Using Genetics and Selection to Improve Your Herd

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UW-Extension Kewaunee County
Beef Cow/Calf Meetings
Overview

- AI or Natural Service
  - Pros/Cons
  - Solutions
- Genetic Lingo
- Reading Pedigrees
- Understanding EPDs
- What does all that stuff mean in an AI Directory
- Handling options and opportunities
The majority of genetic change in beef herds comes from sire selection

Over 50% of heifers must be selected to maintain cow numbers, but only 4–5% of bull calves need to be selected. Therefore, selected bulls will be of greater average BV than the selected heifers.

A single bull can produce 25 to 40 calves per year with natural service or several hundred calves per year with A.I. whereas a cow produces only 1 calf per year naturally or up to 20 calves per year with embryo transfer – superior genetics are spread faster with bulls than with cows.

Bull EPDs have greater accuracy than cow EPDs due to greater number of offspring from bulls.
Why AI?

- I don’t have the handling facilities
- I don’t want to bring ALL the cows up to the barn just to breed one!
- I don’t have time to breed my cows
- I don’t have time to heat detect
- I don’t know how to breed cows
Why NOT AI?

- Guaranteed calving ease data
- Heifers bred to an AI sire bring more money at auction
- Purchasing a natural service sire is costly and he is only going to produce 30-40 calves a year
  - Is he really worth that purchase price?
- Less than 10% of beef producers currently use estrus synchronization and AI (ESAI)
First Understand the Basics

- **Reading EPDs (Expected Progeny Difference)**
  - Predicted performance of a bull’s calves compared to the calves of a bull with an EPD of zero.

- **Performance Data**
  - Growth and Phenotype

- **Daughter Evaluation**
  - How the sire’s daughters are expected to perform

- **Carcass/Ultrasound Evaluation**
  - Predictors of what the sire’s progeny should express at a given time

- **Bio-Economic $Values**
  - Expressed average difference of progeny performance
AI Sires

Pros
- Superior Genetics
- Always have EPDs
- Accuracy
- Sexed Semen
- Use outcrosses
- Pinpoint herd progress/goals

Cons
- Additional handling facilities needed for breeding
- Heat detection
- Time
- Additional equipment/skills needed to breed cows
Herd Bulls

Pros
• No heat detection
• You can use a bull from your herd
• Minimal handling facilities needed for breeding

Cons
• Dangerous
• Spread disease
• Fertility
• Rough on equipment
• Rough on cows/calves
Using natural service the right way

If you use natural service:

• Buy the right bull
• Fits your herd goals
  o Calving
  o Performance
• Pedigree/EPDs
  o His sire or grand sire may have been an AI bull – check the numbers
• Test for FERTILITY and Morphology!
  o Will he get your cows pregnant?
• Mobility/Health
  o He can’t breed cows unless he can see, walk, and eat
AI Overview

• Most major AI companies offer a variety of beef sires

• Breeds most commonly available
  o **Angus**
  o Red Angus
  o Simmental
  o Polled Hereford
  o Gelbvieh

• Depending on trends and location, some breed’s popularity come and go:
  o Charolais
  o Limmousin
  o Brahman

- Depending on the stud, Black Angus semen is 60-80% of beef semen sales
AI Overview

• Each AI stud has its own unique stud code assigned by the National Association of Animal Breeders (NAAB)
  - 001 Genex/CRI
  - 007 Select Sires
  - 014 Accelerated Genetics
  - 029 ABS Global
  - 054 Hawkeye Breeders (Collection Site Only)

• 282 studs are registered, most are inactive
AI Overview

• Each breed has an assigned breed code
  o AN Angus
  o AR Red Angus
  o SM Simmental
  o CH Charolais
  o HH Horned Hereford
  o HP Polled Hereford
  o LM Limmousin
  o BR Brahman

• Crossbreed or “percentage” cattle may be listed as a “breed” but check the pedigree
Reading Pedigrees

- Stud Code
- Breed Registration Number
- Sire
Breed Differences

• Unlike the dairy industry, the beef AI industry/breeds use breed EPDs and terminology, so be sure to understand the breeds you use/want to use

• Watch for words like
  o Appendix
  o Maintainer
  o Composite
  o LimFlex
  o SimAngus
  o High Percentage/Percentage

• That means crossbred!
  o Crossbred bulls infuse good outcross genetics into your herd, especially in a terminal scenario
Breed Usefulness

• Hybrid Vigor (Heterosis)
  o Breeding to take advantage of a breed’s best qualities
  o Mothering ability
    • Milk production
    • Calving ease
  o Growth
    • Carcass rib eye area
    • Rate of gain
  o Other traits
    • Polled
    • Hide color
    • Carcass merit

