



The #1 Killer

The barber pole worm and how to manage it

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What is the barber pole worm?

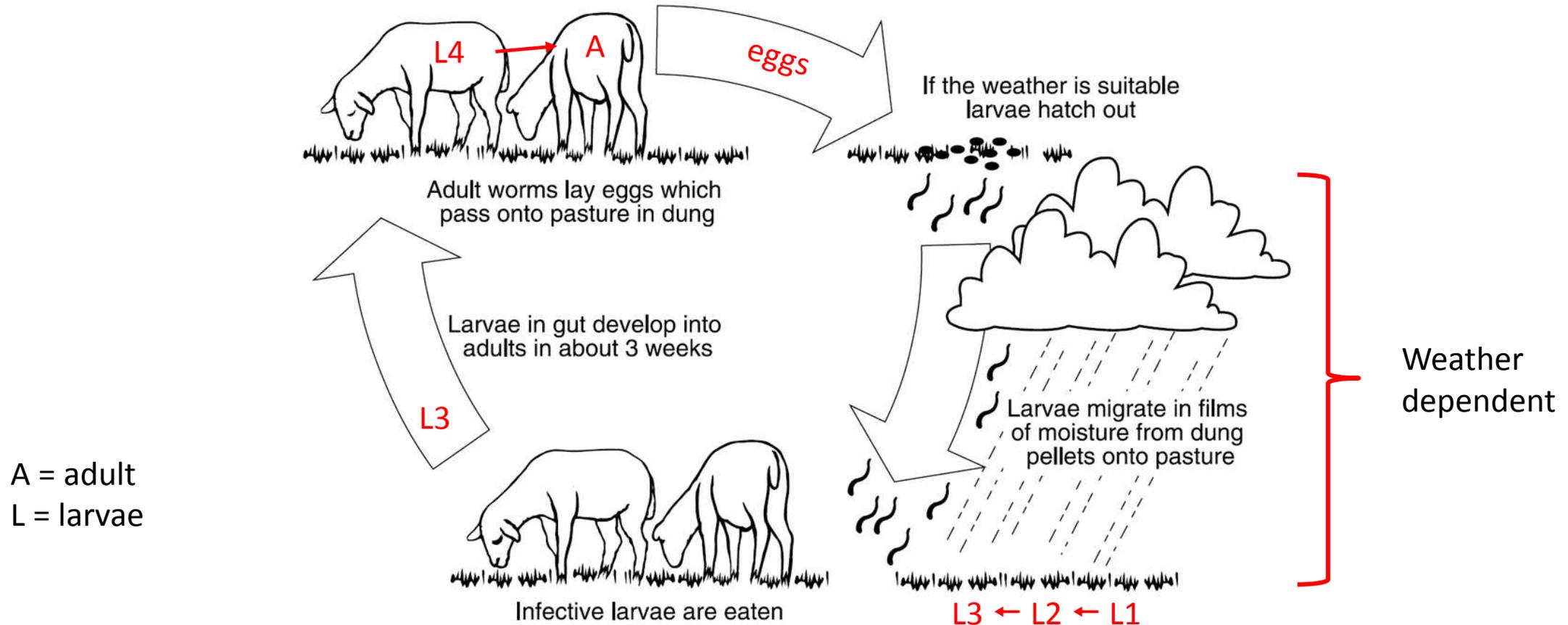
Haemonchus contortus

- **Blood-sucking parasite** of ruminants, especially small ruminants (sheep, goats, camelids).
- So-named because it has a red and white appearance that resembles a barber's pole.
- Large roundworm, up to 1 inch in size
- Develops in abomasal (stomach) wall of host C3 in camelids
- Has a small “tooth” that lacerates stomach wall
- Adults and immature worms (L4) consume blood.



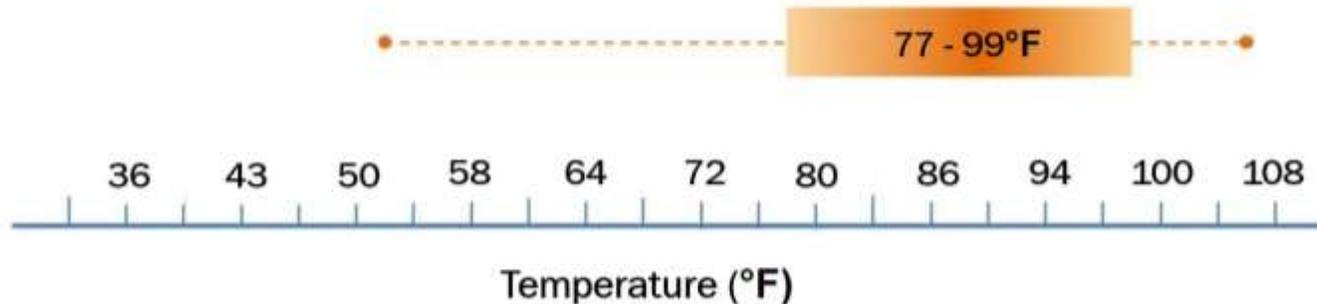
Life cycle of the barber pole worm

(and other roundworms)



Weather is everything!

