Bull Selection and E.P.D.

Introduction

Kari Lewis
Glacier County Extension
Buying a Bull

- Where to begin?
  - Pedigrees
  - Ratios
  - EPDs
  - Bull Catalog Scenarios
Bull – Primary Method of Genetic Change

Over 3 generations, bull accounts for 87% of genetic variation in herd
Goals for Cowherd

• Considerations
  – Herd and ranch’s strengths and weaknesses
  – Labor availability
  – Feed base
  – Environment
  – Marketing

• Opportunities for improvement
  – Calving Ease
  – Cow size
  – Pounds of calf weaned/
  – cow exposed
  – Uniformity
  – Pregnancy rates
  – Animal health
  – Longevity
Breeding Considerations
Marketing Plan Drive Breeding Plan or Breeding Plan Drive Marketing Plan?

Sell by the pound at weaning
- Maximize weaning weight
- Hybrid vigor
- Terminal cross

Retain ownership through feedlot and/or rail
- Feed efficiency
- Yearling growth
- Carcass traits

Retain replacement heifers
- Match mature frame size to match environment
- Maternal characteristics
# Breeds Summary

<table>
<thead>
<tr>
<th>Calving Ease</th>
<th>Weaning Weight</th>
<th>Yearling Weight</th>
<th>Milk</th>
<th>Marbling (Quality Grade)</th>
<th>Ribeye area (Muscling)</th>
<th>Leanness</th>
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</thead>
<tbody>
<tr>
<td>Angus</td>
<td>Charolais</td>
<td>Charolais</td>
<td>Red Angus</td>
<td>Angus</td>
<td>Charolais</td>
<td>Charolais</td>
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<tr>
<td>Red Angus</td>
<td>Simmental</td>
<td>Simmental</td>
<td>Gelbvieh</td>
<td>South Devon</td>
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<td>Simmental</td>
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<tr>
<td>Gelbvieh</td>
<td>Angus</td>
<td></td>
<td>Red Angus</td>
<td>Gelbvieh</td>
<td>Gelbvieh</td>
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<tr>
<td>Limousin</td>
<td></td>
<td></td>
<td></td>
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<td>Salers</td>
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</table>

MARC data
## Management & Genetics ➔ Result

<table>
<thead>
<tr>
<th>Trait</th>
<th>Percentage heritable</th>
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<tbody>
<tr>
<td><strong>LOW HERITABILITY</strong></td>
<td></td>
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<tr>
<td>Conception rate</td>
<td>0-10</td>
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<tr>
<td><strong>MODERATE HERITABILITY</strong></td>
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<tr>
<td>Milking ability</td>
<td>15-25</td>
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<tr>
<td>Calving ease</td>
<td>10-40</td>
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<tr>
<td>Birth weight</td>
<td>35-40</td>
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<tr>
<td>Weaning weight</td>
<td>25-30</td>
</tr>
<tr>
<td>Postweaning gain &amp; feed conversion</td>
<td>30-40</td>
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<tr>
<td><strong>MODERATE TO HIGH HERITABILITY</strong></td>
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</tr>
<tr>
<td>Scrotal circumference</td>
<td>40-45</td>
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<tr>
<td>Postweaning ADG</td>
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<tr>
<td>Yearling weight</td>
<td>50-55</td>
</tr>
<tr>
<td>Ribeye area</td>
<td>60-65</td>
</tr>
<tr>
<td>Tenderness score</td>
<td>50-60</td>
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</table>
Selection Measurements

• Pedigree
• Visual observation
• Objective Measurements
  – Expected Progeny Differences (E.P.D.s)
    • 7 to 9 times more effective in generating response to selection than actual measurements
  – Adjusted weights
  – Ratios
  – Selection Indexes

• Be mindful of correlated traits
## Positively Correlated Traits

<table>
<thead>
<tr>
<th>Increase....</th>
<th>→ Increase</th>
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<tr>
<td>Birth weight</td>
<td>Growth</td>
</tr>
<tr>
<td>Growth</td>
<td>Mature Size</td>
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<tr>
<td>Mature Size</td>
<td>Maintenance Energy Requirements</td>
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<tr>
<td>Marbling</td>
<td>Fleshing Ability</td>
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<tr>
<td>Early Sexual Maturity</td>
<td>Fertility</td>
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<tr>
<td>(Scrotal size)</td>
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Negatively Correlated Traits

