

Strategies for Reducing Internal Parasites in Small Ruminants

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Please see www.wormx.info for more information on topics presented





Mission: To develop scientific principles and technologies to enhance the profitability of small scale farms.



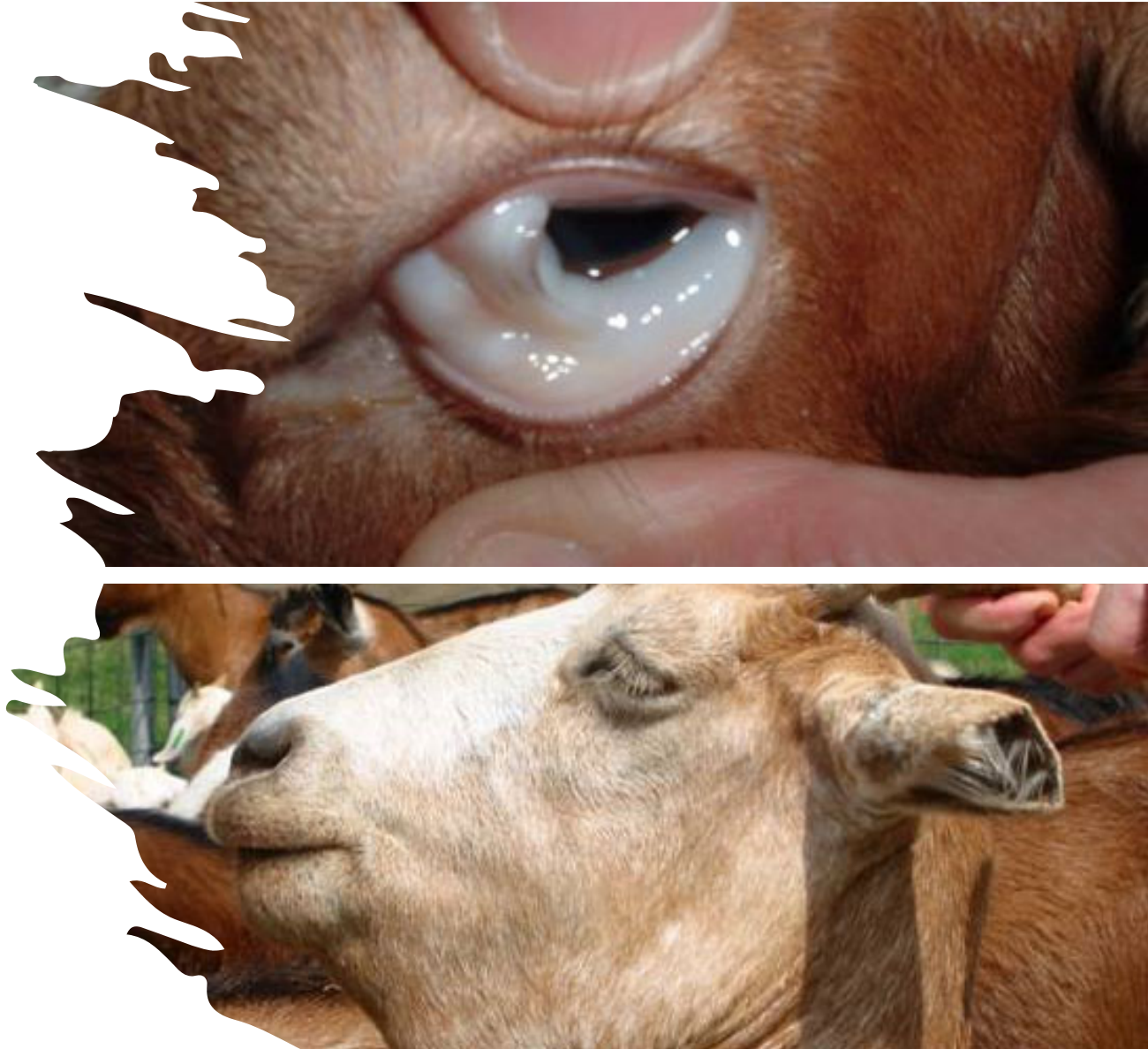
Overview

- Biology and background
- Alternative approaches
 - *Sericea lespedeza*
 - Copper oxide wire particles
 - *Duddingtonia flagrans*
 - Genetic/genomic Selection
- Other considerations
- American Consortium for Small Ruminant Parasite Control (www.wormx.info)

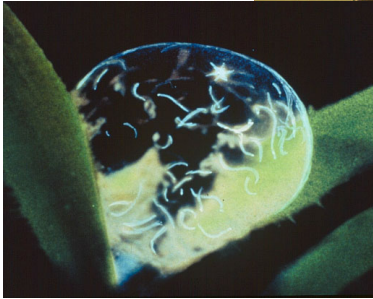
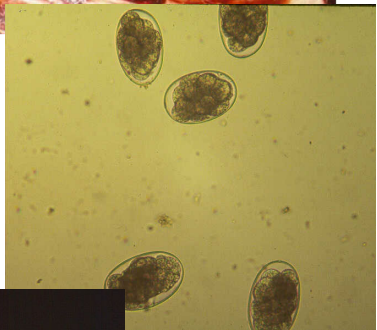
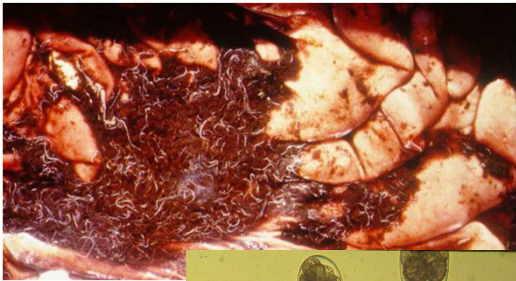
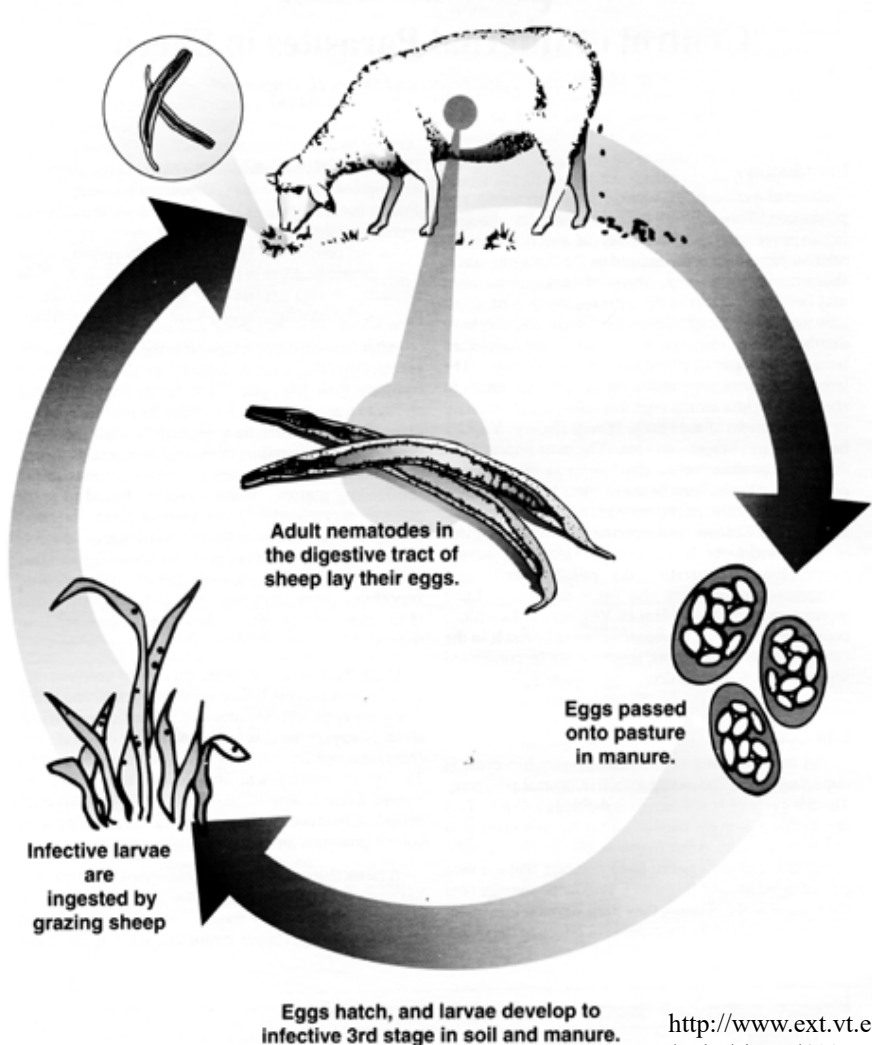


Haemonchus contortus (Barberpole Worm)

- Sheep, goats, deer, exotic ruminants
- Blood-sucking worm - Highly pathogenic, causes anemia, bottle jaw
- Most important worm parasite in warm humid climates (others include *Trichostrongylus* spp. which causes diarrhea; and a protozoan parasite, coccidia (*Eimeria* spp.) which can also lead to diarrhea.
- In the southeastern U.S., most worms are resistant to available dewormers. Uh oh! We need alternatives!!



