UF UNIVERSITY of FLORIDA
Department of Animal Sciences

The interplay between host genetics, microbiota and immune response for enhanced health in sheep

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Gastrointestinal parasites in small ruminants

- **Producing and raising healthy animals** is integral to the **profitability and success of sheep operations**

- Gastrointestinal parasites are a **major health problem** in flocks worldwide

- **Economic losses** due to parasitism are two-fold
  - Direct cost of **anthelmintic treatment**
  - **Production losses** due to ill-thrift and in extreme cases death

- **Drug-based parasite control strategies**
  - Increased anthelmintic resistance
  - Need to minimize residual in animal products and the environment

Breeding for host resistance

- **Breeding for host resistance** has been shown to be a **viable method of nematode control**
  - *Resistance* refers to the ability of the host to resist infection
  - *Tolerance* indicates the host is infected by the pathogen, but suffers little adverse effect
  - **Goal**: avoid the spread of the disease, resistance rather than tolerance is required

- **Selection of resistant individuals**
  - **Egg worm count** in fecal samples has been used as a as proxy for parasite resistance
  - Extensive between-animal variation
  - Moderate heritability: **0.2-0.3**

- Additional indicator traits
  - **Resilience**: growth rate and required treatment frequency
  - **Impact of infection**: anemia level (e.g., FAMACHA score)
  - **Immune response**: antibody levels such as IgA, IgG and IgM

Immune response and the resistance to parasite

- The **ability to resist gastrointestinal infection** is dependent on the **development of a protective acquired immune response**

- **Adaptative immune system** can **learn and remember** specific pathogens, providing **long-lasting defense and protection** after initial exposure to specific pathogens

- Both **Humoral and Cellular immune responses** are elicited by helminth parasites
  - ***Humoral*** response centers on the production of antibodies by lymphocytes called **B cells**
  - ***Cellular*** response is mediated by specialized lymphocytes called **T cells**

- **Gastro-intestinal resistant vs susceptible animals**
  - Increased IgA, IgG1 and IgE antibody production
  - Faster immune response than susceptible individuals

McRae et al. (2015)

UF Sheep Project Goal

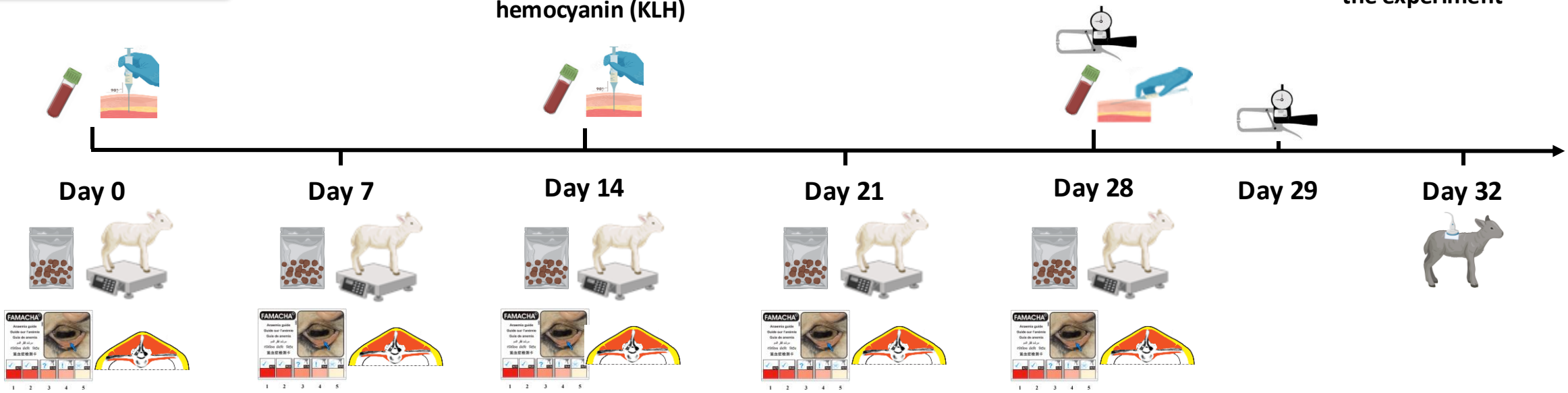
To understand the **genetic basis of immune responses** to foreign antigen and the **interplay between genetics, immune response and gut microbiota** composition to **enhance parasite resistance**