<table>
<thead>
<tr>
<th>Increase....</th>
<th>→ Decrease</th>
</tr>
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<tbody>
<tr>
<td>Growth</td>
<td>Calving Ease</td>
</tr>
<tr>
<td>Marbling</td>
<td>Yield</td>
</tr>
<tr>
<td>Growth</td>
<td>Milk</td>
</tr>
<tr>
<td><strong>CED</strong></td>
<td><strong>BW</strong></td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>+9</td>
<td>+1.4</td>
</tr>
</tbody>
</table>

- **CE**: 34.16
- **Marb**: .17
- **RE**: .58
- **Fat**: .047
- **SG**: 13.98
- **SB**: 71.38

- LOT 30 recorded 92 BW with 103 NR and 106 YR
- Ranks in the top 20% for WW EPD and top 15% for YW EPD
- Outstanding cow family where the first three dams record 4 NR 103, 4 NR 110 and 5 NR 108

**AVOID SINGLE TRAIT SELECTION**
• EPDs
  • Allow animals *within a breed* to be compared for their genetic potential to produce a specific trait
  • Statistically calculated from performance data of:
    – Individual
    – Dam, granddams, etc.
    – Sire, grandsires, etc.
    – Siblings, Progeny
    – 9 times more accurate than selection between herds based on adjusted weights and ratios
• Genomic Enhanced EPDs
  – Do not make one bull better than another, makes EPDs more accurate
Reading an E.P.D.

**E.P.D.’s** - Measured in units of traits – pounds at weaning, yearlings, etc.

Lot 30 vs Lot 32 - Lot 30 – 57 WW  Lot 32 – 47 WW  
Expect Lot 30’s calves to be on average, under similar conditions, 10 pounds heavier at weaning

10 pound difference/calf x 25 calves/year x 4 years x $2/lb = $2,000 advantage to Lot 30
Accuracy Explained – Who do you want on your team?

Yearling Angus bull

Mytty In Focus
Stevenson Rockmount RX933  Reg: AAA +16647203  Bull
Birth Date: 03/24/2010 Tattoo: RX933
Parentage: Stevenson Rockmount RX933
Breeder: 539471 - Stevenson Angus Ranch, Hobson MT
Owner(s): 539471 - Stevenson Angus Ranch, Hobson MT
1058214 - ABS Global Inc, De Forest WI
A R New Trend  AAA #9956634
Boyd New Day 8005  AAA #13506780
S V F Forever Lady 57D  AAA 12133159
MCC Daybreak  AAA #14777016
S A F Focus of E R  AAA #12618076
MCC Miss Focus 134  AAA #14107277
M C C Miss Chief 519  AAA +12492816
Sitz Traveler 8130  AAA #11367940
Sitz Alliance 6595  AAA #12347670
Sitz Barbaramere Jet 2598 AAA #11067488
FSHK Pride 180  AAA #13868609
FSHK Pride 725  AAA +12879957
FSHK Pride 430  AAA 12208506
# Pathfinder + Embryo Transplant

WW EPD: +61, Accuracy .81
Number of progeny = 476

0.99

E.P.D. Accuracy Range (and Risk) 0.01

Stevenson Rockmount 50491  Reg: AAA 18285530  Bull
Birth Date: 02/27/2010 Tattoo: 50491
Breeder: 159963 - Kani Lynn Gillespie, Cut Bank MT
Owner(s): 539471 - Stevenson Angus Ranch, Hobson MT

Boyd New Day 8005  AAA #1350780
MCC Miss Focus 134  AAA #14107277
Sitz Alliance 6595  AAA #12310707
M C C Miss Chief 519  AAA #13668600
FSHK Pride 725  AAA #12879797
Boyd On Target 1063  AAA #13828202
Stevenson Moneymaker R 185  AAA #15063238
Stevenson Clove Pride L083  AAA #13801184

KG Clove Pride Money 154Y  AAA #17112311
Stevenson CE Deluxe 1914  AAA #14659834
KG Clove Pride’s Deluxe 800U  AAA #16342950
KG Clove Pride’s Focus 907S  AAA #15778834
# Pathfinder + Embryo Transplant

WW EPD: +69, Accuracy .28
Number of progeny = 0

0.99
Adjusted Measurements versus Actual Measurements

• Allow for comparisons at common age, and account for age of dam, birth weight, etc.