- Barber pole worm needs warmth and moisture (humidity) to complete its life cycle.
- If weather is favorable, eggs can develop into infective third stage larvae (L3) in as short as 3 to 4 days.
- Takes longer (sometimes months) during cooler weather.
- In Mid-Atlantic, peak disease outbreaks usually occur mid to late summer.



☔ ☔ **RAIN** ☔ ☔

- Rain is important in releasing larvae from the manure.
- During dry weather, larvae are retained in the pellets.
- With the next rain there will be a release of larvae.
- There may be an outbreak of parasitic disease a few weeks after a drought ends.

Signs of barber pole worm infection

Symptoms associated with blood loss

- Anemia (pale mucous membranes)
 - Edema (bottle jaw)
 - General ill thrift
 - Failure to thrive
 - Lethargy
 - Weakness
 - Loss of weight and body condition
 - Sudden death
- ✗ Diarrhea (scours) is not a characteristic sign.



Anemia

- Anemia is a decrease in the amount of red blood cells in whole blood.
- It is measured by packed cell volume (PCV) or blood hematocrit (% red blood cells in blood).
- Indications include pale mucous membranes conjunctiva, gums, vulva
- Primary symptom of barber pole worm infection
- FAMACHA© system estimates PCV (level of anemia).
- Other causes of anemia (and bottle jaw)
Other parasites (liver fluke, coccidia), trauma, chronic disease (e.g. Johne's) or malnutrition.

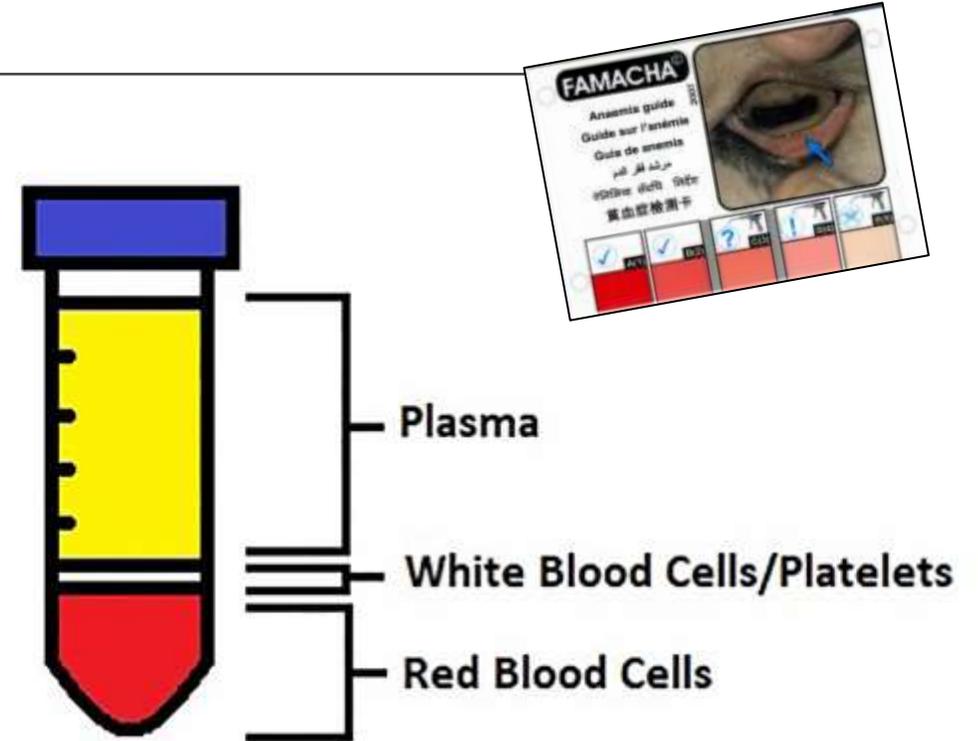


Figure 4. Whole blood sample following centrifugation.

Bottle jaw



- Accumulation of fluid (liquid) under the skin of the lower jaw.
- Gravity causes fluid to pool in the loose tissue while animals have their heads down eating.
- Result of severe anemia
Shortage of protein in the blood
- Most common cause is severe barber pole worm infection.
- Also called sub-mandibular edema or hypoproteinemia.

