







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



### Outline

- Worm parasites to select for
- Resistant breeds
- Genetic selection within breed


### 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.

### 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.





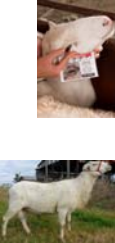

### *Haemonchus contortus* or Barber Pole Worm

- 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

### Parasite Control

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

### Use of Resistant Breeds

- Spanish and Kiko > Boer






### Use of Resistant Breeds





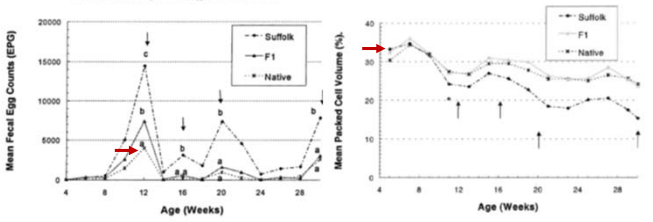
- St. Croix
- Gulf Coast or Florida Native
- Barbados Blackbelly
- Katahdin



### Effect of cross-breeding or heterosis on resistance

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

*Y. Li et al. Veterinary Parasitology 98 (2001) 273-283*



### Resistance within a Breed




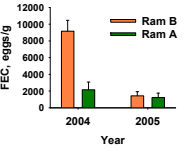


- Katahdin
- Polypay
- Dorper
- Others




### 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.

Year	Ram B	Ram A
2004	~9000	~2000
2005	~1500	~1000

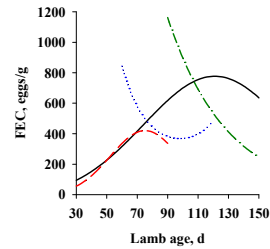


## Using NSIP to select for parasite resistance

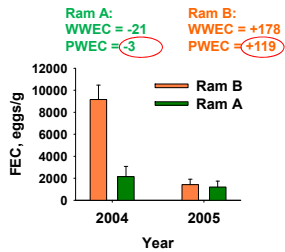


- NSIP allows recording of FEC at 2 different ages:
  - Weaning (42 to 90 d)
  - Postweaning (90 to 150 d)
- Weaning FEC are generally collected at the time the lambs are first dewormed. In flocks using FAMACHA, producers are encouraged to collect weaning FEC prior to treating more than a small percentage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

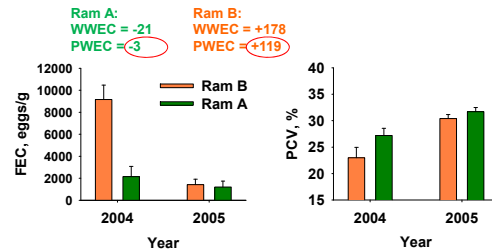
## Changes in Katahdin lamb FEC with age (Notter, Burke et al., 2017)



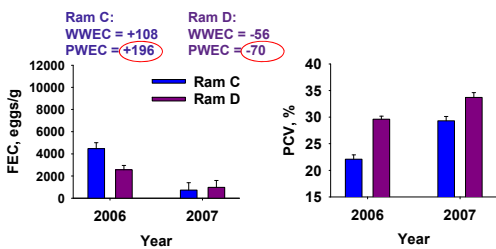
## FEC and PCV of offspring sired by Katahdin rams A or B (Year 2004, 2005) at 120 d of age (Burke & Miller, 2008 Vet. Parasitol. 153, 85)