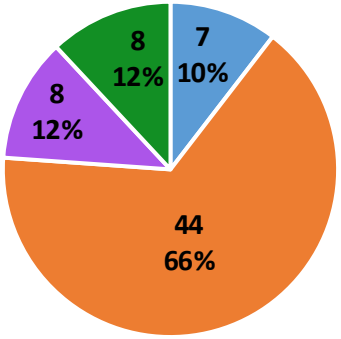
Experiment summer 2024

67 lambs:
44 females
23 males

Foreign antigen: keyhole limpet hemocyanin (KLH)

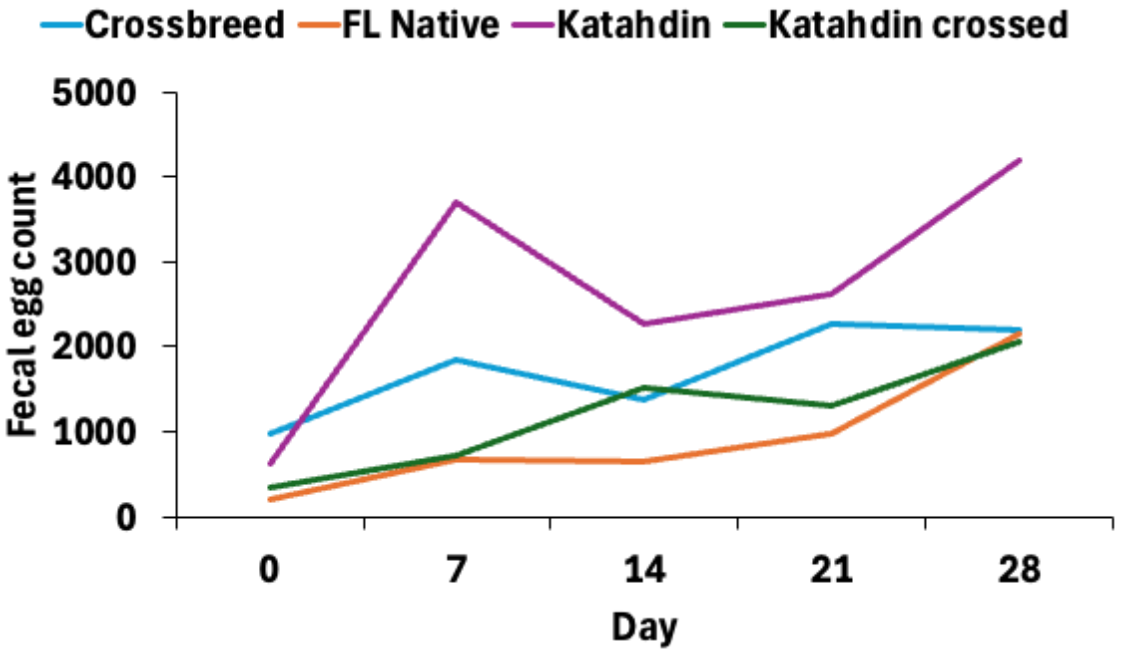
Natural parasite infestation
No deworming during the experiment