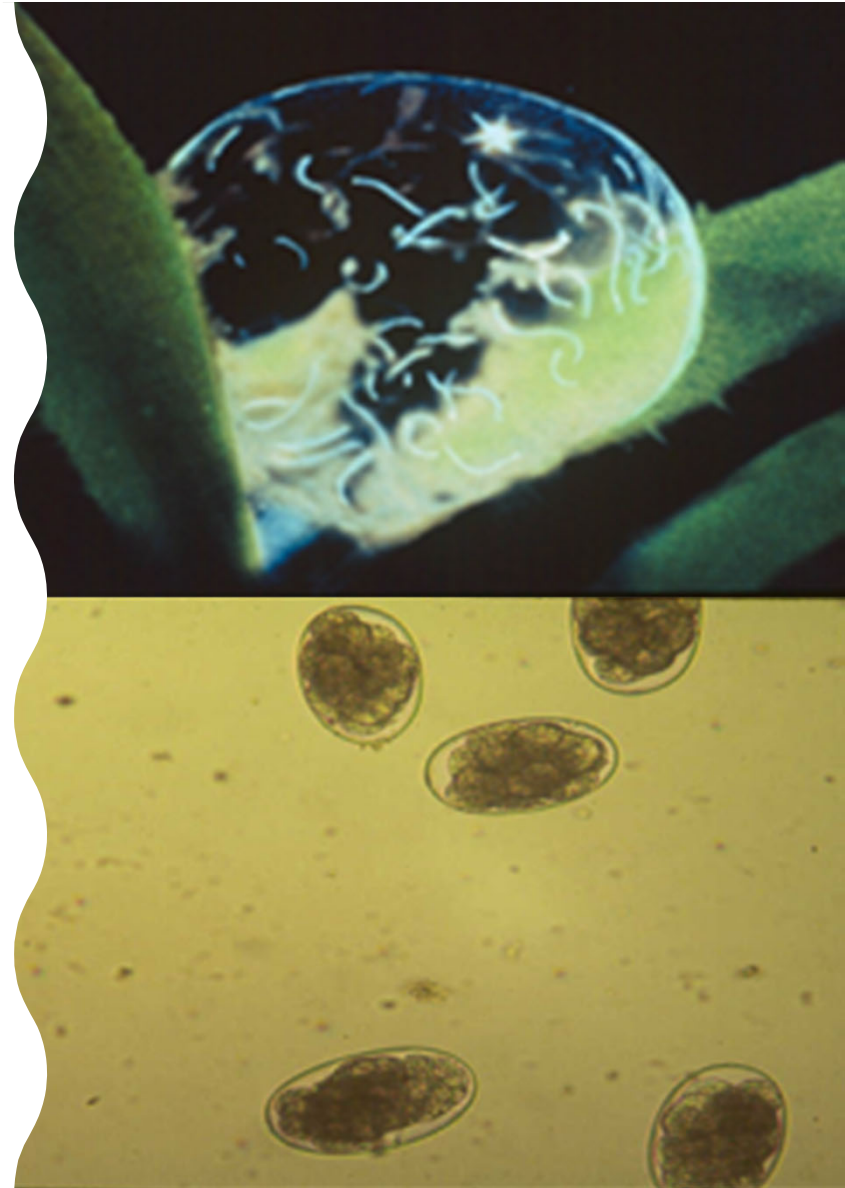
Life Cycle of *H. contortus*



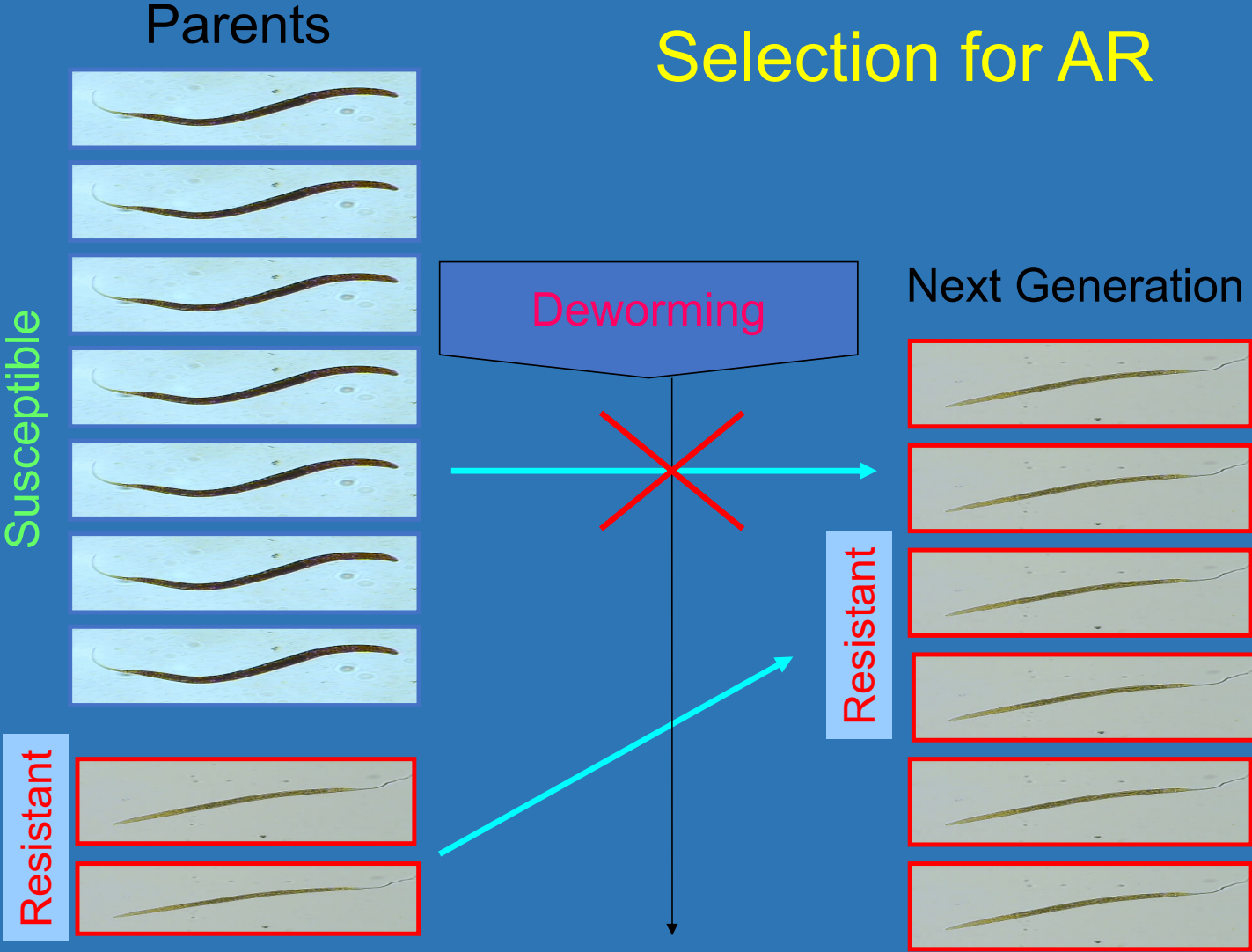
<http://www.ext.vt.edu/pubs/sheep/410-027/figure1.html>

Why is *H. contortus* such a problem?

- Evolved in tropics, thrives in warm/wet climates
- Very fecund, ~ 5,000 eggs per day: 30 goats/sheep → 300 worms/animal → 1.5 million eggs per day per animal → Over 1 billion eggs per month
- Long transmission season - southeastern US
- Short life cycle – 4/5 weeks during summer
- Immunity to worms is slow to develop. Can take up to 6-8 months of age; Immunity wanes around the time of parturition



Selection for AR



Goal is to use selective deworming to maintain refugia (worms that will respond to dewormer)

The more of the population that is in refugia, the slower the rate with which resistance develops

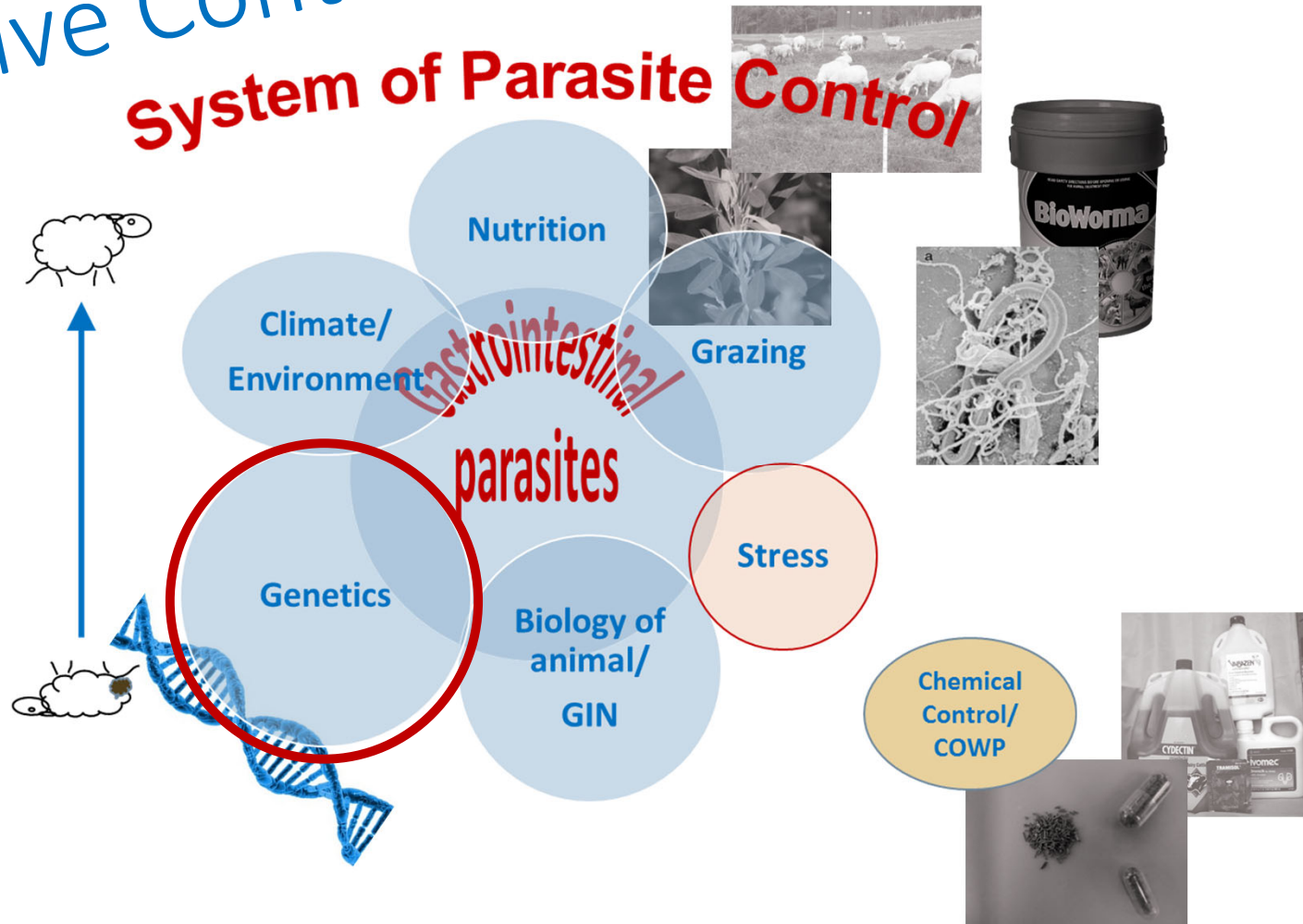
Selective deworming significantly increases the percent of the population in refugia



