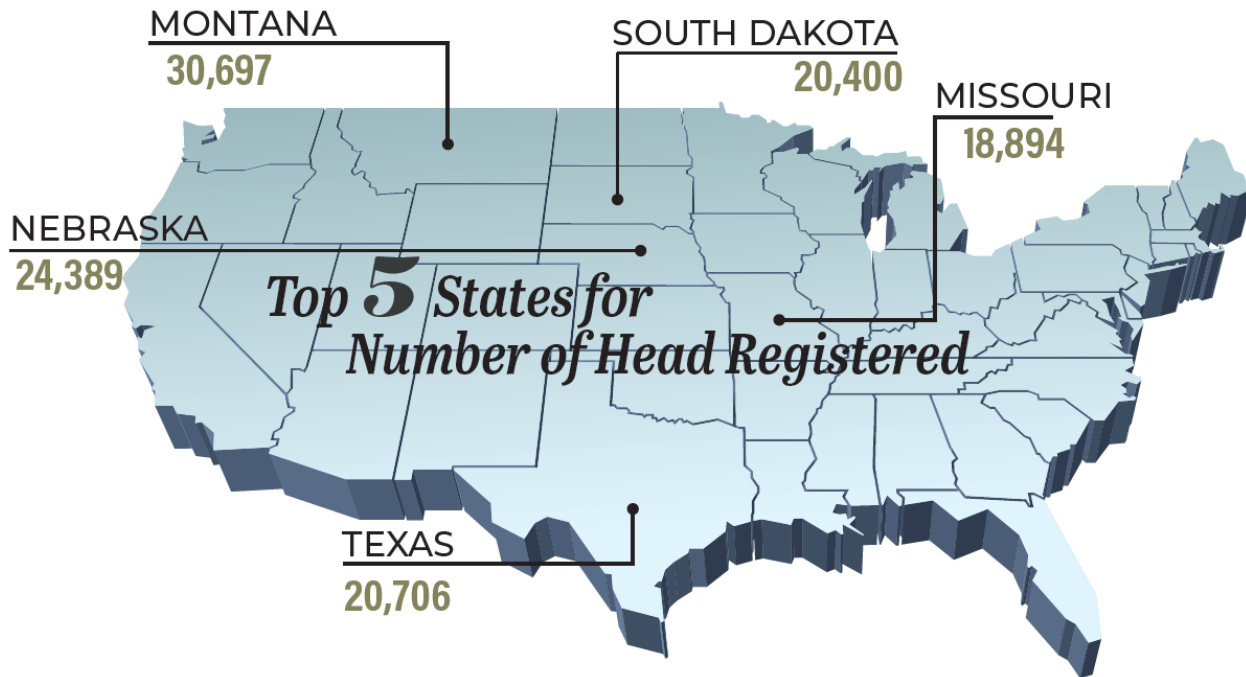




# The USA Angus Experience: Adopting New Technologies for Precision Livestock Farming


Oct 22, 2019 – Beef School – Bulawayo, Zimbabwe

**Stephen Miller, Genetic Research Director**

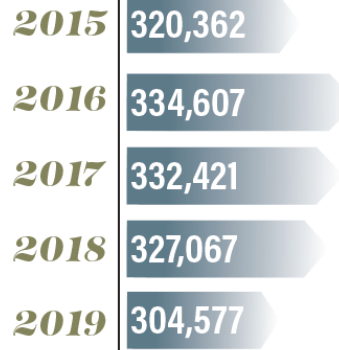


Angus is  
~70% of  
America's  
Cowherd

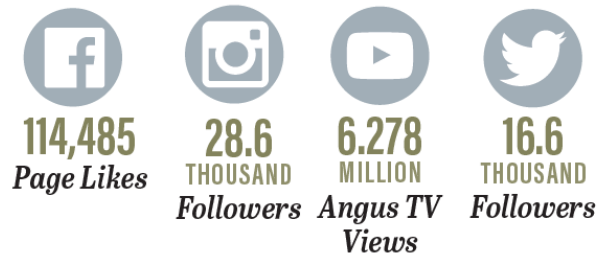
**1.250**  
**BILLION POUNDS**  
Certified Angus Beef® sold  
+2.9%  
FROM  
2018



**Total Registrations**



**53,786** American Angus Association Mobile App Users



REGISTERED **ANGUS** TRANSFERS

**69,369** *cows*

**74,384** *bulls*

GENOMIC TESTS  
SUBMITTED

**159,841**

1.6% ↓ FROM 2018

TOTAL  
GENOTYPED  
ANIMALS

**697,901**

28.6% ↑ FROM 2018

# Precision farming is not just for crops



pre·ci·sion

/prə'si:ZHən/

*noun*

the quality, condition, or fact of being exact and accurate.  
"the deal was planned and executed with military precision"

**Similar:**

exactness

exactitude

accuracy

accurateness

correctness



- marked by or adapted for accuracy and exactness.  
modifier noun: precision  
"a precision instrument"



# Precision Livestock Farming from an Animal Breeding Perspective

$$\begin{bmatrix} X' \hat{R}^{-1} X & X' \hat{R}^{-1} Z \\ Z' \hat{R}^{-1} X & Z' \hat{R}^{-1} Z + \hat{G}^{-1} \end{bmatrix} \begin{bmatrix} \hat{\beta} \\ \hat{u} \end{bmatrix} = \begin{bmatrix} X' \hat{R}^{-1} Y \\ Z' \hat{R}^{-1} Y \end{bmatrix}$$

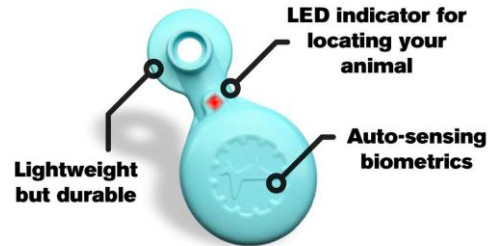


Give me a measurement, if it is heritable, I can change the cattle .... And that is a good thing.