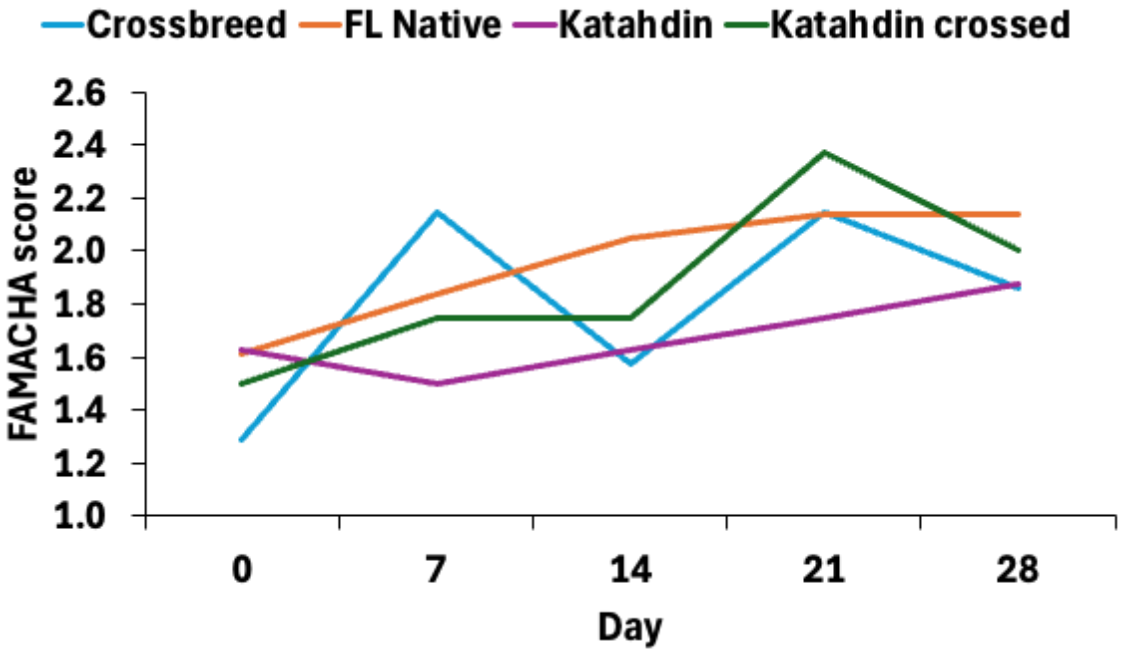




	Mean	Min	Max	CV(%)
Age	135	119	145	5.4
Weight	61.13	37.00	95.00	21.25
BCS	2.79	2.25	3.5	9.46

