



**MISSISSIPPI STATE**  
UNIVERSITY™

**EXTENSION**

*Extending knowledge. Changing lives.*

# Sustainable Parasite Control for Small Ruminants



**MISSISSIPPI STATE UNIVERSITY™**  
DEPARTMENT OF ANIMAL  
AND DAIRY SCIENCES

**Leyla Rios**

MSc., PhD., Assistant Professor Extension & Research  
Sheep and Goat Specialist  
Mississippi State University  
[leyla.rios@msstate.edu](mailto:leyla.rios@msstate.edu)

# Life Cycle Gastrointestinal Nematodes

The **direct life cycle** of gastrointestinal nematodes that most commonly affect sheep and goats. **Short life cycle.** On average 2 to 3 weeks, and as short as 7 days

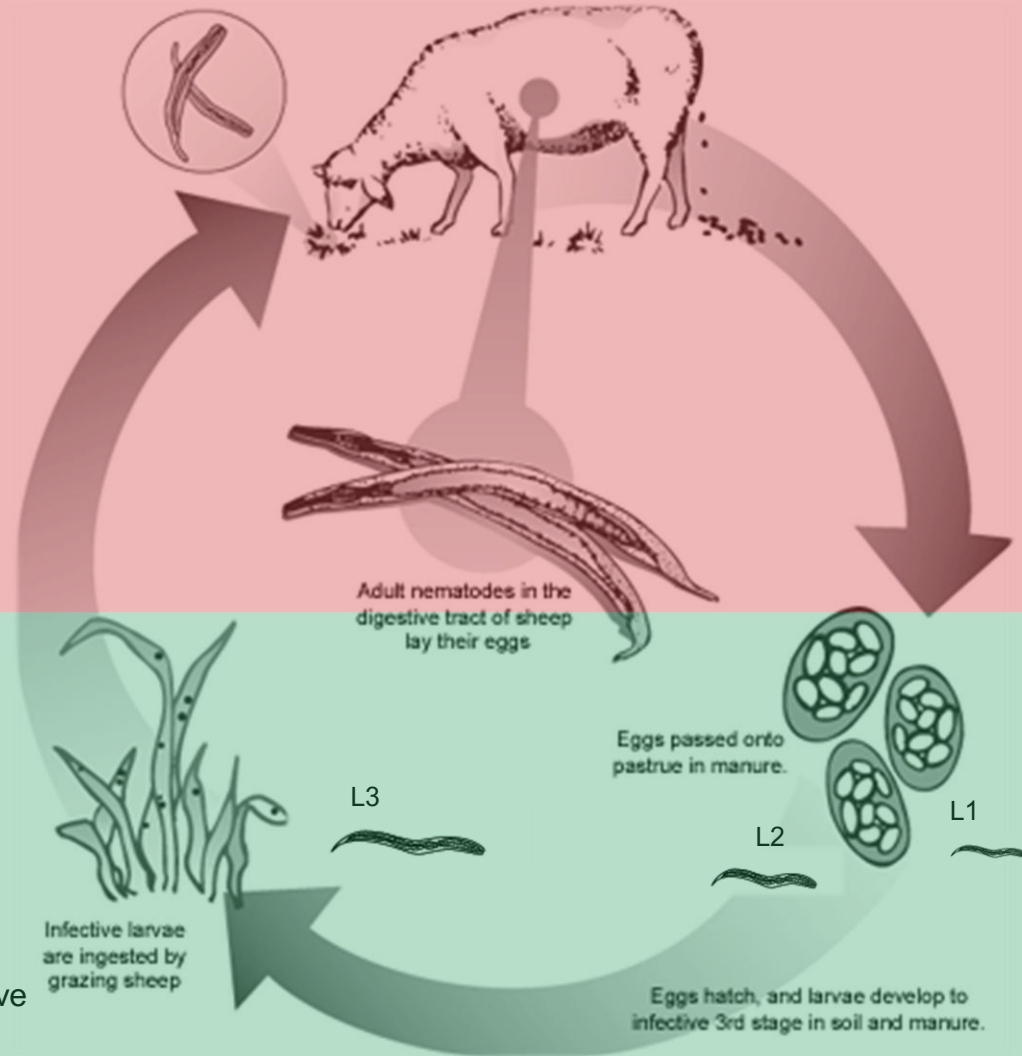
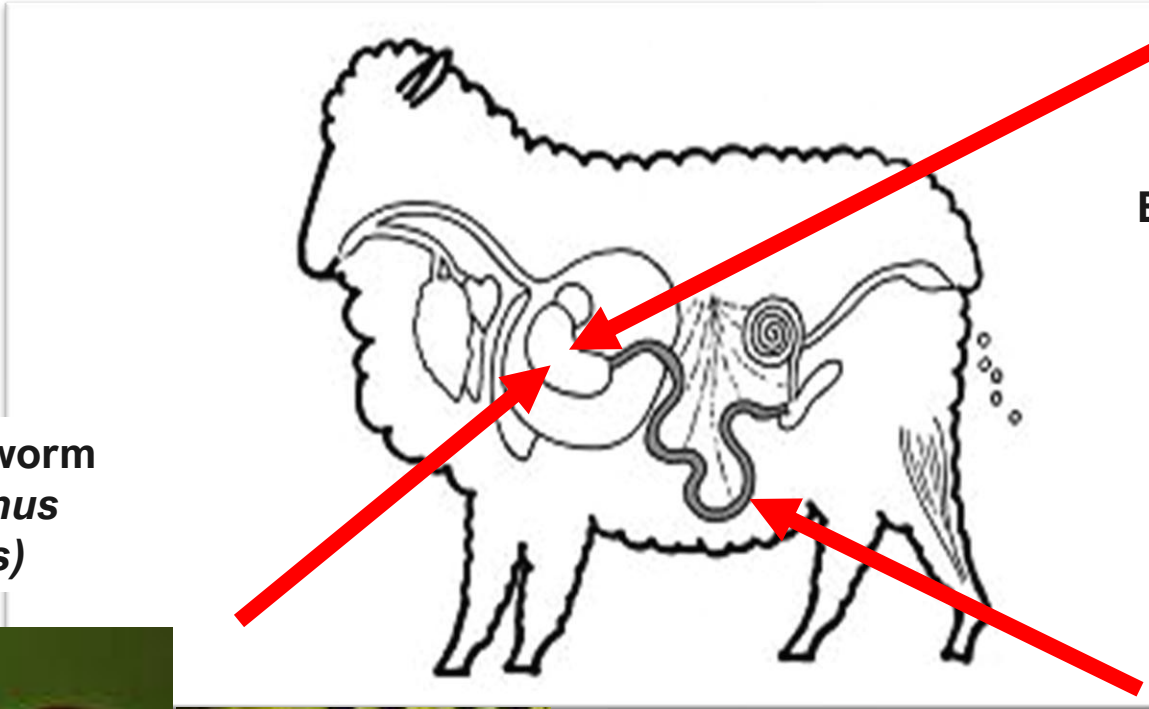