# “Wearables” for Cows have arrived



## DoggTag™



Simple, Swappable, 2-year Tag



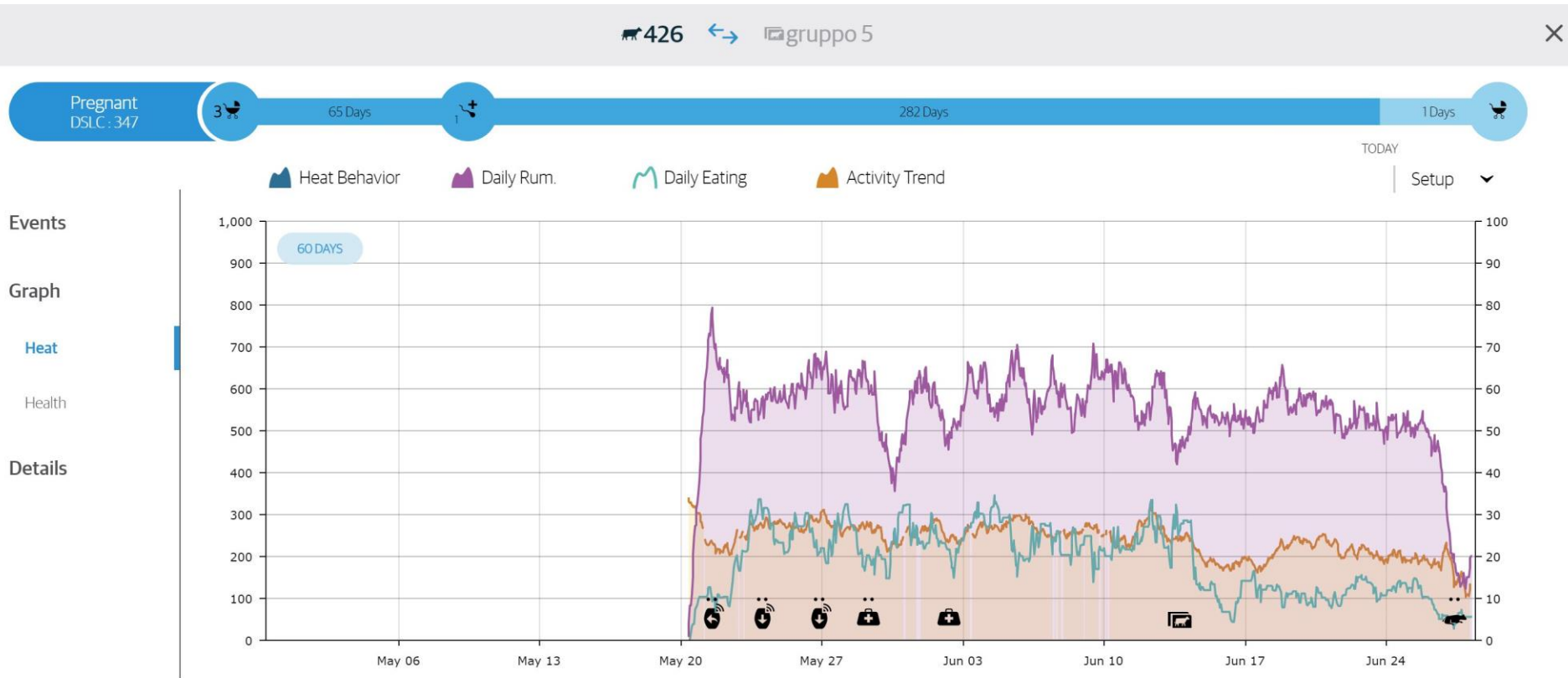
CERES TAG



**ANGUS**  
THE BUSINESS BREED



# What value do these technologies have for breeding?

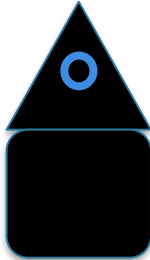




Location

Activity

Respiration



Rumination

Wearable

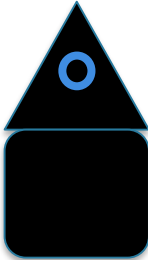
Eating

Location

Grazing Behaviour

Activity

Respiration



Wearable

Rumination

Eating

Location

Grazing Behaviour

Activity

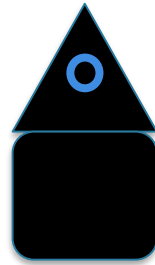
Temperament

Estrous

Calving

Health

Respiration



Wearable

Rumination

Eating

Location

Grazing Behaviour

Activity

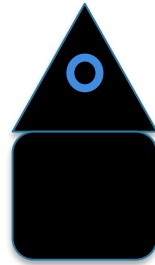
Temperament

Estrous

Calving

Health

Respiration



Wearable

Rumination

Efficiency

Health

Eating

Location

Grazing Behaviour

Activity

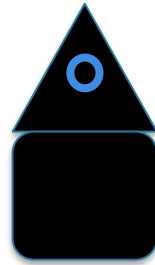
Temperament

