Start with the **End in sight.**

In business to produce **Beef**

- **Breed Characteristics: An Overview & Crossbreeding Programs**
  - Robert S. Wells, Ph.D., PAS
  - Livestock Consultant

- **Perfect Breed??**

- **Goal**
  - Draw a target

- **2 Species of Cattle**
  - **Bos taurus**
    - British breeds (Angus, Hereford)
    - Continental breeds (Charolais, Simmental, Limousin, Gelbvieh, etc.)
  - **Bos indicus** (Zebu, humped cattle)
    - Brahman
    - Nelore
    - Gir
    - Guzerat, etc.

- **What Breeds Should you consider?**
  - Types
  - Heterosis
  - Complementarity effects
  - Marketing goals

- **What is the Right Cow Type?**
- **What is the Right Bull?**
- **Where to buy cattle?**
Pure Breeds

Angus (British)
Reputation: Carcass and Maternal, Growth???

Red Angus
Reputation: Carcass and Maternal

Hereford (British)
Reputation: Maternal, easy fleshing, longevity

Shorthorn (British)
Reputation: Maternal and Carcass

Red Poll (British)
Milk, Carcass, Maternal
Simmental (Continental) Reputation: Maternal and growth

Gelbvieh (Continental) Reputation: Maternal and growth

Limousin (Continental) Reputation: Growth

Charolais (Continental) Reputation: Growth
American Brahman (*Bos indicus*)
Maternal, lean, hardiness, insect, disease & heat tolerance

Longhorn
Reputation: Hardiness, Lean beef

Corriente
Reputation: Hardiness, roping stock

Waygu
Carcass Quality, Light birthweights

Akaushi
Marbling, fertility

Composites and Cross Breeds
Santa Gertrudis

Beefmaster
Maternal Heterosis, Growth,

Brangus
Carcass, Growth, Maternal, Heat Tolerance

Balancer

LimFlex

Simbrah
Black Baldy

F1 Tiger Stripe

Photo credit: https://southtexascattlemarketing.com/cattle-

Super Baldy

Commercial Angus

Ultra Black

Crossbreeding

Hybrid vigor = Heterosis
Hybrid Vigor

The increase/decrease in a particular trait when compared to the average of that trait for each parent.

\[
(2 + 3)/2 = 3.5
\]

Heterosis = Hybrid Vigor

Maximum Heterosis

F1 x F1 Cross
Parents are from 4 unrelated breeds

Maternal Hybrid Vigor

Maternal hybrid vigor increases calving rate (6%), weaning rate (8%), weaning weight (6%), and birth weight (2%).

Levels of Heterosis

<table>
<thead>
<tr>
<th>Trait</th>
<th>Individual Heterosis, %</th>
<th>Maternal Heterosis, %</th>
<th>Total Heterosis, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaning rate</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Age @ Puberty</td>
<td>-3</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Birth weight</td>
<td>-4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Weaning weight</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Yearling weight</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Cow Condition</td>
<td>-4</td>
<td>-4</td>
<td>-4</td>
</tr>
<tr>
<td>Carcass weight</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>USDA quality grade</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Rib eye area</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Feed conversion, (F:G)</td>
<td>-2</td>
<td>-2</td>
<td>-4</td>
</tr>
<tr>
<td>Days on feed</td>
<td>-4</td>
<td>-4</td>
<td>-8</td>
</tr>
<tr>
<td>Calv WW/exposed cow</td>
<td>18</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Cow longevity</td>
<td>38</td>
<td>38</td>
<td>76</td>
</tr>
<tr>
<td>Cow lifetime productivity</td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>
Economics of Heterosis

• What does it cost?
• It depends.
• Cow size
  – About 6% increase cost/100 lbs BW
• Milk production
  – ~1.5% increase in energy requirement/lb of milk
  – ~2.7% increase in CP requirement/lb of milk
• Make sure she fits your environment
  – Stocking rate
  – Supplemental feed

