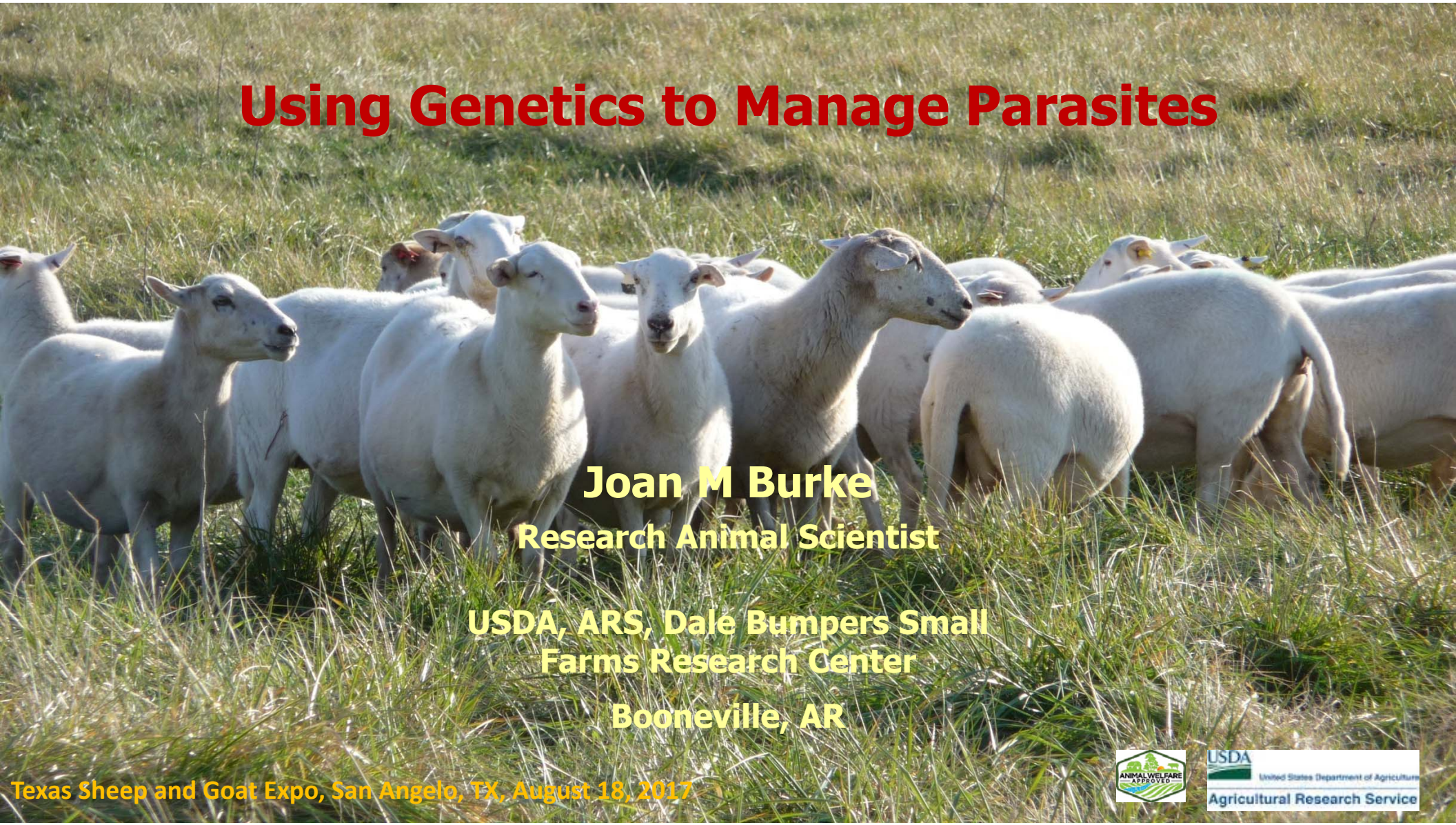
Using Genetics to Manage Parasites



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Booneville, AR

Texas Sheep and Goat Expo, San Angelo, TX, August 18, 2017

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Dale Bumpers Small Farms Research Center Mission: To develop scientific principles and technologies to enhance the profitability of small scale farms.

Outline

- Worm parasites
- Resistant breeds
- Genetic selection within breed

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Gastrointestinal Parasites

- **Infect sheep and goats.**
- **One of greatest health issues, causing anemia, reduced weight gains, poor performance, and death.**
- **Widespread anthelmintic resistance limits tools to control.**

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Gastrointestinal Parasites

- ***Haemonchus contortus*** **or barber pole worm is the most pathogenic, and thrives in warm, humid climates.**
- **Others include *Trichostrongylus* spp., *Cooperia*, *Oesophagostomum*, *Teladorsagia circumcincta*, *Nematodirus*, and are less pathogenic.**

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Haemonchus contortus

- **A blood sucking worm**
- **Very prolific – one adult female can produce 5,000 eggs per day**
- **Short life cycle – about 3 weeks from time of infection until eggs are produced**
- **Affects weak, young, pregnant, or lactating animal**

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Parasite Control

- **Widespread anthelmintic resistance necessitates the use of alternative control measures.**
- **Selective treatment with anthelmintics – use 3-way combination (see www.wormx.info).**
- **Other tools, but most promising is parasite resistance, which is influenced by genetics.**