Estrous

Calving

Health

Respiration



Wearable

Rumination

Efficiency

Health

Eating

Efficiency

## Location

Grazing Behaviour

## Activity

Temperament

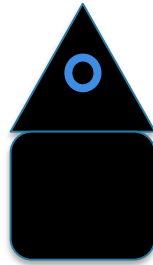
Estrous

Calving

Health

## Respiration

Health



Wearable

## Rumination

Efficiency

Health

## Eating

Efficiency

## Location

Grazing Behaviour

## Activity

Temperament

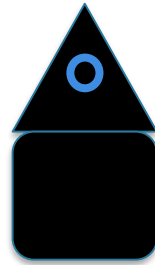
Estrous

Calving

Health

## Respiration

Health



Wearable

## Rumination

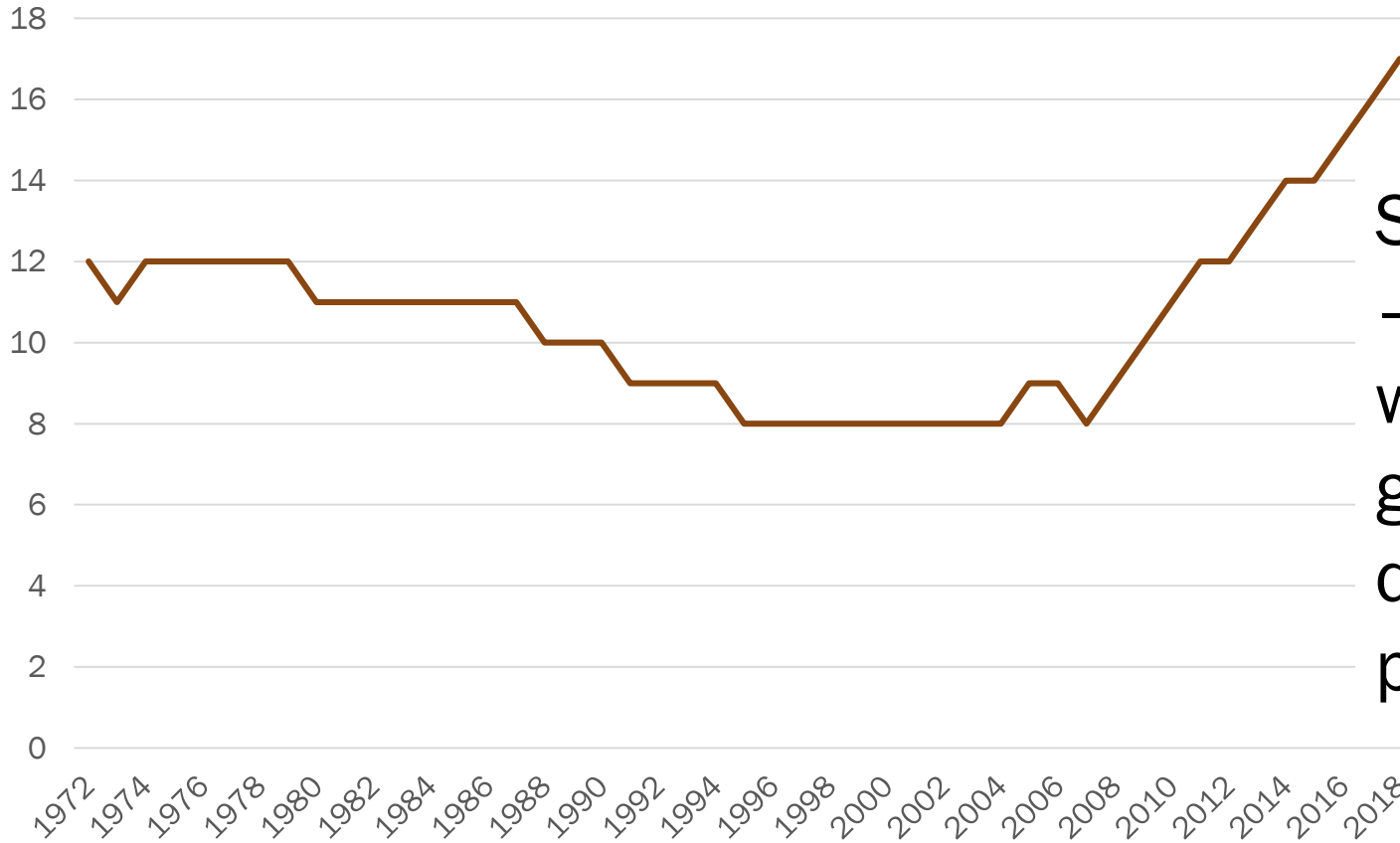
Efficiency

Health

## Eating

Efficiency

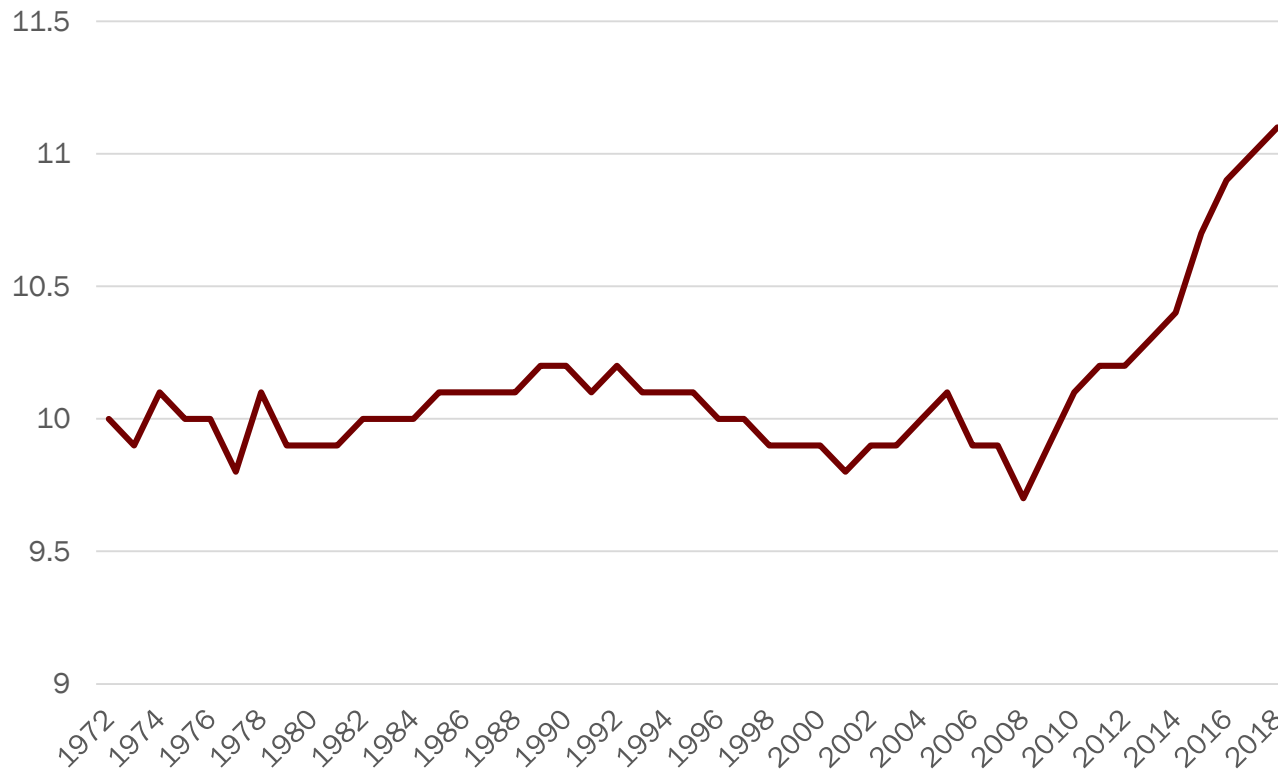
# Docility is Improving



Simple Score  
– What  
would more  
granular  
data  
provide?



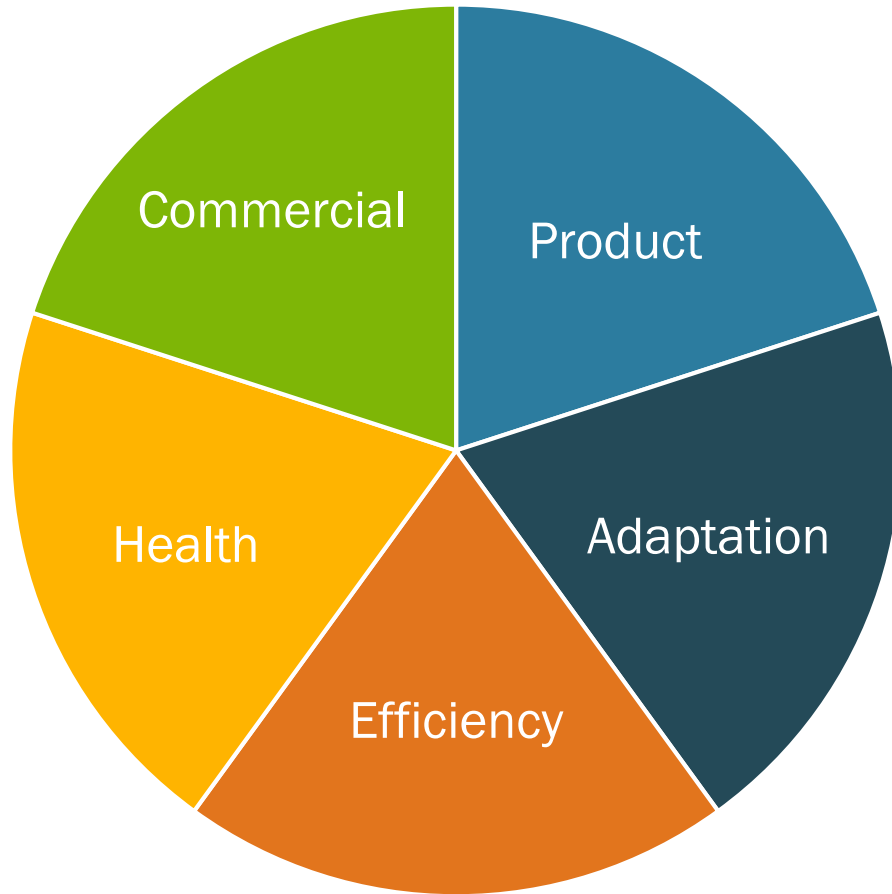
# Heifer Pregnancy also Improving



Wearables could add

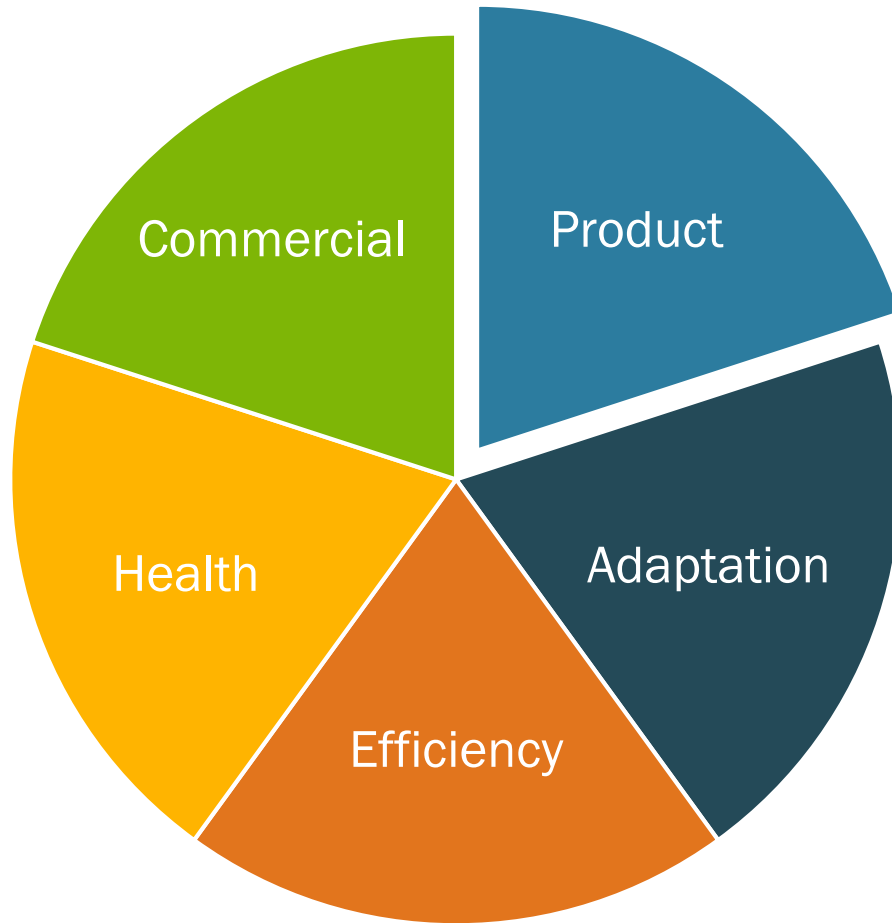
Age at Puberty  
Conception  
Lost embryos