Figure Modified from Extension Cooperative Virginia Tech, Publication 410-027.



# Gastrointestinal parasites of small ruminants

Barberpole worm  
(*Haemonchus contortus*)



Brown stomach worm  
(*Teladorsagia circumcincta*)



Bankrupt worm or Black scour worm  
(*Trichostrongylus colubriformis*)



# **Sustainable:**

Able to continue over a period  
of time

---

Meeting our own needs without  
compromising the ability of  
future generations to meet their  
own needs



# Concepts

- \* **Sustainable parasite control:** minimize animal production loss, prevent parasitic diseases, avoiding anthelmintic resistance (Besier, 2012). Uses the **REFUGIA** concept and the **Targeted Selective Treatment (TST)**
- \* **Integrated Parasite control:** is a sustainable parasite control that integrates chemical and nonchemical options (Kahn and Woodgate, 2012).



# Sustainable parasite control

## 1. Practices that help on the control of parasites IN THE HOST

- **Selection / culling animals**, keeping in the herd the most productive and resistant animals to parasitism
- **Use of resistant breeds to parasitism**, some sheep and goat breeds that tend to be more tolerant to parasitism and that despite their parasite load, grow and reproduce properly
- **Selective deworming or TST**, use of the indicators is a successful way to maintain refugia, deworming only those animals that require it.
- **Strategic supplementation of the herd**, adequate nutrition of the animals and their level of immunity to resist different diseases
- **Alternative treatments**, copper particles (COWP), bioactive forages, etc



# Sustainable parasite control

## 2) Practices that help reduce the ingestion of infective L3 larvae from the pasture. FOCUS OUTSIDE THE HOST.

- Adequate periods of rotation/rest of the paddocks (rotate each 3 to 5 days)
- Grazing of young/low immunity animals in "clean" grasslands
- Avoid overgrazing
- Adjust stocking density
- Use of **bioactive forages** or plants containing secondary metabolites
- Use of **multispecies paddocks**, using plants of different heights allows animals (mainly goats) to alternate grazing with browsing
- The use of **co-grazing** (mixed animals)
- Alternative treatments such as **nematophagous fungi** (*Duddingtonia flagrans*, BioWorma®),



# Targeted selective treatment

**TST** is deworming only those animals that really requires being dewormed, uses productive performance (milk production) (Hoste et al., 2002) or daily gain weight, other indicators such as anaemia (van Wyk and Bath, 2002) (FAMACHA) and body condition.

