Off-Station Long Reports

Economic Impact of Beef Genomic Research

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Introduction
The beef industry adds value to its product, in part, through health and nutrition programs, through genetic choices, and by addressing temperament of the cattle. Genetic testing of cattle is becoming increasingly important to maximize the economic performance of cattle traits coupled with value-adding production practices. Despite the recognition that genetic traits have economic value, and the priority on funding for functional genomics, there is little information on the economic benefits and distribution of benefits among beef industry participants from these scientific investments.

Objectives
Our objectives are to develop and test an empirical model for exploring both the benefits and the distribution of economic benefits of genetic technologies within the vertically segmented beef cattle industry, including an estimate of the potential distribution of benefits to Wyoming’s cow-calf producers.

Materials and Methods
To analyze the distribution of benefits among industry sub-sectors, we developed an equilibrium displacement model (EDM) of the U.S. beef industry and its reaction to the adoption of a specific genetic predictive technology. (An EDM model takes into account changes in quantities and prices from supply and demand changes caused by a change across all market segments analyzed and then estimates the economic changes in benefits or costs to those segments.)

We intend to conduct two analyses. The first uses myostatin mutation—which produces double muscling in cattle—as a representative genetic innovation. The genetic predictions and potential changes in costs and revenues for cattle producers in different segments of the industry have been published, making the development of an economic model feasible. The second analysis, now underway, will use data from research being conducted at the James C. Hageman Sustainable Agriculture Research and Extension Center (SAREC) on feed efficiency characteristics in beef cattle.

Results and Discussion
Because of the extensive documentation of the myostatin mutation, its genomic predictability, and its related impacts on physical production, this characteristic was more easily analyzed in an EDM. From this model we estimated the changes in economic benefits for producers and consumers for each industry segment nationally and for Wyoming cow-calf producers due to the adoption of the innovation (Table 1).

A conservative, most likely outcome in terms of costs and benefits nationally under this scenario indicates on a per-head basis that (1) cow-calf operations see a loss of $0.17 when they breed myostatin into their herds; (2) feedlots realize a gain in profit of $0.05; (3) slaughterhouses see a profit gain of $0.19; and (4) retailers see a gain of $0.12 when the industry moves to double-muscled beef.

Putting this into total dollars, cow-calf producers nationally could lose up to $40 million by 100% adoption of this technology, while Wyoming cow-calf producers could lose $323,725 over a 10-year period. However, the feedlot, packing, and retail-to-consumer segments could all show positive gains, creating a net positive of $41 million overall for the total U.S. beef industry (Table 1). Myostatin mutation is a useful case study because it demonstrates clearly how unevenly returns can be distributed across the beef value chain.

Our next analysis on feed efficiency is underway; this research is taking place at SAREC. It is a much more complex genetic trait to analyze economically, but we believe it offers greater opportunities for economic gains to cow-calf producers than was expected for the myostatin
mutation analysis. We hope to have this part of our study completed by spring 2018.

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**Table 1.** A conservative scenario for total change in economic benefits nationally and in Wyoming for myostatin mutation research and adoption.

<table>
<thead>
<tr>
<th>National Market Segment</th>
<th>Total Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow-calf producers</td>
<td>($40,011,769)</td>
</tr>
<tr>
<td>Feedlots</td>
<td>11,633,543</td>
</tr>
<tr>
<td>Packers</td>
<td>42,801,126</td>
</tr>
<tr>
<td>Retail</td>
<td>26,605,064</td>
</tr>
<tr>
<td><strong>Total U.S. Beef Industry</strong></td>
<td><strong>$41,027,964</strong></td>
</tr>
<tr>
<td>Cow-calf producers</td>
<td>($323,725)</td>
</tr>
</tbody>
</table>

PARP: V, VII, VIII

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