# Increasing Precision



Technology is enabling improvement in a number of areas

# Increasing Precision



Technology is enabling improvement in a number of areas



**17,000+**

licensed packers, processors,  
distributors, retailers and restaurants in

**50 COUNTRIES**

**NON-PROFIT**

arm of the American Angus Association



**OVER 1 BILLION**

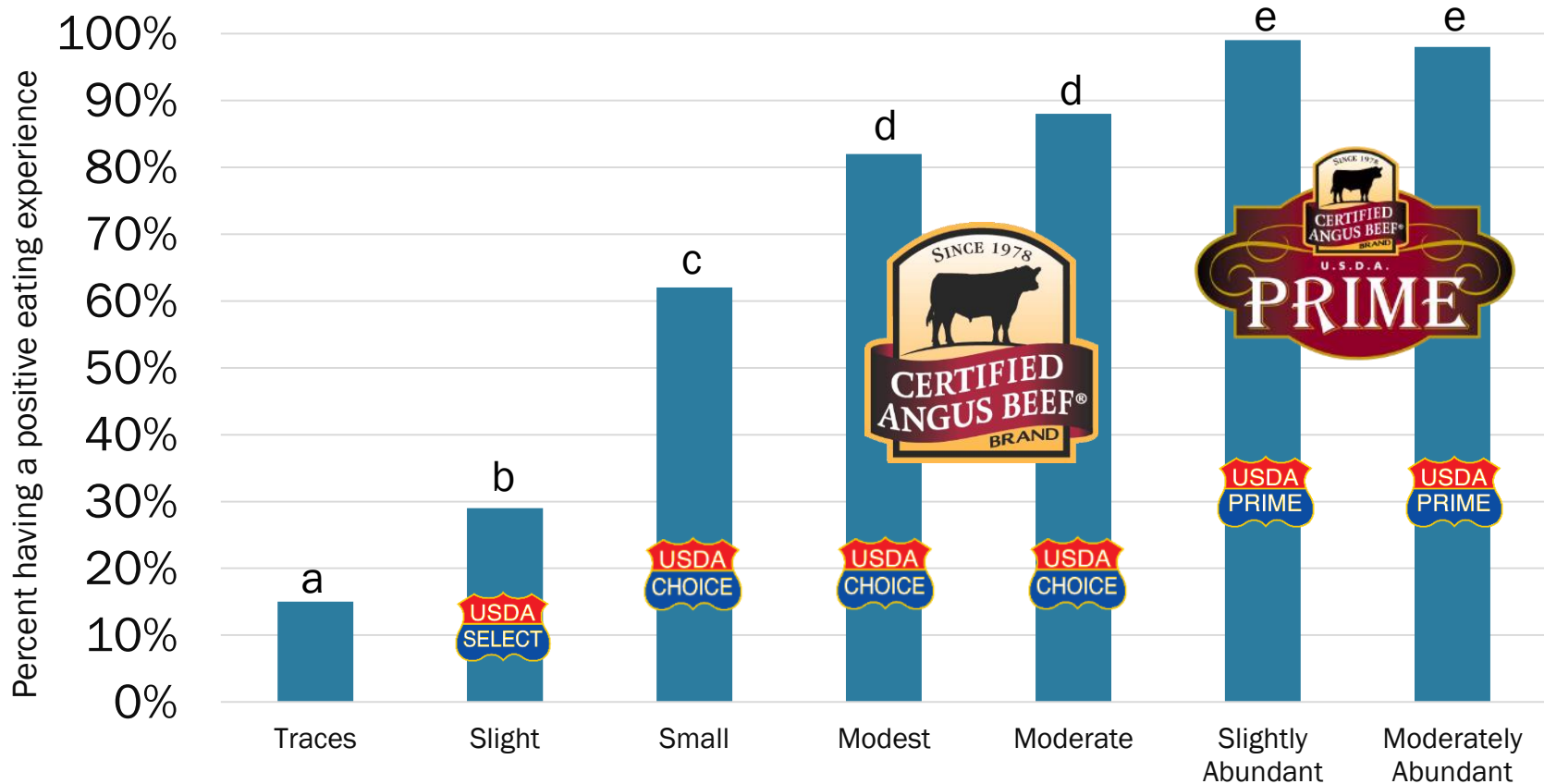
pounds sold



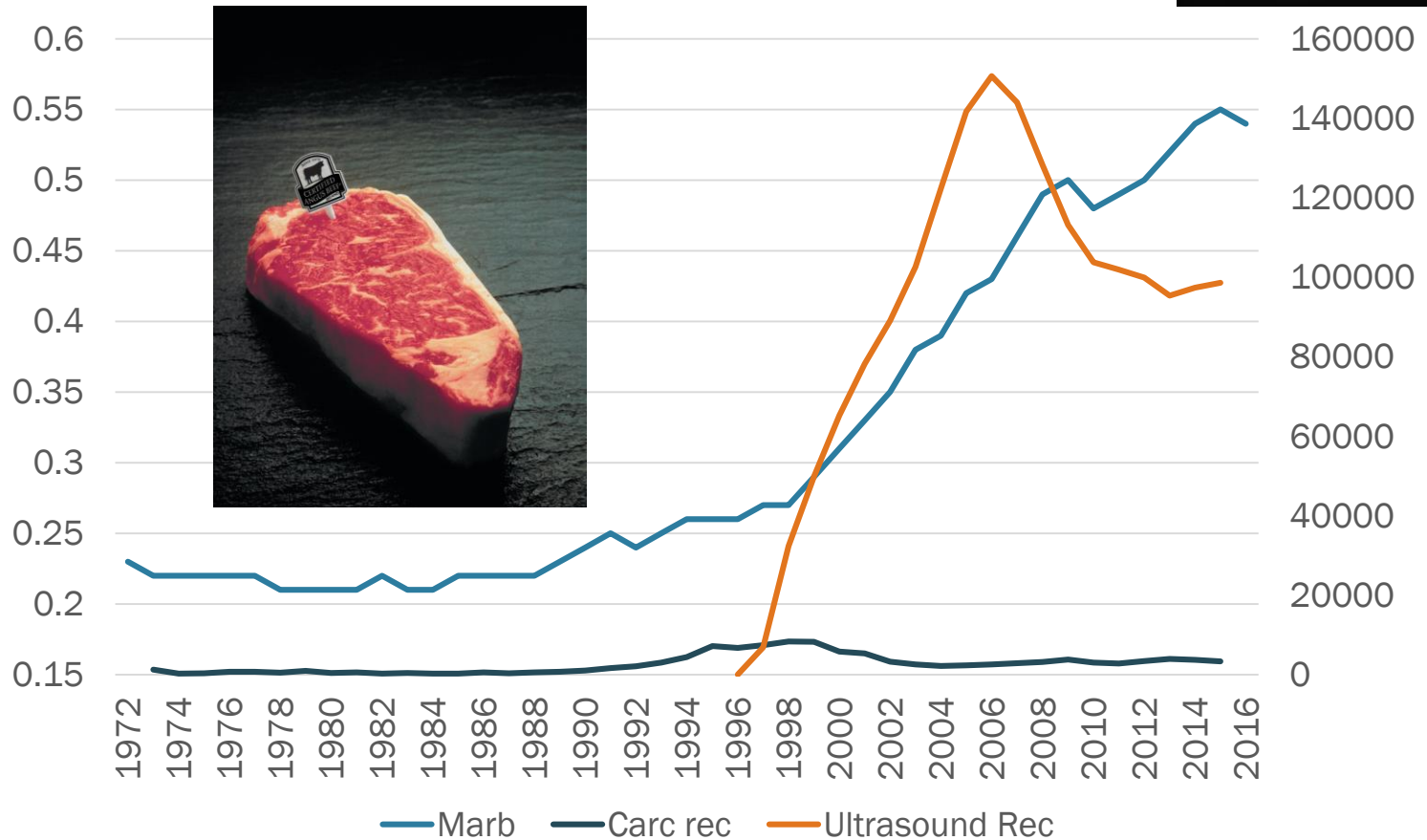
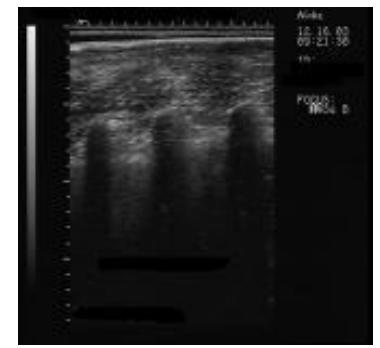
**\$50 MILLION**

paid to cattlemen each year

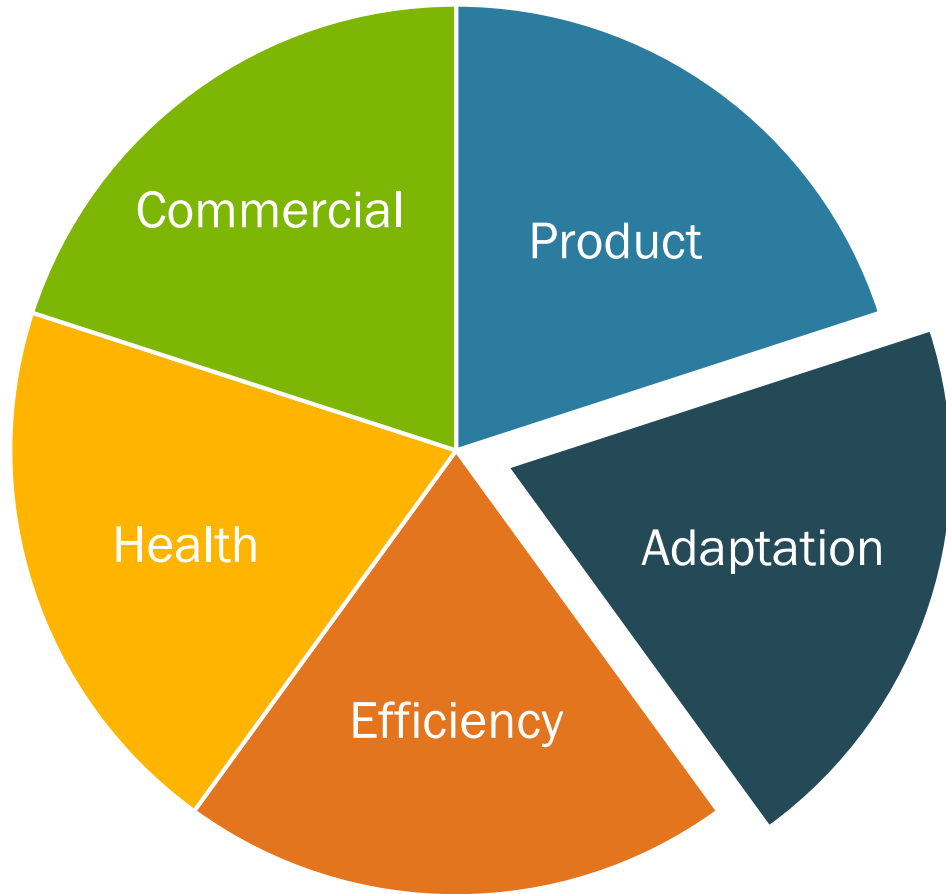
# Consumer satisfaction improves with marbling