**TST** keeps **REFUGIA**: population of parasites not exposed to anthelmintic that survive and “dilute” in the environment those resistant parasites that survived treatment. Avoiding only resistant parasites to infect most of the flock.



# Five point check©

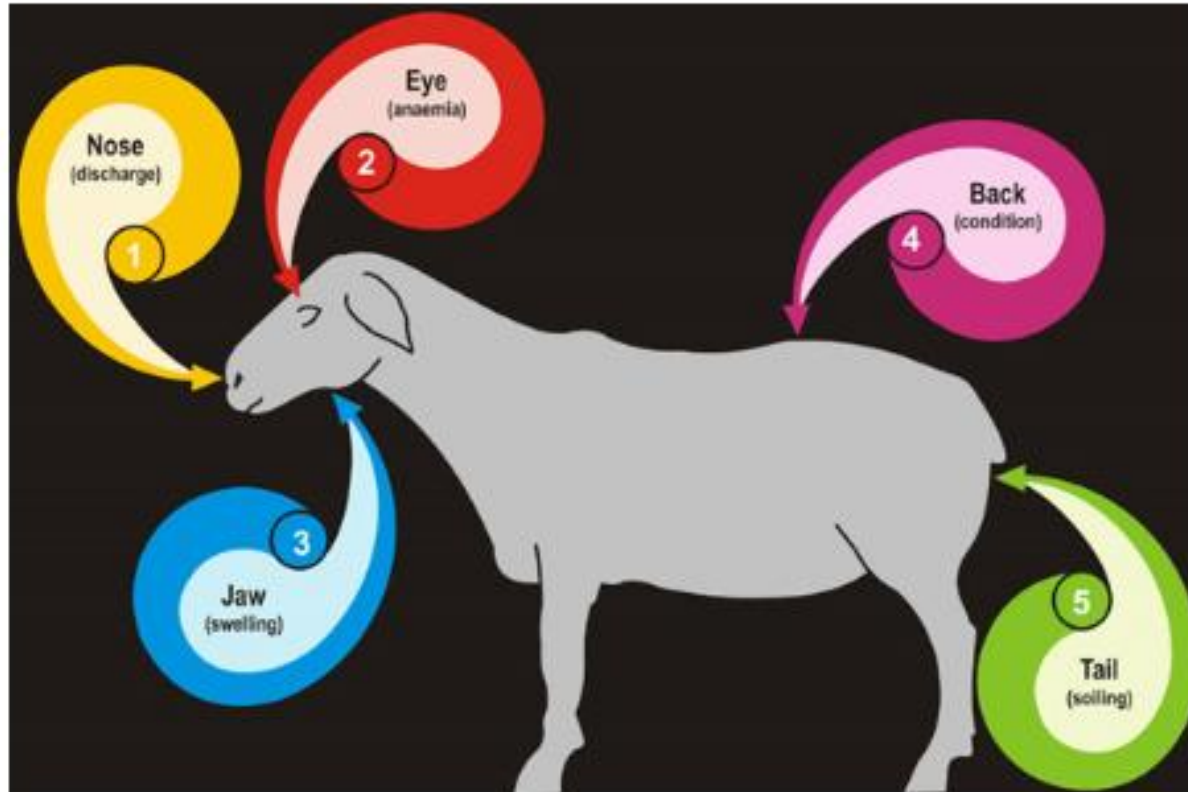



Fig. 1. The Five Point Check©.

# Score cards for the five points

## Score cards for 5✓

**FAMACHA**<sup>®</sup>  
2007

Anaemia guide  
Guide sur l'anémie  
Guia de anemia  
مرشد فقر الدم  
हेमिसिया संघर्ष निर्देश  
貧血症檢測卡



A(1) B(2) C(3) D(4) E(5)



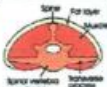



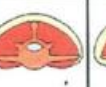
**DAG SCORECARD**

0	No faecal soiling at all No indication for treatment / action	✓
1	Very slight soiling on edge of tail / on each side No treatment / action needed	✓
2	Slight soiling on edge of tail and on each side Usually no treatment / action needed	✓
3	Moderate soiling of tail and wool Dag formation Consider treatment / action	?
4	Severe soiling extending far into the wool Severe dag formation Treatment / crutching recommended	!
5	Very severe, watery diarrhea extending to the hocks Treatment and crutching essential	☠

