternal grandam. Heterosis at each generation also may contribute to differences among breed groups. Data analyses quantified the effects of substituting one breed for another and the effects of heterosis on weaning wt, final wt, carcass wt, and retail product wt per cow exposed.

Terminal sires express genetic effects only through direct influences on their offspring. For this study, we characterized a generic terminal sire breed using results from the Germ Plasm Evaluation Program. Traits of a terminal sire affecting wt produced per cow exposed include: calf mortality to weaning, calving date, birth wt, preweaning daily gain, postweaning daily gain, carcass wt, marbling score, and retail product weight. The basis for the terminal sire breed was expression of these traits by calves from Brown Swiss, Gelbvieh, Maine Anjou, Simmental, Limousin, Charolais, and Chianina sires compared with calves from Hereford and Angus sires.

Thus, Angus, Hereford, Shorthorn, and terminal sire breed resources were available. Using these resources, we then predicted performance of five mating systems. The systems considered were: straightbred, two-breed start rotation (Fig. 1), three-breed rotation, and two- and three-breed maternal rotations with a terminal sire (Fig. 2).

Results

The mating system of choice depends on several resources that are specific to each cattle operation. These resources include: number of cows, number of breeding pastures, availability of labor, and amount and quality of feed and forage. We assume breeding of all cows was by a terminal sire system carefully before deciding to use it.

The straightbred system is the simplest to carry out. Its success requires appropriate matching of available feed resources and environment with an adapted breed. Numbers of cows and breeding pastures, managerial ability, and availability of labor are least restrictive to the straightbred system of all mating systems.

A two-breed rotation requires enough cows to employ two bulls, two breeding pastures, and identifying all females by the breed of their sire. A three-breed rotation requires a corresponding greater amount of resources. In either rotation, bulls are bred to cows that are most distantly related to the breed of the bull. Rotation systems provide limited opportunity to take advantage of breed differences. Environmentally well adapted breeds that are comparable in birth weight, growth, and lactation potentials should be used.

Terminal sire based systems allow use of breeds in specialized roles. Young cows bred in a rotation among breeds that are superior for maternal traits and adapted to the environment produce the replacement heifers. Mature cows are bred to breeds with high genetic potentials for growth rate and lean-to-fat ratio of the carcass. All progeny of the terminal sire are sold for slaughter. Using a terminal sire with a two-breed maternal rotation requires three breeding pastures and enough cows to use four bulls.

All crossbreeding systems produced more lb of product per cow exposed than the straightbred system. Products considered were weaning wt (Fig. 3), final wt (Fig. 4), carcass wt (Fig. 5), and wt of retail cuts (Fig. 6). Heterosis increased weaning wt per cow exposed from the two-breed rotation by 59 lb and from the three-breed rotation by 75 lb over the straightbred system. Adding a terminal sire to a rotation system yielded only small increases in weaning wt per cow exposed. Three-breed rotation and terminal sire on two-breed maternal rotation systems require similar numbers of breeds. Yet the latter system produced only 3.7 lb more weaning wt per cow exposed. We conclude cow-calf producers should evaluate a terminal sire system carefully before deciding to use it.

Comparing among endpoints preceding slaughter, the various crossbreeding systems were similar to the weaning endpoint. Only when we examined retail product wt per cow exposed did important advantages (26 lb or 18%) lie with the terminal sire systems over the rotation systems. If consumers want leaner meat products, then economic benefits from producing calves using terminal sires need to be transferred from consumers back to cow-calf producers.
Figure 1 - Two-breed rotation. Bulls of breed A are bred to females sired by bulls of breed B. Bulls of breed B are bred to females sired by bulls of breed A.

Figure 2 - Terminal sire incorporated with two-breed rotation. Heifers and cows less than four years old are bred in a two-breed rotation. Older cows are bred to bulls of the terminal sire breed and all offspring from the terminal sire breed are marketed.

Figure 3 - Effects of crossbreeding system on weaning weight per cow exposed.

Figure 4 - Effects of crossbreeding system on final weight per cow exposed.
Figure 5 – Effects of crossbreeding system on carcass weight per cow exposed.

Figure 6 – Effects of crossbreeding system on retail product weight per cow exposed.