# IMPLEMENTATION OF MARKER ASSISTED EPD

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## Applications


$$y = X\beta + Za + e,$$

## Disjoined Information=Confusion

| | CE | BW | WW | YW | MCE | MM | MWW |
|---|---|---|---|---|---|---|---|
| Adj. | | 90 | 700 | 1320 | | | |
| Ratio | | 101 | 107 | | | | |
| EPD | 9 | -1.0 | 25 | 49 | 3 | 11 | 23 |
| Acc | .29 | .37 | .30 | .27 | .18 | .19 | .23 |

| | YG | Marb | BF | REA |
|---|---|---|---|---|
| Adj. | | 4.65 | .23 | 12.5 |
| Ratio | | 106 | 100 | 95 |
| EPD | .21 | .44 | .05 | -.39 |
| Acc | .32 | .31 | .33 | .34 |

| RFI | TEND | MARB |
|---|---|---|
| 7 | 6 | 8 |

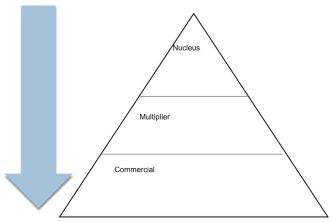
## Three General Approaches

- Molecular information can be included in NCE in three ways:
- "Blending"
  - This is developing an index of MBV and EPD
- Genomic relationship
  - Must have access to genotypes
- Correlated trait
  - Context we are currently in and what AAA does

## Adoption of Genomic Predictions

- AAA, with others quickly following
- Efficacy of this technology is not binary
- The adoption of this must be centered on the gain in EPD accuracy
  - This is related to the proportion of genetic variation explained by a MBV
  - This is equal to the squared genetic correlation

## Technology Adoption

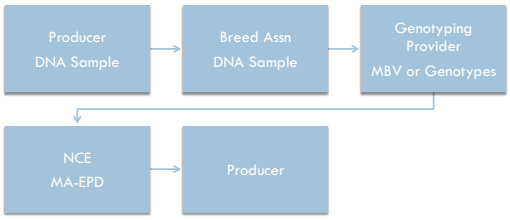


## Simmental Example

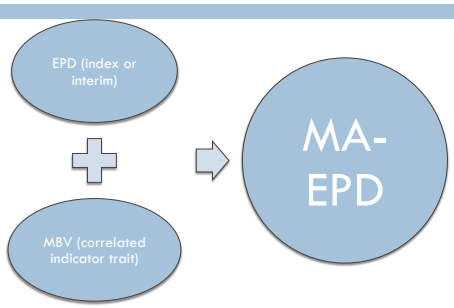
Whitacre and Spangler (2011)

| | 10% | 25% | 50% | 75% | 100% |
|---|---|---|---|---|---|
| SS | 3 | 9 | 29 | 102 | 3,466 |
| SD | 5 | 19 | 81 | 369 | 8,168 |
| DS | 5 | 22 | 100 | 419 | 7,179 |
| DD | 16 | 81 | 361 | 1,360 | 15,291 |

## Flow of Information




## Integrated Information




## Current Angus Panels

| Trait | Igenity (384SNP) | Pfizer (50KSNP) |
|---|---|---|
| Calving Ease Direct | 0.47 | 0.33 |
| Birth Weight | 0.57 | 0.51 |
| Weaning Weight | 0.45 | 0.52 |
| Yearling Weight | 0.34 | 0.64 |
| Dry Matter Intake | 0.45 | 0.65 |
| Yearling Height | 0.38 | 0.63 |
| Yearling Scrotal | 0.35 | 0.65 |
| Docility | 0.29 | 0.60 |
| Milk | 0.24 | 0.32 |
| Mature Weight | 0.53 | 0.58 |
| Mature Height | 0.56 | 0.56 |
| Carcass Weight | 0.54 | 0.48 |
| Carcass Marbling | 0.65 | 0.57 |
| Carcass Rib | 0.58 | 0.60 |
| Carcass Fat | 0.50 | 0.56 |

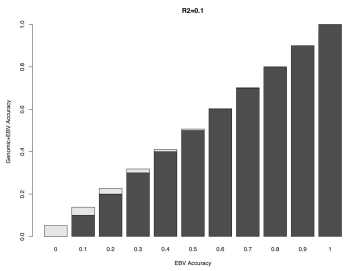
## Hereford-based Predictions

| Trait | rg from NBCEC |
|---|---|
| BW | 0.43 |
| WW | 0.32 |
| YW | 0.30 |
| MILK | 0.22 |
| CED | 0.43 |
| CEM | 0.18 |
| FAT | 0.40 |
| MARB | 0.27 |
| REA | 0.36 |
| SCROTAL | 0.28 |