How to Achieve Selective Deworming

- ID Poor doing animals (lag behind, poor condition, bottle jaw)
- Fecal egg count (FEC) of a group
- The FAMACHA[®] system - Indirectly evaluate worm burden of Hc by level of anemia
- Selective deworming leads to a substantial reduction in dewormer usage
- [ACSRPC | FAMACHA \(wormx.info\)](http://www.acsrpc.org/FAMACHA)

Alternative Control System of Parasite Control



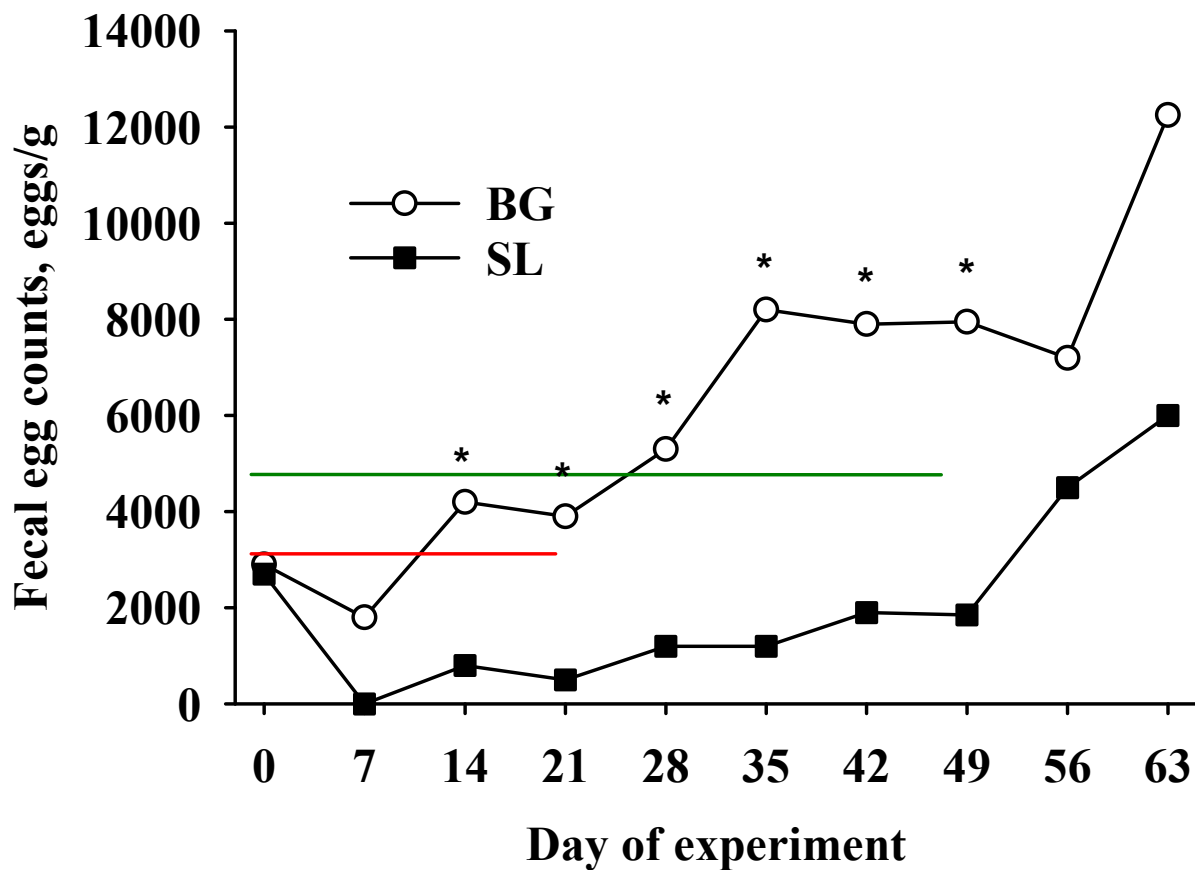
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ACSRPC: Sericea
lespedeza (wormx.info)

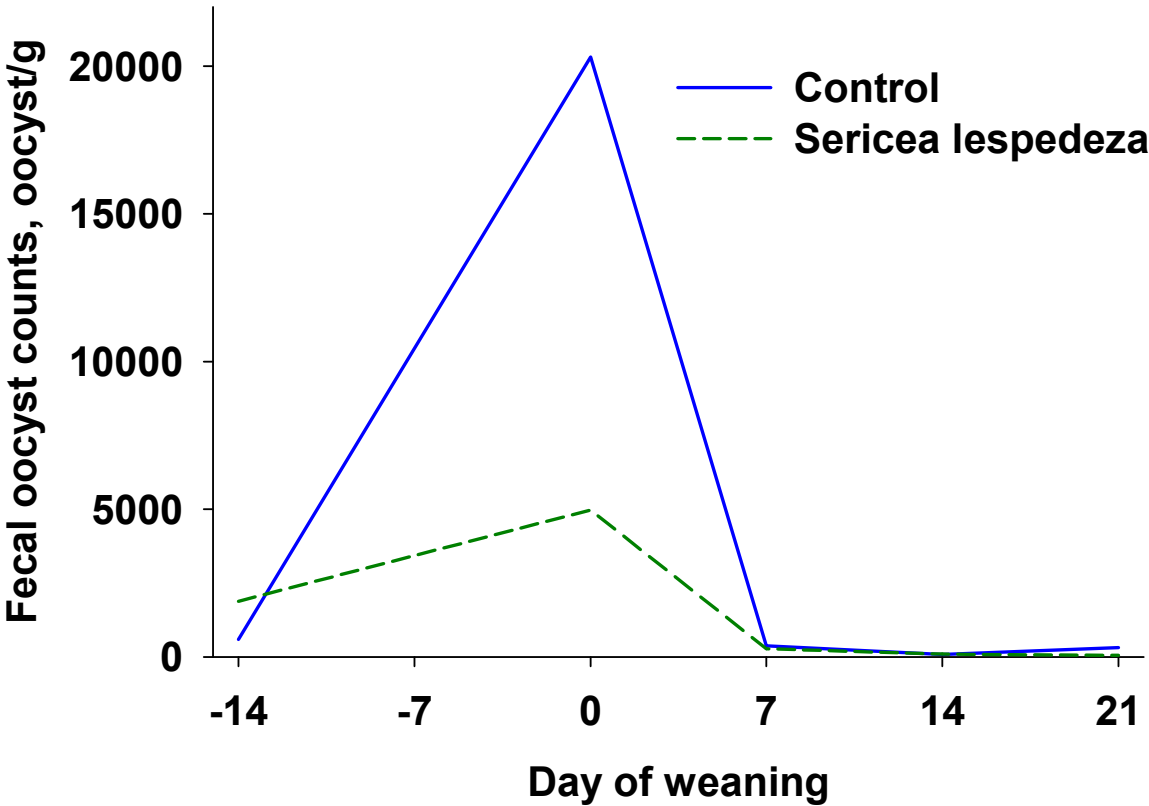




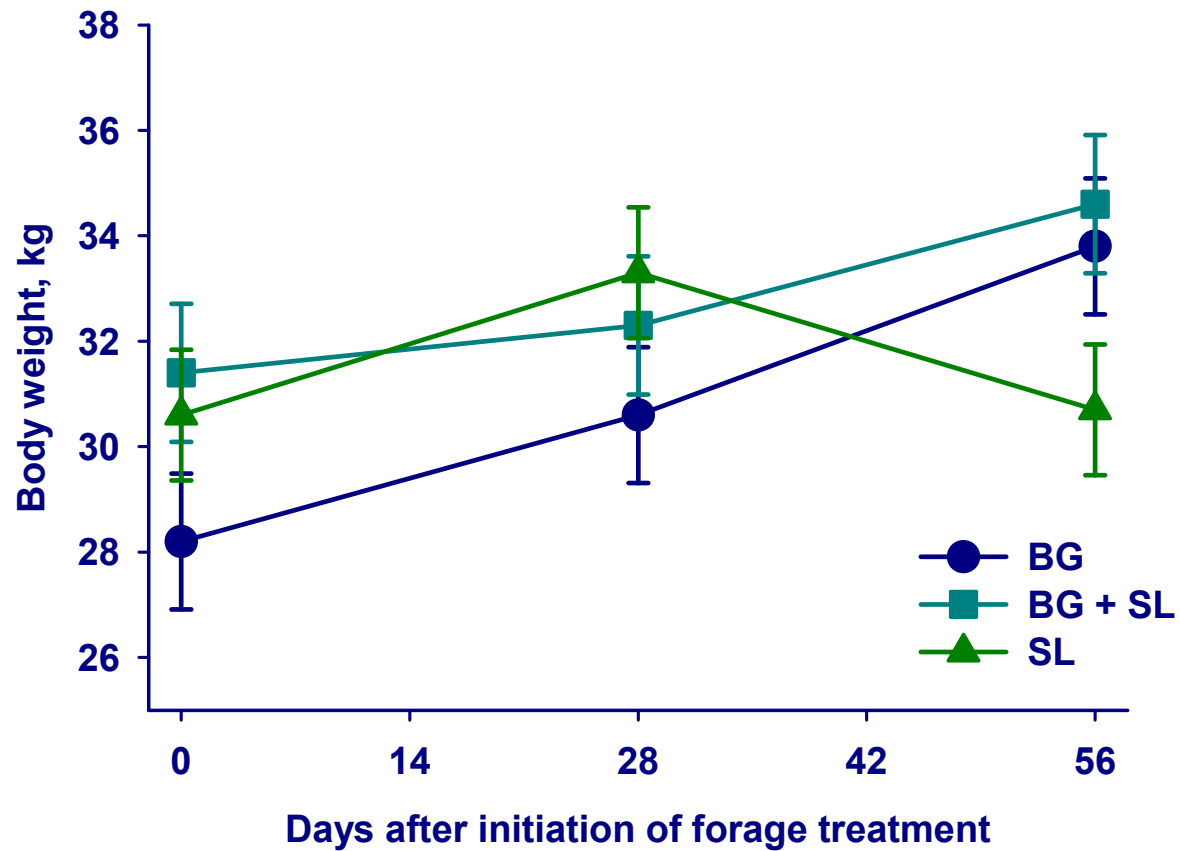
Effect of lambs fed BG or SL hay on FEC (LSU)