• We still need purebred foundation cattle
EPDs by breed

- EPD data is collected by registered breeders
  - Performance data is submitted and EPDs are generated for bulls, cows, and calves
- EPDs are calculated by universities or breed association geneticists
- Breed associations publish sire summaries
  - Available online by breed association
  - Bull studs
  - National Association of Animal Breeders (NAAB)
EPDs by breed

• Most breeds collect similar data
  o Performance Data
  o Daughter Evaluation
  o Carcass/Ultrasound Evaluation
  o Bio-Economic $Values

• Some breeds report other data
  o **Shear** - Warner-Bratzler method of measuring meat for tenderness in laboratory conditions
  o **Stayability** (STAY) is the expressed difference in probability of daughters staying in the herd at least six years. Commonly used in the Red Angus Breed
  o **Limousin $MTI** is Mainstream Terminal Index. This is the expected average profit per carcass of progeny of Limousin bulls mated to British-cross cows, with all calves placed in the feedlot and sold on a mainstream grid. It is a terminal sire index, including growth and carcass information only, since all calves are marketed and no females remain in the herd.
EPDs by breed

• **Hereford CHB$** is Certified Hereford Beef Index. This is the expected average performance of progeny of Hereford bulls mated to British-cross cows, with all progeny sold as fed cattle on a Certified Hereford Beef LLC pricing grid.

• **Simmental and SimAngus API** is All-Purpose Index. This is the expected average performance of progeny of Simmental bulls used on the entire Angus cowherd, with a portion of the daughters being retained for breeding and the remaining progeny being put on feed and sold grade and yield.

• **Simmental and SimAngus TI** is Terminal Index. This is the expected average performance of progeny of Simmental bulls mated to mature Angus cows, with all offspring placed in the feedlot and sold grade and yield. It includes growth and carcass information only, since all progeny are marketed.
Sexed Semen for Beef

- Sexed semen is available in BOTH sexes for beef cattle
  - Female codes start with 6 (example 614AR002028 Conquest)
  - Male codes start with 8 (814AN00359 In Focus)
  - Many more bulls have female sexed semen than male
Understanding Genetics

• Heritability
  o Measure of strength of the relationship between performance and genotypic values for a trait

• Phenotype
  o The visual characteristics of an animal
    • Polled
    • Hair Coat
    • Structure

• Genotype
  o The genetic makeup of an individual

• Hybrid Vigor
  o Crossbreeding
  o Utilizing the best traits of
### Heritabilities of Beef Cattle Traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability</th>
<th>Trait</th>
<th>Heritability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow fertility</td>
<td>.10</td>
<td>Feedlot gain</td>
<td>.35</td>
</tr>
<tr>
<td>Scrotal circumference</td>
<td>.50</td>
<td>Carcass grade</td>
<td>.50</td>
</tr>
<tr>
<td>Birth wt.</td>
<td>.40</td>
<td>Dressing %</td>
<td>.45</td>
</tr>
<tr>
<td>Weaning wt.</td>
<td>.30</td>
<td>Ribeye area</td>
<td>.70</td>
</tr>
<tr>
<td>Yearling wt.</td>
<td>.40</td>
<td>Fat thickness</td>
<td>.40</td>
</tr>
<tr>
<td>Mature wt.</td>
<td>.65</td>
<td>Tenderness</td>
<td>.60</td>
</tr>
<tr>
<td>Hip height</td>
<td>.80</td>
<td>Lb. retail product</td>
<td>.60</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>.40</td>
<td>% retail product</td>
<td>.30</td>
</tr>
</tbody>
</table>

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Heritability

- Structural traits are typically more heritable than performance traits
- Breeding extremes will not "fix" a trait
  - Example: Breeding a cow with bad legs and shallow foot to a bull with a posty leg and steep foot won’t produce a “happy medium”
- Improvement is achieved through smart breeding
• Dominant traits
  o Coat color
    • Black vs. red
    • **Incomplete dominance** - neither trait is dominant
      o Common in Simmental, Gelbvieh, Charolais
        • Diluter gene
  o Coat pattern
    • **Co-dominance** – both traits are dominant
      o Common in crossbred patterned cattle and Shorthorns
  o Polled vs. Horned
    • Polled always dominant over horned
      o **Incomplete dominance** - scurred
Performance and your bottom line