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Use of Resistant Breeds

- **Spanish and Kiko > Boer**

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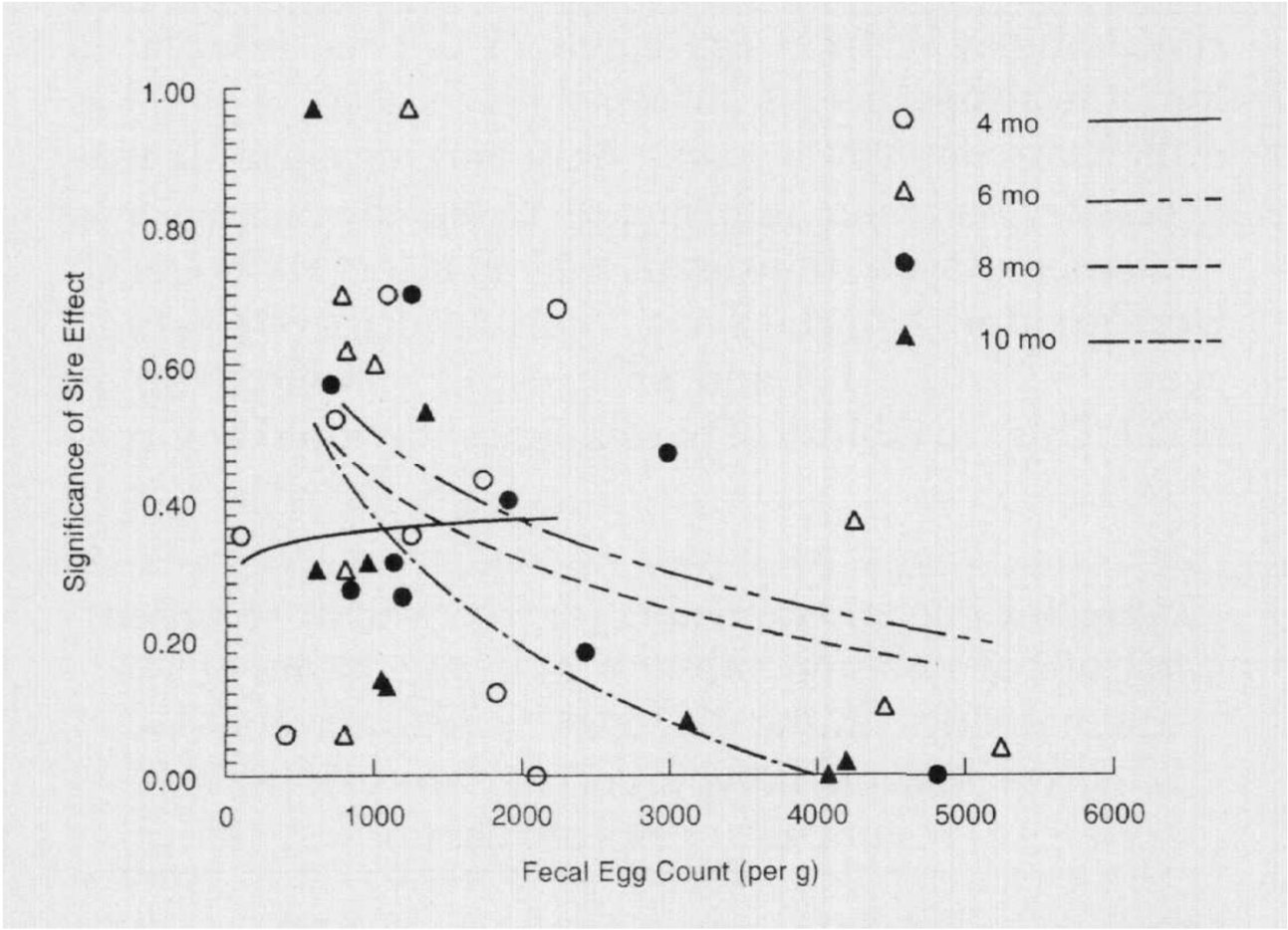
Parasite resistance in goats



Mandonnet et al., 2001, JAS 79:7

- **Relationship between FEC and sire effect – more significant as infection increased.**
- **Heritability as high as 0.37.**

Use of Resistant Breeds

- St. Croix
- Gulf Coast or Florida Native
- Barbados Blackbelly
- Katahdin

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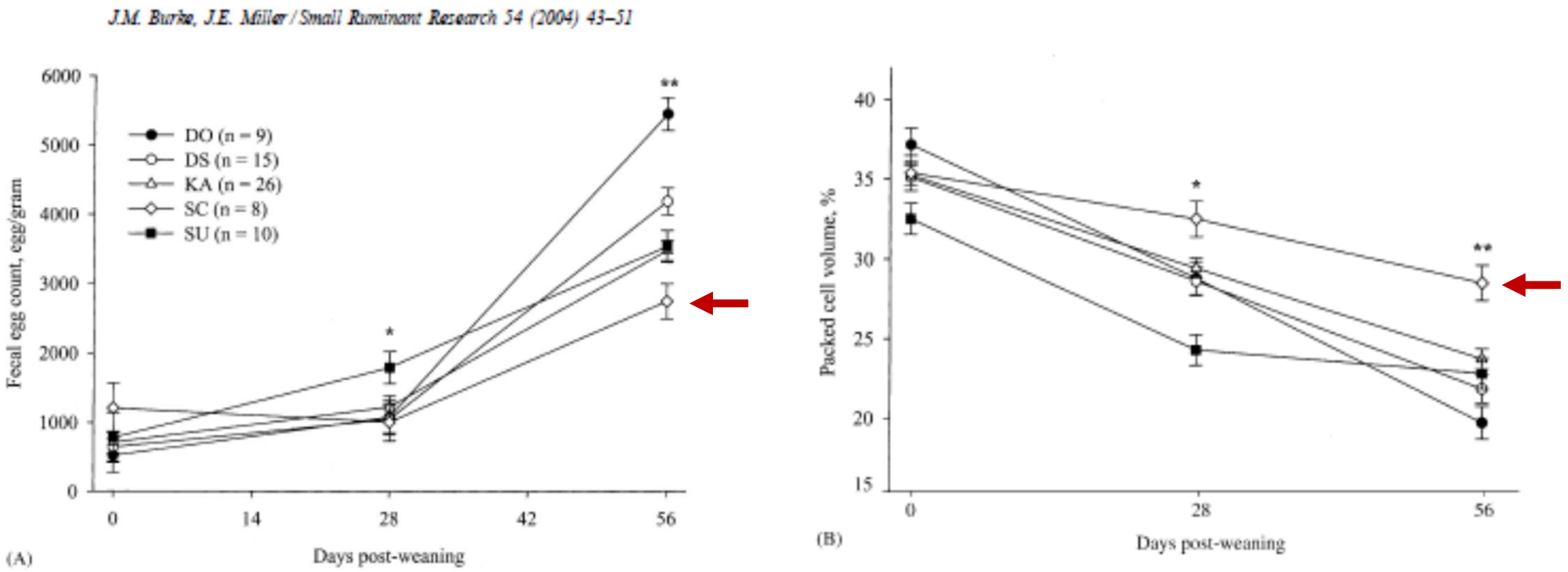
Use of Resistant Breeds



