

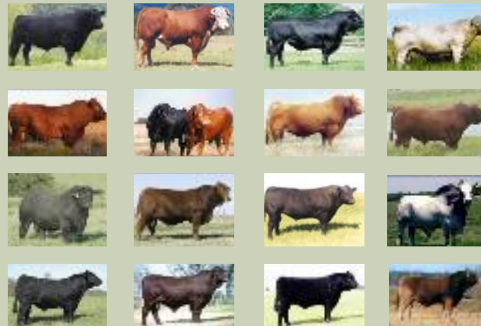
**DEVELOPMENT OF
GENOMIC EPD:
EXPANDING TO
MULTIPLE BREEDS IN
MULTIPLE WAYS**

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ADOPTION OF GENOMIC PREDICTIONS

- AAA, ASA, AHA, NALF 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 Molecular Breeding Values (MBV; Result of DNA Test)
 - % GV = squared genetic correlation

“DISCOVERING” MARKER EFFECTS “TRAINING” GENOMIC PREDICTIONS



Using populations that have phenotypes and are genotyped



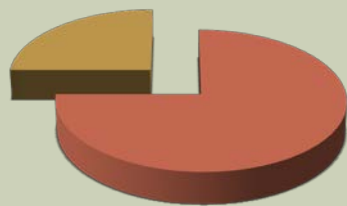
Vector of y can be deregressed EBV or adjusted phenotypes.

Estimate SNP effects.

PROCESS



Training/Discovery– NBCEC



- Training
- Evaluation



$$MBV = \sum_{i=1}^s x_i \hat{\beta}_i$$

FOUR GENERAL APPROACHES TO INCORPORATION

- Molecular information can be included in NCE in 4 ways:
- Correlated trait
 - Method adopted by AAA
 - Similar to how ultrasound and carcass data are run
- “Blending”
 - This is developing an index of MBV and EPD
 - Method of AHA—Post Evaluation
- Treating as an external EPD
 - What ASA currently does
 - Likely RAAA and NALF
 - Allows individual MBV accuracies
- Genomic relationship
 - Must have access to genotypes
 - Dairy Industry
 - Some swine companies

WHY DIFFERENT APPROACHES?

- Make integration of genomic information fit the current NCE system/provider.



CURRENT ANGUS PANELS

Trait	Igenity (Neogen) (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

SIMMENTAL BASED PREDICTIONS

NBCEC

(2,800 TRAINING ANIMALS)