- Birth Weight
- Weaning Weight
- Yearling Weight

- Understanding actual vs. adjusted
Genotype and Performance

Birth weight: Adjust for Age of Dam

<table>
<thead>
<tr>
<th>Age of dam, yr.</th>
<th>Adjustment, lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>+8</td>
</tr>
<tr>
<td>3</td>
<td>+5</td>
</tr>
<tr>
<td>4</td>
<td>+2</td>
</tr>
<tr>
<td>5-10</td>
<td>0</td>
</tr>
<tr>
<td>11+</td>
<td>+3</td>
</tr>
</tbody>
</table>
## Example of Adjusted Birth Weight

<table>
<thead>
<tr>
<th>Calf</th>
<th>Actual BW, lb.</th>
<th>Age of dam, yr.</th>
<th>Adj. BW, lb.</th>
<th>Adj. BW ratio&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>78</td>
<td>2</td>
<td>86</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>85</td>
<td>6</td>
<td>85</td>
<td>99</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>4</td>
<td>78</td>
<td>91</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>11</td>
<td>93</td>
<td>108</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>86</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Ratio = (adj. BW / ave. BW) x 100

**Action:**

Don’t retain calves with an adj. BW ratio greater than 110 or a greater adj. BW than recommended by the breed (e.g. greater than 100 lb.) as replacements.

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Production Records for Commercial Beef Herds

Weaning weight: Adjust for calf age at weaning and age of dam

205-d WW = (((WW – actual BW) / wean age, days) x 205) + actual BW

<table>
<thead>
<tr>
<th>Age of dam, yr.</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>+60</td>
<td>+54</td>
</tr>
<tr>
<td>3</td>
<td>+40</td>
<td>+36</td>
</tr>
<tr>
<td>4</td>
<td>+20</td>
<td>+18</td>
</tr>
<tr>
<td>5-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11+</td>
<td>+20</td>
<td>+18</td>
</tr>
</tbody>
</table>

Adj. 205-d WW = 205-d WW + age of dam adj.

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Production Records for Commercial Beef Herds

Yearling weight: Adjust for calf age at yearling weighing and age of dam

\[
\text{Adj. 365-d YW} = \\
\frac{(\text{actual YW} - \text{actual WW})}{\text{days between weights}} \times 160 + \text{adj. 205-d WW}
\]
Selecting Sires

• What are your goals?
  o Commercial operators sell beef pounds sold to market
    • Select sires that will improve performance
  o Purebred/seedstock breeders sell for genetic progress of the breed
    • Select sires that will improve the breed

• The majority of genetic progress in a herd comes from sire selection
  o One natural service sire can produce 30-40 calves a year while an AI sire can produce hundreds of calves

• Accuracy is important!
  o What is your sample size?
  o Bulls have more accurate EPDs than cows due to number of offspring
AI Sire Summaries

What does all that stuff mean and how you can use it?
Direct calving ease is predicted percentage of unassisted calvings from heifers mated to bull compared to the heifers mated to a bull with an EPD of zero.
Predicted Performance of the sire’s calves for actual birth weight, weaning weight, and yearling weight compared to the calves sired from a bull with an EPD of zero.
Predicted percentage of unassisted calvings of this bull’s heifer daughters compared to the heifer daughters of a bull with an EPD of zero.
Predicted weaning weight of the bull’s grand-calves due to milk production of the bull’s daughters compared to daughters of a bull with an EPD of zero.
Predicted weaning weight of the bull’s grand-calves due to milk production of the bull’s daughters plus genes for WW of the calves compared of a bull with an EPD of zero (also represented as Total Maternal (TM) in some breeds)
Stayability is predicted probability that this sire’s daughters will stay in the herd until six years of age compared to a bull with an EPD of zero.
Predicted performance of the bull’s calves for marbling, ribeye area, backfat, carcass weight, and shear score compared to the calves of a bull with an EPD of zero.
All-Purpose Index. This is the expected average performance of progeny of Simmental bulls used on the entire Angus cowherd, with a portion of the daughters being retained for breeding and the remaining progeny being put on feed and sold grade and yield.
Terminal Index. This is the expected average performance of progeny of Simmental bulls mated to mature Angus cows, with all offspring placed in the feedlot and sold grade and yield. It includes growth and carcass information only, since all progeny are marketed.
Genetic Type Summary, represented differently by different AI studs. Not established like dairy (with classifiers) but by committee of AI Beef Professionals. Numbers based off progeny rather than the actual sire.
Each stud has its own way of marketing a bull to show his attributes.
Most bulls are privately owned and rarely owned 100% by the stud. Most sires spend only a few weeks at the stud for semen collection and are returned to the farm for natural service.

Owned by:
- Janssen Farms LLC, IA
- Chris Schick, IL
- Parke Livestock Enterprises, KY
Your herd bull

- Consider your options carefully
- Buy from a reputable breeder
- Your bull can have a similar pedigree and EPDs as an AI stud
You want to use AI....