Copyright © University of Pretoria



**Condition Scoring in Sheep**

	Individually clearly felt, sharp, obvious	Form a smooth line with deep undulations	Only slightly detectable undulations	Only detectable with firm pressure	Not detectable
Spines					
Transverse processes	Fingers easily pass underneath	Smooth round edges	Well covered. Have to push firmly to get fingers underneath	Cannot be felt at all	
Muscle	Very little. Concave	Concave	Not concave. Not convex	Maximally developed. Convex	
Fat layer	No	Very thin	Moderate	Thick	Very thick to form a dia along tail midline
					
Condition score	1	2	3	4	5

**Description:**

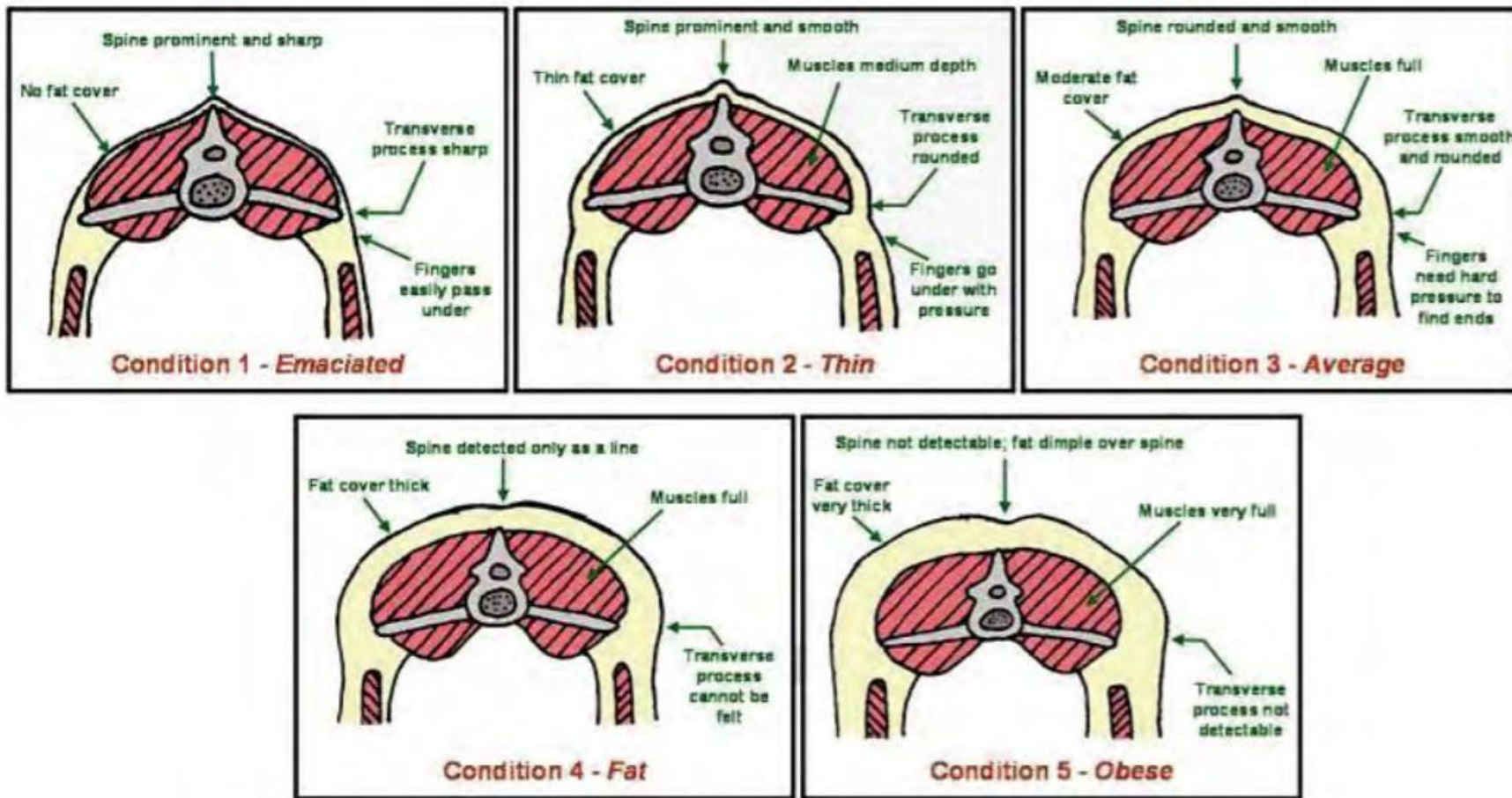
- The condition scoring is performed over the lower back area.
- Cases which do not fit these categories properly i.e. fall between whole numbers, can be assigned half scores eg. 1.5, 2.5 etc.
- This scheme may be used in goats, but half a score is added to the score, since goats preferentially store fat intra-abdominally and not over the lower back.