Effect of lambs fed alfalfa or SL pellets on coccidia

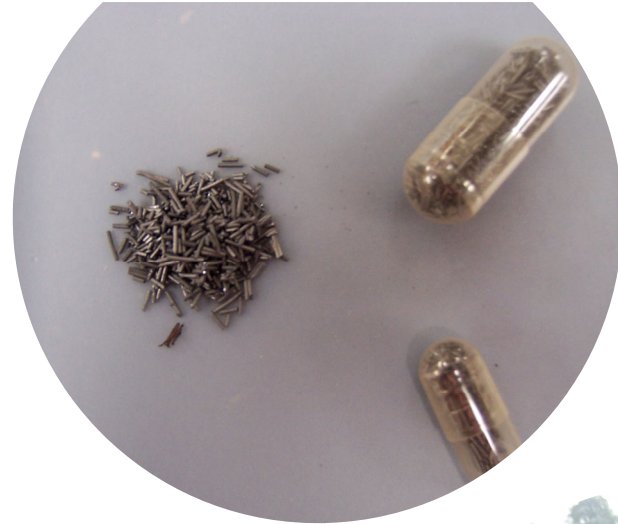


Effect of grazing SL on growth of lambs - 2009

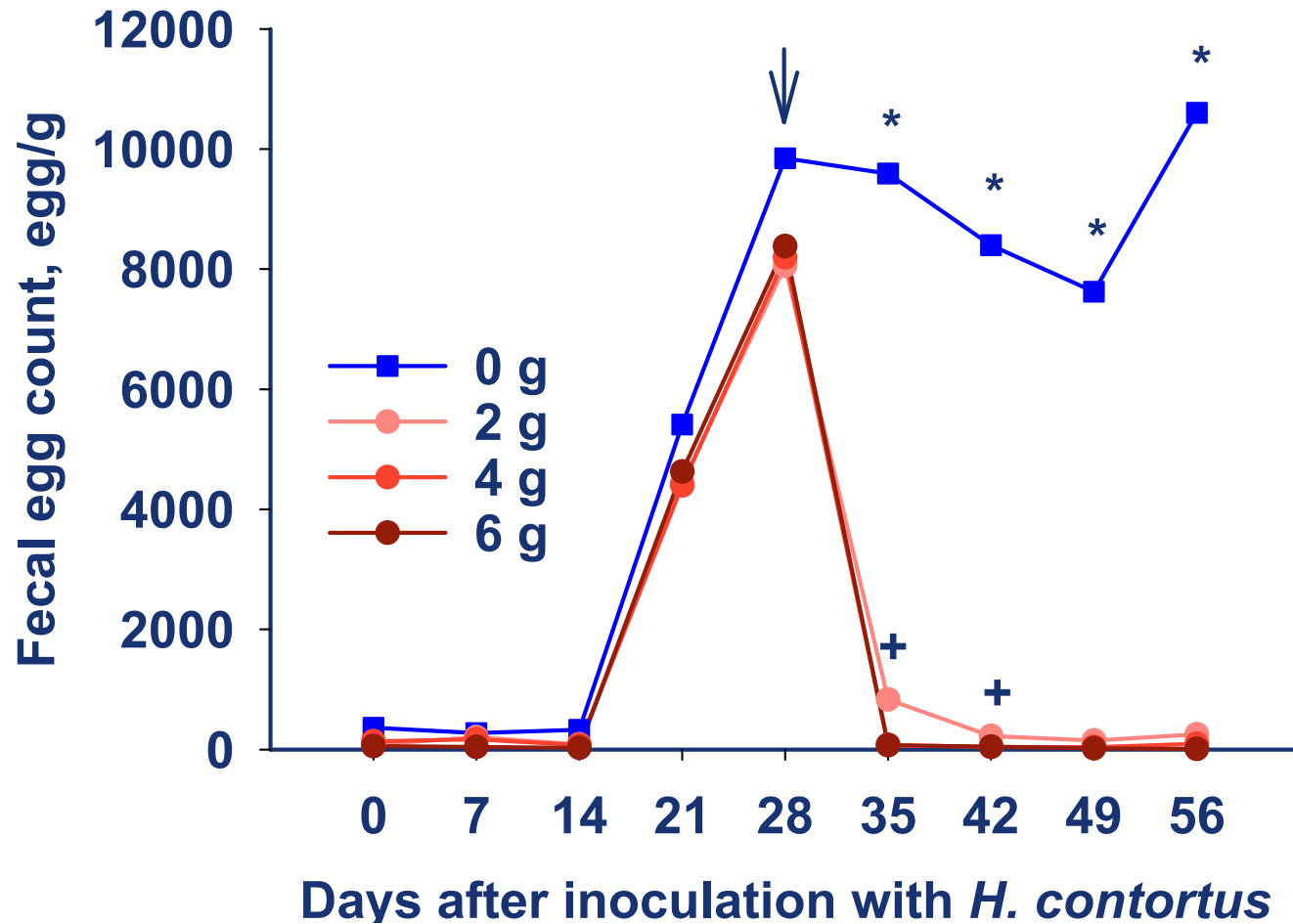


COWP

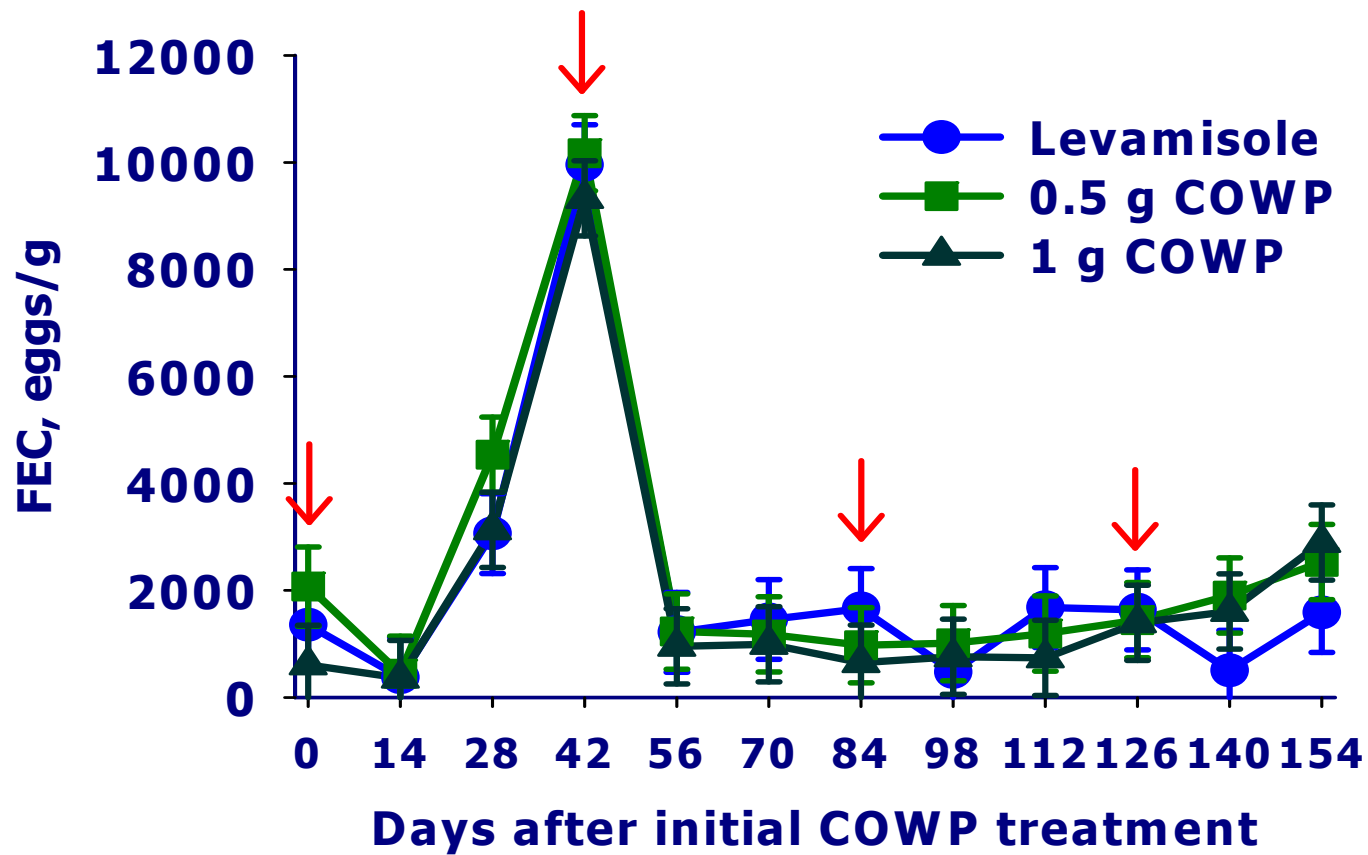
- Copper oxide wire particles (COWP) have been used to treat copper deficiency
- COWP become lodged in the abomasum resulting in expulsion or death of the adult nematode
- COWP have been used in sheep and goats to reduce GIN in the animal
- [ACSRPC | COWPs \(wormx.info\)](http://wormx.info)