Trait	rg ASA
CE	0.45
BW	0.65
WW	0.52
YW	0.45
MILK	0.34
MCE	0.32
STAY	0.58
CW	0.59
MARB	0.63
REA	0.59
BF	0.29
SF	0.53

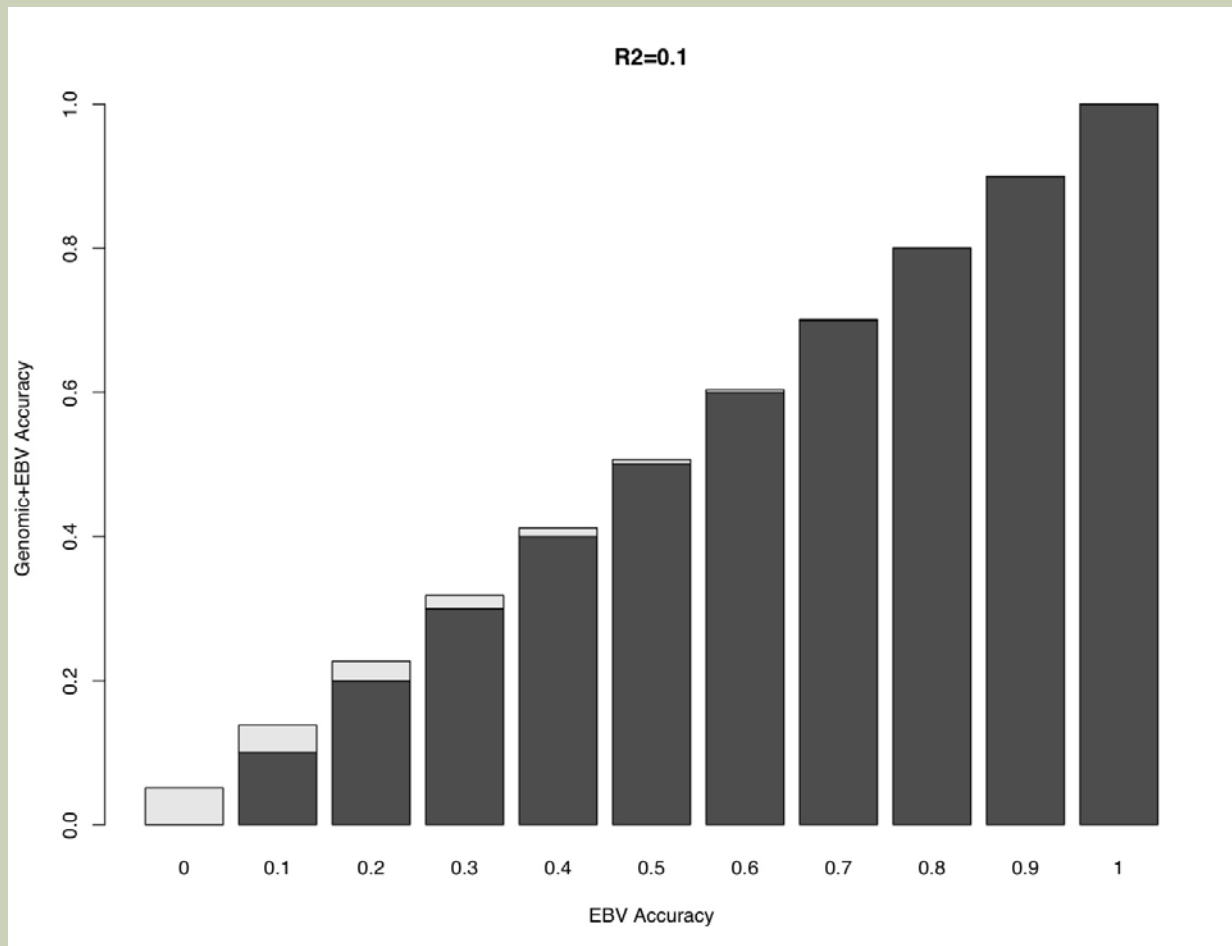
BREEDS WORKING TOWARDS 50K PREDICTIONS VIA THE NBCEC

Breed	No. of Training Records
Hereford	1,725
Red Angus	296
Simmental	2,853
Brangus	896
Limousin	2,319
Gelbvieh	847
Maine Anjou	115

