Taking the BULL out of Sire Selection

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Why is Sire Selection Important?

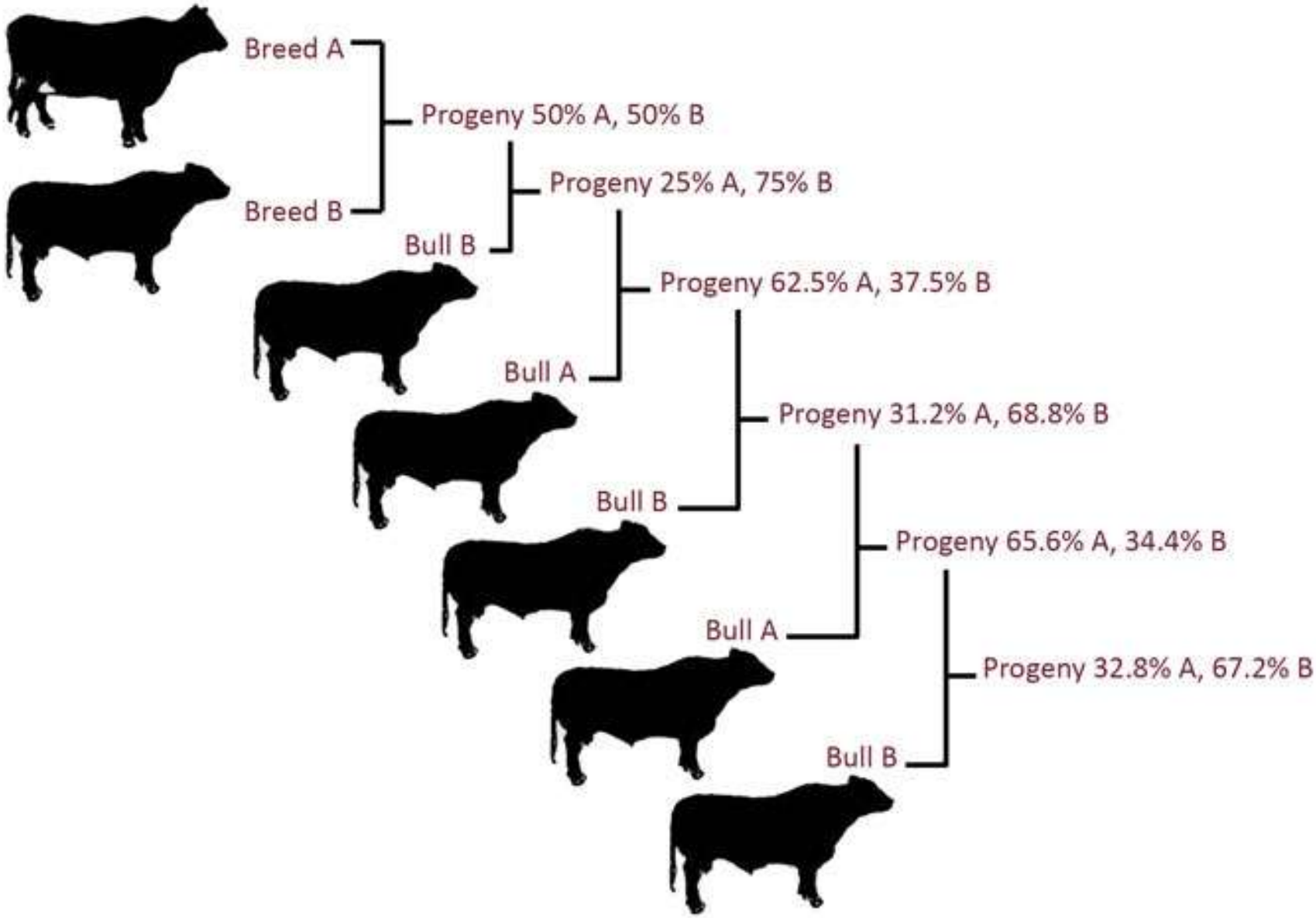
- Greatest opportunity for genetic change
- Long term impact
  - Sire genetics can easily remain in a herd for 25 years
- Permanent change

What to Consider

- Herd Assessment
  - Breed
  - Production Level
  - Weight/Frame Size
  - Feed Quality
  - Availability of Labour
  - Marketing Opportunities
- Set Goals

Crossbreeding

- Many different crossbreeding systems
  - 2 Breed Rotation
  - 3 Breed Rotation
  - 2 Breed Rotational w/Terminal Sire
  - Terminal Cross w/Straightbred Females
  - Terminal Cross w/Purchased F1 females
  - Rotate Bull Every 4 Years
  - Composite Breeds
  - Rotating Unrelated F1 Bulls



Starting at 50/50%, the rotation stabilises at 65/35% or 35/65%, giving 65% from the last sire line used.