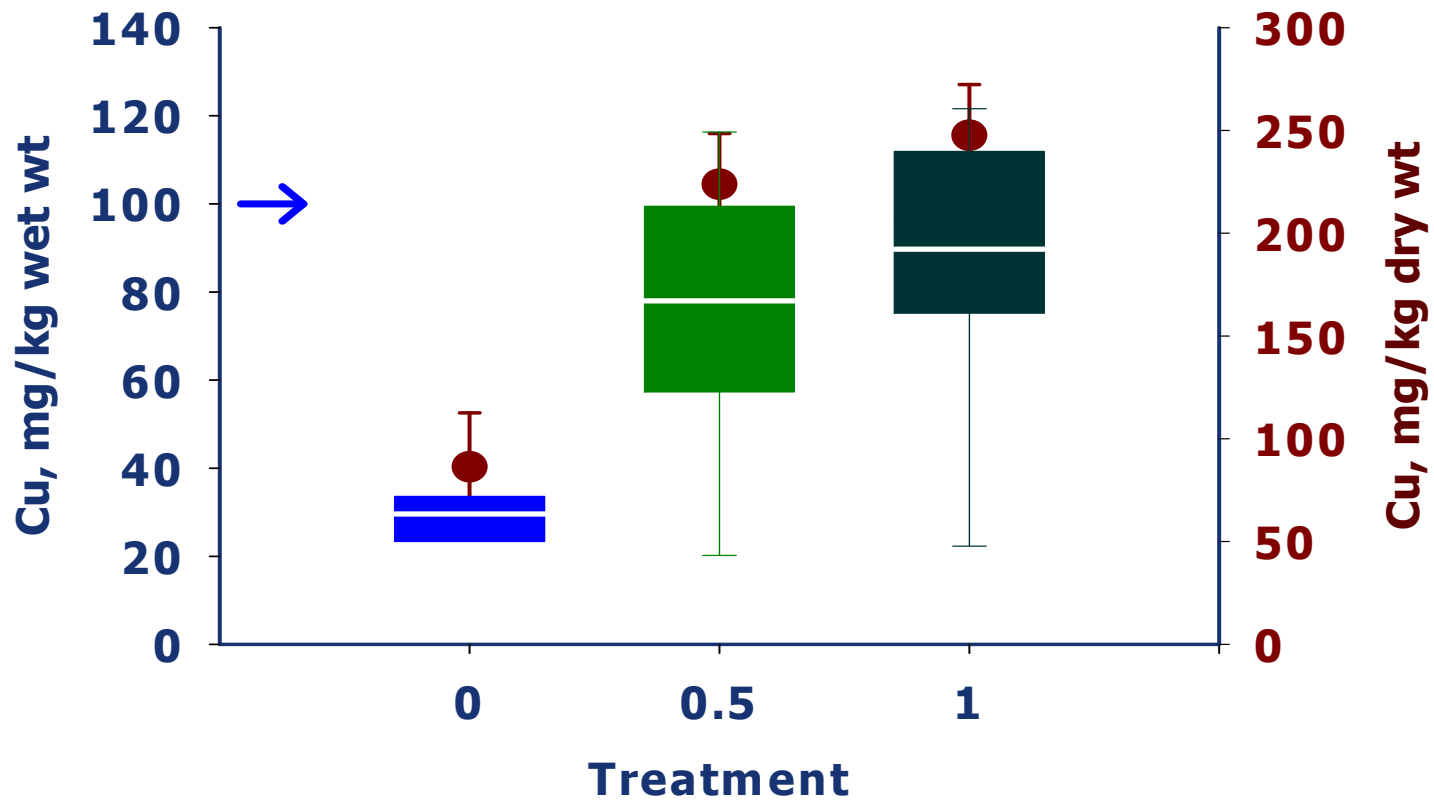
Effect of COWP on FEC of lambs



Effect of COWP on FEC

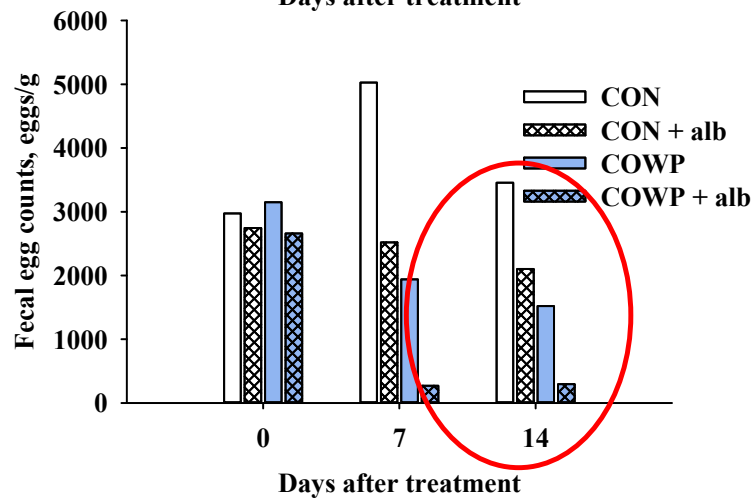
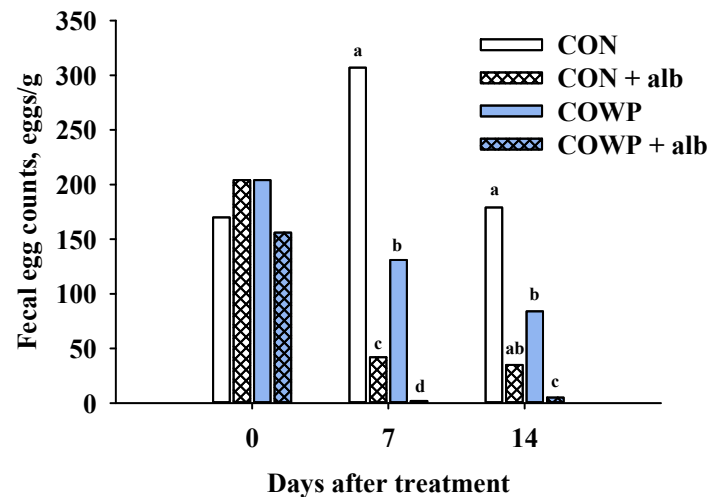


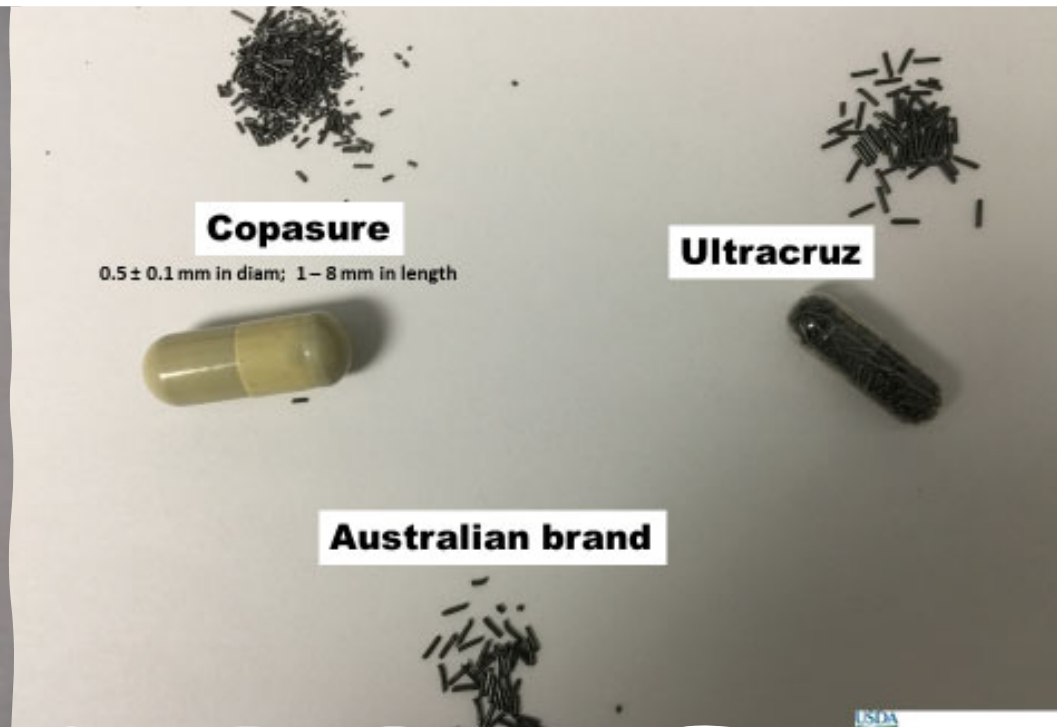
Effect of COWP on concentrations of copper in the liver



- **When used in combination with levamisole or albendazole, effective against other worms (by itself, only barber pole worm).**
- **Increased efficacy by ~30%.**
- **[ACSRPC | Using COWP to increase dewormer efficacy \(wormx.info\)](http://wormx.info)**

FEC means in response to COWP and albendazole





COWP

- COWP available in the U.S. as Copasure (Animax) for cattle and goats and Ultracruz (Santa Cruz Animal Health) for goats.

American Consortium for Small Ruminant Parasite Control
 Best Management Practices for Internal Parasite Control in Small Ruminants
COPPER OXIDE WIRE PARTICLES
 February 2018

INTRODUCTION





▲ 1/4 teaspoon = 2 g COWP

◀ "000" size capsule

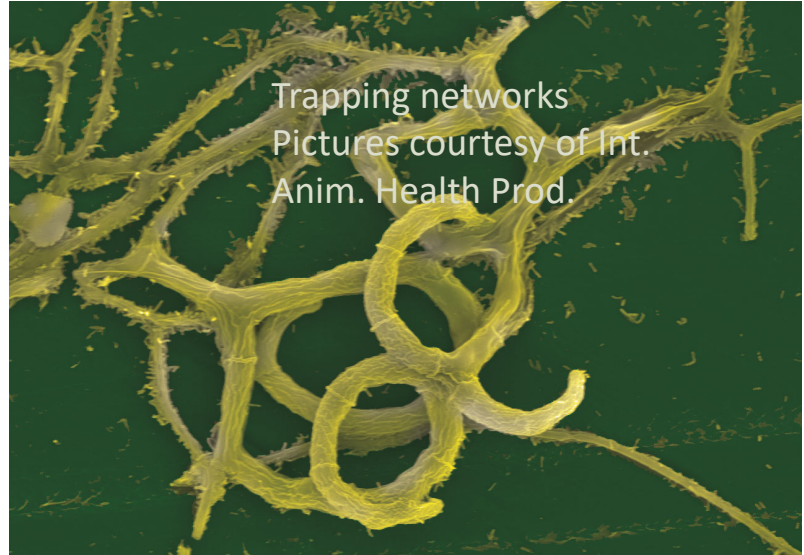
BioWorma[®] - *Duddingtonia flagrans* (Df)

- Nematode-trapping fungus
- Fungal spores are fed to animal in feed supplement and pass through to feces (no effect to animal).
- Gastrointestinal nematode or worm larvae develop along with Df. Df trap the larvae, paralyze and consume it.
- Estimated that 10% of GIN in animal, 90% on pasture (Wormboss.com.au)
- Effective against multiple worm species and resistant worms.
- Available through select feed mills, veterinarians, Premier1.
- Df is a naturally occurring fungus in soil and not detrimental to soil nematodes, environment (Faedo et al., 2002; Knox et al., 2002; Yeates et al., 2002; Saumell et al., 2015).