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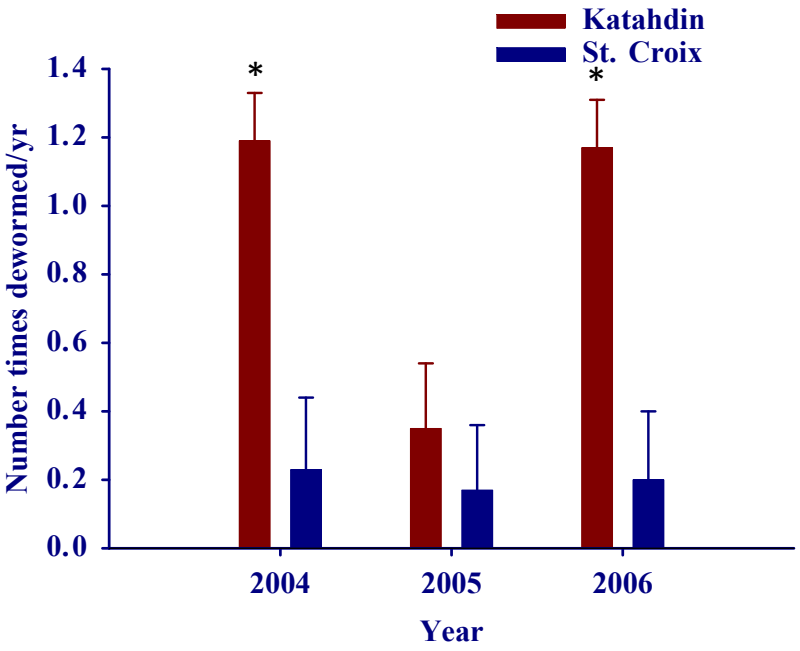
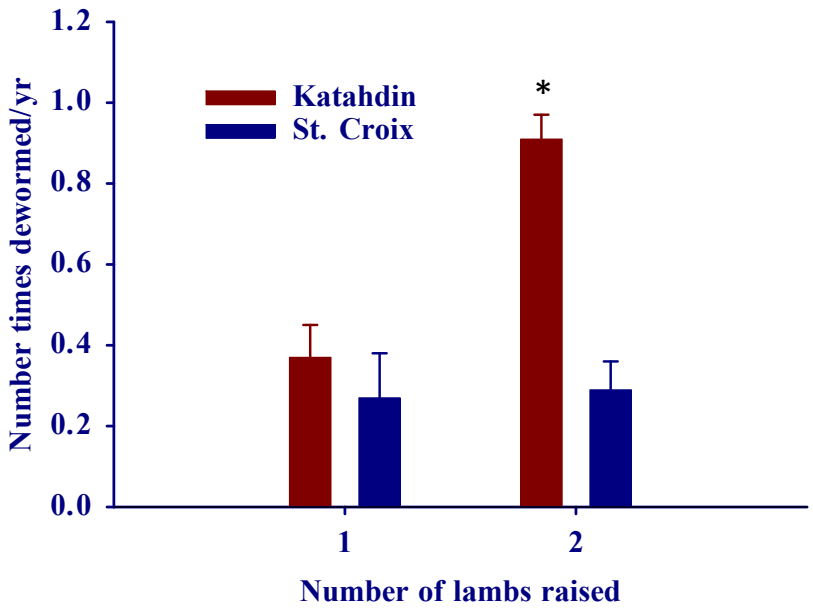
Impact of Resistant Breeds





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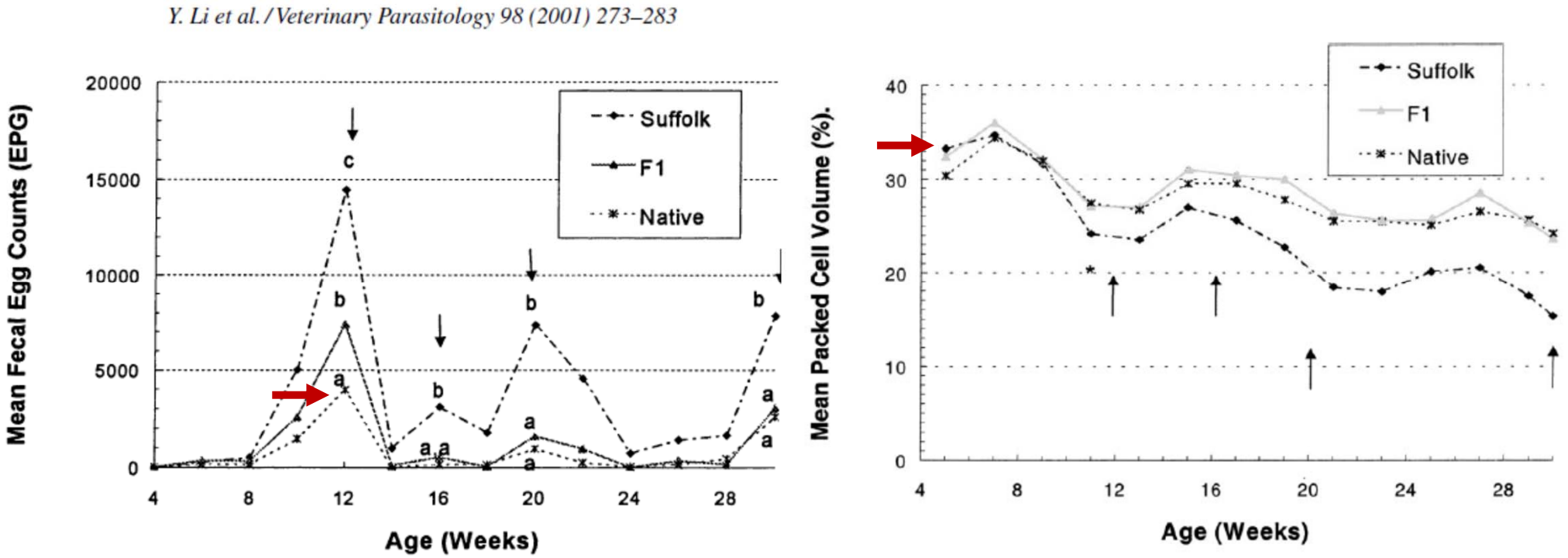
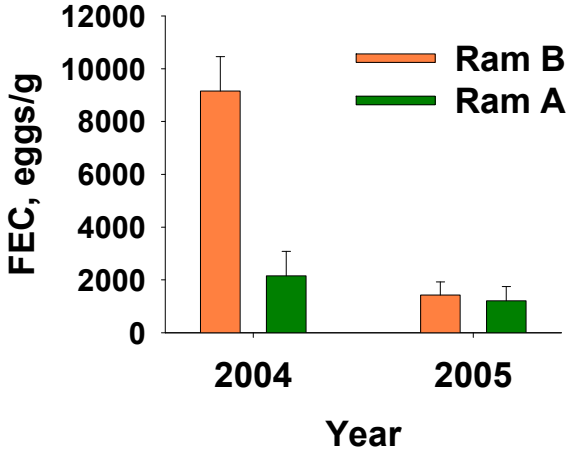
Effect of cross-breeding or heterosis on resistance

-34-82% for FEC, 0-21% for PCV



Using genetics for individual selection

- An animal's ability to resist parasites is heritable (~0.2 – 0.5)
- USDA, ARS progeny of sires have been evaluated since 2004 for parasite resistance (FEC) and tolerance (PCV and FAMACHA), growth, and maternal traits.