Don't get them confused

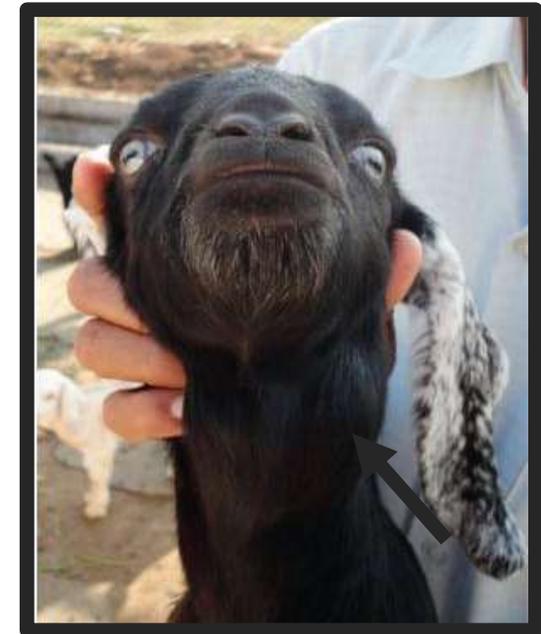
BOTTLE JAW



MILK GOITER (NECK)



GOITER (IODINE DEFICIENCY)



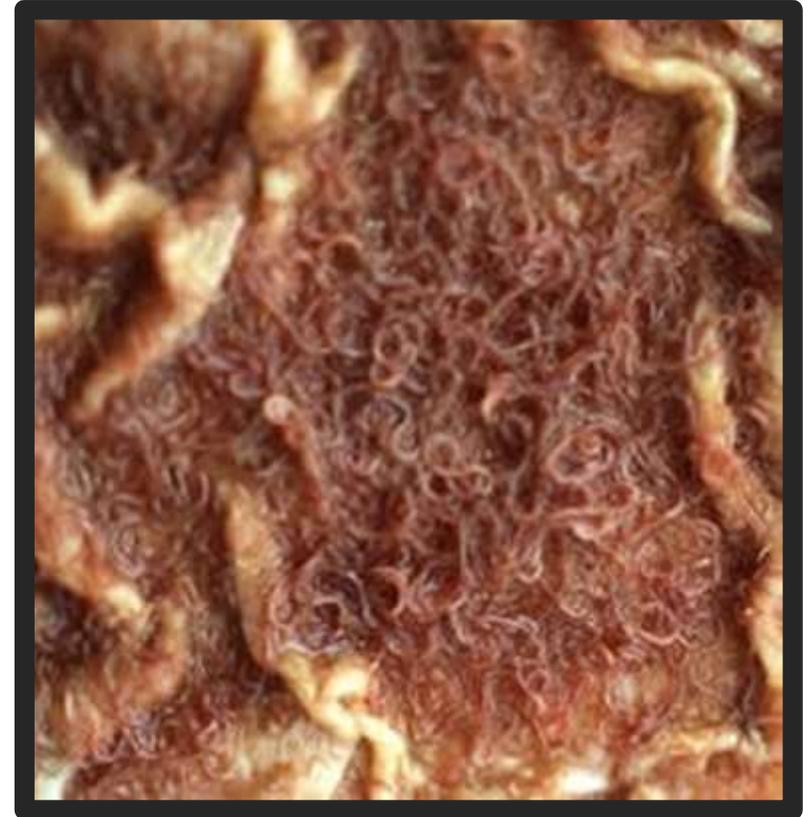
Why is the barber pole worm so difficult to control?

- Highly pathogenic parasite
- Has a short, direct life cycle
- Female is a very prolific egg layer, up to 10,000 per day
- Is a voracious **blood feeder** (0.01 ml/day).
- Ability to go into arrested state (hypobioses) to survive undesirable conditions (over-winter).



Why is the barber pole worm so difficult to control?

- Barber pole worms have developed resistance to all dewormers and dewormer (chemical) classes.
- Animals are easily infected due to close grazing and grazing close to manure pellets.
- Vulnerable hosts, especially goats
 - Lack of immunity in young animals, esp. < 5 months
 - Loss of immunity in periparturient females, esp. high producers



How to manage the barber pole worm

HUSBANDRY

- Host immunity
- General husbandry practices
- Pasture and grazing management
- Good nutrition
- Genetic selection
- BioWorma®
- No grazing

DEWORMING

- Targeted selective treatments
- Combination treatments
- Managing dewormer resistance
- Proper dewormer use
- Copper oxide wire treatments



With husbandry practices

Host immunity (resistance)

- It is normal for small ruminants to have parasites of different types.
- Immunity is developed with age and continuous exposure to low levels of parasites.
- There are differences in immunity among different species, breeds, and individual animals.
- There is a nutritional cost to immunity.