Mature chlamyospore has thick walls that allow survival as passes through GI tract





Chlamydospore

Trapping net
made of loops,
traps the
nematode

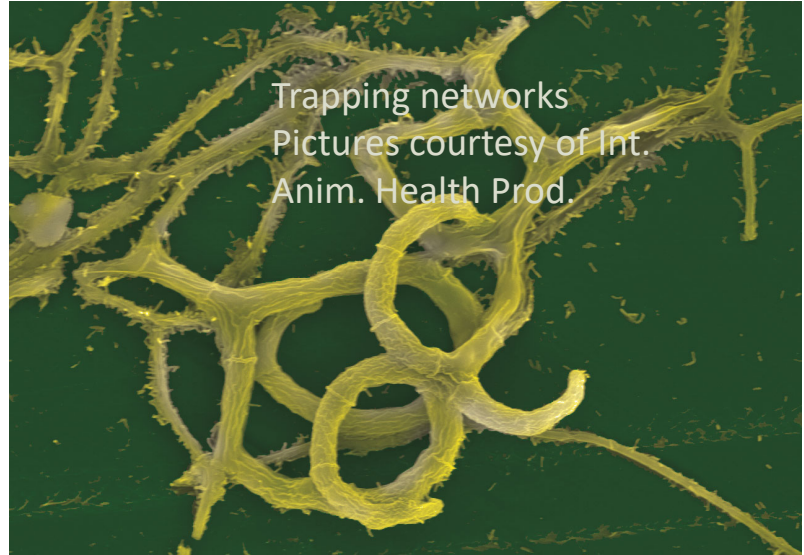
Anterior part of
infective larvae
captured in a
hyphal loop



8 h post-capture

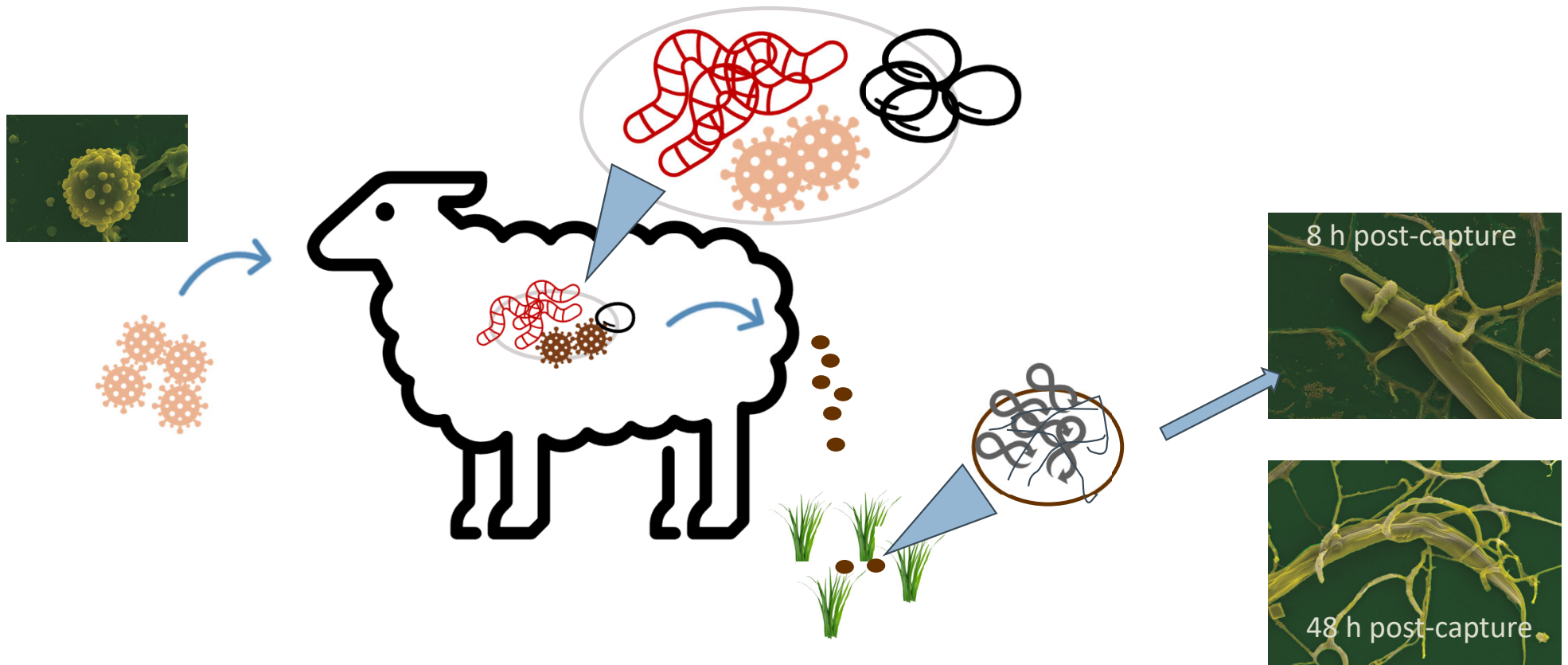


48 h post-capture

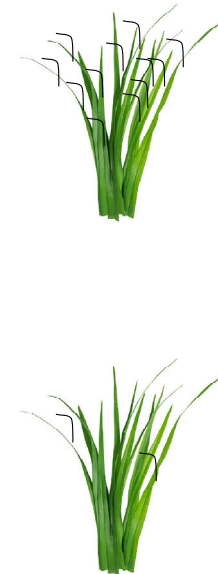
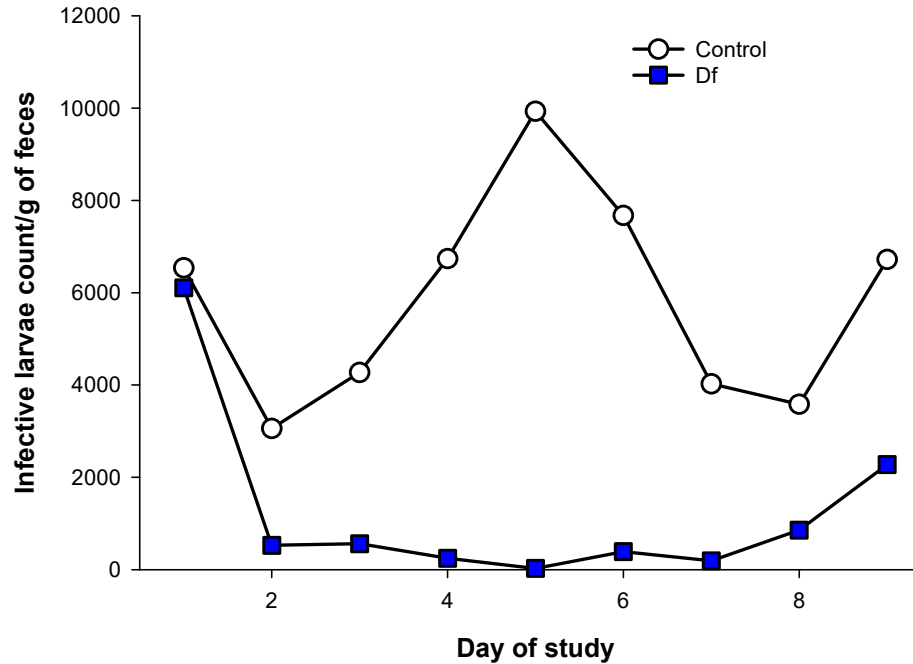


Trapping networks
Pictures courtesy of Int.
Anim. Health Prod.

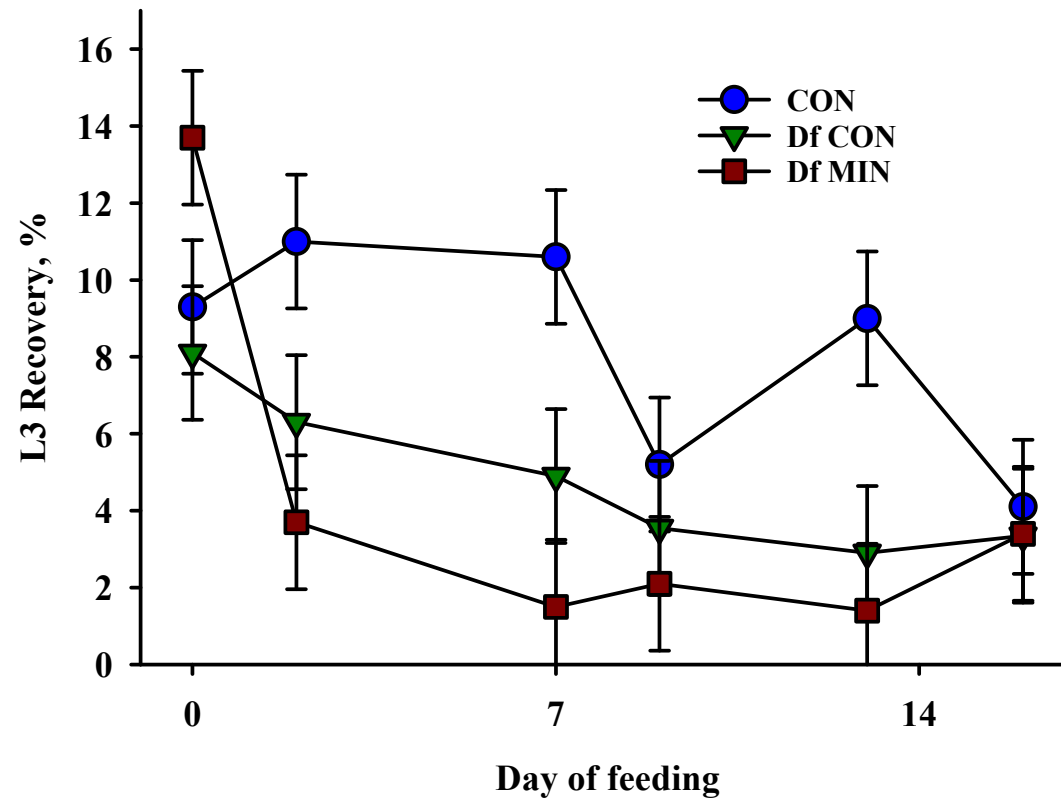
Journey of nematode-trapping fungus (Df)



Effect of Df fed to lambs on larvae counts over time (Peña et al, 2002)