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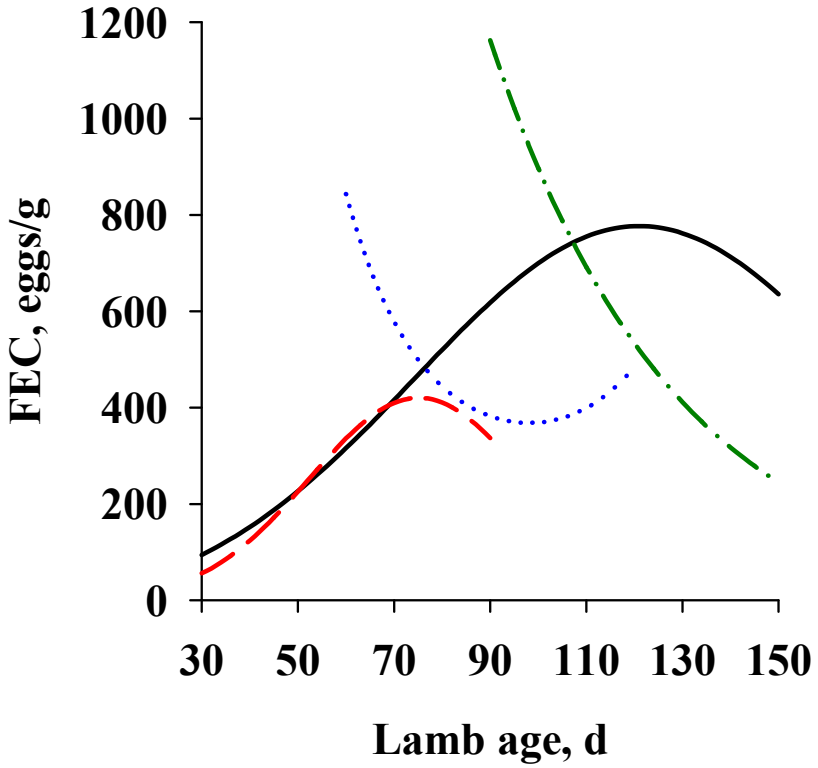
Using NSIP to select for parasite resistance

- NSIP allows recording of FEC at 2 different ages:
  - Weaning (42 to 90 d)
  - Postweaning (90 to 150 d)
- Weaning FEC are generally collected at the time the lambs are first dewormed. In flocks using FAMACHA, producers are encouraged to collect weaning FEC prior to treating more than a small percentage of the lambs.

Changes in lamb FEC with age

(Notter, Burke et al., 2017)



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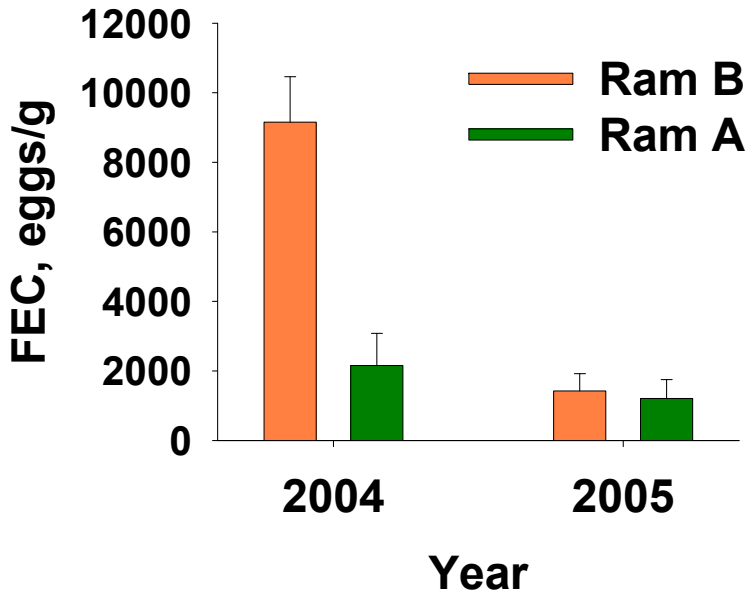
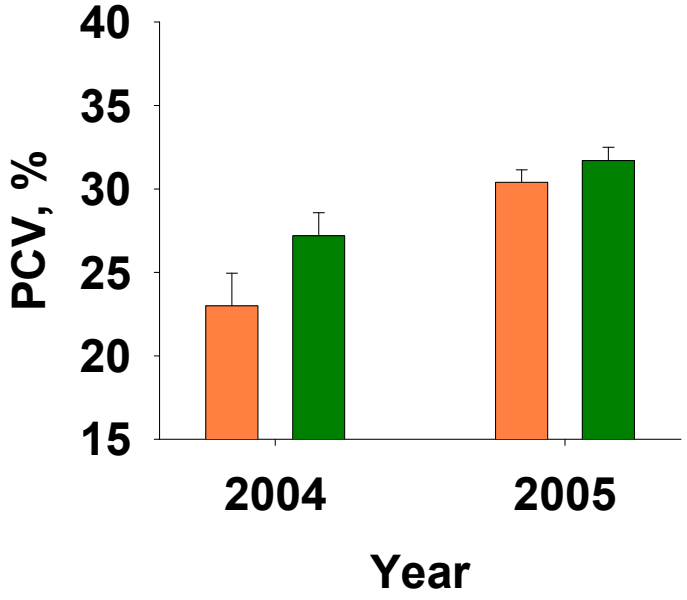
FEC and PCV of offspring sired by Katahdin rams A or B (Year 2004, 2005) at 120 d of age (Burke & Miller, 2008 Vet. Parasitol. 153, 85)

Ram A:
WWEC = -21
PWEC = -3

Ram B:
WWEC = +178
PWEC = +119





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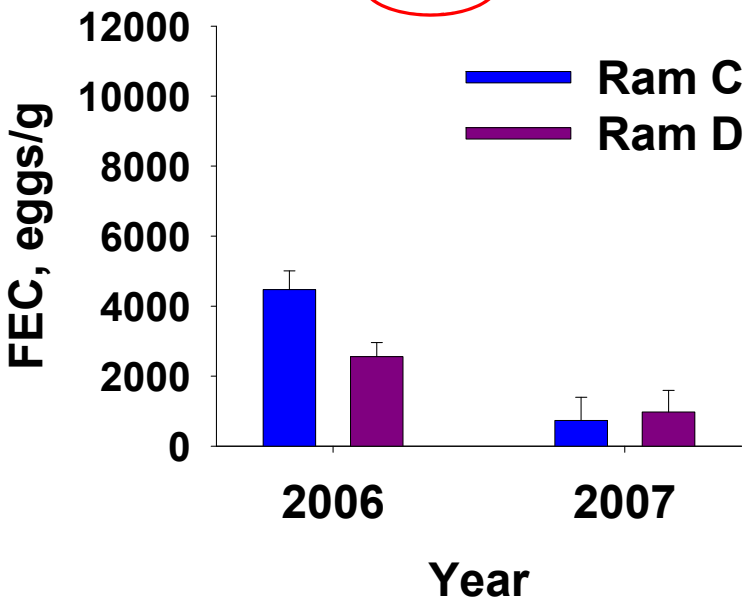
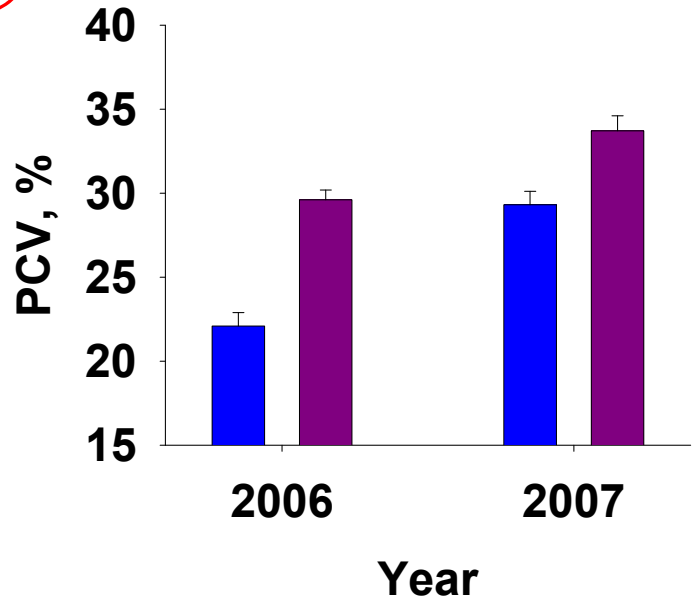
FEC and PCV of offspring sired by Katahdin rams C or D (Year 2006, 2007) at 120 d of age