Parasite infestation and anemia indicator

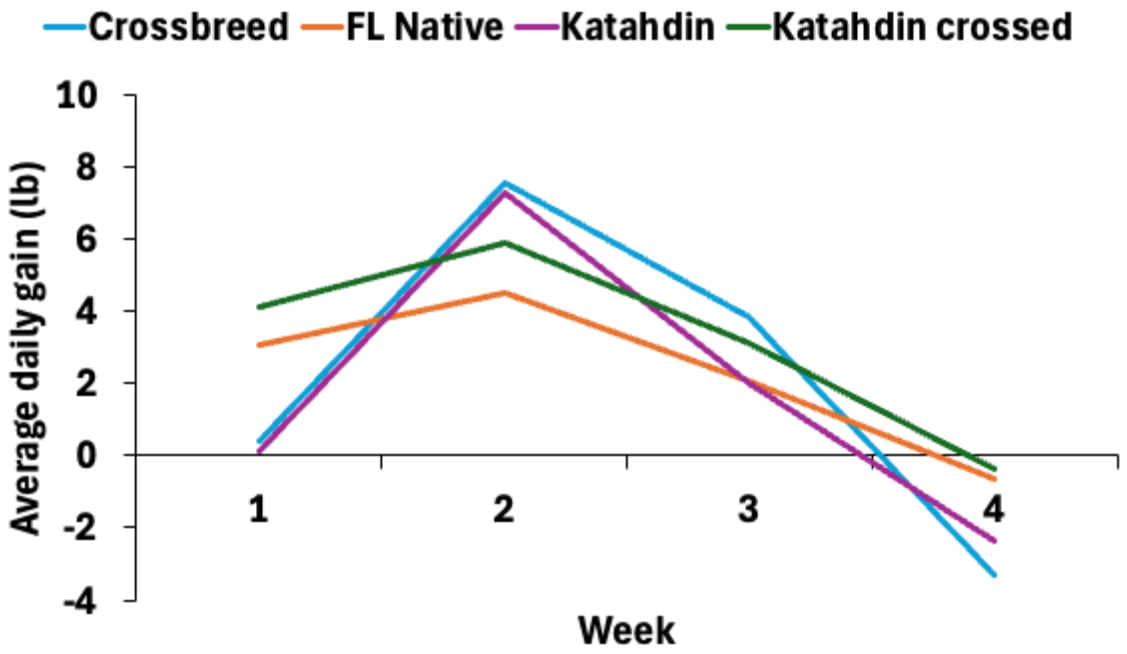


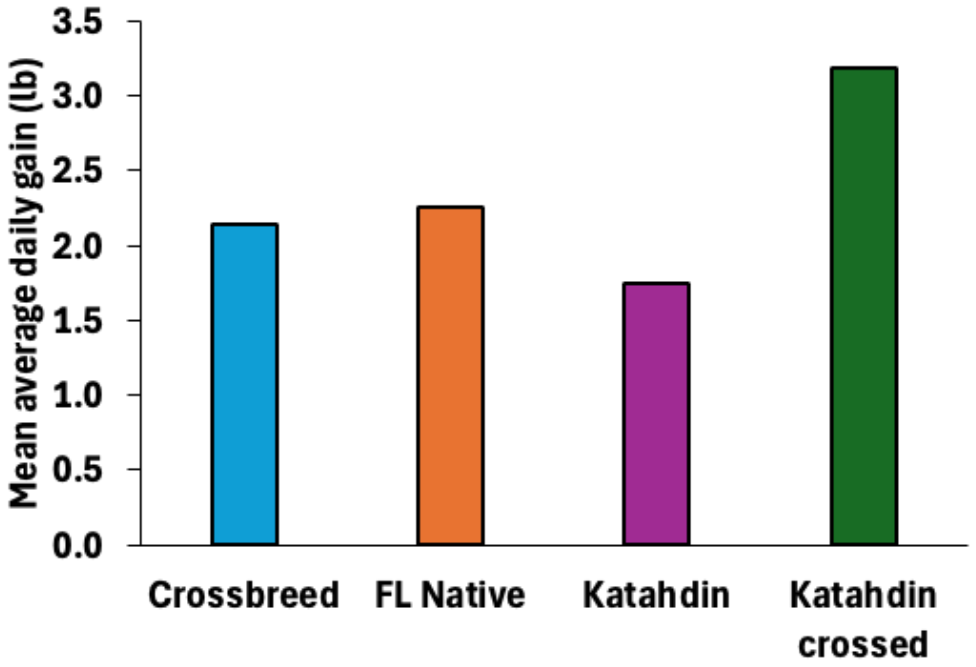


- Increased FEC → **animals were challenged**
- Katahdin consistently highest FEC (susceptibility)
- FL Native consistently lowest FEC (resistance)

- Increased FAMACHA score → **infestation impact**
- FL Native almost linear increase in FAMACHA score
- Katahdin consistently lower score (resilience)