Understanding host immunity

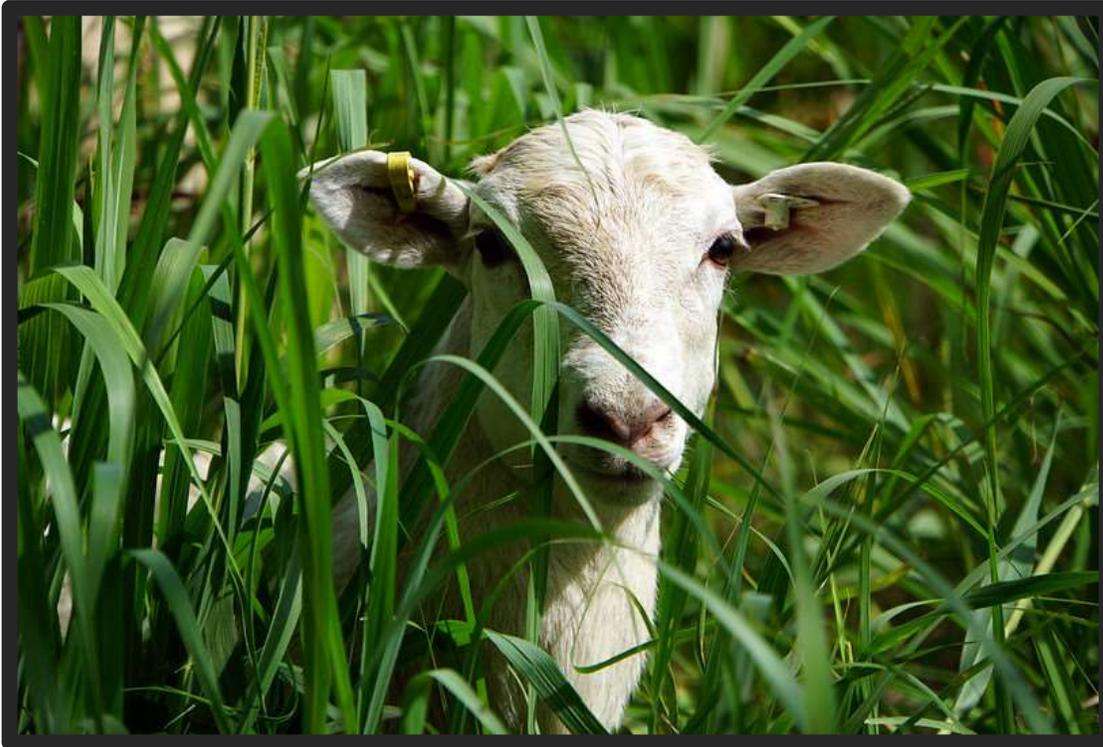
Factor	More susceptible	Less susceptible
Species	Goats	Sheep
Breed	Less resistant breeds	More resistant breeds
Age	Lambs and kids	Mature animals
Age	Lambs/kids under 5 months of age	Lambs/kids over 5 months of age
Weaning	Recently weaned	Still on dam
Exposure	Animals that have not been exposed	Animals that have been exposed
Nutrition	Poorly fed animals	Well fed animals
Body condition	Thin animals	Fat animals
Production	Periparturient female	Dry and open ewes and does
Production	Higher producing females	Lower producing females
Bottle babies	Bottle babies	Dam raised lambs and kids

General husbandry

- Good hygiene and sanitation
- Don't feed on ground
- Avoid hot spots on pasture
- Minimize stress
- Lamb/kid at time of year when parasites are less active.
- Later weaning for lambs/kids finished on pasture diets.



Pasture and grazing management



- Short duration grazing
- Long rest periods
- Minimum grazing heights
- Taller growing forages
- Browsing (esp. goats)
- Haying
- Annual forage crops
- Forages containing condensed tannins
- Mixed swards
- Mixed species grazing (w/cows, horses)
- No grazing

Good nutrition



- There is a nutritional cost to parasites.
- Animals in better body condition are better able to withstand the effects of parasitism.
- Energy supplementation helps with parasite resilience (tolerance to infection).
- Protein supplementation helps with parasite resistance (fecal egg counts).
- Good mineral nutrition: loose preferred to blocks.
- Graze pastures to keep them in a vegetative (more nutritious) state.
- Always supplement the most limiting nutrient to the most susceptible animals.

Genetic selection: two traits

PARASITE RESILIENCE

Ability to tolerate infection

Good FAMACHA© score

Good body condition

Good performance

Don't require deworming

Cull animals that require more deworming

☞ Some animals that are resilient are still shedding a lot of worm eggs onto pasture

PARASITE RESISTANCE

Ability to prevent or clear infection

Estimated by fecal egg count (EPG)

Moderately heritable (~20-30%)

70:30 rule

~30% of flock/herd is responsible for ~70% of fecal egg output (pasture contamination)

Need to select animals (especially males) that shed fewer eggs onto pasture.