• Used for
  – Weaning Weight
  – Yearling Weight
  – Ultrasound measurements

• When to use actual measurements
  – Scrotal circumference
Ratios

• Indicate performance within a contemporary group
  – Contemporary group
    • Set of animals that have had an equal opportunity to perform:
      – Same sex, management, environmental conditions and feed resources.
    • Best way to account for environmental effects
      → Remaining differences among animals may be attributed to genetics

• Example
  – Herd average weaning weight = 600 pound
    • Calf 501 weighs 700 pounds = \((700 / 600) \times 100 = 117\)
    • Calf 518 weighs 550 pounds = \(550/600 \times 100 = 92\)

• Footnotes
  • Dam records 9 @ 98 BR, 8 @ 102 WR, 6 @ 98 YR
    – Below average at birth & yearling
    – Above average at weaning
Indexes

• Number that combines performance values, such as ratios or EPD percentile ranks into a single value for each animal.
  – May weight economic importance of trait

• Example - Angus (in $/head)
  – Expected average difference in future progeny performance for:
    • Feedlot Value ($F) - Post weaning merit
    • Grid Value ($G) - Carcass grid merit
    • Beef Value ($B) - Postweaning and carcass value compared to progeny of other sires.

  – Cow Energy Value ($EN), expressed in dollar savings per cow per year, assesses differences in cow energy requirements as an expected dollar savings difference in daughters of sires.

  – Weaned Calf Value ($W), expressed in dollars per head, is the expected average difference in future progeny performance for preweaning merit. $W includes both revenue and cost adjustments associated with differences in birth weight, weaning direct growth, maternal milk and mature cow size.
Bull Buying Steps

• Choose a Breeder
  – Environment similar or harsher than yours?
  – Reputation & integrity to performance testing?
  – Opportunities for calf marketing?

• Before the sale
  – Do your homework
    • How many and what type of bulls do you need?
    • Review catalog for EPDs and pedigrees, sale pictures, videos, etc.
    • Mark 1) No’s 2) Yes’s 3) Maybes
    • Look for half-brothers for increased uniformity
  – Set your budget

• At the sale
  – Review bulls in person
    • Structural correctness, soundness, muscle
  – Ask for data sheets / BSE evaluation
  – Stick to budget

• After the sale
  – Make sure registration papers are transferred

KEEP CALM AND DO YOUR HOMEWORK
Summary

• Be strategic in choosing breeds
  – Match market and environment
  – Consider benefits of heterosis

• Use both objective and subjective measurements
  – Visual evaluation
    • Structural soundness, movement
    • Frame size, muscling
    • Fleshing ability, depth of rib
  – E.P.D.s
    • 9 times more accurate than performance measures alone
Questions

Bull Catalog Scenario
Work in groups to compare bulls given scenarios

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County Extension

kari.lewis@montana.edu
873-2239
<table>
<thead>
<tr>
<th>Breed</th>
<th>Birth Wt.</th>
<th>Weaning Wt.</th>
<th>Yearling Wt.</th>
<th>Maternal Milk</th>
<th>Marbling Score&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Ribeye Area</th>
<th>Fat Thickness</th>
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</thead>
<tbody>
<tr>
<td>Angus</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
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<tr>
<td>Hereford</td>
<td>2.7</td>
<td>-4.2</td>
<td>-23.6</td>
<td>-17.7</td>
<td>-0.31</td>
<td>-0.08</td>
<td>-0.051</td>
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<tr>
<td>Red Angus</td>
<td>4.1</td>
<td>-22.1</td>
<td>-29.9</td>
<td>1.5</td>
<td>-0.34</td>
<td>-0.02</td>
<td>-0.027</td>
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<tr>
<td>Shorthorn</td>
<td>6.2</td>
<td>9.9</td>
<td>27.8</td>
<td>21.7</td>
<td>-0.19</td>
<td>0.23</td>
<td>-0.135</td>
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<tr>
<td>South Devon</td>
<td>3.3</td>
<td>-5.2</td>
<td>-24.4</td>
<td>1.3</td>
<td>-0.11</td>
<td>0.23</td>
<td>-0.135</td>
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<tr>
<td>Beefmaster</td>
<td>6.4</td>
<td>37.2</td>
<td>33.3</td>
<td>6.4</td>
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<td></td>
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<td>Brahman</td>
<td>11.0</td>
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<td>10.1</td>
<td>23.9</td>
<td>-0.85</td>
<td>-0.08</td>
<td>-0.150</td>
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<td>15.4</td>
<td>5.2</td>
<td>2.1</td>
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<td>Santa Gertrudis</td>
<td>7.0</td>
<td>40.6</td>
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<td>-0.67</td>
<td>-0.09</td>
<td>-0.103</td>
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<td>-47.7</td>
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<td>Charolais</td>
<td>8.8</td>
<td>37.9</td>
<td>40.9</td>
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<td>1.04</td>
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<td>Gelbvieh</td>
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<td>-19.4</td>
<td>-24.9</td>
<td>3.2</td>
<td>-0.35</td>
<td>0.67</td>
<td>-0.131</td>
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<td>Limousin</td>
<td>3.8</td>
<td>-0.8</td>
<td>-38.7</td>
<td>-7.0</td>
<td>-0.71</td>
<td>1.08</td>
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<tr>
<td>Maine-Anjou</td>
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<td>-41.5</td>
<td>-7.1</td>
<td>-0.72</td>
<td>0.93</td>
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<td>-0.10</td>
<td>0.82</td>
<td>-0.206</td>
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<td>Simmental</td>
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<td>-6.4</td>
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<td>-0.41</td>
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<td>Tarentaise</td>
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<td>30.7</td>
<td>10.3</td>
<td>25.1</td>
<td></td>
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</tr>
</tbody>
</table>