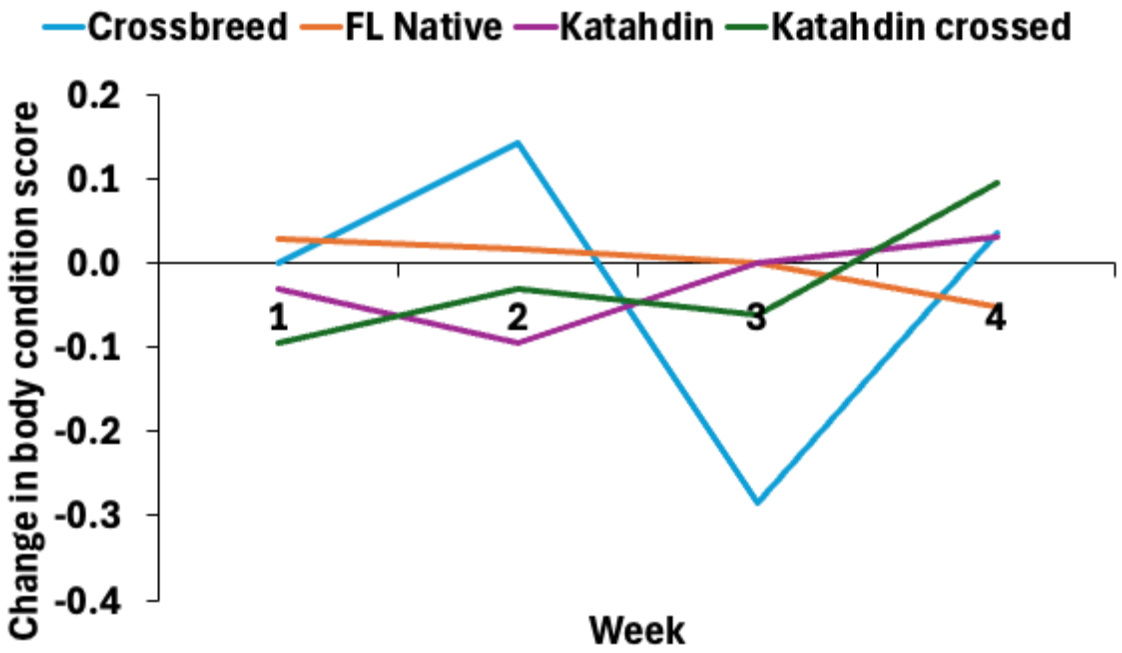
Change in average daily gain

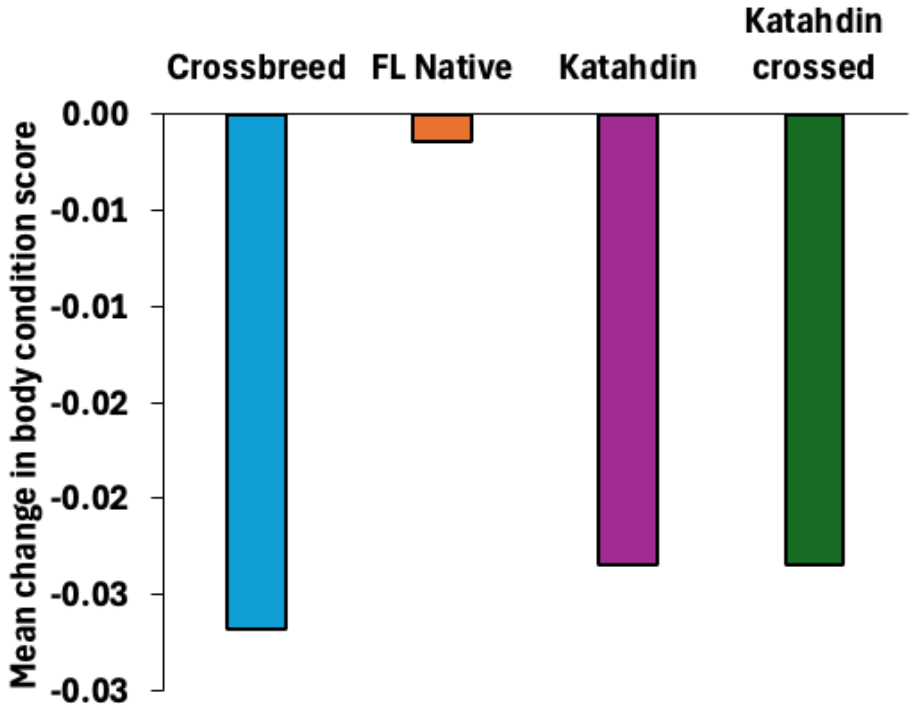




- Weight loss → **impact of parasite load on growth rate**
- FL Native & Katahdin crossed showed lowest weight loss at the last week (resilience?)
- Pure Katahdin showed lower mean average daily gain during the experiment