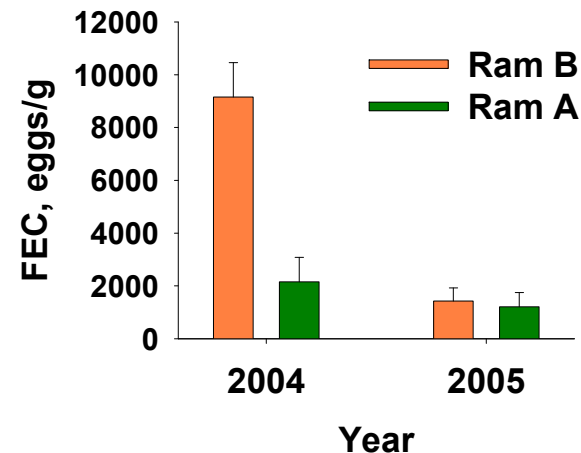


Effect of Df on feed or loose mineral on larval recovery



Using genetics for selection of parasite resistance

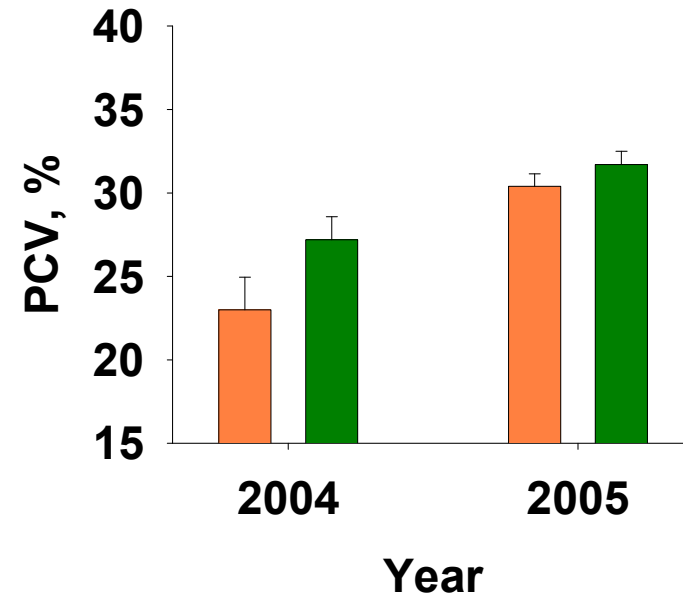
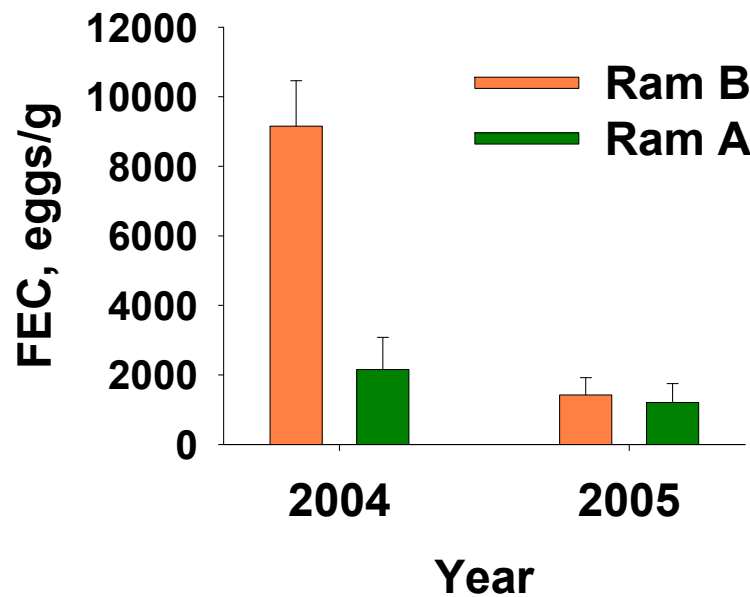
- An animal's ability to resist parasites is heritable (0.18 - 0.23)
- USDA, ARS progeny of sires have been evaluated since 2004 for parasite resistance (FEC) and tolerance (PCV and FAMACHA), growth, and maternal traits.



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

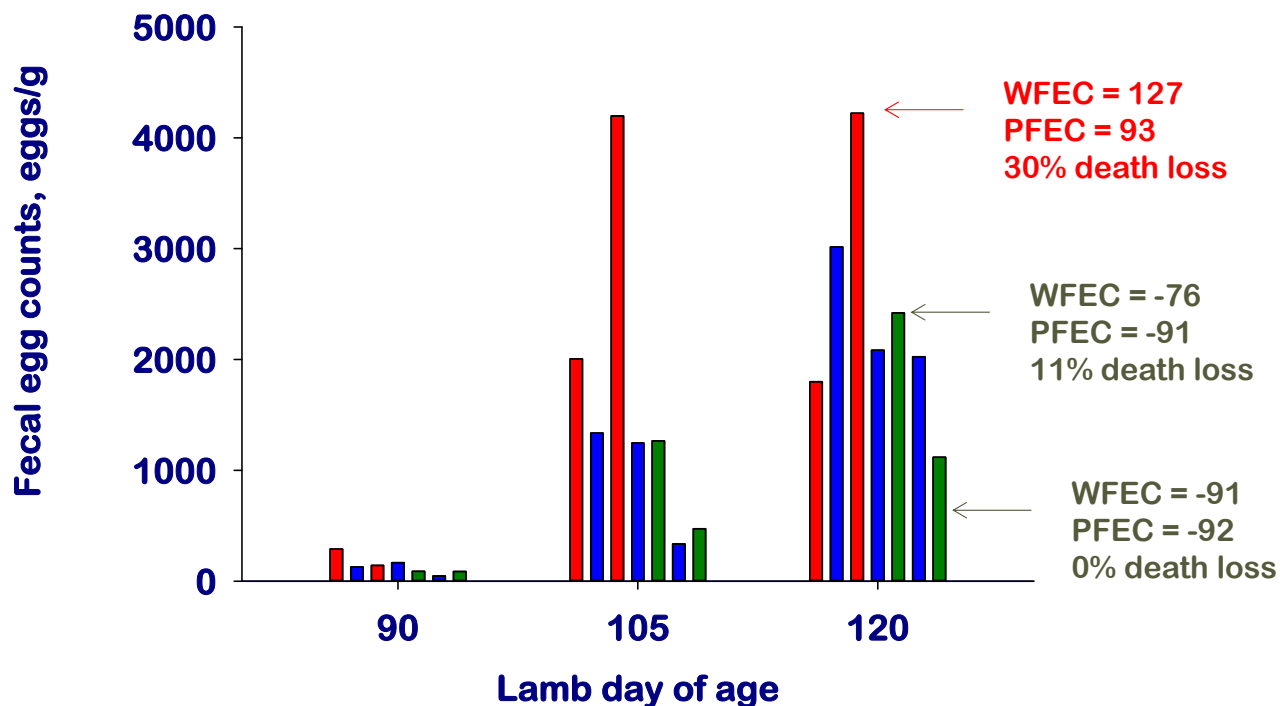
Ram A:
WWEC = -21
PWEC = -3

Ram B:
WWEC = +178
PWEC = +119



Comparing offspring FEC among sires

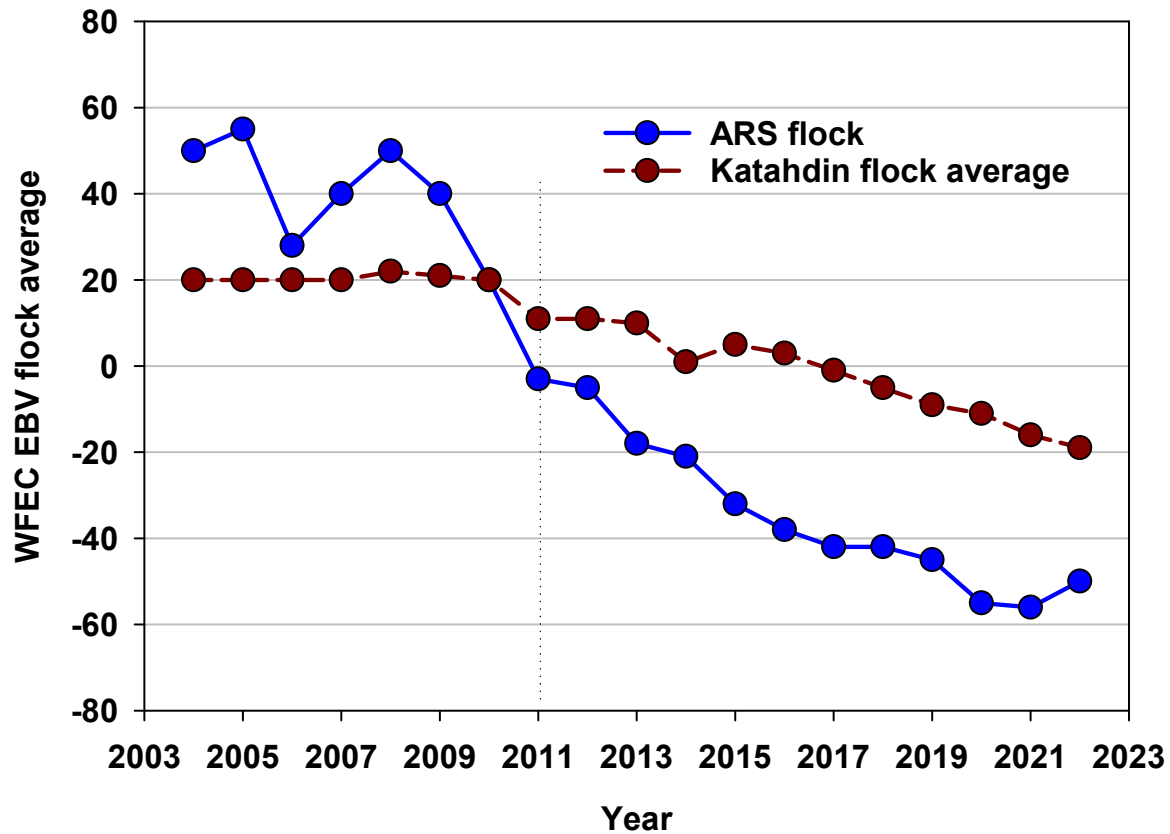
Effect of sire on PR on offspring
(n = 20 - 45/sire)



