

## Should BIF Expand its Mission to Include Genetic/Phenotypic Evaluation of Commercial Cattle?

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## Should BIF Expand its Mission to Include Genetic/Phenotypic Evaluation of Commercial Cattle?

- I raised this question during the BIF Strategic Planning Workshop.
- This would be a rather substantial change for BIF.
- It was decided that we should address this question at the Convention.



## What Do I Mean by Genetic Evaluation in Commercial Cattle?

- Estimation of the total genetic merit
  - Additive component
    - Predicts performance of progeny
    - This is the breeding value that we normally deal with in genetic evaluation and which responds to selection.
  - Non-additive component
    - Predicts individual performance
    - This component can be managed effectively through mating systems, but not through selection.
- It may or may not incorporate knowledge of breed composition

## What is Non-Additive Genetic Variation?

- There are two components of genetic variation:
  - Additive: this is the portion that is heritable (transmitted from parent to offspring) and that selection operates on. It is the primary component that BIF and seedstock breeders have focused on.
  - Non-additive: this portion is not heritable, but does influence phenotype. It is due to genetic interactions known as dominance and epistasis.
- The proportions of additive vs nonadditive variation vary by trait: generally, lowly heritable traits have a greater proportion of non-additive genetic variation.

## What Do I Mean by Phenotypic Evaluation of Commercial Cattle?

- It is the prediction of the future phenotypes of commercial cattle based on analysis of large data sets, analogous to current national cattle evaluation of seedstock.
- It includes both genetic and non-genetic factors
- It could be based on:
  - Additive and non-additive genetic evaluation of the individuals in the group as deviated from the individuals in the historical averages.
  - Historical average phenotypes for each producer.
  - Predictions of deviations in performance relative to the historical average for each producer based on differences in weather conditions, management practices, and other factors yet to be determined.
  - DNA tests that predict total genetic merit

## Vision

- A system that predicts phenotypic value for use in:
  - **Value differentiation** – determining the price of cattle based on predicted performance.
  - **Targeted marketing** - determining the optimal market niche for individuals based on their predicted phenotypic potential.
  - **Precision management** – different management (e.g., implants, ration, time on feed) of individuals to meet their targeted markets based on predicted performance.

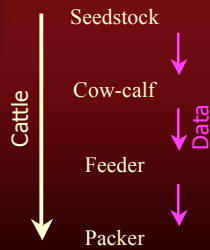
## How Could We Achieve the Vision?

- A National Cattle Evaluation System for commercial cattle
- or
- DNA testing for total genetic merit
- or
- A synergistic combination of NCE and DNA testing

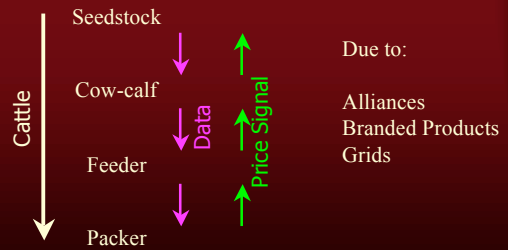
## A National Cattle Evaluation System for Commercial Cattle



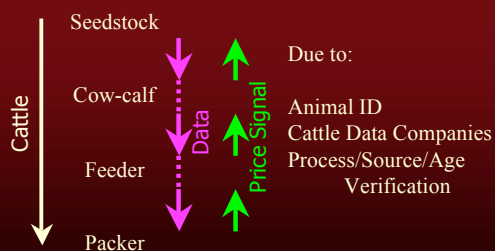
## Traditional Information Flow in the Beef Industry



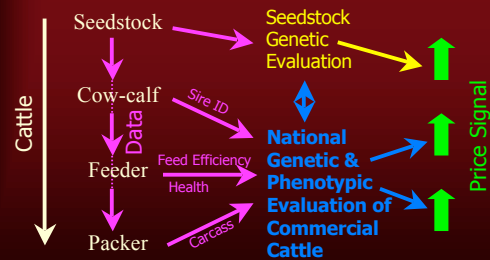
## Value-Based Marketing



## Capturing Added Value Due to Enhanced Information Flow



## Is There a More Efficient System of Value Discovery?



## What Might this System of Value Discovery Provide?

- Predictions of future performance for economically important traits of commercial cattle, considering genetics and past performance of the herd of origin.
  - Could be used for value differentiation.
  - Would be much more effective at predicting performance of groups than in predicting differences among individuals within those groups.
- Improved accuracy of culling bulls and selecting replacement heifers in commercial herds.