Change in body condition score

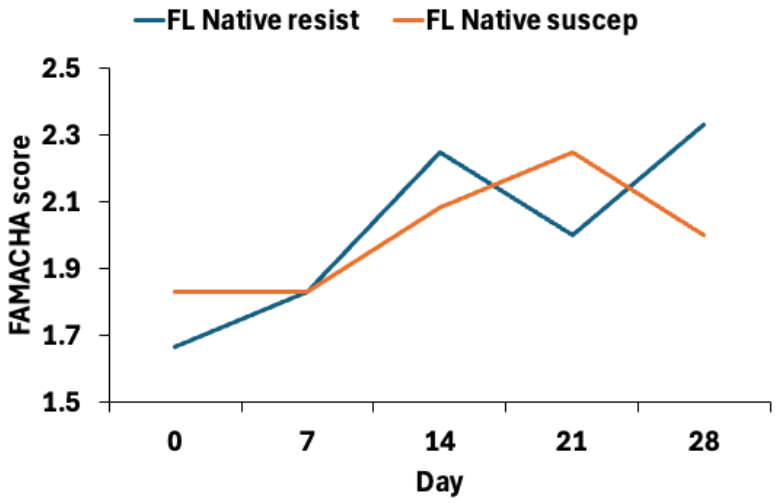


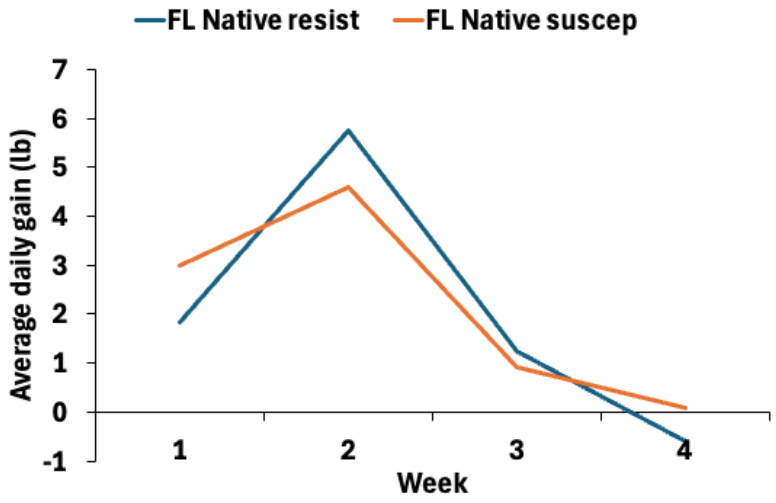


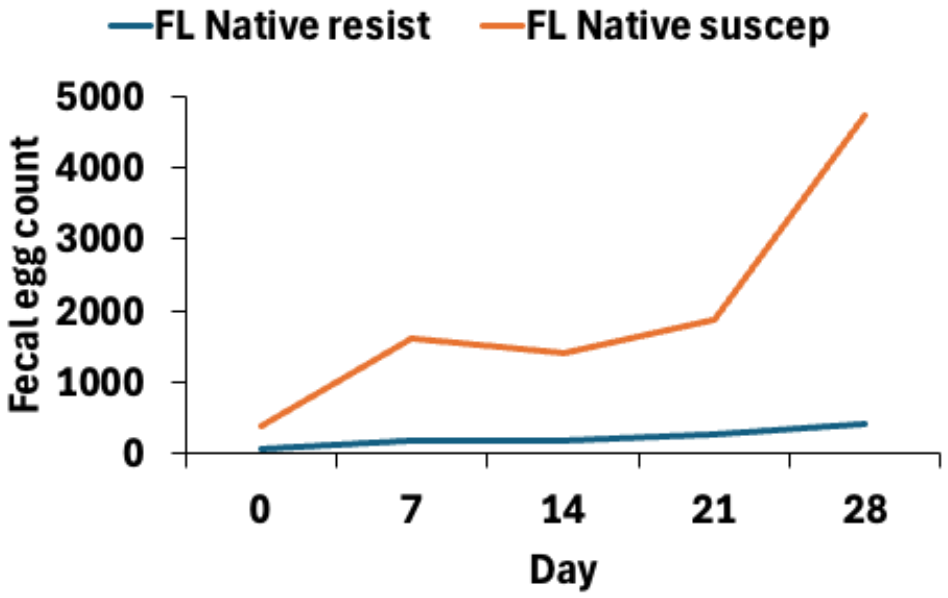
- **No drastic change in body condition score** during the experiment
- Crossbreed reduced BCS in week 3 but recovered later
- Katahdin & Katahdin crossed slightly increase in BCS compared to initial values
- FL Native lowest change in mean body condition score during the experiment