<sup>a</sup>Marbling score units: 4.00 = S<sup>100</sup>, 5.00 = S<sup>00</sup>
# Accuracy

Approximate number of progeny needed to reach accuracy levels (true R and the BIF standard for three heritabilities ($h^2$))

<table>
<thead>
<tr>
<th>R</th>
<th>BIF</th>
<th>$h^2$ (0.1)</th>
<th>$h^2$ (0.3)</th>
<th>$h^2$ (0.5)</th>
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<td>0.1</td>
<td>0.01</td>
<td>1</td>
<td>1</td>
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<tr>
<td>0.2</td>
<td>0.02</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.3</td>
<td>0.05</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>0.4</td>
<td>0.08</td>
<td>8</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>0.5</td>
<td>0.13</td>
<td>13</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>0.6</td>
<td>0.2</td>
<td>22</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>0.7</td>
<td>0.29</td>
<td>38</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>0.8</td>
<td>0.4</td>
<td>70</td>
<td>22</td>
<td>13</td>
</tr>
<tr>
<td>0.9</td>
<td>0.56</td>
<td>167</td>
<td>53</td>
<td>30</td>
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<tr>
<td>0.999</td>
<td>0.99</td>
<td>3,800</td>
<td>1,225</td>
<td>700</td>
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</table>
Which calf is better?

501
• 750 pound weaning weight on Oct. 15
• DOB – February 20, 2014
• Dam age - 7

570
• 600 pound weaning weight on Oct. 15
• DOB – April 1, 2014
• Dam age - 2
**Adjusted Weaning Weight**

Adj. 205 day WW = (WW-birth weight)/weaning age in days X 205 + birth weight + age of dam adj. factor

*For Angus cattle*

If age of dam (at calf 205 date) is

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>thru 2 yrs. 243 days</td>
<td>68</td>
</tr>
<tr>
<td>2 yrs. 244 days thru 3 yrs. 91 days</td>
<td>67</td>
</tr>
<tr>
<td>3 yrs. 92 days thru 3 yrs. 273 days</td>
<td>37</td>
</tr>
<tr>
<td>3 yrs. 274 days thru 4 yrs. 91 days</td>
<td>29</td>
</tr>
<tr>
<td>4 yrs. 92 days thru 5 yrs. 91 days</td>
<td>15</td>
</tr>
<tr>
<td>5 yrs. 92 days thru 10 yrs. 91 days</td>
<td>0</td>
</tr>
<tr>
<td>10 yrs. 92 days and older</td>
<td>22</td>
</tr>
</tbody>
</table>
205 day adjusted weaning weight

• Calf 501
  \[
  \frac{(750 \text{ WW} - 90 \text{ BW})}{237 \text{ days of age}} \times 205 \text{ days of age} + 90 \text{ BW} + 0 \text{ dam adjustment} = 661 \text{ AWW}
  \]

• Calf 570
  \[
  \frac{(600 \text{ WW} - 80 \text{ BW})}{197 \text{ days of age}} \times 205 \text{ days of age} + 80 \text{ BW} + 68 \text{ lb. dam adjustment} = 689 \text{ AWW}
  \]
Terminal Indexes

Angus (in $/head)
- **Feedlot Value (\$F)** - Expected average difference in future progeny performance for postweaning merit compared to progeny of other sires.
- **Grid Value (\$G)** - Expected average difference in future progeny performance for carcass grid merit compared to progeny of other sires.
- **Beef Value (\$B)** - Expected average difference in future progeny performance for postweaning and carcass value compared to progeny of other sires.

