Fit Your Herd to Its Environment

BIF general session focuses on efficiency, matching genetics to environment.

Thursday's general session of the 2006 Beef Improvement Federation (BIF) Annual Meeting and Research Symposium was themed, "Where Do I Fit With My Production Environment?" Speakers during the April 2006 meeting in Choctaw, Miss., focused on defining efficiency and matching cattle to their environments. Following are summaries of the presentations.

To listen to the talks, view the PowerPoint® presentations or read the proceedings, visit the newsroom at *www.bifconference.com.* This Web site, compiled and maintained by Angus Productions Inc., provides complete coverage of the 2006 event, as well as archived coverage of past meetings.

Residual Feed Intake Explained

Many measures of efficiency have been described in the past 50 years — feed conversion being the most popular, said Denny Crews, research scientist at the Agriculture and Agri-Food Canada Research Centre in Lethbridge, Alberta. Crews pointed out that using feed conversion, the units of feed required to put on a unit of gain, has given producers a trait to select for, and the genetic trend has been positive. But some of the indirect consequences have not been good, as seen in the corresponding increase in mature weights.

Very little genetic improvement has occurred in improving efficiency of the entire beef production system as measured by reducing inputs per unit of output, he noted.

In fact, Crews said, selection for improved feed conversion ratio (FCR) would result in increased correlated genetic responses for growth rate, mature size and, presumably, mature maintenance requirements.

Crews said a measure of efficiency not related to other traits is needed.

RFI offers potential

Residual feed intake (RFI) is the difference between actual feed intake and that predicted by regression accounting for requirements of production and body weight maintenance. A more functional definition of RFI, Crews said, is "that portion of feed intake that is not accounted for by measurable factors."

There are several advantages to using RFI as a measure of efficiency, Crews said. Most agree that RFI is moderately heritable, and it can be measured independent of other traits. Preliminary research shows it is uncorrelated to mature size and highly correlated with mature cow efficiency.

Research has shown that selection for improved (decreased) RFI would result in cattle that eat less, but gain the same and produce similar carcasses.

— by Shauna Rose Hermel

PHOTOS BY SHAUNA ROSE HERMEL

►Denny Crews, research scientist with Agriculture and Agri-Food Canada, explained the limitations of traditional measures of feed efficiency and offered RFI as a potential better predictor of overall efficiency.

Defining Feed Efficiency

►"A notable feature that distinguishes RFI from other feed efficiency traits is that it is phenotypically independent of the production traits used to compute expected intake," Texas A&M University's Gordon Carstens said.

Feed inputs and outputs are measured in targeted stages of the beef production cycle, said Gordon Carstens, Texas A&M University, in helping define feed efficiency. Since it is not practical to measure forage intake of mature cows, emphasis is placed on growing animals.

"Expectations are that appropriate use of a feed efficiency trait in growing cattle, which accounts for genetic variation in efficiency of feed utilization to support maintenance and growth requirements, will generate progeny that are efficient in all segments of the industry," he said.

Efficiency is a ratio of outputs to inputs. Live-weight gain and daily dry-matter intake (DMI) are typically used to measure efficiency ratios.

"A phenotypic linear regression equation, computed using intake and performance data from a contemporary set of animals, is used to determine an animal's expected feed intake based on its weight and growth rate over a given test period," Carstens explained. "The animal's actual feed intake net (more

or less) its expected intake is referred to as residual feed intake."

Animals that require less feed than expected to put on 1 pound (lb.) of gain are considered efficient and show a negative RFI number. On the other hand, inefficient animals require more feed than expected to put on 1 lb. of gain and show a positive RFI number.

"A notable feature that distinguishes RFI from other feed efficiency traits is that it is phenotypically independent of the production traits used to compute expected intake," Carstens noted.

Through research field trials, Carstens observed that RFI is highly correlated phenotypically with FCR, even though FCR is negatively correlated with growth traits. Further, RFI has been shown to be moderately heritable, suggesting that selection for improved postweaning RFI has the potential to produce progeny that are efficient in all segments of the industry.

"Studies indicate that RFI is a trait that appears to reflect inherent variation in biologically relevant processes that are related to feed efficiency," Carstens said, "but not growth."

In closing, Carstens said considerable genetic variation exists in cattle feed intake that is unaccounted for in weight and growth rate. RFI provides opportunities to improve profitability through reductions in feed inputs, while having minimal effects on growth and mature size.

— by Micky Wilson

Need to Predict Profitability, Not Efficiency

►Creating an EPD for feed efficiency would be a disservice to the industry, CSU's Dorian Garrick said.

Many seedstock breeders and commercial producers lament the fact that there are no existing tools to aid genetic selection for feed efficiency. Their cries have been heard by the National Beef Cattle Evaluation Consortium (NBCEC), which seeks out new genetic traits and technologies to enhance breeding programs.

Producers keep asking for a tool to select for feed efficiency, said Dorian Garrick, Colorado State University (CSU) geneticist and NBCEC director. "They think it would be great to have an EPD (expected progeny difference) for feed efficiency, but we shouldn't. It would be a disservice to the industry."

Garrick explained that efficiency is a function of the relationship between inputs and outputs. Typically, feed efficiency is expressed as a ratio of the amount of feed consumed by an animal (input) relative to its weight gain (output).

"As a tool to improve efficiency by selection, EPDs for measures of input and for measures of output are more effective than a new EPD based on some ratio of inputs and outputs," Garrick stated.

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Selection on the basis of efficiency could increase efficiency without changing profit. Furthermore, animals that vary in profit may share the same efficiency.

