The Potential for Genetic Improvement of Cattle Health

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Goal is to reduce the incidence of disease

- Resilience? Resistance? Tolerance?

The economic case for genetic improvement of cattle health

- 1997 estimates put prevention and treatment of disease in the feedlot at >$3 billion (Griffin, 1997)
- ~1.1 million cattle with an estimated value of over $692 million were lost to respiratory causes in 2005 (USDA, 2006).
- ~7.25 kg (16 pounds) reduction in hot carcass weight for treated animals in 1st 40 days (Snowder et al., 2007)
- Lung damage (yes/no) – 15.4 kg (34 pounds) of carcass weight (Engler, 2007)

The incidence of this problem has increased

- Total feedlot deaths increased 69% in 2003 compared to 1994
- Bovine Respiratory Disease Complex (BRDC) deaths more than doubled (118%) during same time

Guy Loneragan, WTAMU, (2008)
Sentinel Feedlot Monitoring Program (USDA:CEAH)

The genetic case for improvement in cattle health

- Snowder et al. (2006)
  - Calves from 1987 to 2001 with incidence of BRD ranging from 5% to 44%
  - Heritability on observed scale was .04 to .08
    - .18 on the underlying continuous scale
  - Concludes that selection against susceptibility to BRD using producer/industry data is practicable

Heritability appears to increase with increasing incidence

- Low incidence versus high incidence years (Snowder et al. 2006)
  - True for other binary traits (yes/no)
    - Comstock 2006
- There is genetic variability
  - We can make progress with the appropriate tools
- What about correlated response?

The genetic case for improvement in cattle health

- Snowder et al. (2007)
  - Same calves as previous study (1987 to 2001)—Incidence of BRD ranged from 5% to 44%
  - Reported low genetic correlations between BRD and growth, carcass and palatability traits
  - Suggests we can likely improve resistance to BRD without adverse effects on other traits.

QTL for disease resistance?

- Casas and Snowder (2008)
  - A QTL for resistance to pathogenic disease incidence that combined BRD, pinkeye, and footrot

Literature reports successful selection against disease traits

- New Zealand selection lines against fecal egg counts in sheep
  - 40 fold difference between divergent lines (Morris, 2007)

Ongoing study investigating these differences

- Initiated because of the relationships established through the National Beef Cattle Evaluation Consortium

National Beef Cattle Evaluation Consortium

Study Background

- Steers (1551) from a single source in Nebraska were shipped to cooperating Five Rivers Cattle Feeding Lot (Lamar, CO)--341 miles

About the location

- Close proximity to CSU's Southeastern Colorado Research Center
- Willing commercial participant

Background continued

- Cattle had been vaccinated twice on the ranch and were subject to a 45 day backgrounding phase before shipment
- Cattle shipped early and held 1 day in receiving pens before processing began (1 to 2 day delay)
- Blood collected for DNA extraction/storage
  - Parentage, SNP analysis, etc

Background continued

- No vaccines upon arrival
  - Wanted a higher incidence of BRD (higher heritability)
- Wormers administered
- Cattle were implanted

Sick versus not

- Commercial lot personnel identified "sick" animals
  - What is "sick"? (clinical signs)
- Animals are then move to the CSU-SECRC
  - personnel treats the animal
  - Remain in hospital pens until "recovered"

Defining "sick"

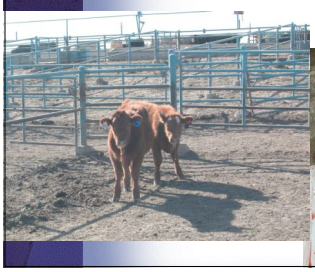
	Lung Lesions	No Lung Lesions
Treated/Pulled	70%	30%
Not Treated/Pulled	56%	44%

G. Loneragan (Wittum 1996; Thomson 2003)

31% average pull/treatment rate

Treated animals

- First treatment
  - 5 day evaluation, 7 day re-treat



Phenotypes to be collected

- Phenotypes characterizing morbidity
  - Sick (yes/no)
  - Time to recovery
  - Treatment records
    - drugs, temperatures, weight change
  - Mortality
    - Necropsy results
      - Bacteriology
      - FA tests
  - Lung lesion scores collected at harvest
  - BVD PI information
  - Respiration rates
  - Visual scores
    - Nasal discharge, Eye, Cough, Depression, rapid breathing

- Performance traits
  - Weights
    - Arrival, re-implant, slaughter
  - Carcass traits
    - Hot carcass weight
    - Marbling score/quality grade
    - Ribeye area
    - Backfat thickness
    - Yield grade
    - Liver scores
    - Carcass value
  - Ultrasound (3 times):
    - %IMF, REA, Backfat

Phenotypes continued

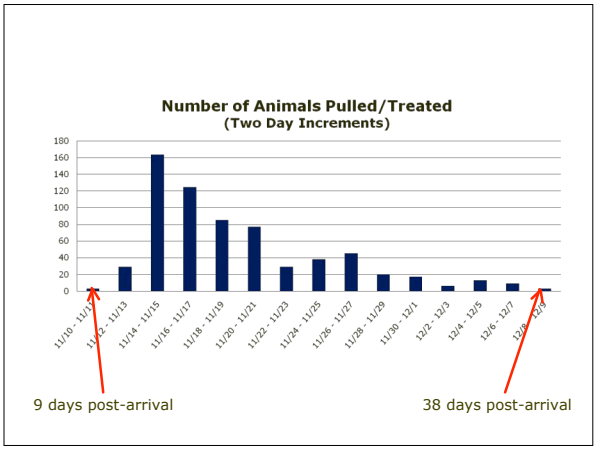
- Baseline stress and behavior characteristics
  - Temperament
    - Flight speed
    - Chute score – 2 evaluators
  - Stress indicators

Phenotypes continued

- Baseline disease/immunological status measures
  - Baseline for exposure in the feedlot
    - BVD I & II, PI3, IBR, BRSV
  - Tests for differences in immune response
  - Body temperature profiles

Phenotypes continued

- Environmental variables
  - Weather characteristics
    - Station on site
    - Backup station 1 mile to the south
  - Ration composition
    - Ration change dates



Current Status

- 45% overall treatment rate
  - 22% re-treat rate (2nd treatment before return to home pen)
- 6% returned to home pens and then re-pulled at a later time
- 6.25% mortality rate
  - 14% as percent of treated

Next step

- Begin to quantify
  - Relationships amongst the phenotypes
  - Amount and nature of genetic control
- Repeat the study with calves born this year
- Goal:
  - To develop tools that will allow us to select animals with greater resistance/tolerance to BRD

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Questions?