ARC • ENR  
University of Pretoria

Fig. 3. Score cards used for the five points.



# Body Condition Scores – Sheep/Goats



Adapted from "Body Condition Scoring of Sheep" by J.M. Thompson and H. Meyer (Oregon State University).

# Common signs of parasitism

Bristly hair



MISSISSIPPI STATE  
UNIVERSITY

EXTENSION

# Common signs of parasitism

## Submandibular edema



MISSISSIPPI STATE  
UNIVERSITY

EXTENSION

Francisco A. Rojo-Vázquez, Jorge González, Julia N. Hernández, María Martínez-Valladares. 2017. Resistencia genética a helmintosis digestivas. Albeitar

# Adult barber pole worms from the abomasum of a goat



# Adult barber pole worm from the abomasum



# Dewormers

**I-Benzimidazole** – “white dewormers”, includes **fenbendazole** (Safeguard®, Panacur®), and **albendazole** (Valbazen®)

**II-Macrolytic Lactones** - **ivermectin** (Ivomec®), **eprinomectin** (Eprinex®, LongRange®), **doramectin** (Dectomax®) and **moxidectin** (Cydectin®).

**III-Membrane depolarizing class (nicotinic)** – includes **levamisole** (Prohibit®, Levamed®) , **morantel tartrate** (Rumatel®), and **pyrantel pamoate** (Strongid®)

*Proper drenching procedure is essential for dewormer efficiency: the chin is level, and the nozzle dispenses behind the tongue.*



