Role of Genetic Evaluation Technology in Enhancing Global Competitiveness

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Introduction

Livestock producers seek to use the genetic variation which exists between animals for making directional changes in their herds and breeds for selected traits of interest. When selection decisions are made there are expectations of a response to those selections. Going back in history there are key events; the importation of beef genetics, establishment of research, education and extension programs, the beef cattle performance revolution and the printing of the first Sire Summaries which all have had a profound impact on the U.S. beef population increasing value and production.

Since the Spaniards first introduced cattle to the new world through the great cattle drives of the late 1800s beef has become a major economic business in the U. S. As America became settled and our economy grew, ranching became a way of life. Regardless if genetics move from one breeder to another or across continents there is an anticipation of adding value, increasing output and/or creating efficiencies of the nations beef herd. This transfer of genetics wasn't only about serving domestic demand for beef but also enhancing our competitiveness in a global economy.

Given the U.N. has projected the world's population to reach 9 billion people by the year 2050 which has lead to the call for food production around the world to double by the year 2050 (Green, 2009) increasing production levels and efficiencies are a growing concern. Additionally, meat is demanding an increasing share of the global market as diets in developing countries are changing and as incomes rise (FAO, 2002). Although global competition has intensified for the growing international demand for beef, opportunities exist for U.S. producers to capitalize.

American beef producers historically have responded aggressively to an increasing demand for our product with increased production levels and improved efficiencies. While current beef cow inventories have returned to levels of the 1950s beef production has more than doubled (USDA, 2011) over the same period of time.

While much of the improvements in productivity can be traced to the migration of genetics, it has been the last 30-40 years that our increased focus on performance and genetics has been responsible for significant gains as well. Many of our successes can be traced to work done within the framework of the Beef Improvement Federation.

While research is continuing here in the U.S. we should be concerned about the funding for such research. We have not always enjoyed the abundances in this country as we do today. Our system of research, education and extension should be credited for much or our standard of living and our abundance of affordable and healthy foods.

We can trace the roots of our current system of research, education and extension back to 1903 when Seaman Knapp arrived in east Texas to talk to the local farmers. Knapp identified Walter C. Porter of Terrell, Texas to set aside a small part of his farm as a demonstration farm using new technologies to grow cotton. Because of the success of this first step the U.S.D.A. Cooperative Extension Service was formed and by 1920 there were seven thousand federal extension agents, working in almost every county in the nation, and by 1930 they had set up more than seven

hundred and fifty thousand demonstration farms. (Gawande, 2009) However, investments in public agricultural research have slowed since 1980 (Pardey et al., 2006) placing research stations and our land grant universities under growing budget constraints. During this same period of time the private sector has increased research and development significantly faster than the public sector (Huffman et al., 2011).

Genetic evaluations have played a significant role in the improvement of beef cattle in the United States for many characteristics. Genetic trend tables, readily available on association websites, are a testament to our success domestically and have also helped establish the U.S. as a leading genetic source. This is particularly evident in a 2007 report prepared for Meat and Livestock Australia which showed consistent trends for breeds in the USA and Canada for reduced birth weight and stronger trends for yearling weight (McDonald, 2007).

As the international community continues to develop stronger objective based performance and genetic improvement programs the intensity of identifying superior genetics may expand across borders beyond current levels for those breeds and breeders who can better characterize their populations for important traits. As I commented in the opening paragraph there is an expectation of response to imported genetics. This question has been addressed by joint international research projects which have shown when using current genetic evaluation methodology, sires ranked similarly across countries and within regions of the United States (de Mattos et al., 2000; Donoghue and Bertrand, 2004) which has lead to a greater interest for international evaluations.

The production of international genetic evaluations can provide improved marketing opportunities for genetics with increased accuracy, increase confidence of selection across international borders and accelerate genetic progress given the benefits of the larger pedigree and performance information that is made available. However, international evaluations are not without their problems given the timing of data collection, production sales and marketing competition.

Challenges Faced by Beef Breed Associations

Both, the U.S. beef cow inventory and U.S. breed registries reached their peaks in the 1970s with breed associations recording record numbers of animals. However, a decline in the U.S. beef cow inventory (USDA, 2011) has created a shrinking demand for seedstock bulls since 1975. In fact the industry today needs approximately 400,000 fewer bulls than it did in 1974-75. The decreasing size of commercial beef cow numbers is the direct cause for a loss of approximately 430,000 registrations for U.S. beef breed associations over the same period of time (NPLC, 2010). This loss of registration numbers continues to strain association budgets for research and development as well as other services.

Beef breed associations have benefited greatly from the research and development from USDA ARS and land grant universities among others. However, development of new technology often takes a building-block approach where new discoveries are based on earlier discoveries and increased knowledge. We are a witness to this today as genomic enhanced selection continues to improve and the optimism that it will play a larger role in the genetic characterization of our cattle. The question whether to use genomic information will be replaced by how to use it efficiently (Misztal et al., 2010).

Historically in the United States genetic evaluation services have been provided by a few land grant universities. However over the course of the last several years genetic evaluations have moved in house for some breeds (Angus and Simmental) while others have contracted with service providers other than the traditional land grant universities. This change was necessitated

as land grant university budgets became strained and an increasing need and desire to focus more efforts on improving genetic evaluation models. This transition has not been without its bumps and bruises as we have moved forward.

Our transition is far from complete, however. Today we spend more time trying to access, prepare and manipulate data sources and less time modeling data and applying expertise to improve and expand evaluations. The challenge is compounded further as the amount of data and complexity of problems increase. Additionally, new technology will offer more computing options and new genetic tools for traits which historically have been difficult to characterize in our populations.

The current system of "islands of data" is inefficient and inhibits active associations from moving forward in an efficient way. We need to begin capturing data more efficiently which can benefit the building of resource populations for research and development of genomic tools. The current situation is that we have multiple and disparate sets of data that are intended to represent the same or similar concepts.

The cornerstone for our success the last 30-40 years has been the collection of quality phenotypic data which has allowed our producers to capitalize on research/technology transfer programs for genetic improvement. This will continue to be important or research into genomic markers may have little if any impact. The old adage "genetic evaluations are only as good as our data" will continue to be true and will be important information as the expansion of genomic data will require large volumes of phenotypic data and will be required to update existing marker effects (Funk, 2009).

We must identify synergies and further evaluate the sharing of resources between associations. I believe synergies exist that will make each of us stronger and ready to address the challenges. We must concentrate our efforts to build a more efficient information infrastructure which support the formation of research and technology development and partnerships. This will help provide a quality genetic evaluation service which incorporates the best technology to provide superior responses to the needs of our producers to ensure competitiveness both domestically and internationally.

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