BEEF CATTLE RESEARCH UPDATE

Britt Hicks, Ph.D., PAS
Area Extension Livestock Specialist
Oklahoma Panhandle Research & Extension Center

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Breeding Cost for Artificial Insemination vs. Natural Service

A Kansas State University study used computer simulation models to compare costs of natural-service breeding with several synchronization of estrus and artificial insemination (AI) systems and to identify important factors in determining the differences in expected economic returns between systems.[1] These researchers modeled three herd sizes (30, 100, and 300 head), three cow to bull ratios (20, 30, and 40), and seven estrus synchronization and AI protocols (3 heat detection only systems, 2 combination heat detection and cleanup timed AI systems, and 2 fixed-time AI systems). In each model, the breeding season consisted of one synchronization and AI period, followed by a natural-service period. Breeding cost per pregnancy ranged from $46 to $95 and largely reflected the difference in synchronization product inputs.

Averaged across the three herd sizes and three cow-to-bull ratios, the AI systems were economically preferred over natural service 33 to 49% of the time. Heat detection and cleanup fixed time AI synchronization systems, strict fixed-time AI systems, and heat detection only systems were favored over natural service 33, 41, and 49% of the time, respectively. These data illustrate that heat detection only systems were most likely to have lower costs than natural service. These simulation models also showed that as herd size increased, AI was more likely to have lower costs than natural service. It was reported that heat detection only systems in large herds (300 cows) using low cow-to-bull ratios (20) demonstrated a net economic advantage relative to natural service 85% of the time. Whereas, the proportion of times AI was less costly than natural service was less than 5% for herd sizes of 30 and cow-to-bull ratios of 40 regardless of the synchronization system. In addition, the models showed that the AI systems were more cost effective at lower cow-to-bull ratios. The frequency of lower breeding costs for AI than natural service for cow to-bull ratios of 20, 30, and 40 was 63, 46, and 14%, respectively.

These simulation models showed that genetic value premiums and semen cost were consistently included in the top 3 factors that determined expected economic differences between natural service and AI systems across herd sizes and cow-to-bull ratios. The increased value of the AI-sired calves based on genetic strengths of AI sires and semen costs were the most important variables at higher cow-to-bull ratios and larger herd sizes. Whereas, the most important factor when the cow-to-bull ratio was low was the variability in bull purchase price. Higher bull purchase prices resulted in AI systems becoming more economically competitive since as the bull price increased, the cost of natural service increased.

In summary, these researchers concluded that estrus synchronization and AI were economically advantageous compared with natural service when a sufficient genetic value premium could be obtained from AI-sired calves.

Relationship between Residual Feed Intake and Performance and Profitability

Since feed is the most expensive input within any livestock production system, feed efficiency has a tremendous influence on the cost of production. Traditionally, efficiency has been evaluated based on feed to gain ratio (F:G) or gain to feed ratio (G:F). For many years, it was generally assumed that feedlot feed efficiency (G:F) was positively related to feed intake. Based on this theory; the animal that consumes the most, in relation to body weight, gains more and is more efficient. The theory was that the more an animal ate the more energy that was left, after taking care of body maintenance, to meet production. It was also thought that there was little difference in efficiency of utilizing feed for maintenance or gain. However, research has shown that feed conversion ratio is more related to growth, body size, composition of gain and appetite than to the energy required for maintenance.[2] It appears that the beef industry selected for faster, larger animals with increased appetites, but with no improvement in feed efficiency.[2]

Several trials conducted over the last several years have suggested that a better means of evaluating efficiency is by using the concept of residual feed intake (RFI). RFI is defined as the difference between an animal's actual feed intake and its expected intake based on body weight and growth rate. Positive RFI animals eat more than expected in relation to their weight and gain, so they are less efficient. A negative RFI value is better and indicates a more efficient animal. Unlike F:G which is strongly correlated with growth and mature size, RFI is a measure of feed efficiency which is independent of level of production (growth and body weight).[3]

Recent California research evaluated the relationship between performance, carcass composition, dry matter digestibility, and profitability in low- and high-RFI cattle.[4] In this study, 60 head of Angus X Hereford crossbred steers (653 lb initial weight) were fed an 80% corn-based finishing diet during two periods of 60 days each. The steers were fed approximately 2 additional months after the 120 day feeding trial. Based on data collected during the feeding trial, RFIs were calculated for each steer. The 15 greatest and 15 least RFI steers were classified as high and low RFI groups.

These researchers reported that the low RFI steers had significantly lower dry matter intakes and higher G:F than the high RFI steers. No differences between low and high RFI groups for dry matter digestibility, days on feed, slaughter weight, carcass weight, and carcass composition were observed. Their analysis also showed that the feedlot cost of gain was significantly less for low RFI steers than high RFI steers. However, analysis of the data showed that G:F explained 98.5% of the variation in cost of gain, while RFI only explained 18% of the variation. These researchers concluded that even though RFI might be more desirable as a selection criterion for breeding stock than gain to feed ratio (since it is independent of production level) that RFI is less useful than G:F as an indicator of feedlot efficiency and profitability.

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