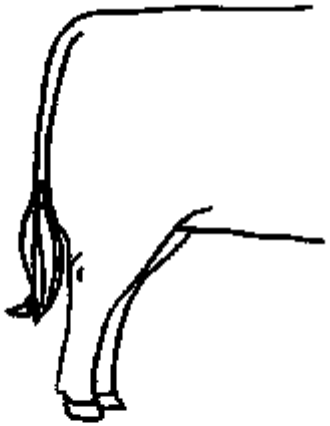
Why Crossbreed?

- Complementarity
  - Match breed strengths
- Heterosis!
  - Progeny superior to parents due to increased heterozygosity
  - Breeds that are not closely related will experience more heterosis
  - Generates most benefit in lowly heritable traits (e.g. fertility)

Conformation

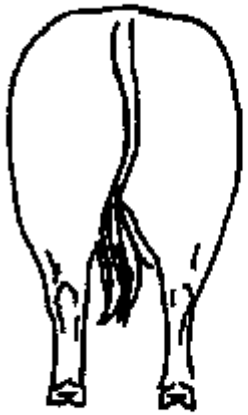
Correct Rear Side

Sickle Hocked



Post Legged

Rear Leg Correct Pastern



Correct Rear

Bow Legged

Cow Hocked

Rear Leg Weak Pastern

Conformation

Correct Pastern Straight Front Leg

Straight Front Leg Weak Pastern

Back at the Knee

Buck Kneeded

Conformation

-Muscling
-Width
-Length
-Depth of Body
-Rib Shape/Capacity
-Testicular Development
-Head/Neck/Shoulder Shape

Other Considerations

- Breed
- Birth Weight
- Semen Test
- Condition
- Herd Health/Vaccination
- Intended usage (heifers vs. cows)
- Reputation
- EPDs

P = G + E

- P = Phenotype
- Phenotype is anything we can measure
- G = Genetics or genotype
- E = Environment
- EPDs estimate the genetic component (breeding value)

P = G + E

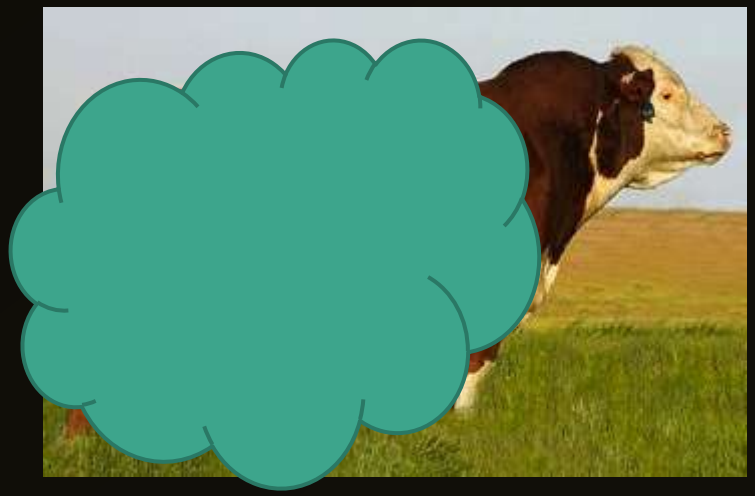
- To estimate the genetic component we need to compensate for differences in environment

Environmental Effects

- Age & sex of calf, age of dam
- Creep feed
- Contemporary groups
  - Animals which are managed the same, under the same conditions
  - Larger groups = more comparisons
  - Common animals across contemporary groups
- Unknown

Measuring the Unknown?

- Heritability
  - Proportion of the observed differences explained by our knowledge of genetics
  - Unknown = 100% - heritability
- 25% heritability = 25% due to breeding value, 75% unknown



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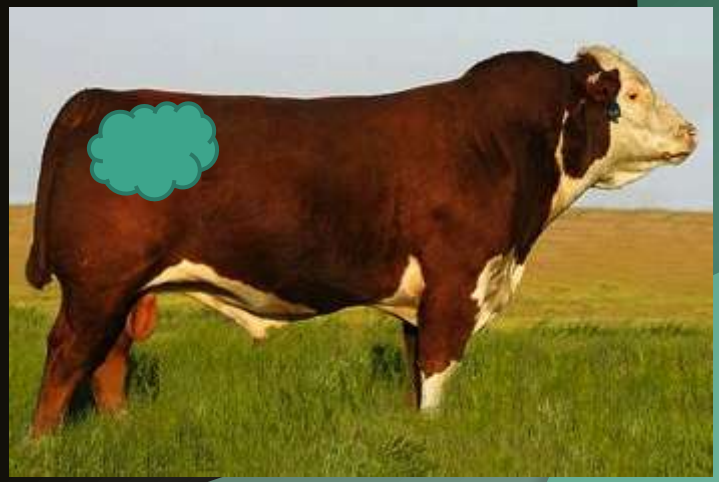

Expected Progeny Differences – What do all those numbers mean?