Ram C:
WWEC = +108
PWEC = +196

Ram D:
WWEC = -56
PWEC = -70





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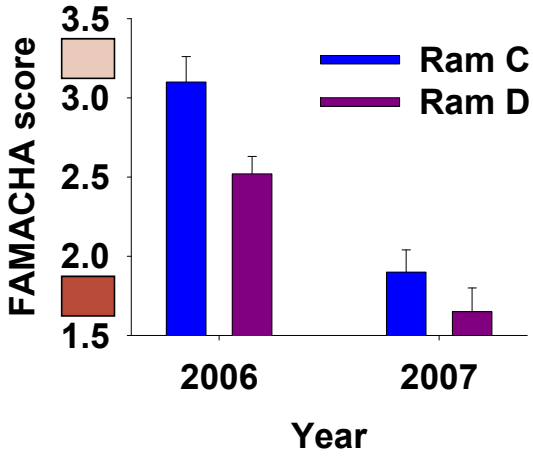
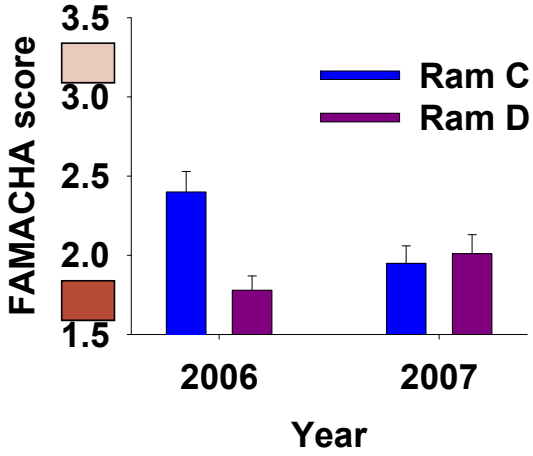
FAMACHA scores of offspring sired by rams C or D at 120 and 150 d of age





Ram C:
WWEC = +108
PWEC = +196

Ram D:
WWEC = -56
PWEC = -70

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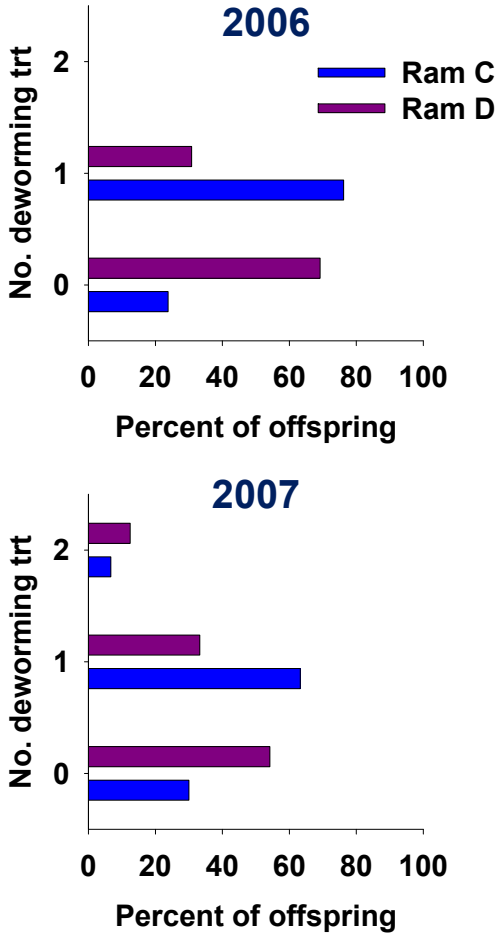
Percentage of offspring sired by rams C or D dewormed at 120 d of age



Ram C:
WWEC = +108
PWEC = +196

Ram D:
WWEC = -56
PWEC = -70

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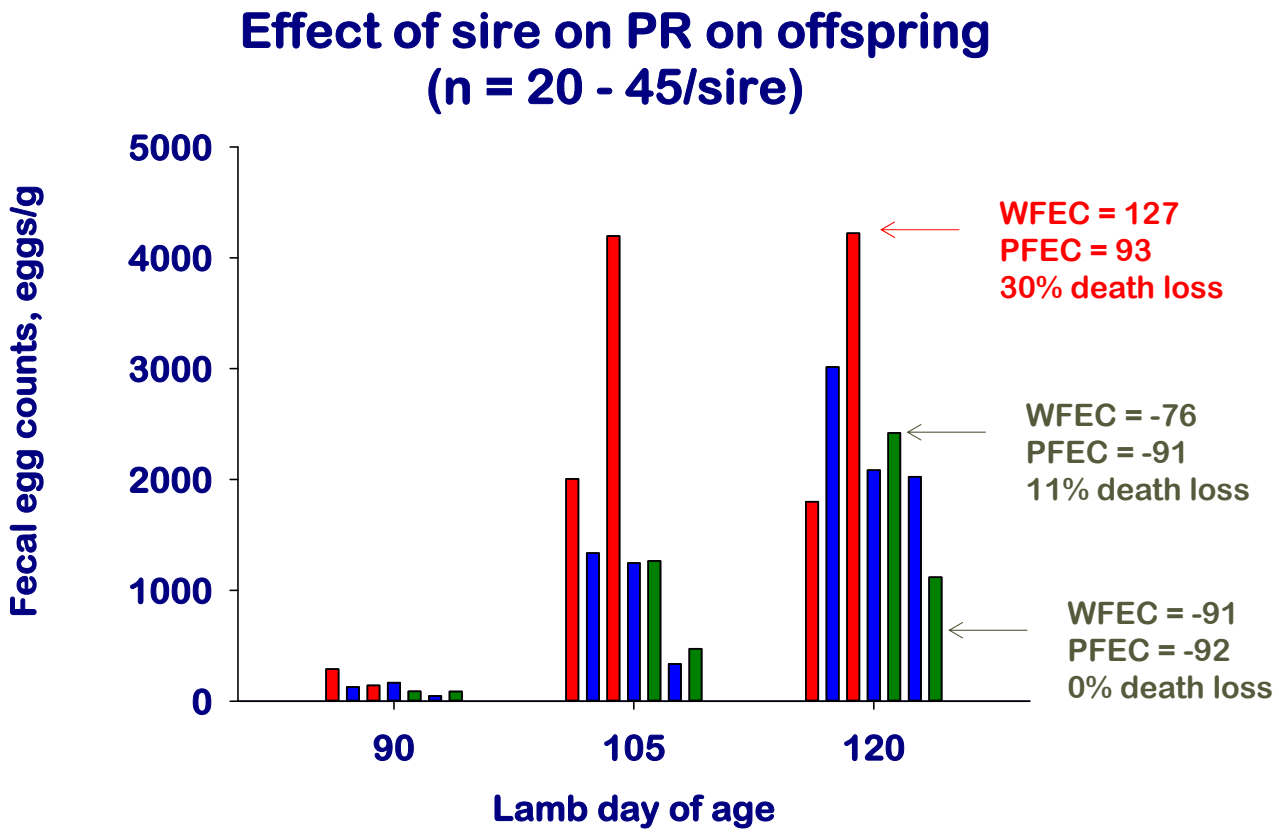
Comparing offspring FEC among sires