Zero (no) grazing

- There is little transmission of worms in confinement (barn) or dry lot.
- Dry lot means no vegetation for grazing, including along fencelines.
- Extremely susceptible or parasitized animals should be kept in confinement or dry lot.
- Animals should be put into confinement or dry lot if pastures are too short for grazing.
- For small ruminants, sacrifice areas should be confinement or dry lot.
- Confined animals will not develop immunity to parasites; exposure is required.
- *Coccidia (Eimeria spp.)* is usually more of a problem in confinement or dry lot.

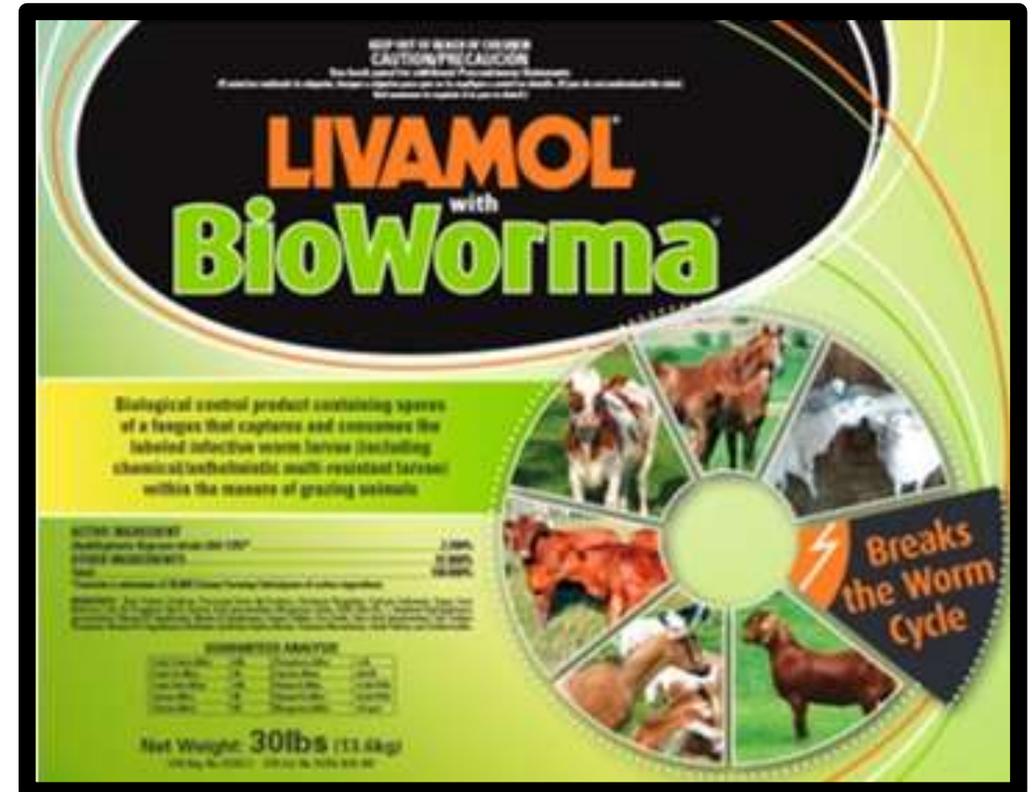


BioWorma®

Nematode-trapping fungus (nematode = roundworm)

- Fungus that you feed to livestock to prevent them from infecting the pastures with infective worm larvae.
- Fungus traps and kills worm larvae in the manure of the livestock (biological control).
- Feed-through product that has no effect in the animal (still need to deworm a clinically-parasitized animal).
- Feed daily during peak transmission season and to most susceptible animals.
- Two products available for purchase:
BioWorma® and Livamol® with BioWorma®.

~\$0.60 per day per 100 lbs. (Livamol®)





Using dewormers to manage the barber pole worm

What is a dewormer?



- Drug that kills or expels worms by starving or paralyzing them.
- Must be selectively toxic to the worms without killing the host.
- Today's dewormers are much safer and more powerful than older drugs or old-time remedies.
- Dewormers are also called anthelmintics.

Dewormers for small ruminants

BENZIMIDAZOLES (white)

Fenbendazole
SafeGuard[®]
Panacur[®]

Albendazole
Valbazen[®]

Oxybendazole
Synanthic[®]

1960's

MACROCYCLIC LACTONES (clear)

AVERMECTINS

Ivermectin
Ivomec[®]

Eprinomectin
Eprinex[®])

Doramectin
Dectomax[®]

Moxidectin
Cydectin[®], Quest[®]

1980-1990's

MILBIMLYCIN

CELL DEPOLARIZERS

Levamisole
Prohibit[®]
LevaMed[®]

Morantel tartrate
Rumatel[®]
Goat dewormer
Positive Goat Pellet

1960's

FDA-approved dewormers for small ruminants

SHEEP

1. Albendazole
Valbazen® drench
2. Ivermectin
(Ivomec® drench)
2. Moxidectin
(Cydectin® drench)
3. Levamisole
Prohibit® drench
LevaMed®

GOATS

1. Fenbendazole
SafeGuard®
LevaMed®
3. Morantel tartrate
Rumatel®
Goat dewormer
Positive Goat Pellet

CAMELIDS

None

Using a drug in any manner that differs from its label requires extra-label drug use and veterinary involvement.