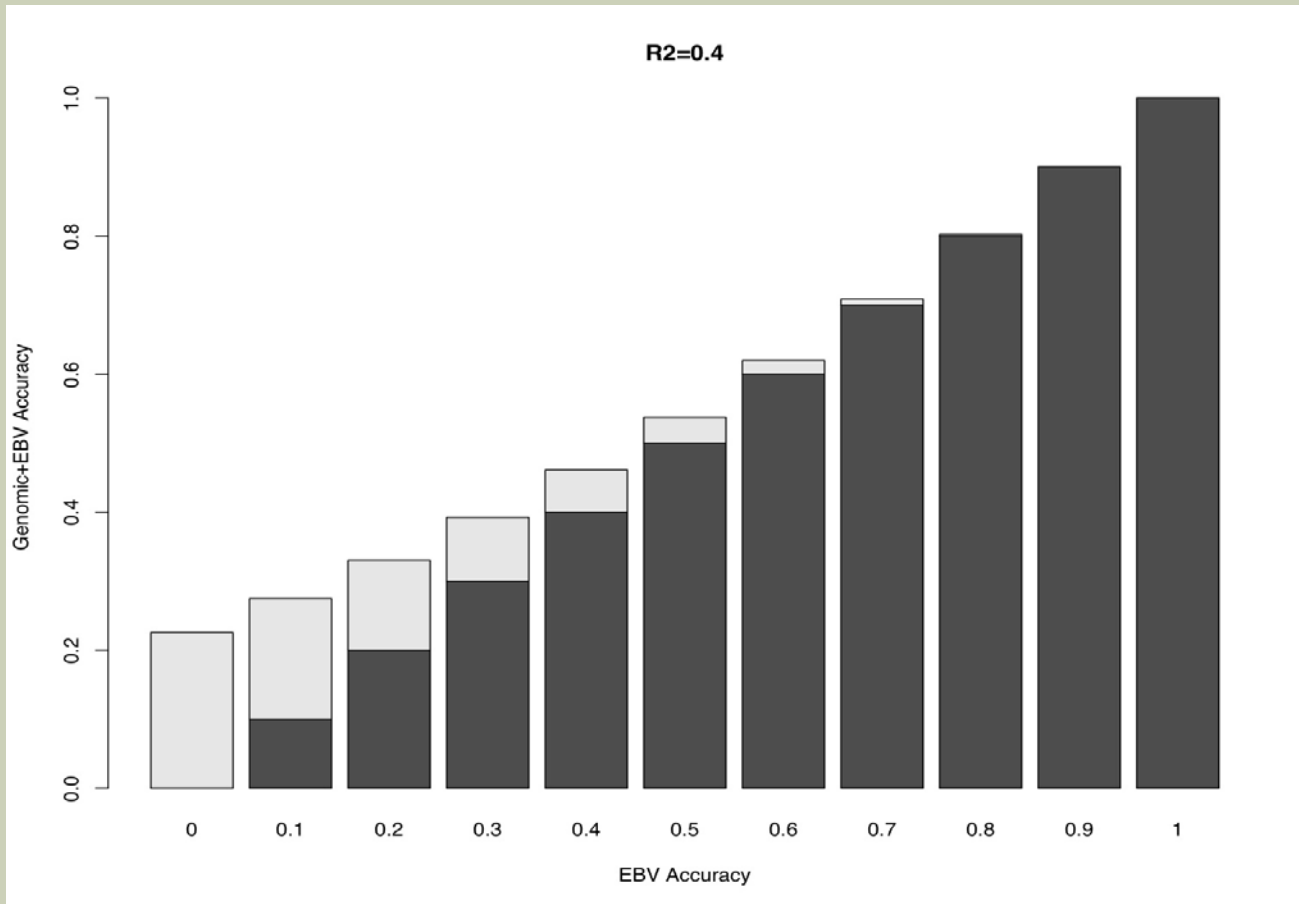
NBCEC RESULTS

	Angus 3,500	Hereford 800	Gelbvieh 847	Gelbvieh + Angus (1,181)
BW	0.64	0.43	0.38	0.41
WW	0.67	0.32	0.31	0.34
YW	0.75	0.30	0.21	NC
MILK	0.51	0.22	0.36	0.34
FAT	0.70	0.40	NA	NA
REA	0.75	0.36	0.38	0.48
MARB	0.80	0.27	0.54	0.56
CED	0.69	0.43	NC	0.48
CEM	0.73	0.18	NC	NC
SC	0.71	0.28	0.50	0.50

IMPACT ON ACCURACY--%GV=10%



IMPACT ON ACCURACY--%GV=40%



WHY A SHIFT AWAY FROM COMMERCIAL PRODUCTS?