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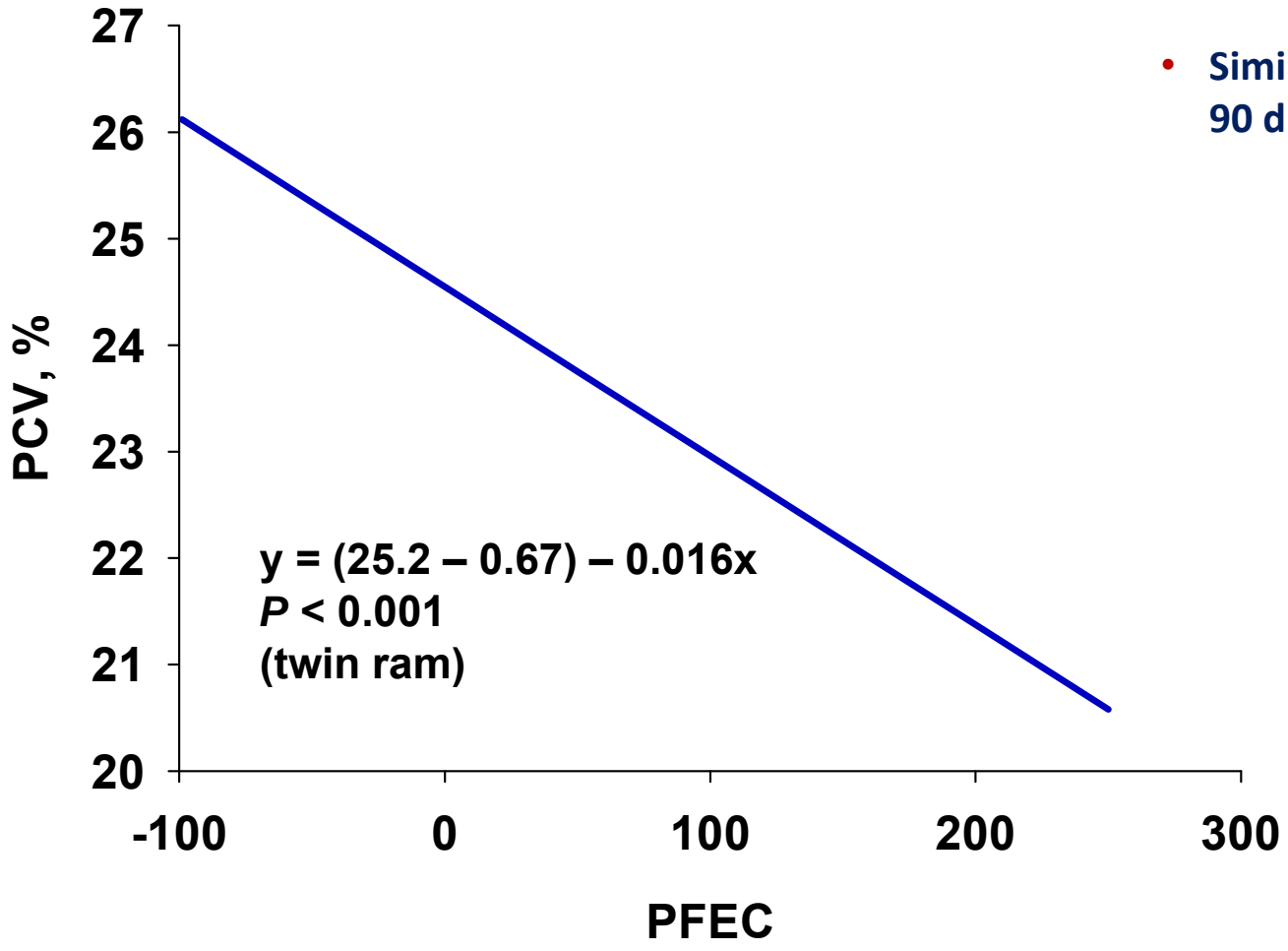
The effect of sire's PFEC EBV on PCV of offspring at 120 d



- Similar relationship at 90 d of age ($P < 0.02$)