This includes a different species, indication, dosage, route of administration, and/or frequency of treatment.

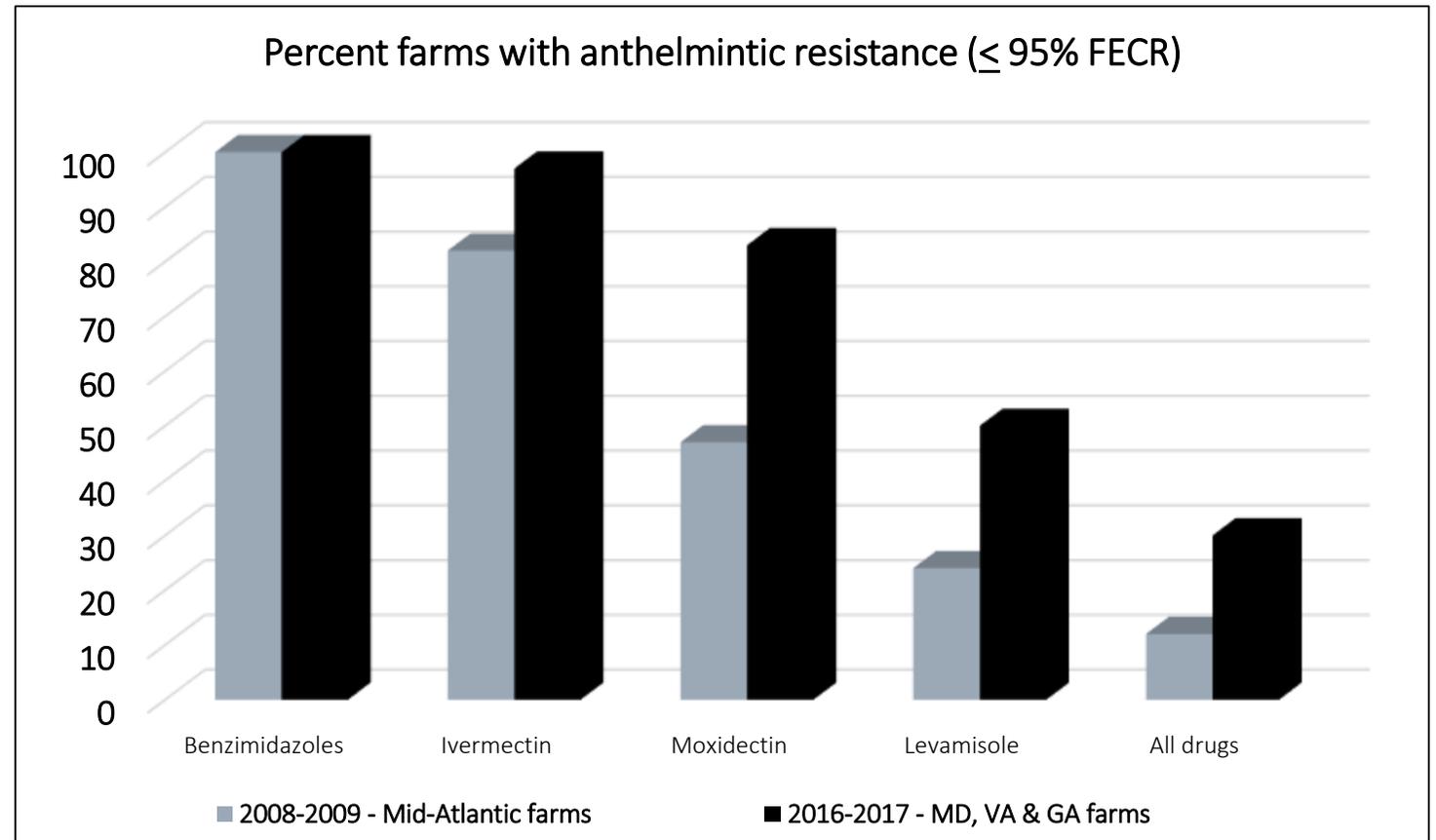
Dewormer resistance

- Heritable ability of a worm to survive a dose of dewormer that should have killed it.
- Exists in a population of worms if more than 5% of worms survive treatment.
- Resistant genes are passed onto the next generation of worms.
- May not be noticed until more than 50% of worms survive treatment, and deworming fails to alleviate clinical symptoms.
- Resistance is generally thought to be permanent (differs somewhat in levamisole).



Current state of dewormer resistance

- Worms have developed varying degrees of resistance to all dewormers and dewormer classes.
- Resistance varies by geographic region and individual farm.
- Many farms have resistance to multiple drugs.
- The only way to know which drugs work on your farm is to test (fecal egg count reduction test or DrenchRite® assay).