Economics of Heterosis – Cow Breed A x Terminal bull

Original Scenario:
• 100 cows; Cow Breed A x Bull Breed A
• 525 lb weaning weight
• Average weaning rate 82%
• 43,050 lbs marketed
  Switch to
• Cow Breed A x Bull Breed B
• Individual heterosis (+5%)
  – ~51 lb weaning weight F1 calf
  – 45,203 lbs marketed
  – +2152 lbs/year = +$5,725.65/year

Capturing Heterosis

<table>
<thead>
<tr>
<th>System</th>
<th>% Max Heterosis</th>
<th>% Increase in Calf Wt./Cow Exposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure breeds</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2 breed rotation</td>
<td>67</td>
<td>16</td>
</tr>
<tr>
<td>3 breed rotation</td>
<td>86</td>
<td>20</td>
</tr>
<tr>
<td>2 breed composite</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>3 breed composite</td>
<td>63</td>
<td>15</td>
</tr>
<tr>
<td>Term. Sire/purch. F1 female</td>
<td>100</td>
<td>23-28</td>
</tr>
</tbody>
</table>

Economics of Heterosis - F1 cow x Terminal bull

Original Scenario:
• Cow Breed A x Bull Breed A
• 525 lb weaned calf
• Average weaning rate 82%
• 43,050 lbs marketed
  Switch to
• F1 cow X (Terminal Bull Breed C)
• +WW total heterosis +25% (↑ Weaning rate [25%] & weight[15%])

Economics of Heterosis - F1 cow x Terminal bull

Original Scenario:
• Cow Breed A x Bull Breed A
• 525 lb weaned calf
• Average weaning rate 82%
• 43,050 lbs marketed
  Switch to
• F1 cow X (Terminal Bull Breed C)
• +WW total heterosis +25% (↑ Weaning rate [25%] & weight[15%])
• 656 lb calf
  = +131 lbs
• 59,040 lbs
• +15,990 lbs = +$40,295

Economics of Heterosis

• +$5,725.65 increased weaning weight (Bull Affect)
  – Breed A cow x terminal bull
  – (½ Breed A x ½ Terminal bull breed calf)
• +$40,295 increase in weaning rate & weight
  – F1 cow x terminal bull breed
  – (½ F1 x Terminal bull breed calf)
• Keep after weaning and $$$ increase as you can take advantage of additional heterotic effects of improved growth rates
Heritability vs. Heterosis

<table>
<thead>
<tr>
<th>Traits</th>
<th>$h^2$</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproductive</td>
<td>&lt; .2</td>
<td>Low</td>
</tr>
<tr>
<td>Growth</td>
<td>.2-.4</td>
<td>Moderate</td>
</tr>
<tr>
<td>Carcass</td>
<td>.4-.6</td>
<td>High</td>
</tr>
</tbody>
</table>

Few traits have $h^2 > .6$

Heritability Estimates

<table>
<thead>
<tr>
<th>Trait</th>
<th>$h^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>0.85</td>
</tr>
<tr>
<td>REA</td>
<td>0.70</td>
</tr>
<tr>
<td>Tenderness</td>
<td>0.60</td>
</tr>
<tr>
<td>Birth weight</td>
<td>0.45</td>
</tr>
<tr>
<td>Feedlot gain</td>
<td>0.34</td>
</tr>
<tr>
<td>Weaning weight</td>
<td>0.24</td>
</tr>
<tr>
<td>Fertility</td>
<td>0.10</td>
</tr>
<tr>
<td>Calving interval</td>
<td>0.08</td>
</tr>
<tr>
<td>Conception rate</td>
<td>0.07</td>
</tr>
</tbody>
</table>

The Ideal Cow

- Early puberty
- Never misses a breeding season (1 calf/365 d)
- Calves unassisted
- Doesn’t require a lot of supplemental feed
- Easy fleshing
- Converts forage to lbs of raised calf
- Stays in the herd a long time
- Good temperament
- Good muscling and carcass characteristics
- Adequate but not too much milk
- Looks good doing all the above

Parting Thoughts

- Must be able to manage for the benefits
- Heterosis will not make up for poor animal husbandry/management
- Heterosis will not make up for poor bull selection