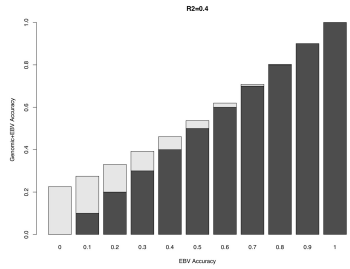
## MBV BIF Accuracy

| Genetic Correlation | % GV | BIF Accuracy |
|---|---|---|
| 0.1 | 1 | 0.005 |
| 0.2 | 4 | 0.020 |
| 0.3 | 9 | 0.046 |
| 0.4 | 16 | 0.083 |
| 0.5 | 25 | 0.132 |
| 0.6 | 36 | 0.2 |
| 0.7 | 49 | 0.286 |

## Impact on Accuracy--%GV=10%




## Impact on Accuracy--%GV=40%



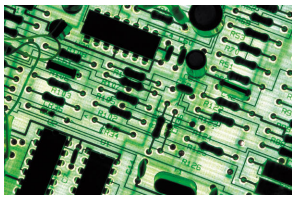

## MENDELIAN SAMPLING

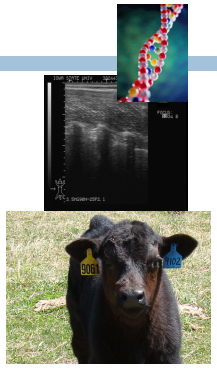
**How many possible genetically different full sibs from a mating?**

**1,152,921,504,606,850,000**

**Every one has the same Pedigree Index EPD**

## Mendelian Sampling





## Increased Accuracy-Benefits

- Mitigation of risk
- Faster genetic progress

$$\Delta_{BV} / t = \frac{r_{BV,EBV}\, i \sigma_{BV}}{L}$$

- Increased accuracy does not mean higher or lower EPDs!
  - Increased information can make EPDs go up or down

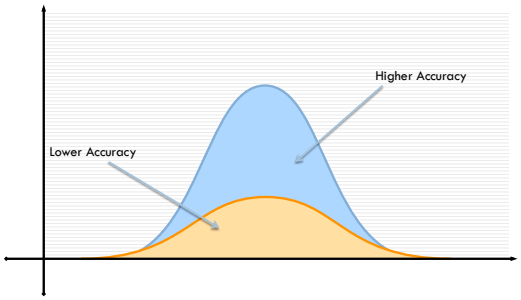
## Calving Ease

- Two yearling bulls with a +5 CED EPD with accuracy of 0.2.
  - Possible change of 6
- With the addition of more information their EPDs change
- One favorably and the other unfavorably
- More information earlier allows you to choose animals more accurately

## Example-CED

- Bull A Bull B
  - +5 +5
- Add molecular scores as additional information
- Bull A Bull B
  - -1 +11
- In this extreme case risk was 12% more calving difficulties
- Average is still +5*

## Distribution Change-Mitigating Risk




## Issues to Address Robustness

- Angus •Angus
- Angus •Charolais
- Angus •Bos indicus

## Robustness Over Time

- Discovery • Progeny of Discovery Population
- Discovery • Grandparent Progeny of Discovery Population
- Discovery • Unrelated Population (i.e. one country vs another)

## Example of Robustness--Breed

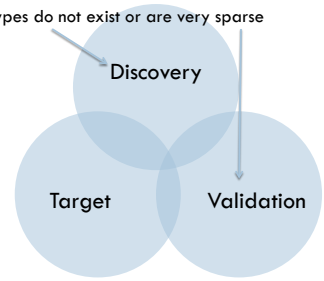
| Breed | WW | YW |
|---|---|---|
| AN | 0.41 | 0.54 |
| AR | 0.28 | -0.36 |

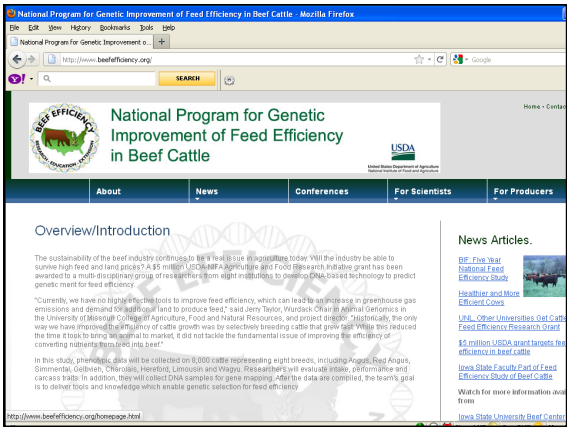
## "New Traits" In the Genomic Era

- Healthfulness of beef
- Disease susceptibility
- Tenderness
- Adaptation
- The list will continue to grow
- INFORMATION OVERLOAD!

## Why didn't we start with these traits?

Phenotypes do not exist or are very sparse




## Summary

- For commercial bull buyers the fundamentals are still in place
- Phenotypes are still critical to collect
- Genomic information has the potential to increase accuracy
  - Proportional to %GV
  - Impacts inversely related to EPD accuracy
- Multiple trait selection is critical and could become more cumbersome
  - Economic indexes help alleviate this
  - Use index values that meet your breeding objective

## Summary

- Phenotypes are still critical to collect.
- Predictions will continue to improve.
- Lower cost SNP panels will enter the market place.
- This arena is far from stagnant!