Testing for dewormer resistance

FECAL EGG COUNT REDUCTION TEST

- Compare before and after fecal egg counts (before treatment and 10-14 days later).
- Use individual or pooled samples from at least 10 animals for each dewormer you want to test.
- Need a lot of animals to test all drugs.
- Minimum FEC of 250 EPG.
- Determines percent fecal egg count reduction
- Cost varies. Can learn to do yourself.

DRENCHRITE® LARVAL DEVELOPMENT ASSAY

- Lab test that determines resistance to all dewormer groups simultaneously from a single pooled fecal sample from at least 8 animals.
- Minimum FEC of 500 EPG.
- Reports resistance, suspected resistance, and susceptibility (detects resistance sooner).
- Identifies species of parasites from hatched larvae.
- University of Georgia is only place that does test in North America (~\$500 per sample)

What is the goal of deworming?

- Therapeutic, not prophylactic
- Treat clinically-parasitized animals to save their lives, improve their welfare, and reduce production losses.
- Need to do so in a manner that minimizes the development of resistant worms.
- Dewormers are a valuable, but limited resource.



General recommendations for using dewormers



- Always give orally.
- Use drench (liquid) formulations.
- Use oral dosing syringe with long metal nozzle to deliver drug over tongue into oral cavity.
- Use proper drenching technique (be gentle)
- Make sure syringe delivers proper amount of drug.
- Deworm based on accurate weight (be careful not to underdose).
- Follow labels.
- Store properly.

Targeted selective treatment (TST)

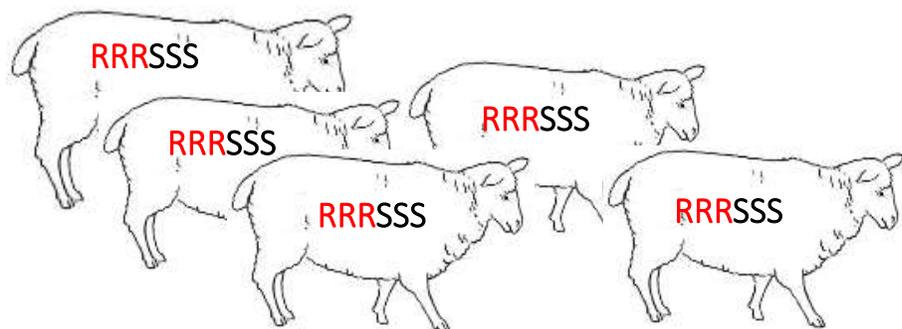
- Recommended strategy for deworming small ruminants
- Only deworming animals that require treatment or would benefit from treatment.
- Leave some animals untreated.
- TST reduces number of treatments, which increases refugia and prolongs effectiveness of drugs.



Refugia

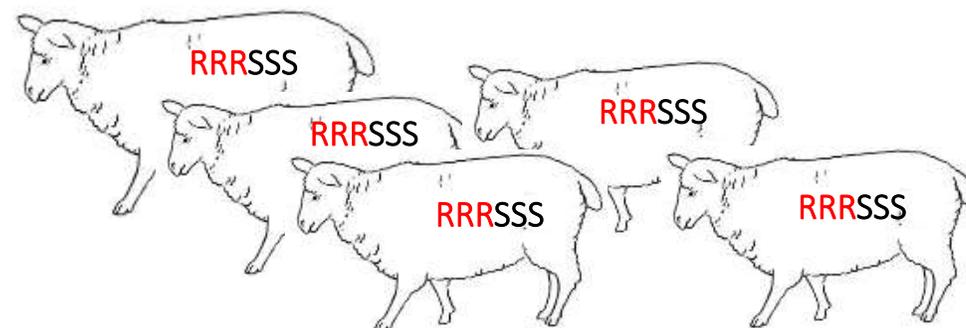
Worms that have not been exposed to dewormers

Deworm 20%



RRR SSS RRR SSS RRR SSS RRR SSS RRR SSS

Deworm 100%



RRR RRR RRR RRR RRR

R=resistant worms

S=susceptible worms

Is worse if you put treated animals on a clean pasture.

