SHEEP PARASITE MANAGEMENT
Past, Present and Future

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How does drug-resistance develop?
Assumption: All de-wormers are 100% effective

Dead worms!

How does drug-resistance develop?
Reality: No dewormers are 100% effective
But are most effective when they are new

Everyone say hello to our new drug-resistant little friends
How does drug-resistance develop?

New Reality: De-wormer doesn’t work anymore!

Maintaining Refugia

Every time you de-worm your animal you change the worm population

FAMACHA

- Deworming only the animals that need it.
- Allowed maintenance of drug-susceptible parasites. (Refugia)
- Preserving efficacy of a finite number of deworming drugs.
- Excellent tool to manage parasitism within your flock.
Band-aid solution to a bigger problem

We (sheep producers) forgot how to (or never learned to) raise animals with disease resistance.

“The prime requisite of economic sheep production is to raise animals that are resistant to the effects gastrointestinal nematode parasite infection”

How do we manage parasitism while improving parasite resistance in the host population?

Hygiene Hypothesis

- Early childhood exposure ex: children eating mud pies?
- The hypothesis is based on observations of autoimmune diseases in people in 3rd world countries.
- Early childhood exposure to different pathogens helps in the development of “learned” regulatory immune responses.
- Ex: mice with T1D

Hygiene hypothesis…applied to sheep!

- Since the discovery of avermectins we have been raising sheep in a helminth-parasite sterile environment
  
  Until recently

  So essentially we have been creating sheep that forgot how to generate an effective immune response to parasite infection?
  
  Maybe?
Quick experimental explanation

• All lambs were born on elevated floor barn at WVU

• Six weeks after weaning, 5 St. Croix lambs and 5 Suffolk crossbred lambs were given 10,000 L3 \textit{H. contortus}
  • 5 weeks later lambs were dewormed with levamisole and rested for 4 weeks

• During “real” experiment 10 St. Croix and 10 Suffolk cross lambs were given 10,000 L3 \textit{H. contortus}
  • Naïve lambs = did not receive a dose of larvae
  • Primary infection = first exposure to \textit{H. contortus}
  • Challenge infection = Infection given to lambs that have developed memory

Fecal egg count after infection

Parasite exposure and memory

• During challenge infection Suffolk crossbred lambs had:
  • half the FEC of their primary infected contemporaries
  • an FEC comparable to primary infected St. Croix lambs

Might consider exposing lambs to parasites (pre-weaning)

Bring them into barn, deworm and hold for 4 weeks and grass finish those lambs?

Managing parasitism using the immune response of the animals!
What is so special about St. Croix sheep?

- These sheep haven’t been dewormed for generations.
- They come from an environment where they are constantly challenged with parasites.
- During a challenge infection they seem to generate a greater inflammatory immune response.

Inflammation in the abomasum

Our commercial crossbred sheep have an impaired immune response to parasite infection.

Should I begin crossbreeding St. Croix sheep?

- NO! well maybe?
- Impaired ability to accurately select parasite resistant F1 progeny
- Too many questions as to the profitability of the St. Croix cross
  - Reduced carcass weight
  - Lighter muscled
  - Hair in pelt
- What is their role??
The importance of inflammation in response to helminth infection

Inflammation is critical for the recruitment of other arms of the protective immune response.

Antibody differences between a primary and challenge infection.

Can we capitalize on our knowledge of immune responses to improve immunity in commercial crossbred sheep?

What if we were able to give sheep a feed additive or a shot prior to exposure to parasitism that would improve immunity?

The future of sheep parasite management

1.) Managing parasite exposure of commercial lambs to allow for development of sufficient immunologic memory.

2.) Discovering the crossbreeding “dose”.

3.) To make commercial breeds of sheep more like St. Croix sheep in their immune responses: “Immunomodulation”

Can we stimulate or “wake up” immunity in crossbred lambs

Questions