Simulated Effects of Herd-Level Management Strategies on Efficiency of Beef Production

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Introduction

Beef producers make some decisions that affect production at the herd level. In many cases these decisions are not supported by data, since resources needed to obtain experimental data are limited. Computer modeling is a logical way to evaluate herd level effects. Here we examine options for culling cows based on age and pregnancy status under four crossbreeding systems.

Procedure

We used a computer model to calculate inputs and outputs needed for beef production. This model followed from earlier work at Texas A&M University and at MARC. Monthly estimates of diet digestibility for each class of stock described the production environment. Classes of cattle included cows, replacement heifers, and steers and surplus heifers destined for slaughter. We summed all inputs and outputs needed to produce, on avg, low choice carcasses. Conclusions from these results apply to herds where management retains ownership until steers and surplus heifers are marketed at a grade constant (low choice) endpoint.

Input costs for cows and replacement heifers were obtained from a survey of production costs per cow unit in the ranching area of Nebraska. Costs for inputs included: grazing at $13/animal unit mo, native hay at $35/ton, protein supplement at $190/ton, other cash costs (including interest) $98/cow, and labor at $6/hour. Input costs for feeding calves were from a similar survey associated with feeding steers from weaning to market weight on corn-based high concentrate rations. These costs included: corn at $2.25/bushel and other cash costs including interest at $79/head. We used ten-yr (1977-1986) avg prices paid for beef cattle in Nebraska to calculate returns. These avg prices per lb were: $0.61 for choice market-ready steers, $0.50 for choice market-ready heifers, and $0.39 for cull cows.

We examined four mating systems to study gains obtained from either separately or jointly using heterosis and breed differences. A straightbred system makes the most use of breed differences, using only the single "best" breed, but does not capitalize on heterosis. A three-breed rotation captures 87% of available heterosis, but takes less advantage of breed differences than the straightbred system. Terminal sire systems use both heterosis and breed differences to varying degrees. We simulated a roto-terminal system and a specific cross system. The roto-terminal system is a maternal two-breed rotation with terminal sires bred to cows 4 yr old and older. First-cross females are produced and then bred to terminal sires in the specific cross system. Except for the straightbred system, all systems require three breeding pastures. Cows simulated had a 1,100 lb genetic potential for mature weight and 33.7 lb/day maximum milk yield. Genetic potential of terminal sires for mature size was 40% greater than for the females.

Among the mating systems studied, the straightbred system was least efficient (Fig. 1). It required 10.05 Ib of TDN for every Ib of slaughter wt equivalent output. Economically, inputs costing $1.68 returned $1.00 in income and the net return per cow was -$105 for the straightbred system. By using heterosis, but not breed differences, the three-breed rotation system improved biological efficiency to 9.65. For the three-breed rotation, economic efficiency was 1.60 and net return was -$86. Using a terminal sire with a two breed maternal rotation was most efficient. In that system with bio-
logical efficiency at 9.16, economic efficiency was 1.43 and net return was -$29. The three-breed specific cross system was intermediate between the three-breed rotation and using terminal sires in combination with a two-breed rotation.

In Figure 2, we present simulated effects of culling based on pregnancy status. Culling open females at all ages improved herd-level efficiency and profitability. When keeping open females, 9.96 lb TDN produced a lb of slaughter wt equivalent output. Economically, inputs costing $1.61 returned $1.00 and net return per cow was -$82 when not culling open females. Culling all open females improved biological efficiency to 9.07. Economic efficiency was 1.48 and net return per cow was -$48 when culling all nonpregnant females.

Shown in Figure 3 are effects of maximum cow age on economic efficiency. Results for biological efficiency and net return were similar. We did not find an optimal maximum age at which to cull cows in this study. Keeping cows as long as they remain sound was the most efficient and profitable strategy simulated. However, the decreasing rate of improvement in efficiency probably results from the relatively small number of cows remaining at the older ages. These results may be sensitive to assumptions about involuntary culling at older ages.