# American Consortium for Small Ruminant Parasite Control



## Dewormer Chart for Goats

## **SHEEP** Dewormer Chart

**\*Important --Please read notes below before using this chart\***

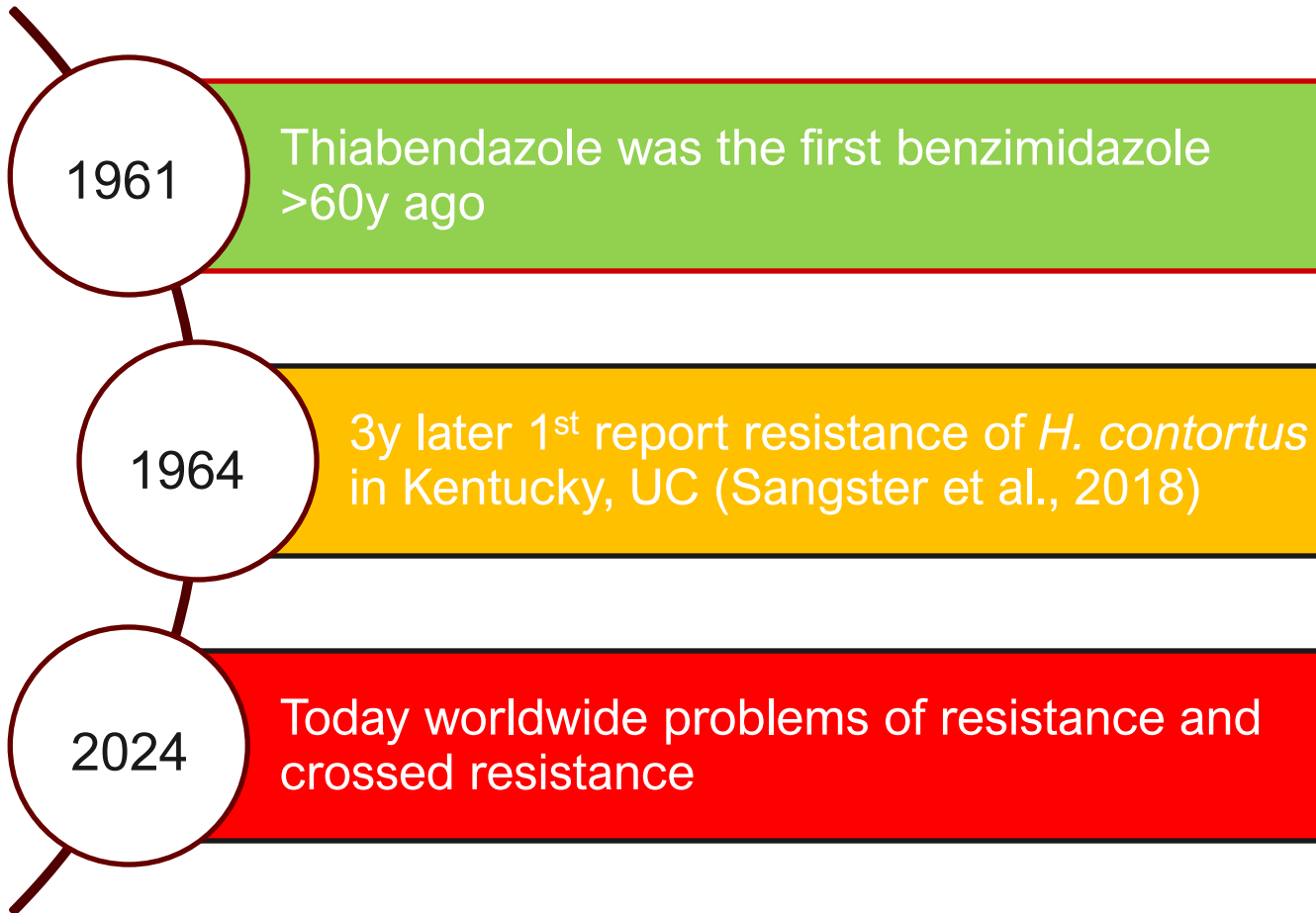
1 ml = 1cc	Valbazen (albendazole) <b>ORALLY</b>	SafeGuard (fenbendazole) <b>ORALLY</b>	Ivomec Sheep Drench (ivermectin) <b>ORALLY</b>	Prohibit (levamisole) <b>ORALLY</b>	Cydetin Sheep Drench (moxidectin) <b>ORALLY</b>	Rumatel (morantel) Feed Pre-mix <b>ORALLY</b>
Weight Pounds (lbs)	20 mg/kg 2 ml/ 25 lb	10 mg/kg 1.1 ml/ 25 lb	0.4 mg/kg 6 ml/ 25 lb	12 mg/kg 2.7 ml/ 25 lb	0.4 mg/kg 4.5 ml/25 lb	10 mg/kg 45 gm/100 lb BW (Durvet)
20	1.6	0.9	4.8	2.2	3.6	
25	2.0	1.1	6.0	2.7	4.5	11 grams
30	2.4	1.4	7.2	3.3	5.4	
35	2.8	1.6	8.4	3.8	6.5	
40	3.2	1.8	9.6	4.4	7.3	
45	3.6	2.1	10.8	4.9	8.2	
50	4.0	2.3	12.0	5.5	9.0	23 grams
55	4.4	2.5	13.2	6.0	10	
60	4.8	2.7	14.4	6.6	11	
65	5.2	3.0	15.6	7.1	12	
70	5.6	3.2	16.8	7.7	12.7	
75	6.0	3.4	18.0	8.2	13.6	34 grams
80	6.4	3.6	19.2	8.8	14.6	
85	6.8	3.9	20.4	9.3	15.4	
90	7.2	4.1	21.6	9.9	16.4	
95	7.6	4.3	22.8	10.4	17.3	
100	8.0	4.6	24.0	11.0	18	45 grams
105	8.4	4.8	25.2	11.5	19	
110	8.8	5.0	26.4	12.1	20	
115	9.2	5.2	27.6	12.6	21	
120	9.6	5.5	28.8	13.2	22	
125	10.0	5.7	30.0	13.7	22.7	56 grams
130	10.4	5.9	31.2	14.3	23.6	
140	11.2	6.4	33.6	15.4	25.4	
150	12.0	6.8	36.0	16.5	27.3	68 grams

**\*Important --Please read notes below before using this chart\***

1 ml = 1cc	Valbazen (albendazole) <b>ORALLY</b>	SafeGuard (fenbendazole) <b>ORALLY</b>	Ivomec Sheep Drench (ivermectin) <b>ORALLY</b>	Prohibit (levamisole) <b>ORALLY</b>	Cydetin Sheep Drench (moxidectin) <b>ORALLY</b>
Weight Pounds (lbs)	7.5 mg/kg 0.75 ml/ 25 lb	5 mg/kg 0.6 ml/ 25 lb	0.2 mg/kg 2.9 ml/ 25 lb	8 mg/kg 2 ml/ 25 lb	0.2 mg/kg 2.3 ml/25 lb
20	0.6	0.5	2.3	1.5	1.8
25	0.75	0.6	2.9	1.8	2.3
30	0.9	0.7	3.4	2.2	2.7
35	1.1	0.8	4.0	2.6	3.2
40	1.2	0.9	4.5	2.9	3.6
45	1.4	1.0	5.1	3.3	4.1
50	1.5	1.1	5.7	3.7	4.5
55	1.7	1.3	6.2	4.0	5.0
60	1.8	1.4	6.8	4.4	5.4
65	2.0	1.5	7.4	4.7	5.9
70	2.1	1.6	8.0	5.1	6.3
75	2.3	1.7	8.5	5.5	6.8
80	2.4	1.8	9.1	5.8	7.2
85	2.6	1.9	9.7	6.2	7.7
90	2.7	2.0	10.2	6.6	8.1
95	2.9	2.1	10.8	6.9	8.6
100	3.0	2.2	11.4	7.3	9.1
105	3.2	2.3	1.02	7.7	9.5
110	3.3	2.5	12.5	8.0	10
115	3.5	2.6	13.1	8.4	10.5
120	3.6	2.7	13.7	8.8	10.9
125	3.8	2.8	14.2	9.1	11.4
130	3.9	2.9	14.8	9.5	11.8
140	4.2	3.0	15.4	10.2	12.7
150	4.5	3.1	16.0	11.0	13.6