Simmental
- **TI – Terminal Index** - For evaluating sires’ economic merit in situations where they are bred to mature Angus cows and all offspring are placed in the feedlot and sold grade and yield.

Hereford - **Certified Hereford Beef Index (CHB\$)**
- Hereford bulls are used on British-cross cows and all offspring are sold as fed cattle on a CHB pricing grid.

Limousin – **Mainstream Terminal Index (\$MTI)**
- 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.

Gelbvieh
- **Carcass Value (CV)** - expected average carcass value of future progeny when sold on a grid. It incorporates carcass weight, yield grade, and quality grade information.
- **Feedlot Merit (FM)** - This is the expected average of future progeny for postweaning feedlot performance.

Charolais – **Terminal Sire Profitability Index**
- Utilize economic and management descriptions of their ranching operation, along with expected progeny differences (EPD) on available Charolais bulls, to assist in identifying the most profitable sires for their unique operation.
Maternal Indexes

Angus - $W, $EN

- **Cow Energy Value ($EN)**, expressed in dollar savings per cow per year, assesses differences in cow energy requirements as an expected dollar savings difference in daughters of sires.
- **Weaned Calf Value ($W)**, an index value expressed in dollars per head, is the expected average difference in future progeny performance for preweaning merit. $W includes both revenue and cost adjustments associated with differences in birth weight, weaning direct growth, maternal milk and mature cow size.

Simmental - API

- **API** - Evaluates sires being used on the entire cowherd (bred to both Angus first-calf heifers and mature cows) with a portion of their daughters being retained for breeding and the steers and remaining heifers being put on feed and sold grade and yield. All EPDs, with the exception of tenderness, are taken into consideration in this index.

Hereford – Baldy Maternal Index (BMI$)

- **BMI$** - This is an index to maximize profit for commercial cow-calf producers who use Hereford bulls in rotational crossbreeding programs on Angus-based cows. Retained ownership of calves through the feedlot phase of production is maintained and the cattle are to be marketed on a CHB pricing grid.
Heterosis or Hybrid Vigor

• Superiority of crossbred as compared to average of straightbred parents
  – % Heterosis = \[
  \frac{(\text{crossbred average} - \text{straightbred average})}{\text{straightbred average}} \times 100
  \]
  – Example
    • Breed A – 470 lb. WW    Breed B – 530 lb. WW    Average = 500
    • A and B crossed → 520 lb. WW = 4% increase (20 pounds) due to heterosis

• More divergent parental lines = more heterosis
• NOT available from within breed matings
• Lowly heritable traits show most improvement from heterosis
  – Maternal ability, reproduction, health, cow longevity, overall cow productivity
• Highly heritable traits show little or no improvement
  – Mature weight, carcass quality
## Advantage of the Crossbred Calf

### Individual Heterosis: Advantage of the Crossbred Calf

<table>
<thead>
<tr>
<th>Trait</th>
<th>Observed Improvement</th>
<th>% Heterosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving rate, %</td>
<td>3.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Survival to weaning, %</td>
<td>1.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Birth weight, lb.</td>
<td>1.7</td>
<td>2.4</td>
</tr>
<tr>
<td>Weaning weight, lb.</td>
<td>16.3</td>
<td>3.9</td>
</tr>
<tr>
<td>ADG, lb./d</td>
<td>.08</td>
<td>2.6</td>
</tr>
<tr>
<td>Yearling weight, lb.</td>
<td>29.1</td>
<td>3.8</td>
</tr>
</tbody>
</table>

<sup>1</sup>Adapted from Cundiff and Gregory, 1999.
Advantage of the Crossbred Cow

Maternal Heterosis: Advantage of the Crossbred Cow

<table>
<thead>
<tr>
<th>Trait</th>
<th>Observed Improvement</th>
<th>% Heterosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving rate, %</td>
<td>3.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Survival to weaning, %</td>
<td>.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Birth weight, lb.</td>
<td>1.6</td>
<td>1.8</td>
</tr>
<tr>
<td>Weaning weight, lb.</td>
<td>18.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Longevity, yr.</td>
<td>1.36</td>
<td>16.2</td>
</tr>
</tbody>
</table>

**Cow Lifetime Production:**

<table>
<thead>
<tr>
<th></th>
<th>Observed Improvement</th>
<th>% Heterosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Calves</td>
<td>.97</td>
<td>17.0</td>
</tr>
<tr>
<td>Cumulative Wean. Wt., lb.</td>
<td></td>
<td>25.3</td>
</tr>
</tbody>
</table>

1. Adapted from Cundiff and Gregory, 1999.