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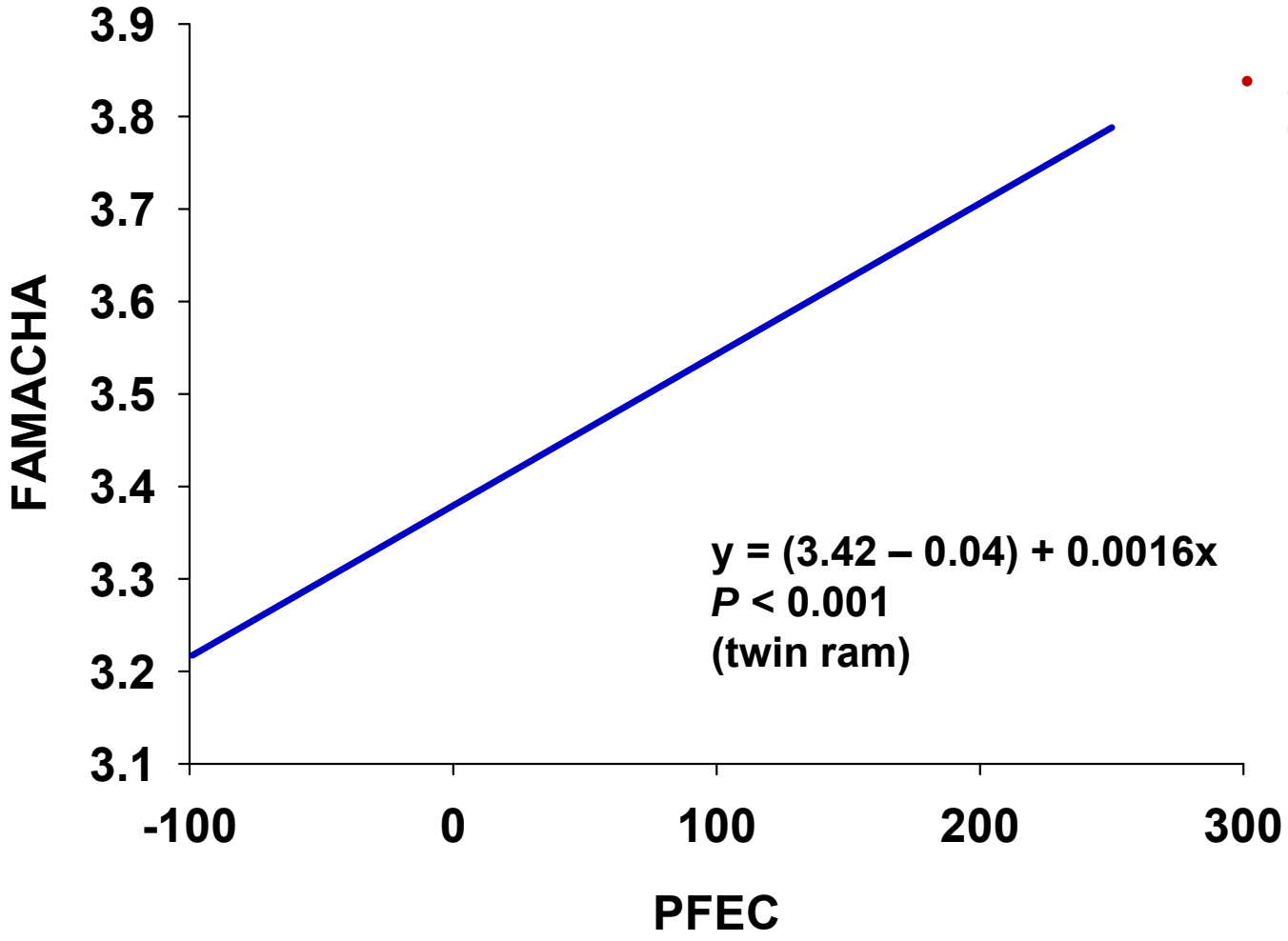
The effect of sire's PFEC EBV on FAMACHA of offspring at 120 d



- Similar relationship at 90 d of age ($P < 0.001$)

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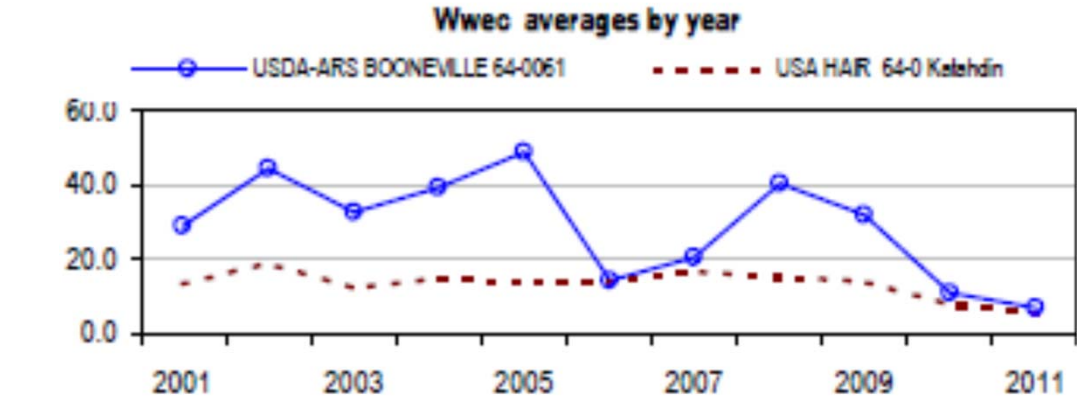
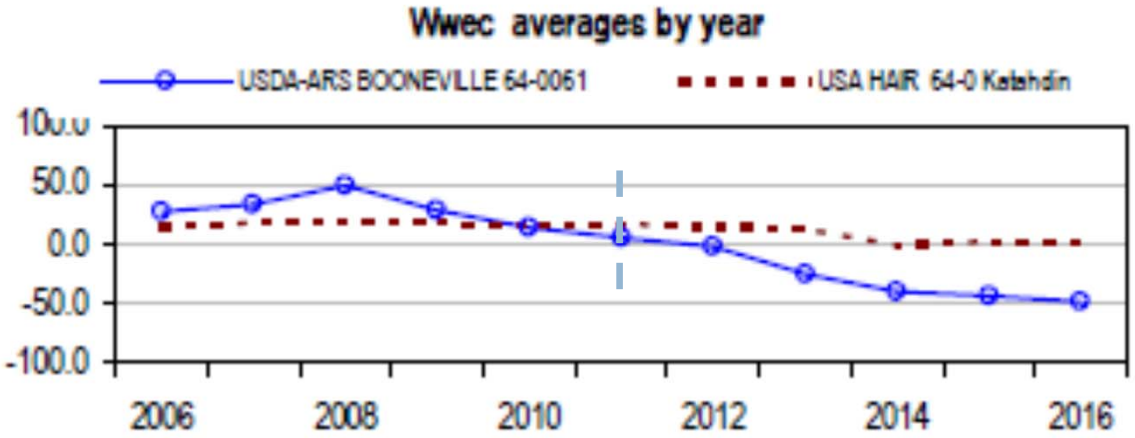
Genetic Trend for ARS flock