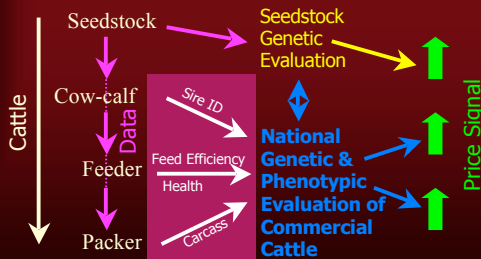


## How Would this System Benefit Genetic Evaluation of Seedstock?

- Improved predictions of genetic merit derived from data on large numbers of commercial cattle for traits such as:
  - Carcass traits and other traits not easily measured in seedstock herds.
  - Reproductive traits and other traits that require larger numbers of observations than are typically available in seedstock herds.
  - Disease Resistance and other traits with both of the above requirements



## What Would this System of Value Discovery Require?



## What Would this System of Value Discovery Require?

- Seamless flow of information on individuals through the supply chain.
- Benefits to everyone in the chain to ensure cooperation.
- New national cattle evaluation models for predicting phenotypic merit as well as genetic merit and for using new data structures.
- A few bits of information that are not typically transferred with commercial cattle.



## What Additional Information Would this System of Value Discovery Require?

- Sire Identification:
  - Sire ID in single-sire or AI matings
  - List of service sires in multiple-sire matings
  - Optionally – sire probabilities determined by paternity testing in multiple-sire matings
- Management and Environmental Factors:
  - Historical average performance for each producer
  - Weather conditions
  - Management practices
  - Other factors yet to be identified

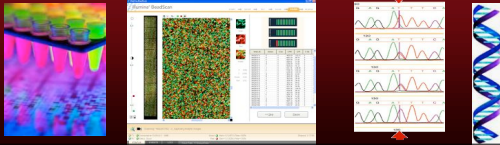


## Paternity Testing for Multiple-sire Matings

- Obvious applications in seedstock herds
- May have benefit in commercial herds if the information is utilized effectively

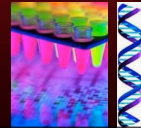


## DNA Testing for Total Genetic Merit in Commercial Cattle



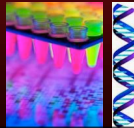
## What Do I Mean by Marker Assisted Management (MAM)?

- Estimation of Total Genetic Merit (additive and non-additive) from DNA testing.
  - Better at predicting differences among individuals than mean phenotypes of groups.
- Objectives could include:
  - Targeted marketing
  - Precision management
  - Value differentiation



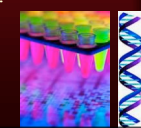
## Will Marker Assisted Management Become a Reality?

- The prospects are improving rapidly due to:
  - Decrease in cost of testing
  - High throughput testing technology that will allow development of tests that account for a much larger proportion of genetic variation than in the past.
- MAM is likely to soon become the driving force in the DNA testing business.
  - Applications in selection of seedstock may ride along on its coattails and benefit substantially from it.

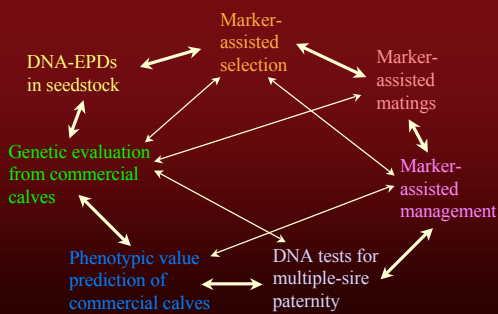


## A Synergistic Combination of NCE and DNA Testing

- DNA markers used for MAM could also be used to determine paternity to considerably enhance NCE of commercial cattle from multiple sire matings.
- Combining NCE and MAM would provide very valuable information from which to improve the power of DNA testing.



## Interactions Among Components



## Should BIF Expand its Mission to Include Genetic/Phenotypic Evaluation of Commercial Cattle?

- I think the time is right.
- What do you think?