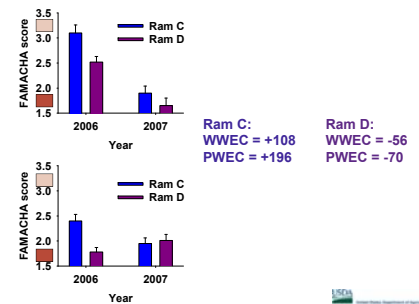
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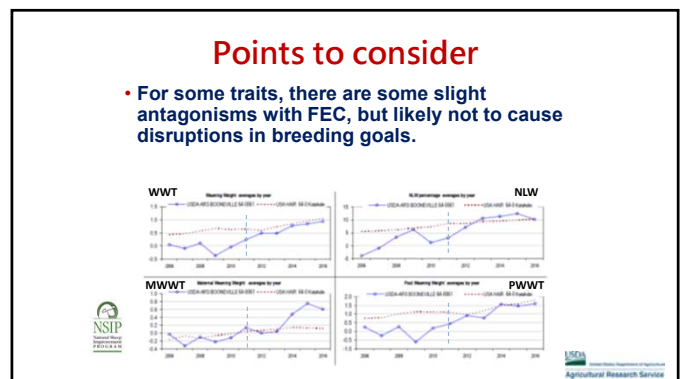
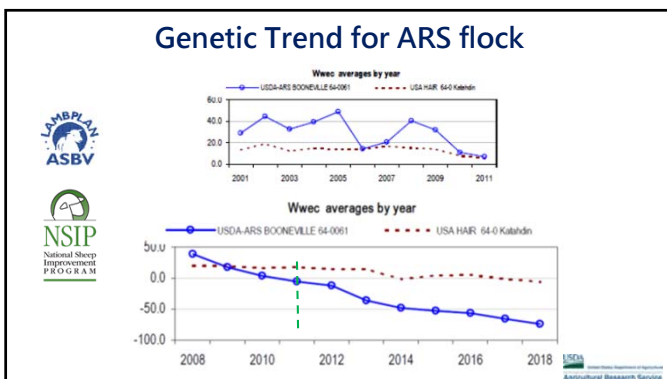
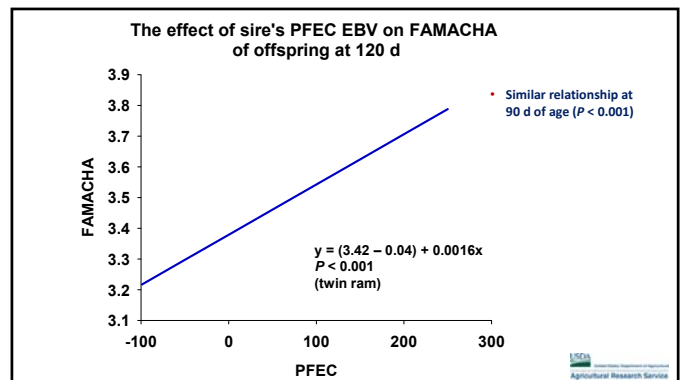
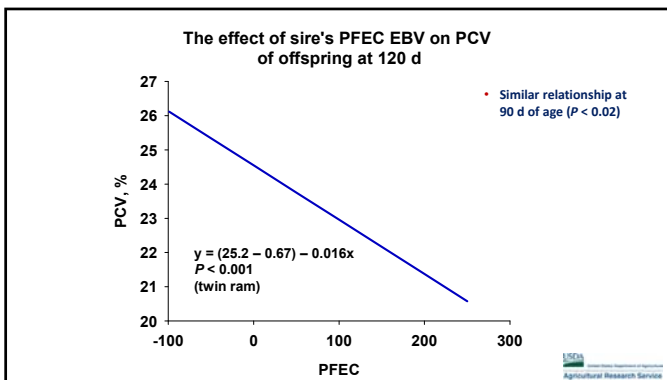
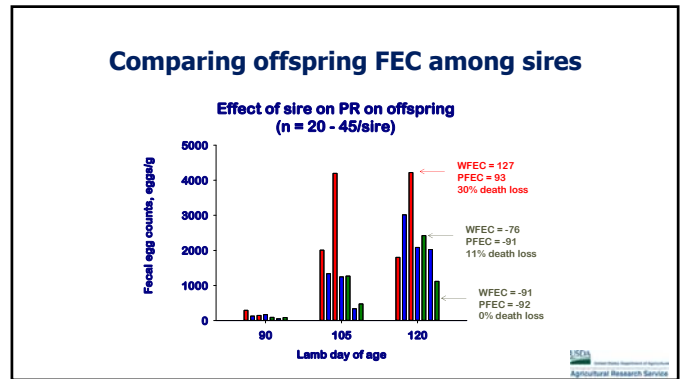
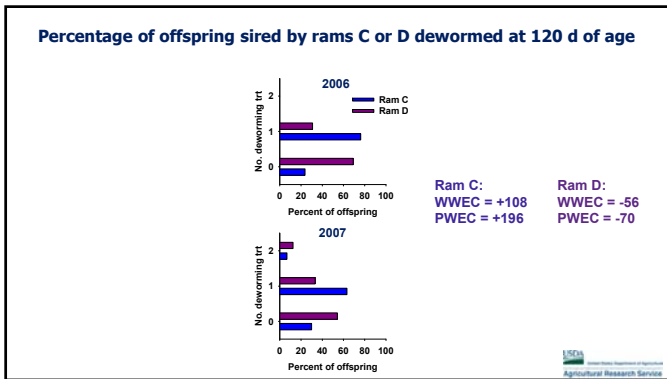


## FEC and PCV of offspring sired by Katahdin rams C or D (Year 2006, 2007) at 120 d of age



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



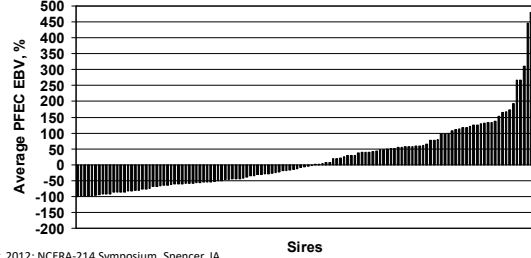


### Progeny-Tested Sires in NSIP

- 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](http://www.wormx.info)
- **University of Maryland:**  
[www.sheepandgoat.com](http://www.sheepandgoat.com)
- **ATTRA publications:**  
<https://attra.ncat.org/>



### Acknowledgments

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

American Consortium for Small Ruminant Parasite Control ([wormx.info](http://wormx.info))



### Tools for Selection



- NSIP – provides predictable, economically important genetic evaluation information to the American sheep industry.
- EBVs – estimated breeding values; inherited genetic potential from sire and dam.
- WWEC or WFEC – weaning FEC
- PWEC or PFEC – post-weaning FEC



## Genetic Selection

- Selection for certain traits are useful to meet farm goals. Select for moderate to high heritability traits.
- National Sheep Improvement Program: genetic selection of sheep based on performance using Estimated Breeding Values. For more information, [nsip.org](http://nsip.org).



USDA  
United States Department of Agriculture  
Agricultural Research Service