Evidence of genetic variability in cattle health traits: Opportunities for improvement

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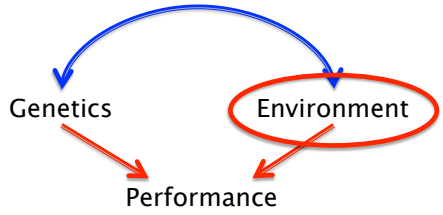
Why Health? What do we stand to gain?

- Reduced costs of production
  - Potentially lower treatment rates
  - Lower mortality losses
- Decline in the poor performance associated with sick cattle

Our historical approach to health

- Focus on management
  - Low stress handling
  - Vaccination
  - Early treatment and/or prophylaxis

Can we do better? Are there other possibilities?



The low hanging fruit are picked…

- Traits with EPD:
  - BW, WW, Milk, YW
  - Carcass traits
  - Calving ease, Fertility(?) and other "cow" traits (especially after THR)
- There are economically relevant "hard-to-evaluate" traits that could improve profitability

"Cattle Health"

- 3 Disease Classes:
  - Single gene defect
    - Or defects controlled by relatively few loci
    - Overwhelming selection **success**
      - (from an industry standpoint)
  - Non-transmittable environmental challenges
    - Fescue toxicity, facial eczema, or high altitude disease
    - **Success?**
  - Vector-related diseases
    - Virus, bacterial or parasitic
      - Pathogen associated diseases
    - **Little to no success? (Have we tried)**

What is the impediment to genetic progress?

- An absence of selection tools
  - In general
    - A lack of base knowledge about the "hard to evaluate" traits
    - A lack of focus
      - What is "animal health"?

Economically Important Traits

Challenges to genetic improvement of health

- Accuracy of diagnosis
- Utility of data collected across production environments
- Pathogen exposure differences

What is the process for developing selection tools?

1. What is(are) the economically relevant traits?
2. Are these traits under genetic control?
3. Are there indicators that are more easily measured?
   - Remember we are addressing the hard-to-evaluate traits
4. Can we collect field data?
   - Are DNA marker tests more appropriate and cost-effective? Or both?

If the above is successful, we will have the tools to improve traits such as animal health.

"Cattle Health"

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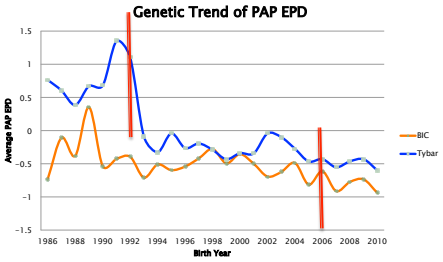
    - Fescue toxicity, facial eczema, or high altitude disease
  - Vector-related diseases
    - Virus, bacterial or parasitic
      - Pathogen associated diseases

Environmental challenge: High Altitude Disease

- Commonly referred to as brisket disease
- Usually manifest above elevations of 5500 feet
- Clinical signs:
  - Swollen brisket area
  - Reduced appetite
  - "Poor doer"
  - Death
  - Physiologically
    - Disease is the result of lower oxygen concentrations at higher elevations.
    - The heart responds vigorously by forcing blood through the pulmonary system forcing fluid out of the circulatory system (swollen brisket)

What is the economically relevant trait?

- Survival at high elevation
- Problem:
  - Precise identification of afflicted animals is problematic (extensive environment).
- Indicator:
  - Pulmonary arterial pressure based on evidence animals with brisket has elevated PAP
- Is there genetic variation?
  - YES!
    - Heritability is 40 to 46%
- Should respond to selection

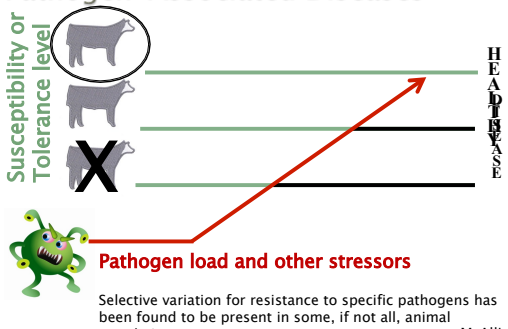


Limitations to evaluation

- Animals are required to be at elevation before PAP can be collected
  - 30 days
  - Typical of many environmental health challenges —animals must be in that environment to determine susceptibility.
    - Limits on accuracy of selection
- Solutions:
  - Find indicator traits appropriate for all elevations (environments)
  - Develop DNA marker tests to screen animals from lower elevations

Genetic Improvement in Pathogen-Associated Diseases

Genetic Improvement in Pathogen-Associated Diseases



Selective variation for resistance to specific pathogens has been found to be present in some, if not all, animal populations (Nicholas, 1987).

McAllister

Pathogen-associated disease traits are problematic

- Were all animals in the contemporary group equally exposed to the pathogen?
  - the opportunity to express genetic differences
- Was a correct diagnosis made?
- Are there differences in severity?
  - Subclinical cases (not identified)
- Were causative pathogens identified?

The economics behind genetic improvement of cattle health

- Prevention and treatment of disease in the feedlot— >$3 billion (Griffin, 1997)
- ~1.1 million cattle were lost to respiratory causes in 2005 @ > $692 million (USDA, 2006).
- ~22 pounds reduction in HCW for animals treated in 1st 40 days (Snowder et al., 2007)

The economically relevant trait

- Susceptibility to bovine respiratory disease
- Genetics of Cattle Health
  - Colorado State University and Pfizer Animal Genetics
  - The premise:
    - Susceptibility/resistance to disease is, in part, genetically controlled and
    - that genetic control can be characterized by DNA markers.

Bovine Respiratory Disease Treatment Rates

- Year 1 –45% treated
- Year 2—7.1% treated

Is there genetic variation?

Trait	heritability
Treated for BRD (yes/no)	**0.17 ± 0.06**

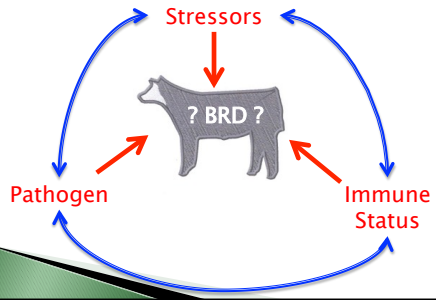
Is there genetic variation?

Trait	heritability
Treated for BRD (yes/no)	**0.17**
Treated for any reason (yes/no)	**0.24**

How do we develop these tools?

- Need to determine:
  1. ✔ What is(are) the economically relevant traits?
  2. ✔ Are those traits under genetic control?
  3. ➡ Are there indicators that are more easily measured?
  4. Can we collect field data?
     - Are DNA marker tests more appropriate?

Bovine Respiratory Disease Complex



Lets leverage available field data

- Challenge to producers and breed associations
  - Keep records of treated animals and reason for treatment
  - Especially true of progeny carcass tests

Summary

- There is evidence that genetic variation exists for health traits in beef cattle populations.
- Can we develop the necessary tools to make selection successful?
- What level of economic importance do these traits hold?