Resistant versus Susceptible Florida Native lambs

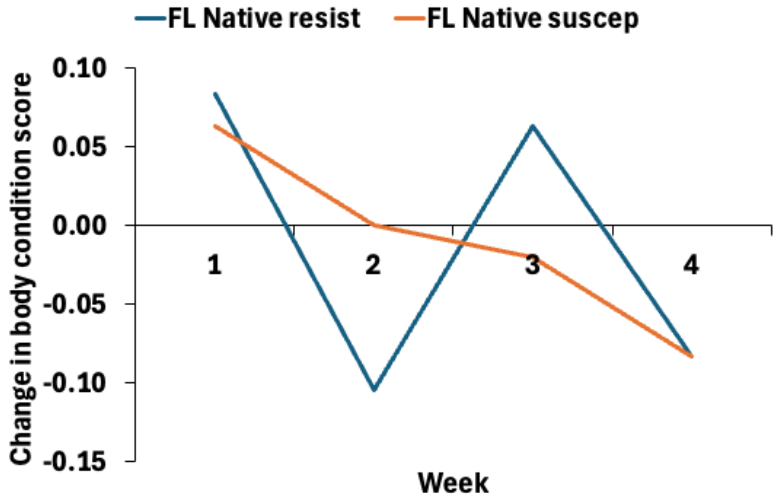
12 resistant
12 susceptible





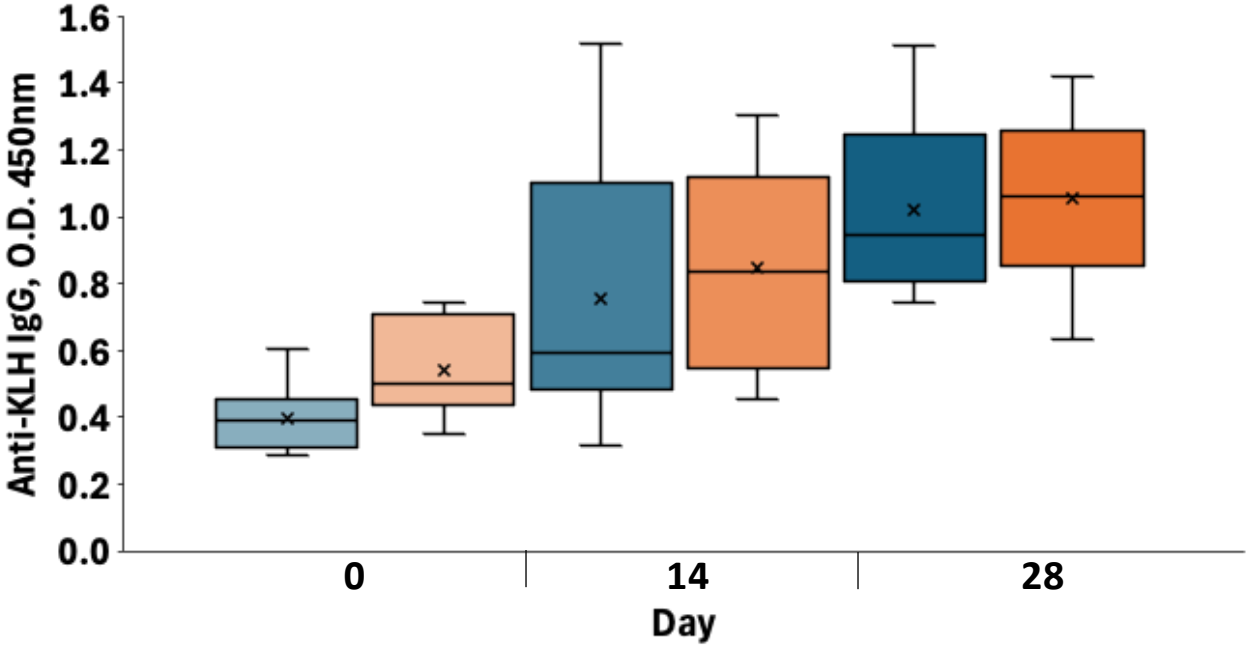


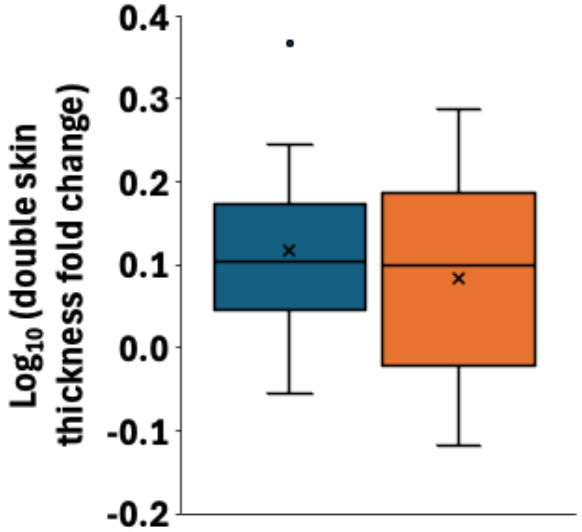
- Considerable **difference in fecal egg count** between groups
- **Similar performance** (FAMACHA, ADG, BCS)
- Resilient instead of susceptible?