# Marbling - an example of technology adoption



# Increasing Precision



Technology is enabling improvement in a number of areas

# Angus Cattle perform in diverse environments



New Mexico



Not - New Mexico



# High Altitude Adaptation

Angus PAP EPDs

## American Angus releases PAP EPDs

Prototype EPD needs data

By Dr. Bob Hough, WLJ correspondent Feb 1, 2019

2396 Moderate Elevation and 9108 High Elevation Records  
Heritability 25% and 0.68 genetic correlation

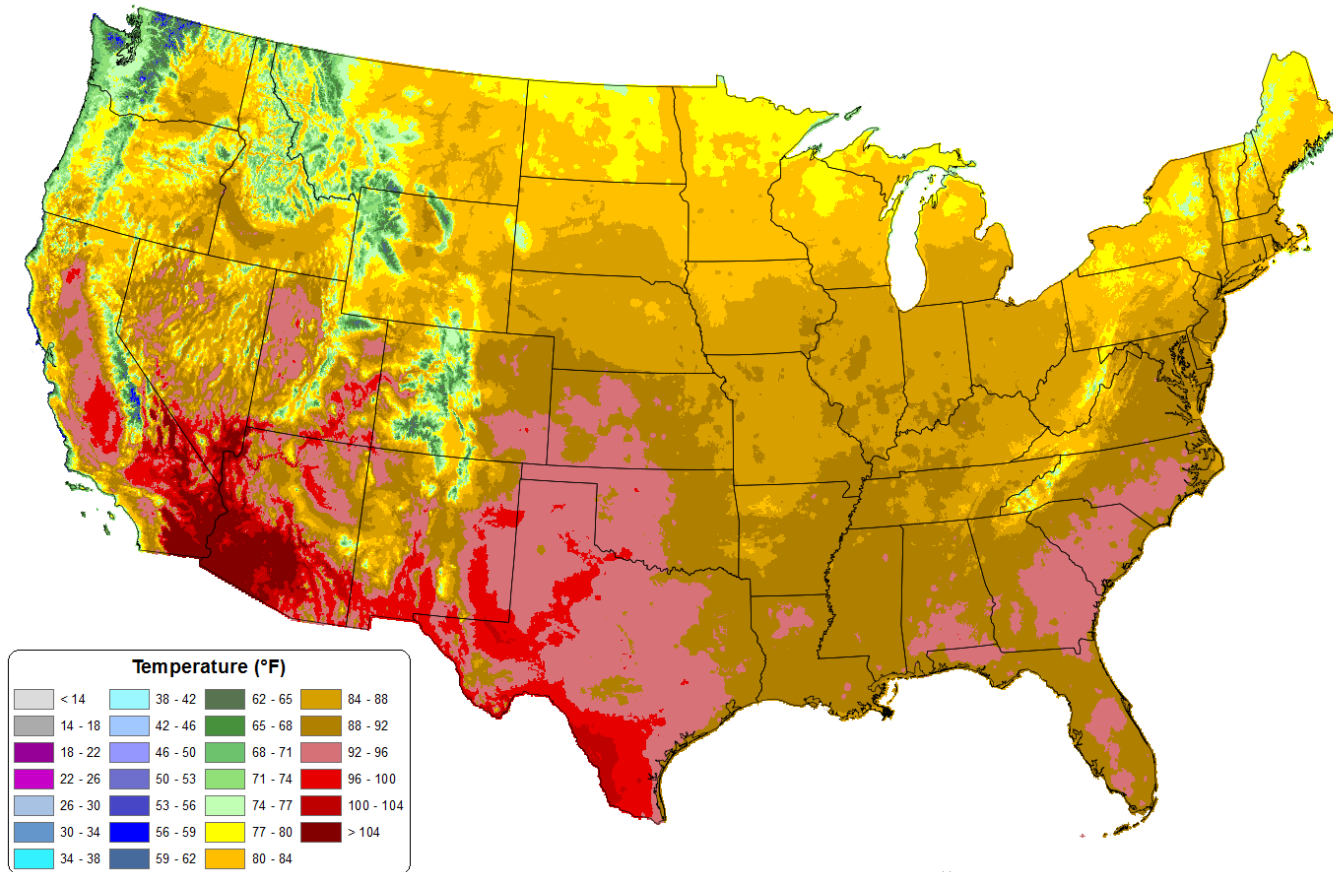


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**ANGUS**  
THE BUSINESS BREED

# Adaptation to Heat Stress

Average Daily Maximum Temperature: Jul 2019  
Period ending 31 Jul 2019  
(Map created 20 Sep 2019)

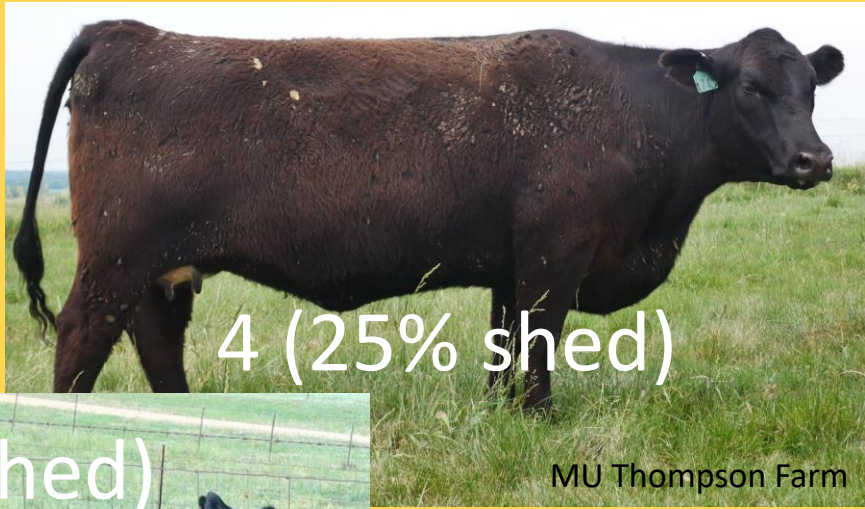


Copyright (c) 2019, PRISM Climate Group, Oregon State University



5 (0% shed)

Eldon Cole



4 (25% shed)

MU Thompson Farm



MU Thompson Farm

3 (50% shed)



2 (75% shed)

Trent Smith

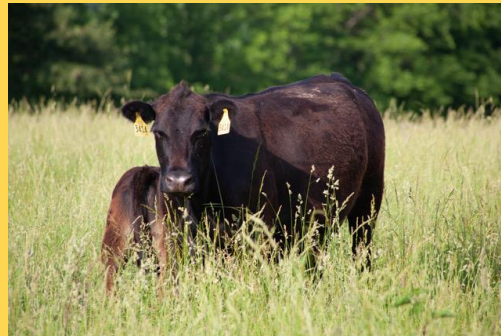
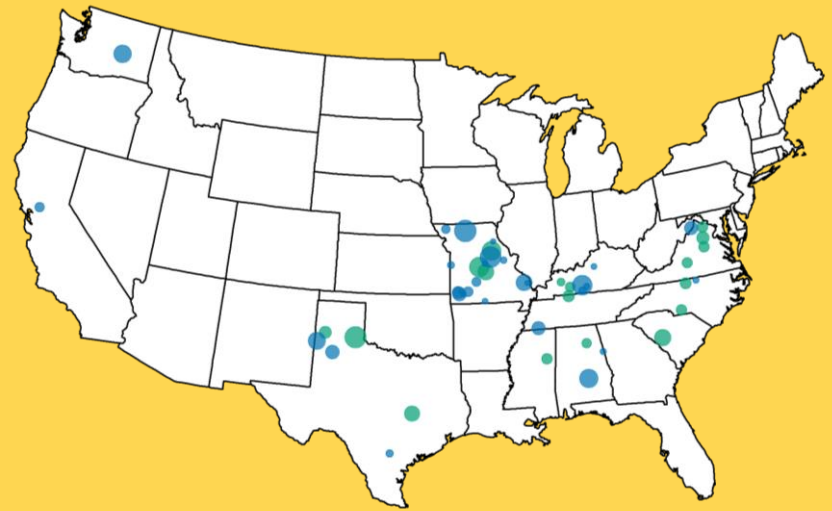


1 (100% shed)