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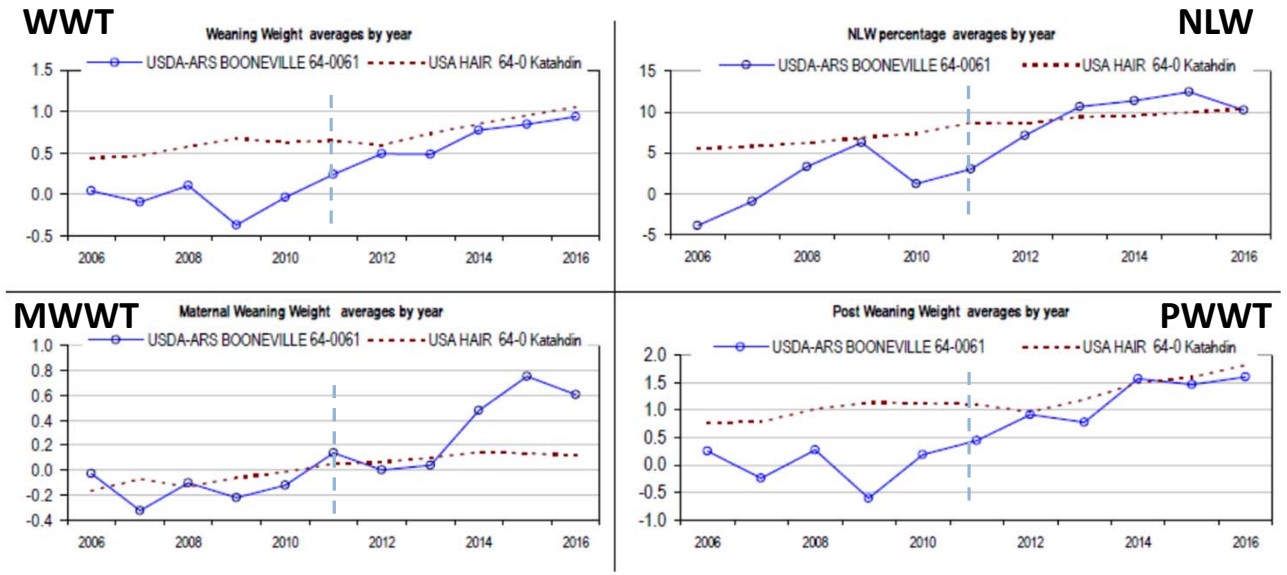
Points to consider

- **For some traits, there are some slight antagonisms with FEC, but likely not to cause disruptions in breeding goals.**

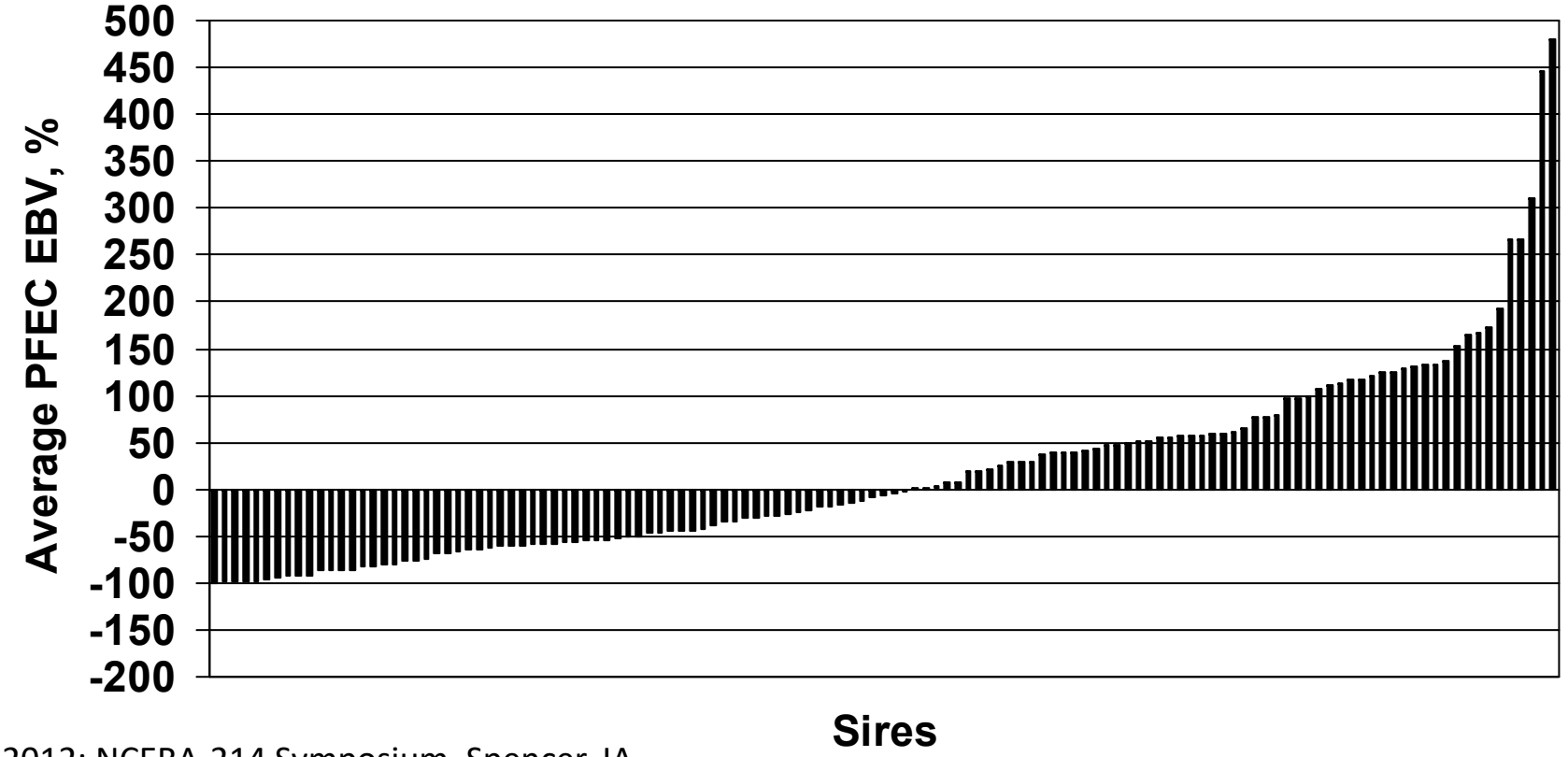


Progeny-Tested Katahdin Sires in NSIP

- **A -100 EBV thus predicts a 100% reduction in average progeny FEC relative to the mean, and is the lower limit for FEC EBVs. Note that a number of sires approach that limit.**
- **There is no upper limit. For example, a +150 EBV predicts that progeny will have means for FEC that are 150% above average.**
- **Variation within the population: the more variation that is present, the easier it is to identify the best.**

D. Notter, 2012; NCERA-214 Symposium, Spencer, IA

Average PFEC EBVs by sires--sires with at least 10 and minimum accuracy of 0.75 for WFEC or PFEC EBVs (N = 127)



D. Notter, 2012; NCERA-214 Symposium, Spencer, IA

Summary

- Genetic resistance to GIN infection is one of the most promising means to control worms in a flock.
- Selection of resistant sires using EBVs leads to lower FEC and FAMACHA scores and higher PCVs in offspring.
- Producers should select sires with balanced EBVs, including +EBVs for weights and maternal traits.

Resources

- **American Consortium for Small Ruminant Parasite Control: www.wormx.info**
- **University of Maryland: www.sheepandgoat.com**
- **ATTRA publications: https://attra.ncat.org/**

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Acknowledgments

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- Contributions from D.R. Notter and the ACSRPC.

American Consortium for Small Ruminant Parasite Control (wormx.info)

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