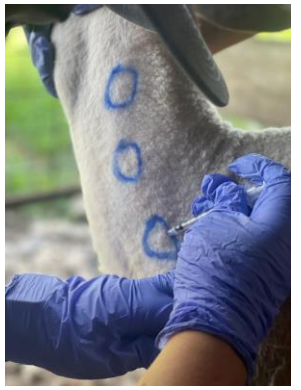


FL Native resistant
FL Native susceptible

Antibody and cellular immune response







- Increased level of anti-KLH antibody (IgG) → **humoral response**
- Change in skin fold thickness → **cellular response**
- Variability in immune response → genetic variability
- No difference immune response between resistant and susceptible animals

Acknowledgements

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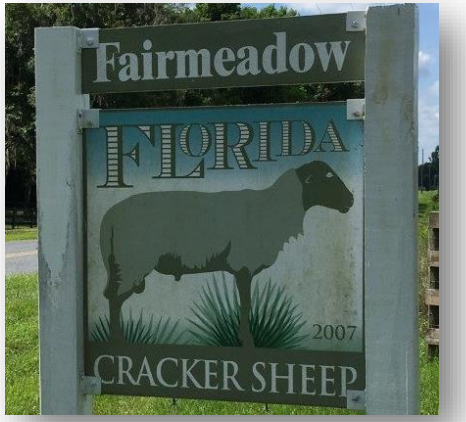
SMALL RUMINANT PROGRAM



Mrs. Carol Postley

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Rezende Lab
Animal Statistical Genetics &
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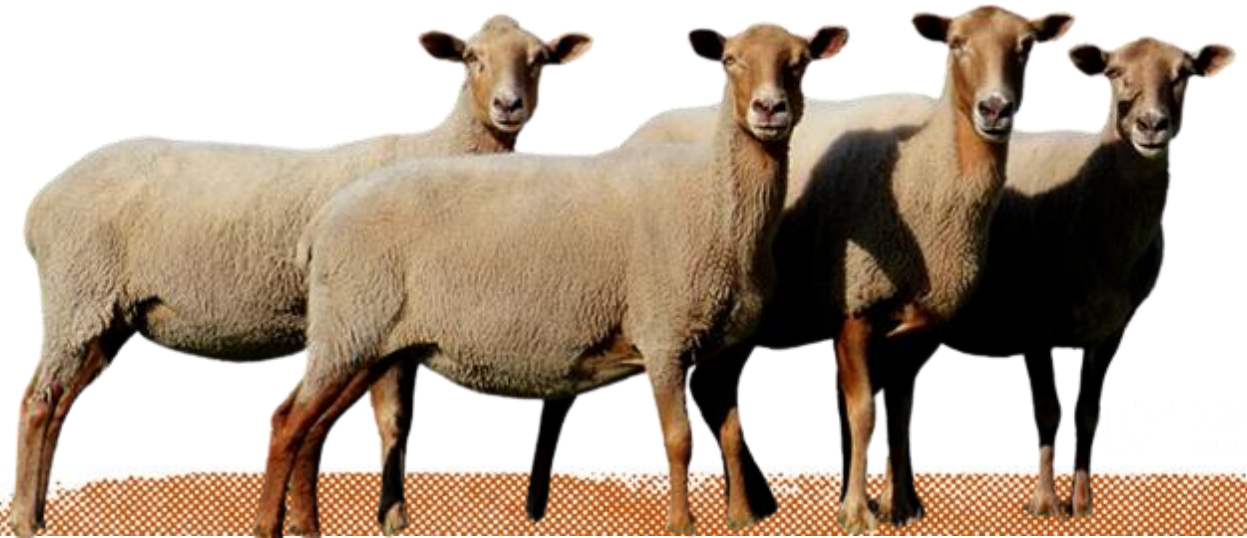
Thank you for your attention!



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