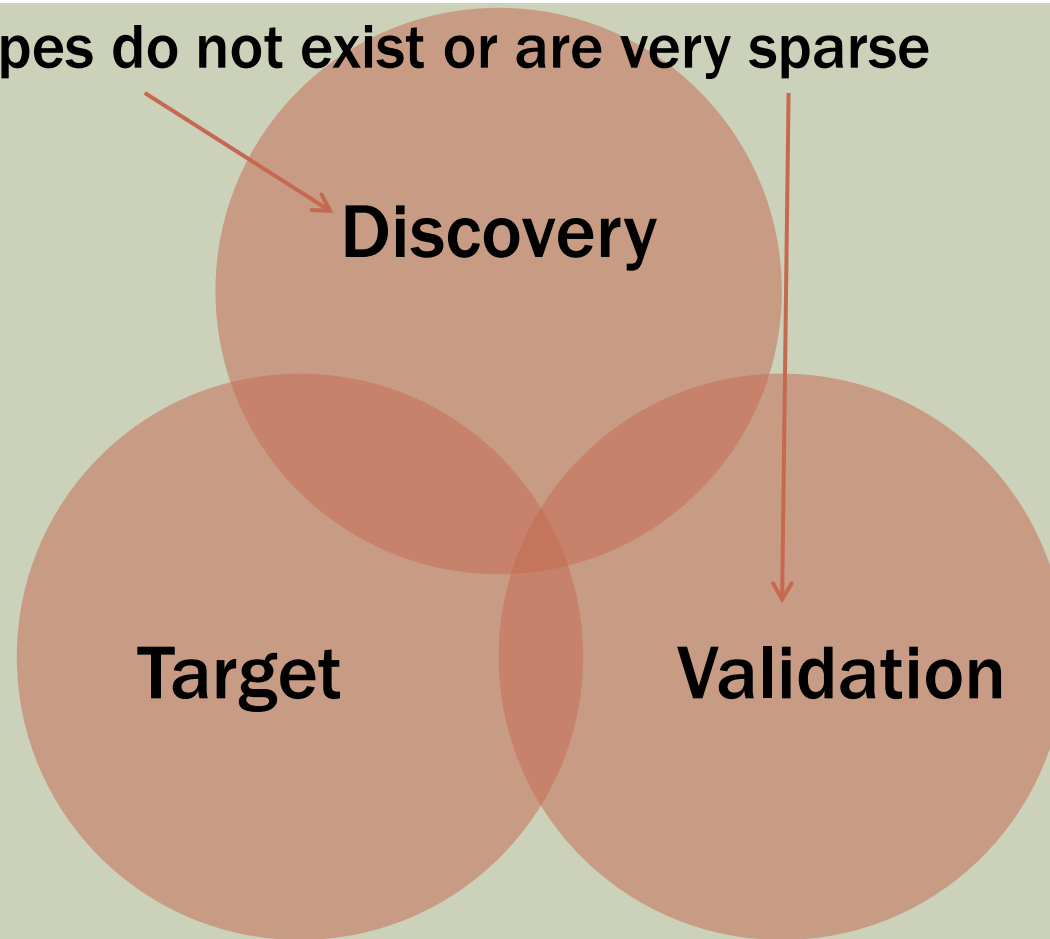
- Decreased cost of the technology
 - 50K ~\$85
 - 770K~\$185
- Flexibility
 - “Control your own destiny”
 - Can alter integration methods

WILL GENOMICS ENABLE SELECTION FOR...

- Densely recorded traits
 - Yes, for low accuracy animals that are “closely” related to training
- Sparsely recorded traits
 - Not as much
- Traits where we have “uncertainty” around the phenotype that is recorded
 - Poor phenotype recording
 - Junk in, Junk out
 - Always check for reasonableness!!

WHY DIDN'T WE START WITH TRAITS THAT ARE SPARSELY RECORDED?

Phenotypes do not exist or are very sparse



WHY BREED-SPECIFIC MBV?

(KACHMAN ET AL., 2012)

Breed	WW	YW
AN	0.36 (0.07)	0.51 (0.07)
AR	0.16 (0.16)	0.08 (0.18)

ACROSS BREED PREDICTIONS POOLED TRAINING DATA FOR REA

- If breeds are contained in training, predictions work well
- If not, correlations decrease

	Pooled Training (AN, SM, HH, LM)
AN	0.43 (0.07)
SM	0.34 (0.09)
HH	0.33 (0.08)
GV	0.17 (0.11)

IS YOUR BREED READY FOR GENOMICS?

- Implement “strategic phenotyping”?
- Ready to Retrain?
 - Relationship to training population is important
- Imputation
 - 50K or HD quality at Walmart prices?
 - LD Panels
 - Maybe not that simple
- Sequence Data
 - How to use?
 - Screening of bulls for genetic defects?
 - Will there be such a thing as a “non-carrier” bull?

SUMMARY

- Phenotypes are still critical to collect
- Methods for lower cost genotyping are evolving
- Breeds must build training populations to capitalize
- 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
- Adoption in the beef industry is problematic
 - ~30% of cows in herds with < 50 cows
 - Adoption must start at nucleus level
 - **BEEF INDUSTRY HAS TO BECOME MORE SOPHISTICATED!**