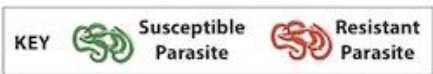
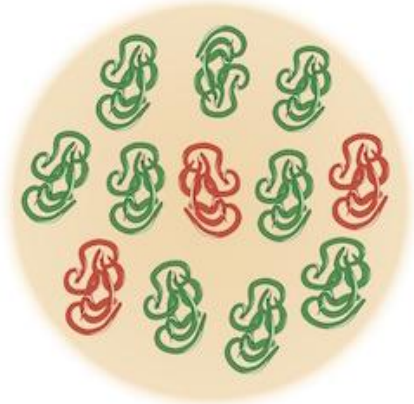
# Resistance to Anthelmintics



# REFUGIA

## The Importance of Preserving Refugia

Parasite population within the herd:

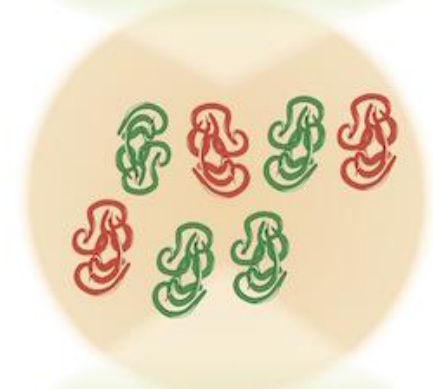


Treat the entire herd, so no refugia is preserved.



All susceptible parasites die. Only resistant parasites remain to breed and pass on resistant genes to their offspring.

Treat only 50% of the herd, so some refugia is preserved.



Some susceptible parasites remain to dilute the resistant parasites, slowing the development of a fully resistant parasite population.

# Common signs of parasitism

## Anemia



FAMACHA chart, created by Dr. **F**affa **M**Alan **C**HArt from South Africa who is the creator of the score for **selective treatment for controlling the level of barber's pole worm (*Haemonchus contortus*)**



# Dr. Faffa Malan



# What is FAMACHA<sup>©</sup>?

## Technique

DO: Use proper FAMACHA<sup>©</sup> scoring technique to expose the lower eye mucous membranes and match them to the equivalent color on the FAMACHA<sup>©</sup> card (Figure 1). COVER, PUSH, PULL, POP is a 4-step process describing the proper technique.

1. **COVER** the eye by rolling the upper eyelid down over the eyeball.
2. **PUSH** down on the eyeball. An easy way to tell if you are using enough pressure is that you should see that the eyelashes of the upper eyelid are curling up over your thumb.
3. **PULL** down the lower eyelid.
4. **POP!** The mucous membranes will pop into view. Make sure that you do not score the inner surface of the lower eyelid, but rather score the bed of mucous membranes.

ACSRPC Webpage: <https://www.wormx.info/dosdonts>



[https://www.google.com/search?q=famacha+technique&rlz=1C1GCEA\\_enUS936US936&oq=famacha+technique&aqs=chrome..69i57.4399j0j7&sourceid=chrome&ie=UTF-8#kpvalbx=\\_t1BiYZH8AoWMxc8P26GY6AU18](https://www.google.com/search?q=famacha+technique&rlz=1C1GCEA_enUS936US936&oq=famacha+technique&aqs=chrome..69i57.4399j0j7&sourceid=chrome&ie=UTF-8#kpvalbx=_t1BiYZH8AoWMxc8P26GY6AU18)



# FAMACHA© Card

**FAMACHA©**

2019

Anaemia guide  
Guide sur l'anémie  
Guía de anemia  
مرشد فقر الدم  
ऐनिमिया संबधि निर्देश  
貧血症檢測卡



Cover



Pop

Push

Pull



Contact: FAMACHA Coordinator  
FAMACHA@UGA.EDU  
Phone: (706) 542-0742  
(706) 542-5771



MISSISSIPPI STATE  
UNIVERSITY

EXTENSION



# FAMACHA in a Nutshell



Ver más ta...