Gibbs Farms

# Hair shedding research at AGI

- Indicator trait for heat tolerance and fescue toxicosis tolerance
- Research EPD forthcoming in 2020
- **14,465** scores on 8,642 animals between 2011-2019
  - **3,893** genotyped at 50K level or higher
- **0.44  $h^2$** : on par with carcass traits



University of Missouri data  
(n = 8,041)

AGI legacy data (n = 6,374)

# Increasing Precision



Technology is enabling improvement in a number of areas

Feed intake  
measurement  
continues to evolve



# Interest in Indirect Predictors of Intake



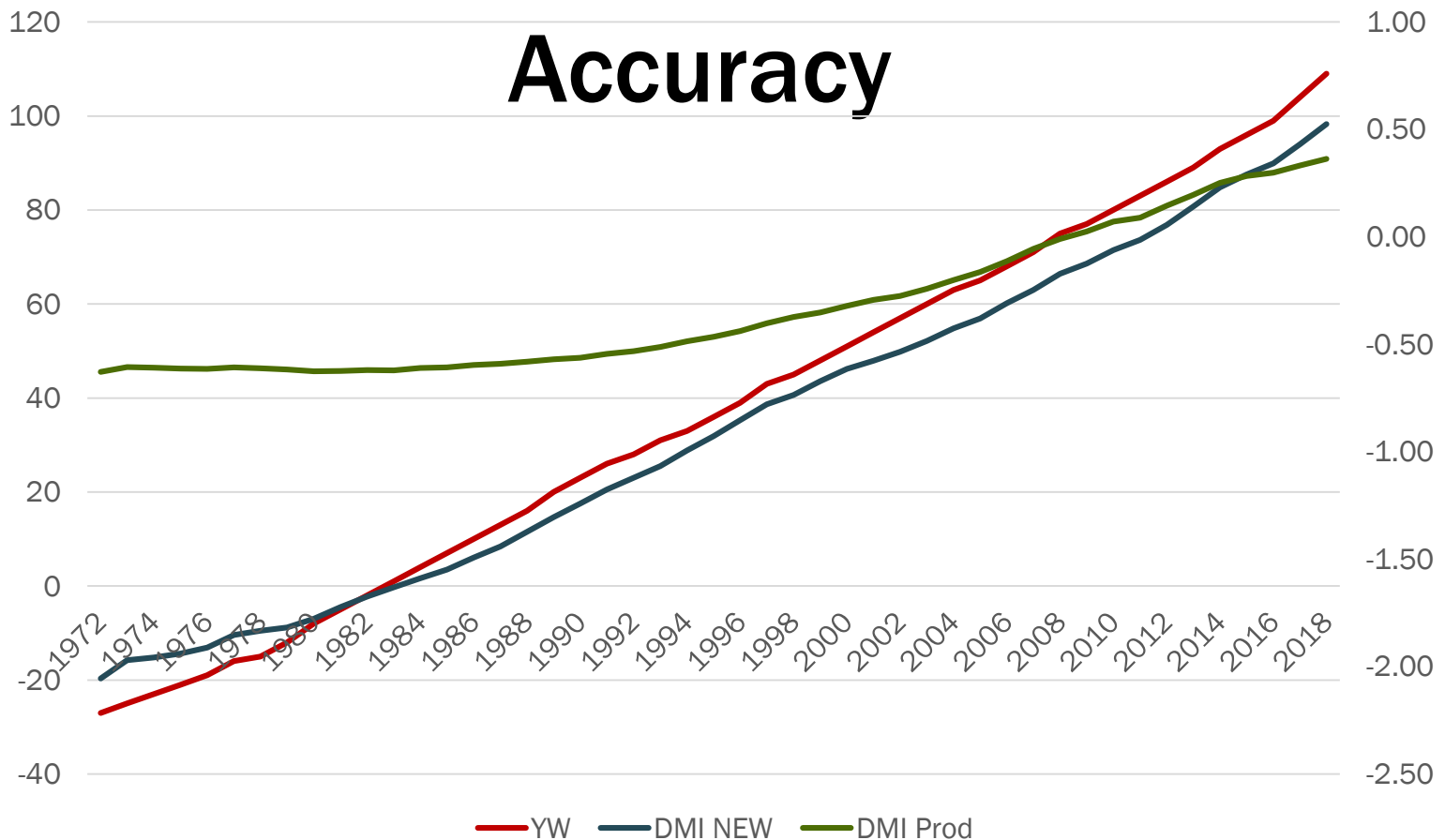


# Updated Models

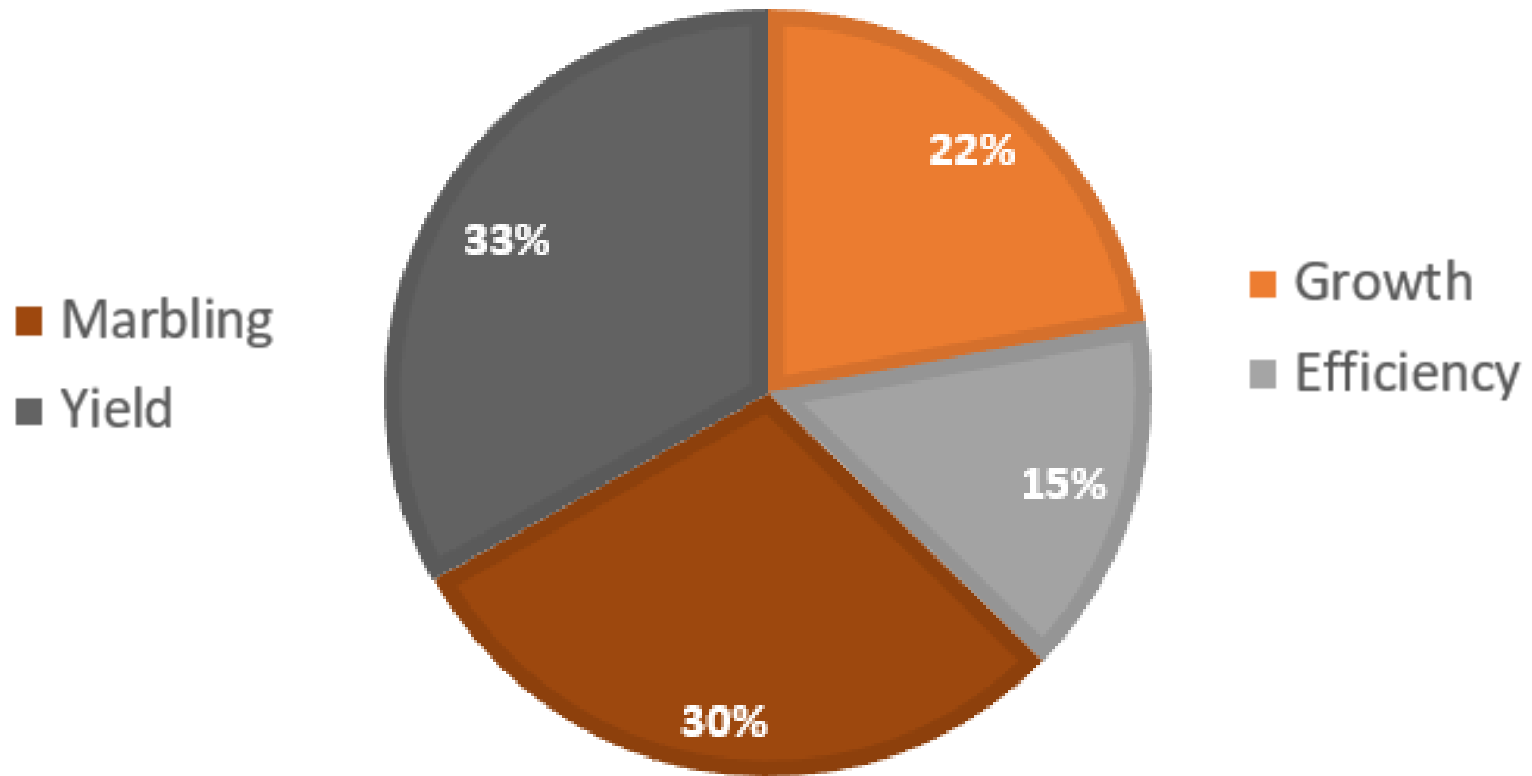
	Growth (BW, WW, YW)	Mature (MW)	Feed (RADG, DMI)
OLD - Number of Animals in Evaluation	11 M	1.4 M	1.2 M
New - Number of Animals in Evaluation	11 M	11 M	11 M

Weaning Weight now included in Both the Mature Weight evaluation and Feed Intake Evaluation