- Estimate differences in progeny averages between animals
  - True breeding value (sum of independent effects of genes on phenotype)
  - EPD = ½ breeding value
- Do not equal actual numbers
  - A weaning weight EPD of +40 lbs does not mean a sire's progeny will sire calves that average 650 lbs at weaning
- Predicts average progeny performance assuming sires are mated to similar dams under similar management
  - Not comparable between breeds

EPD Basics

- The most important thing to remember:

NEVER SELECT ANIMALS BASED ON THEIR PERFORMANCE IN A SINGLE TRAIT!!

- Bigger is not always better – balance & moderation

Example

	Sire A (WW EPD +10)	Sire B (WW EPD +30)
Bull Calf #1	625 lbs	650 lbs
Bull Calf #2	700 lbs	700 lbs
Bull Calf #3	800 lbs	725 lbs
Bull Calf #4	575 lbs	705 lbs

Sire A Average = 675 lbs

Sire B Average = 695 lbs

Even though a calf from Sire A has the largest weaning weight, the avg. wt of his progeny is 20 lbs lower than that of Sire B, just like the EPDs predict

EPD Basics

- Complete reporting – selective reporting of the top performing animals causes bias
- report all animals or no animals
- Breed Average ≠ 0
- Accuracy
  - Measures how close the EPD is to the true breeding value

Accuracy Level	Interpretation
PE to <0.10	Very low accuracy. EPDs should be considered a preliminary estimate. They could change substantially as more performance information becomes available
0.10 to 0.25	Low accuracy, usually based on the animal's own records and pedigree. Useful for screening "best bet" animals. Still subject to substantial changes with more information, particularly when the performance of progeny are analysed
0.26 to 0.40	Medium accuracy and includes some progeny information. Becoming a more reliable indicator of the animal's value as a parent
0.41 to 0.70	High accuracy. Some progeny information included. Unlikely that the EPD will change very much with the addition of more progeny data
>0.70	Very high accuracy estimate of the animal's true breeding value

Example

- Low accuracy = Lots of movement, High accuracy = little movement

Accuracy	CE (%)	BW (lbs)	WW (lbs)	YW (lbs)	Milk (lbs)
0.05	±12.6	±5.4	±25.5	±42.6	±18.4
0.20	±10.0	±4.3	±20.4	±34.0	±14.8
0.50	±6.1	±2.7	±12.8	±21.3	±9.2
0.75	±3.0	±1.3	±6.4	±10.6	±4.6
0.90	±1.2	±0.5	±2.6	±4.3	±1.8
0.95	±0.6	±0.3	±1.3	±2.1	±0.9

Calculating EPDs

- Need: phenotypic data, pedigree, heritability for traits, correlations between traits
  - Best linear unbiased prediction (BLUP)
  - Used in linear mixed models to estimate random effects
- Account for: animal's own production, performance of all known relatives, relationship of all traits, performance of all herds over all recording years
- An evaluation with 200,000 records requires over 1 million equations to be solved simultaneously

EPD Summary

- EPDs are our best tool for estimating genetic merit
- Result of complex calculations
- EPDs change as more information is added to the system – the amount of change is represented by the accuracy
- EPDs predict AVERAGE progeny performance – there will still be animals that perform above and below the average
  - There are 1.15×10^{18} different genetic combinations possible from a single mating!

EPD Summary

- EPDs rely on data provided
  - garbage in = garbage out
- Complete reporting, accurate measurements & contemporary groupings are of utmost importance
- More Indexes
  - Avoid single trait/single EPD selection!
- Some EPDs involve genetic markers – increasing accuracy at a younger age

Resources

- NBCEC Sire Selection Manual
  - http://www.nbcec.org/producers/sire_selection/manual.pdf
- Beef Sire Selection Recommendations
  - http://www.uky.edu/Ag/AnimalSciences/pubs/asc165.pdf
- Beef Sire Selection
  - http://www.uaex.edu/Other_Areas/publications/PDF/FSA-3075.pdf
- US Across Breed EPD Table
  - http://www.beefimprovement.org/PDFs/2012/Across-Breed-EPD-Factors.pdf
- 4-H Manuals
- Breed Associations

Questions?