Tools to help you make deworming decisions

- FAMACHA© eye anemia system (barber pole worm)
- Body condition score (adult animals)
- Five Point Check© (all worms)
- Happy Factor™ (ADG; growth) (other worms)
- Fecal egg count (large flocks, other worms)
- Other (usually combined factors)



FAMACHA© eye anemia system

- Color eye chart used to assess level of anemia in animal, thus need for deworming (for barber pole worm).
- Estimates packed cell volume (PCV).
- Card has five treatment categories (scores).
- Need to check susceptible animals bi-weekly during peak worm transmission season.
- Training required to purchase card.
- Online training available at <https://www.sheepandgoat.com/online-famacha-certification>

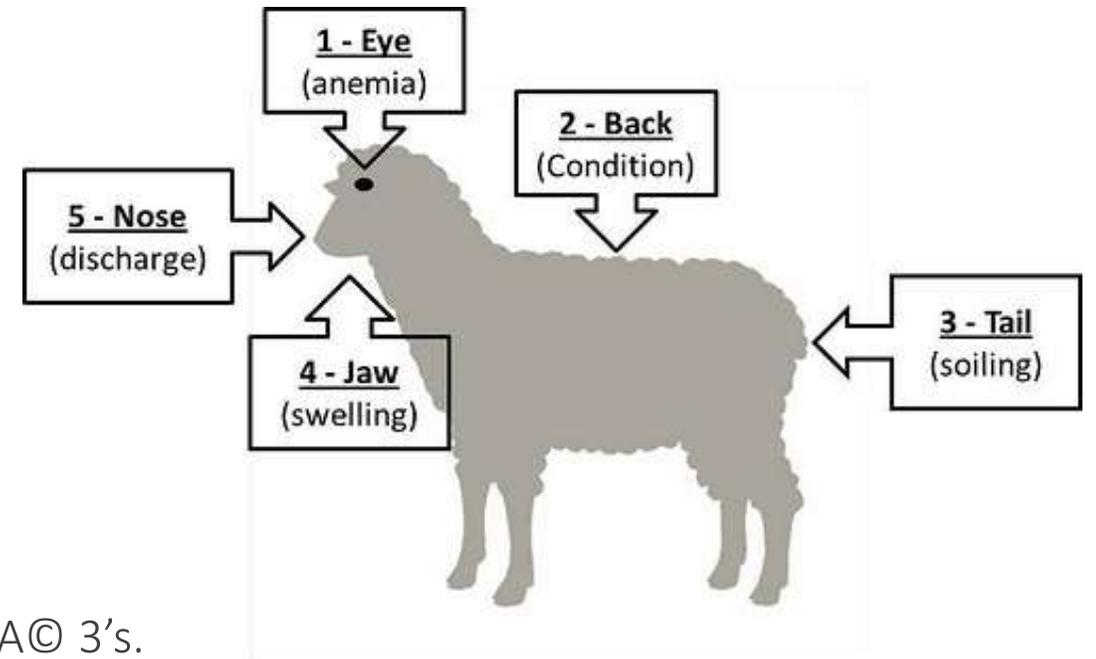


Proper technique is COVER-PUSH-PULL-POP.

Five Point Check®

- Extension of the FAMACHA© system which is only useful for blood-feeding parasites, such as the barber pole worm.
- Uses five check points on the animal's body to determine need for deworming for all parasites that commonly affect small ruminants.

- 1) **Eye** (FAMACHA© score)
- 2) **Back** (body condition score)
- 3) **Tail** (fecal soiling, dagginess, scours)
- 4) **Jaw** (bottle jaw)
- 5) **Nose** (nasal discharge/nasal bots)



- Also useful for determining need to deworm FAMACHA© 3's.

What about fecal exams?



- Make deworming decisions based on the assessment of clinical signs not results of a fecal exam.
- Qualitative fecal flotations aren't very useful.
- Though generally predictive, fecal egg count is not always indicative of worm load and the need for deworming.
- Roundworm (strongyle-type) eggs look the same and cannot be differentiated at the egg stage.
- Can do before and after fecal egg count to see if treatment was effective.
- Use fecal egg counts to 1) determine drug resistance, 2) determine which animals are more resistant (or susceptible) to worms, and 3) assess level of pasture contamination.

Combination treatments



- Since the worms have developed resistance to all of the dewormers and dewormer classes, it is now recommended that small ruminants with clinical signs of parasitism be given combination treatments.
- A combination treatment is when you give more than one dewormer at the same time (sequentially, but not mixed) in order to kill the maximum number of worms of the same kind (additive effect).
- The most potent drug from each class should be given at full dose, usually albendazole (Valbazen®) + moxidectin (Cydectin®) + levamisole (Prohibit®, Leva-Med®).
- Administer combination treatments based on target selective treatment criteria: **do not give to all!**

Copper oxide wire particles (COWP)

- An alternative to conventional dewormers
- Can also use in combination with a dewormer
- Tiny metal rods of copper oxide (slow release, poorly absorbed form of copper)
- Have been shown to reduce barber pole worm infections in sheep and goats.
- Available as copper supplements (e.g. Copasure®) for cattle (12.5, 25 g) and goats (2 and 4 g).
- Repackage into smaller doses (gel caps) for deworming sheep and goats (0.5-1 g for lambs/kids; 1-2 g for mature animals).
- Administer with a plastic balling gun.

*** Use safely ***



Thank you. Questions?



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