# Complete Feed Intake Analyses with All the Growth data is Important for

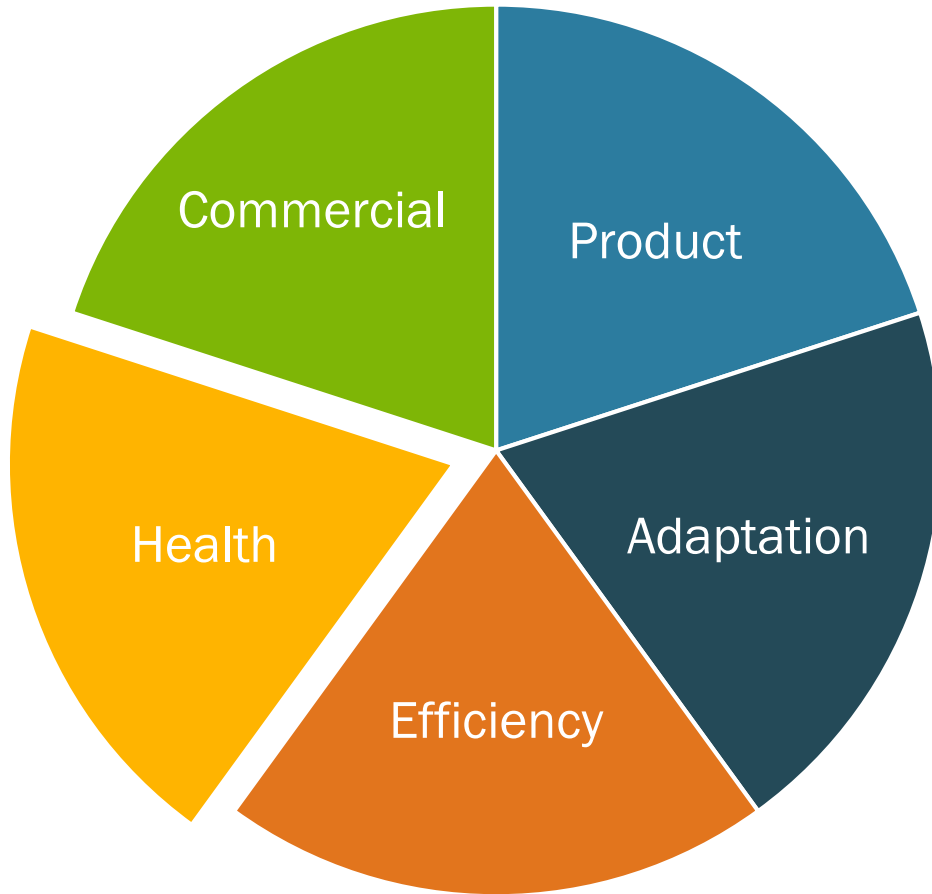


# Feed Efficiency Plays a Significant Role in Angus Terminal Index



Efficiency independent of growth and body composition

# Increasing Precision

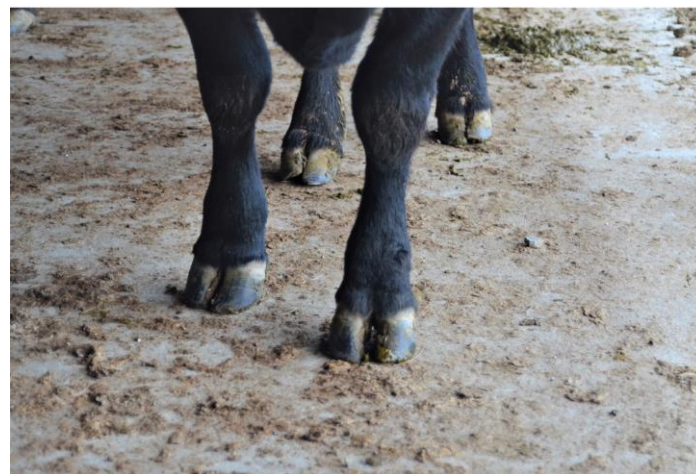


Technology is enabling improvement in a number of areas

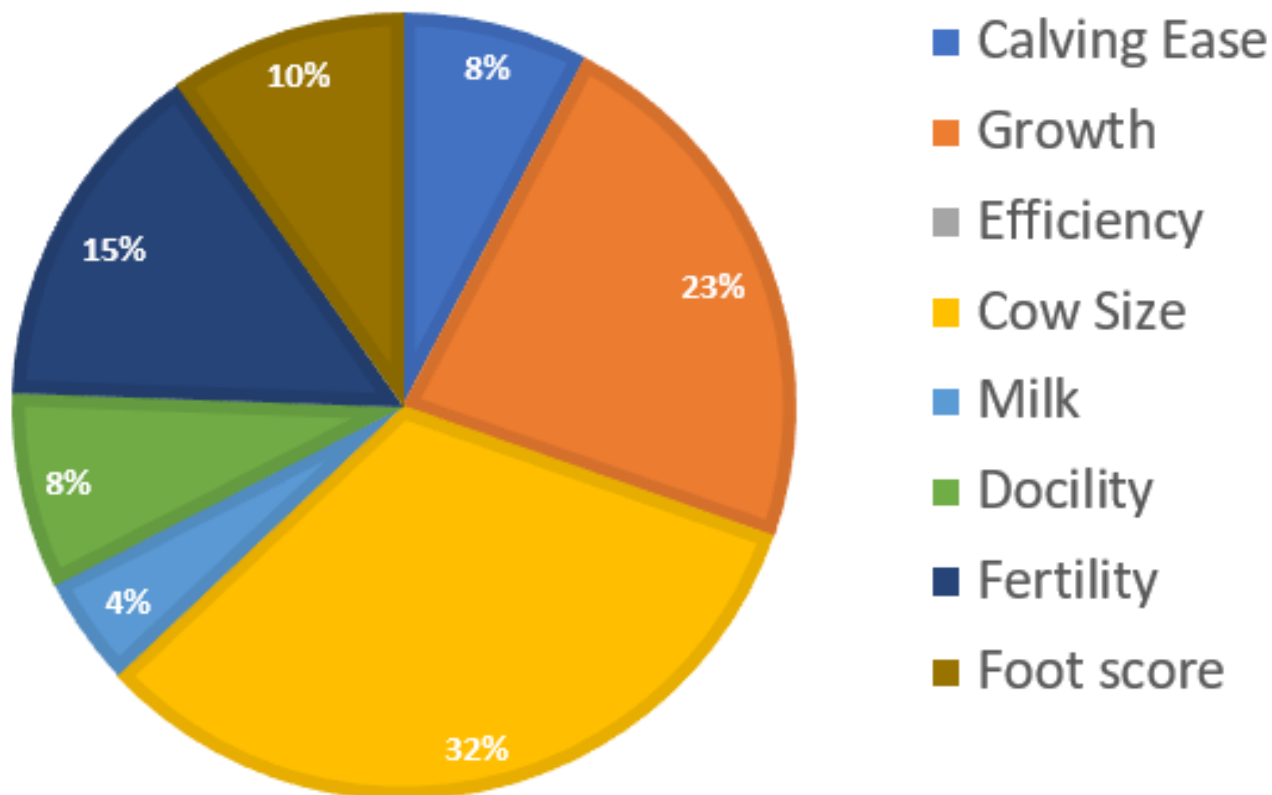
# May 31, 2019

## Angus releases official EPD for foot structure

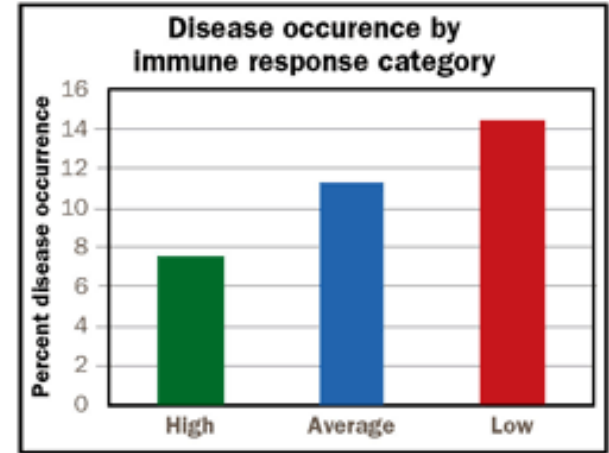
 <p><b>1</b> Extremely straight pasterns. Very short toe. Unsound.</p>	<p>Extremely weak, open, divergent claw set. Unsound.</p>  <p><b>1</b></p>
 <p><b>2</b> Straight front and rear pasterns. Marginally unsound.</p>	<p>Open, divergent claw set. Marginally unsound.</p>  <p><b>2</b></p>
 <p><b>3</b> Moderately straight front and rear pasterns.</p>	<p>Moderately open/divergent claw set.</p>  <p><b>3</b></p>
 <p><b>4</b> Slightly straight front and rear pasterns.</p>	<p>Slightly open/divergent claw set.</p>  <p><b>4</b></p>
 <p><b>5</b> Ideal. Approximately 45-degree angle at pastern joint. Appropriate length of toe and depth of heel.</p>	<p>Ideal. Symmetrical claws, with appropriate space between claws.</p>  <p><b>5</b></p>
 <p><b>6</b> Slightly shallow heel and long toe.</p>	<p>Slight tendency for claws to curl. One claw may be slightly larger than the other.</p>  <p><b>6</b></p>
 <p><b>7</b> Moderately shallow heel and long toe. Somewhat weak pasterns.</p>	<p>Tendency for claws to curl, with one claw larger than the other.</p>  <p><b>7</b></p>
 <p><b>8</b> Shallow heel and long toe. Marginally unsound.</p>	<p>Moderate scissor claw and/or screw claw. Curling of one or both claws. Near crossing of claws. Marginally unsound.</p>  <p><b>8</b></p>
 <p><b>9</b> Extremely shallow heel and long toe. Extremely weak pasterns. Unsound.</p>	<p>Extreme scissor claw and/or screw claw. Pronounced curling of one or both claws. Crossing of claws. Unsound.</p>  <p><b>9</b></p>