When selection to enhance profitability is the objective, Garrick said, the more sensible approach would be to generate EPDs that could be used to predict inputs and outputs for incorporation into a selection index for ranking animals on the basis of predicted profitability.

Efficiency measures appeal to many producers because of the vagaries of costs and prices, and because of the difficulties in predicting what these might be in the future. Garrick said it is not the actual values of beef or feed, but the price-cost relativity that is important. Trends in price-cost relativity may be more consistent than actual prices and costs.

Focusing on biological efficiency does not address the fact that economics determine profit, Garrick said. Producers would make better selection decisions using predictions of output value less input value rather than using predictions of efficiency. Accordingly, the NBCEC has no current plans to develop an EPD specifically for cow-calf or feedlot efficiency.

Garrick said short- and long-term opportunities exist to improve the prediction of outputs and inputs for both scenarios. In the cow-calf system, specifically, improved prediction of reproductive performance is needed. For the long term, modified recording practices are needed to generate phenotypes or inventory information allowing economically relevant traits — including heifer pregnancy, stayability, mature size and maintenance energy — to be evaluated.

— by Troy Smith

Matching Genetics with Environment

When matching cattle to an environment, the first consideration is whether the cattle are capable of converting to beef under the given conditions, said Tom Jenkins of the Roman L. Hruska U.S. Meat Animal Research Center (MARC) near Clay Center, Neb. If there is a disconnect between the cattle and the environment, a need is created to alter the environment to suit the cattle. However, actions such as this may be counter to producer profitability. Using appropriate genetics minimizes the need to modify the environment.

"Broadly defined," Jenkins said, "the production environment is made up of all nongenetic drivers from all segments of the horizontally integrated United States beef cattle industry."

►Trying to modify the environment to accommodate mismatched genetics can be counter to producer profitability, Tom Jenkins of USDA MARC told attendees of the 2006 BIF annual research symposium.

Producers can match genetics with environment, Jenkins said, by using either genetic improvement programs or structured mating systems.

"Management decisions regarding breeding programs can be made once a phenotype is identified that increases profitability of the ranch through cost-effective modification of the production environment," Jenkins explained.

The goal of a breeding program is to create progeny appropriate for the merchandising program and to produce females that are genetically suited to the local environment, Jenkins said. "This variation may be utilized by mating systems designed to exploit breed differences and increasing the fit to the environment by using heterosis."

Jenkins presented the following eight items to consider to successfully match cattle genetics with the environment.

1. Identify your merchandising plan.
2. Identify your most limiting environmental factor.
3. Identify phenotypes that provide an advantage.
4. Identify breeds or animals that overcome limiting factors.
5. Define an objective measure of traits that overcome limiting factors.
6. Determine if traits are under genetic control.
7. Design and implement a breeding program to increase frequency of desired genotypes.
8. Sustain genetic diversity.

"Implementation of these steps reflects a commitment to an underlying philosophy of management to improve profitability through optimizing resource use rather than one of maximizing revenue through environment modification," Jenkins concluded.

— by Micky Wilson

Heterosis: Ignored or Forgotten?

According to rancher and California State University, Chico, animal scientist Dave Daley, many cattle producers have ignored or forgotten about the value of heterosis. While university educators and industry leaders have talked much about the advantages of planned crossbreeding programs for nearly 50 years, Daley said he fears they haven't been communicated very well. He made his comments during Thursday's general session.

"The industry has done a lousy job of applying heterosis effectively," Daley said. "For some reason, poultry and pork have seemed to figure out how to take advantage of genetic diversity and produce a consistent product. The beef industry has not done so on a widespread basis."

Yet the evidence is clear, overwhelming and consistent, Daley added, citing studies showing how breeding programs designed to capture direct and maternal heterosis can increase lifetime cow productivity by more than 20%. The small, net positive effects on

many traits contribute to a large, net positive cumulative effect for the long term.

Daley offers 10 reasons heterosis is ignored or forgotten.

1. Cultural bias reflects "purebreds are better," if for no other reason than they have registration papers. There is value in registries, particularly in the ability to track performance and predict genetic potential of purebreds, he said, but being purebred should not be a presumption of superiority.
2. There is a tendency toward single-trait selection and the mind-set of "bigger is better." The subtle and cumulative improvement from heterosis does not lend itself to maximums.
3. We have decided that measuring outputs is more meaningful than measuring inputs. It's easier to measure production results than costs of production.
4. Uniform phenotypes for qualitative traits (color) have a distinct marketing advantage. It is easier to produce uniform color in purebred programs, but that does not mean you cannot have uniform color within a crossbreeding program.
5. Heterosis is difficult to visualize and even more difficult to measure. Small improvements in morbidity, age at puberty, conception rate and significant changes in longevity are not easily observed.
6. Complicated crossbreeding programs are difficult to implement, particularly in small herds.
7. We have tried to modify or enhance the environment to increase production rather than focusing on how to increase net return by making cattle fit the environment.
8. Historically, there has been resistance to crossbreeding from some marketing outlets, purebred breeders and breed associations.
9. Poor planning of the combination of breeds and selection within breeds has led to inappropriate use of breed diversity.
10. Industry and university systems have focused on individual trait measurement for more than 50 years. We now need measures of inputs more than additional measures of outputs.

►**"The industry has done a lousy job of applying heterosis effectively," said Dave Daley, California State University, Chico.**

There are some producers, Daley noted, who understand their environment and resources. These profit-focused producers have developed plans, targeted their markets and are successfully capitalizing on heterosis. Daley said more producers would do well to remember that heterosis provides greater returns as environments get tougher, when cattle prices drop or when corn prices climb higher.

— by Troy Smith

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