- Facilities are a problem at your farm.....
  - The lack of proper handling facilities is the biggest roadblock for producers
  - You don't need fancy equipment, use what you have

- Despite what you think, cows aren’t stupid and they know bad things happen to them when they get locked up!
  - Cows pretty much think with their stomachs, use that to your advantage
You don’t need this

But it sure is nice!
As simple as it gets
Estrus Synchronization and AI

• Trial on Western Kentucky Farm
  o 351 mature cows and first-calf heifers

• Two-thirds were subjected to heat synchronization and AI \( n=251 \) and the rest were exposed to bull \( n=100 \)

• Synchronized
  o 85% calved in the first 30 days
  o 90% calving rate

• Natural Service
  o 62% calved in the first 30 days
  o 81% calving rate
Increased Revenues

<table>
<thead>
<tr>
<th>Cost of AI</th>
<th>Cost per cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td></td>
</tr>
<tr>
<td>GnRH</td>
<td>$4.00</td>
</tr>
<tr>
<td>Prostaglandin</td>
<td>$4.00</td>
</tr>
<tr>
<td>Technician</td>
<td>$5.00</td>
</tr>
<tr>
<td>Semen</td>
<td>$10.00</td>
</tr>
<tr>
<td>Labor*</td>
<td>$2.88</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$29.88</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weaning Weight</th>
<th>72.6 pounds X $80 cwt = $58.08</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Calf Crop</td>
<td>9% more calves X $80 cwt = $41.54</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>$99.62</td>
</tr>
<tr>
<td><strong>ROI</strong></td>
<td>$99.62 – 29.88 = $69.74</td>
</tr>
</tbody>
</table>

* 8.6 hours X 3 working days X 4 workers X $7.00 for 251 days
How much does that bull really cost you?

Cows/Exposed/Year

<table>
<thead>
<tr>
<th>Cows/Exposed/Year</th>
<th>$1,500</th>
<th>$1,700</th>
<th>$2,000</th>
<th>$2,300</th>
<th>$2,300</th>
<th>$3,000</th>
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</thead>
<tbody>
<tr>
<td>15</td>
<td>75.90</td>
<td>81.84</td>
<td>90.74</td>
<td>99.64</td>
<td>105.58</td>
<td>120.41</td>
</tr>
<tr>
<td>20</td>
<td>56.93</td>
<td>61.38</td>
<td>68.05</td>
<td>74.73</td>
<td>79.18</td>
<td>90.31</td>
</tr>
<tr>
<td>25</td>
<td>45.54</td>
<td>49.10</td>
<td>54.44</td>
<td>59.78</td>
<td>63.35</td>
<td>72.25</td>
</tr>
<tr>
<td>30</td>
<td>37.95</td>
<td>40.92</td>
<td>45.37</td>
<td>49.82</td>
<td>52.79</td>
<td>60.21</td>
</tr>
<tr>
<td>35</td>
<td>32.53</td>
<td>35.07</td>
<td>38.89</td>
<td>42.70</td>
<td>45.25</td>
<td>51.61</td>
</tr>
<tr>
<td>40</td>
<td>28.46</td>
<td>30.69</td>
<td>34.03</td>
<td>37.37</td>
<td>39.59</td>
<td>45.15</td>
</tr>
<tr>
<td>50</td>
<td>22.77</td>
<td>24.55</td>
<td>27.22</td>
<td>29.89</td>
<td>31.67</td>
<td></td>
</tr>
</tbody>
</table>

$Cost Per Pregnancy Based on Purchase Price of Bull and Yardage Cost

University of Kentucky
Genomics

• Every cell in the animal contains DNA which is the genetic basis of everything the animal will become
• Genomics maps the DNA for specific trait potential
  • “Marker”
• Codes are very similar between animals
  • Differences are called Single Nucleotide Polymorphism or SNP
SNPs

• Fundamental differences between animals we can use to our advantage
• Mapping SNPs is a long process and always improving
• One single trait can have over 100 SNP markers
  o For example marbling
• University research is currently mapping over 50,000 SNPs for traits such as birth weight, tenderness, etc
• Advanced research on feed efficiency
• 60-80% traits environmental
• 20-40% are “set”
Genomics

- Emerging in beef cattle
- This is a “stay tuned” topic
Factors for your farm

• What are your goals?
• What are your culling and breeding decisions?
• Are your cows costing you money?
  o What changes can be made?
• Don’t let emotions affect your decisions
• What steps can you take to improve reproduction and performance?
• All the best genetics in the world won’t make any difference unless you provide an optimal environment
Questions?

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