# Foot Score EPD Playing a role in Angus's New Maternal Index



# High Immune Response Technology



**Immunity+**<sup>TM</sup>

**DISEASE RESISTANT**

# HIR proven in Australian Angus



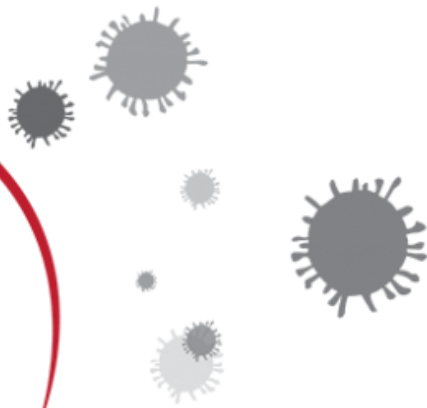
Number of mortalities at the feedlot were highest in low immune competence phenotype animals (6.1%), followed by average immune competence animals (1.2%) and lowest in high immune competence animals where no mortalities observed.



	Low	Average	High	TOTAL
Total Deaths	6	8	0	14
Total Animals	98	653	88	839
Deaths <sup>#</sup>	6.12% <sup>a,A</sup>	1.23% <sup>b,B</sup>	0% <sup>b,B</sup>	1.67%

Moderately heritable  $\sim .25$ , favorably correlated with Docility





# Immune DEX



# Pathway to High Immune Angus

## HIA

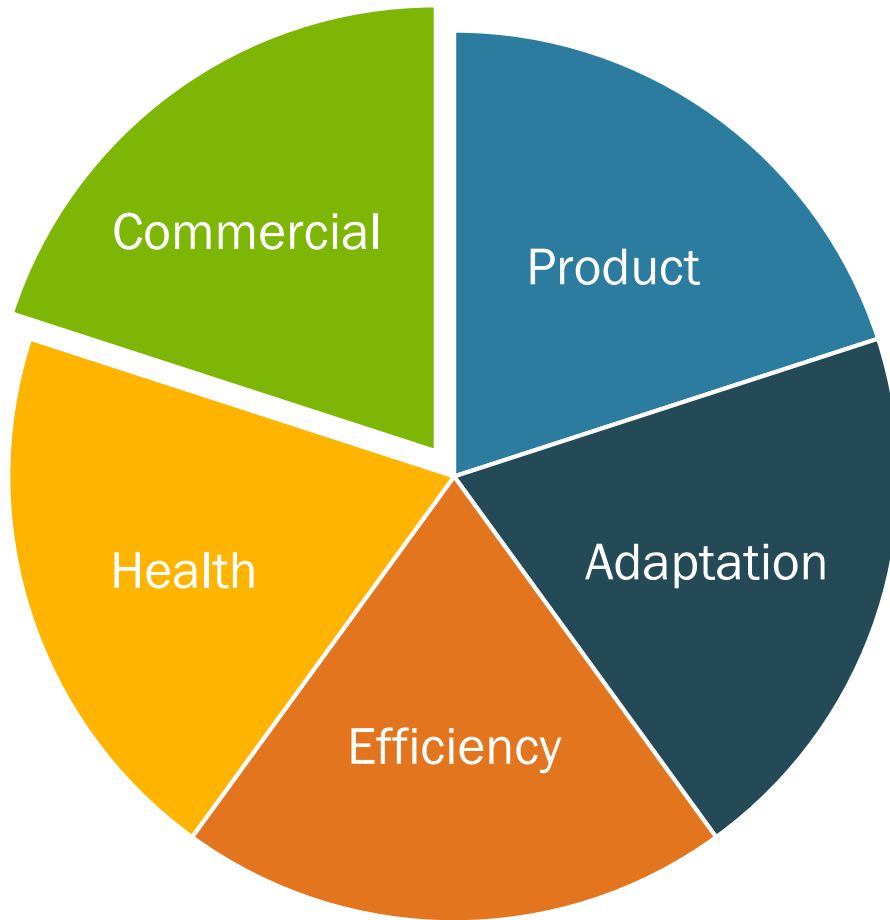
- Approval to start in MO, KS and NE

Develop Reference  
Population ~4,000 head



Genomic Prediction in  
100,000 plus Angus Breeding  
Stock per year

# Increasing Precision



Technology is enabling improvement in a number of areas

Know the score.

Bringing Genetic information direct to market will influence change



<b>BEEF SCORE</b>	
<b>155</b>	
<b>FEEDLOT PERFORMANCE SCORE</b>	<b>GRID SCORE</b>
<b>115</b>	<b>110</b>

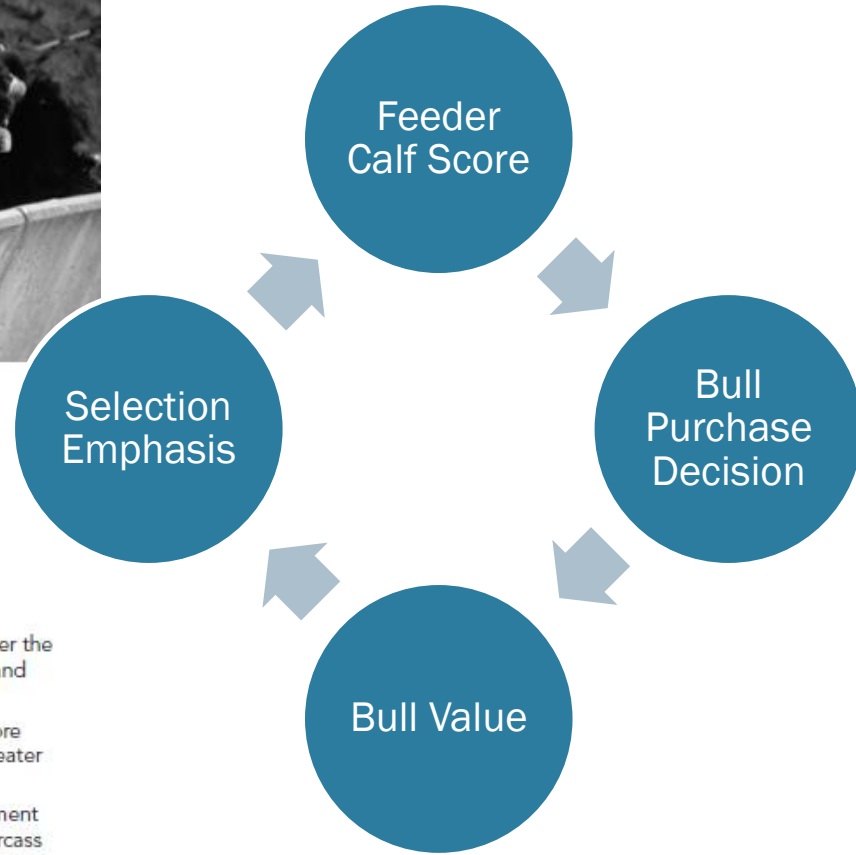
Three Scores.  
0-200 Range.  
100 Average.  
All Feeder Cattle.  
No Matter the Breed.

**Beef Score** - the higher the score, the higher the genetic potential for feedlot performance and carcass merit.

**Feedlot Performance Score** - a higher score indicates enrollment group potential for greater postweaning performance.

**Grid Score** - a higher score predicts enrollment group performance potential to excel in carcass grid merit.

\* Example calf group index score



# A little bit of where we call home .....

[https://www.youtube.com/watch?v=yU\\_4z6UcTPw](https://www.youtube.com/watch?v=yU_4z6UcTPw)