J hqhwl#Wuhgg#iru#UV#iar fn



NSIP WFEC averages by year



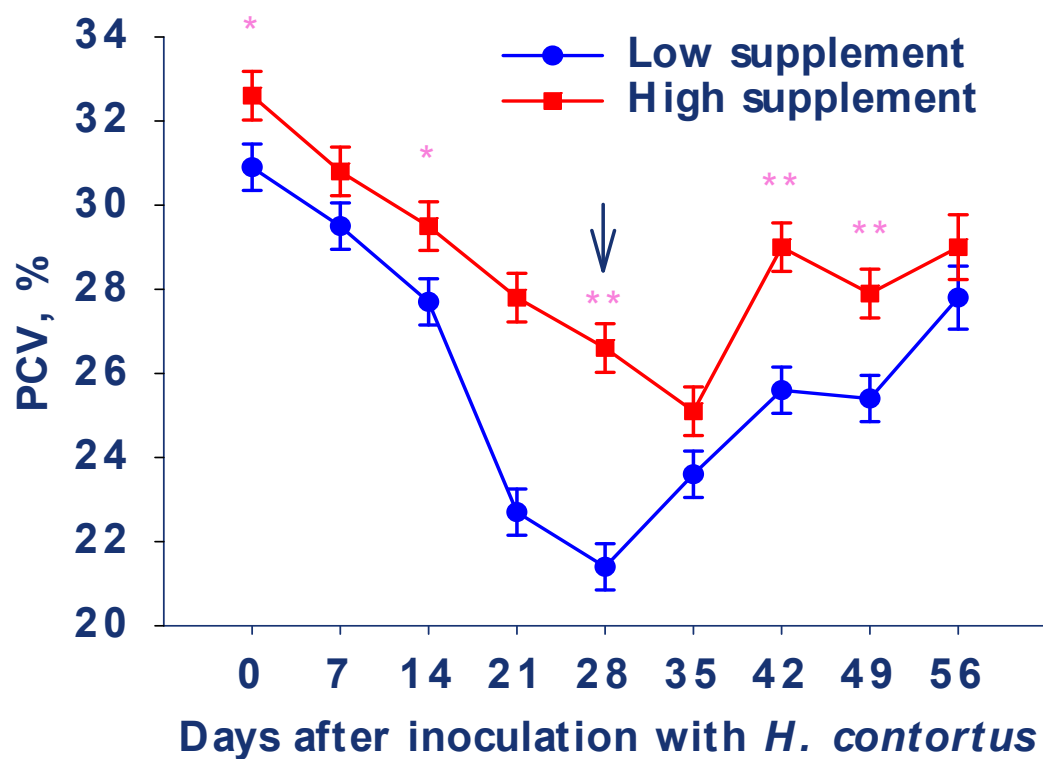
Nutrition



- Nutrition is extremely important in managing GIN.
- The most important measure of good nutrition is body condition.
- Increased protein during times of stress increases resilience to GIN. Can be provided as a supplement or good forages (test if not sure the quality!)
- [ACSRPC | Understanding Risk Factors \(wormx.info\)](http://wormx.info)
- [C:\Users\sschoen\AppData\Local\Temp\ms_oB50C.tmp \(wormx.info\)](http://wormx.info)

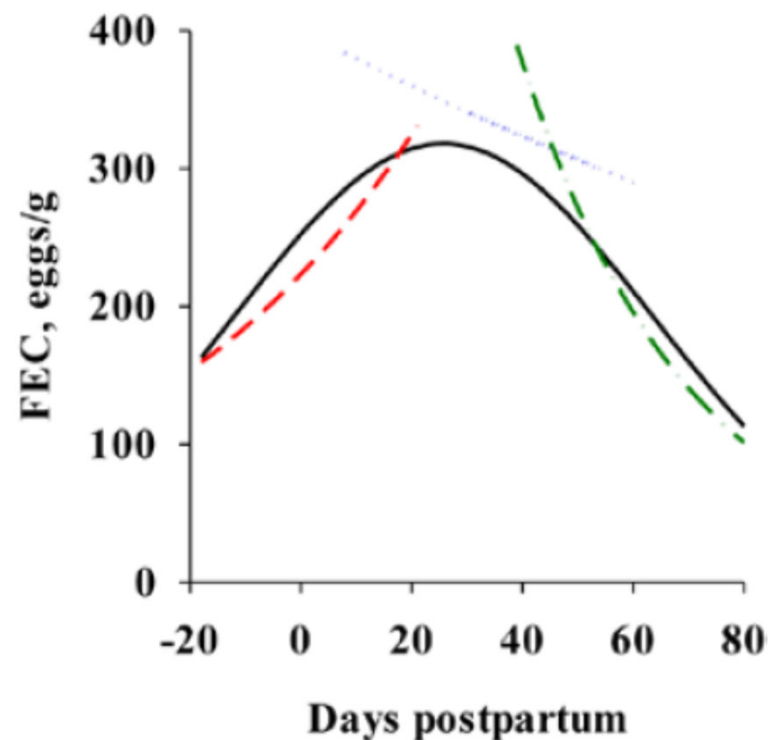
Nutrition

Effect of supplement on PCV

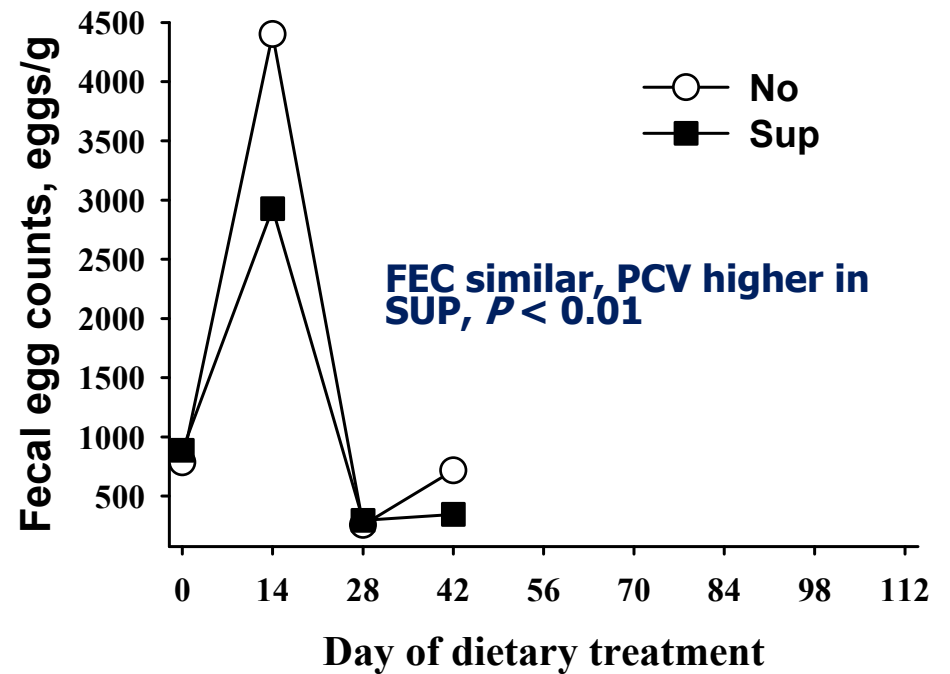
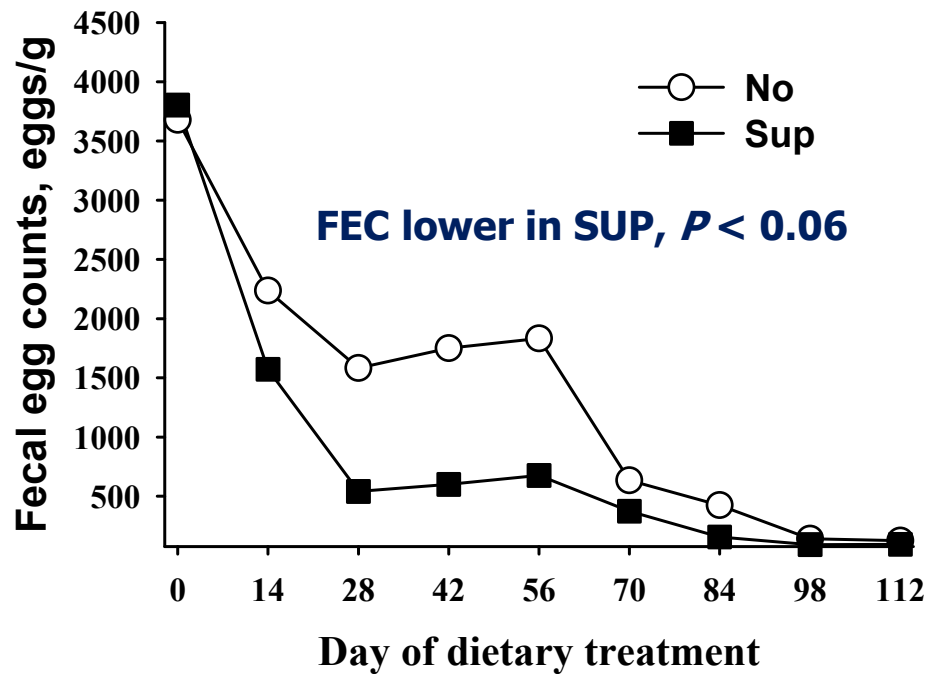


Peri-parturient Rise

- Immune suppression around the time of kidding leads to increased FEC/parasite infection
- Moderately heritable trait
- [C:\Users\sscho\AppData\Local\Temp\ms0145C.tmp \(wormx.info\)](C:\Users\sscho\AppData\Local\Temp\ms0145C.tmp (wormx.info))



Effect of season and supplementation on FEC



Things that DO NOT work

- Herbal dewormers (Mollys, Hoegggers)
- Garlic – no effect (ARS, LSU)
- Papaya – no effect (ARS, Heifer Ranch)
- Diatomaceous earth – no effect
- Ginger – No good evidence
- [ACSRPC | Herbal dewormers \(wormx.info\)](#)
- Copper sulfate – do not include extra in mineral. Can kill sheep.





Other Considerations

- Look at animals. Pay attention to those lagging behind or that look different: head hung down, lying down/not getting up, bottle jaw.
- Select the best, cull the rest using measures such as 5-Point Check, EBVs.
- Quarantine new animals and triple deworm.
- See www.wormx.info (Amer. Cons. Sm. Rum. Paras. Cont.) for fact sheets and more information.





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