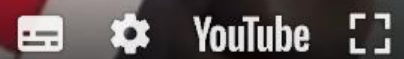
Compartir



FAMACHA  
in a  
Nutshell

MÁS VIDEOS

6:34 / 6:55





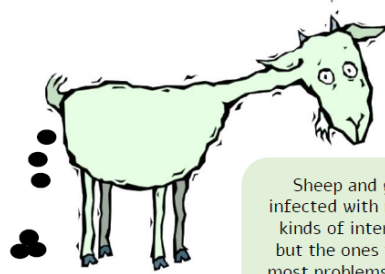
# FAMACHA in a Nutshell



MISSISSIPPI STATE  
UNIVERSITY

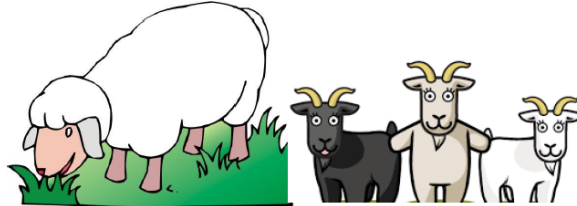
EXTENSION

# Internal Parasites 101 **for KIDS**



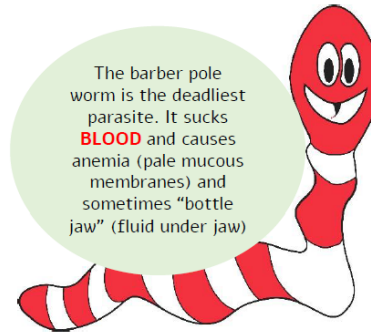
Sheep and goats can be infected with many different kinds of internal parasites, but the ones that cause the most problems are the barber pole worm and coccidia.

Parasites can be deadly, especially to lambs/kids, nursing mothers, and any animal that is thin and/or underfed.

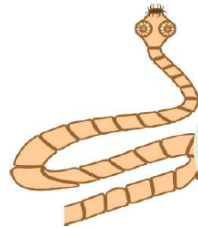


Sheep and goats get infected with worms when they eat infective larvae (immature form of worm) on the grass, so don't let them graze too close to the ground. They get infected with coccidia when they ingest feed and water contaminated with fecal material or live in a contaminated environment. Be sure to sure to keep pens dry and feed and water troughs clean. Worms are more of a problem on pasture, whereas coccidia is a bigger risk in the barn or dirt lots.

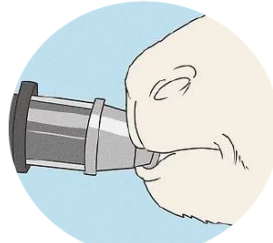
The barber pole worm is the deadliest parasite. It sucks **BLOOD** and causes anemia (pale mucous membranes) and sometimes "bottle jaw" (fluid under jaw)



Coccidia are microscopic single-cell protozoan parasites. You can't see them, but they can cause problems in the small intestines. Nasty diarrhea (scours) is the common symptom.



Tapeworms are the only internal parasite you can see in the poop. While they look "yucky" they don't usually cause any harm.



You should only give deworming medicine to sheep/goats that are showing obvious signs of worm infection, such as anemia (blood loss) or weight loss. Additives in the feed or mineral can help to prevent outbreaks of coccidiosis. Consult with a veterinarian if you need to treat your animals for coccidiosis.



By Susan Schoenian (2023)  
Sheep & Goat Specialist Emeritus  
University of Maryland Extension



# American Consortium for Small Ruminant Parasite Control



Visit this webpage for all updated information on  
parasite control!



MISSISSIPPI STATE  
UNIVERSITY

EXTENSION

# Sustainable Practices

Do not **BLANKET DEWORM** your animals

**USE EXTERNAL INDICATORS:** BCS, feed intake,  
ADG & FAMACHA©

**Targeted selective treatment (TST)**



MISSISSIPPI STATE  
UNIVERSITY

EXTENSION

<https://www.merck-animal-health-usa.com/safe-guard/goats>

# Alternative treatments: Use of Bioactive Forages



# Gastrointestinal Nematodes



Parasite Control

**Anthelmintic Drugs**

**Alternative Control**

**Parasite resistance**

Environmental problems

**Residues in food**

Genetic selection  
Vaccines  
Biological control

**Bioactive Forages**

Tannins  
Lectins  
Saponins



# Anthelmintic residues in the environment, is this really a concern?

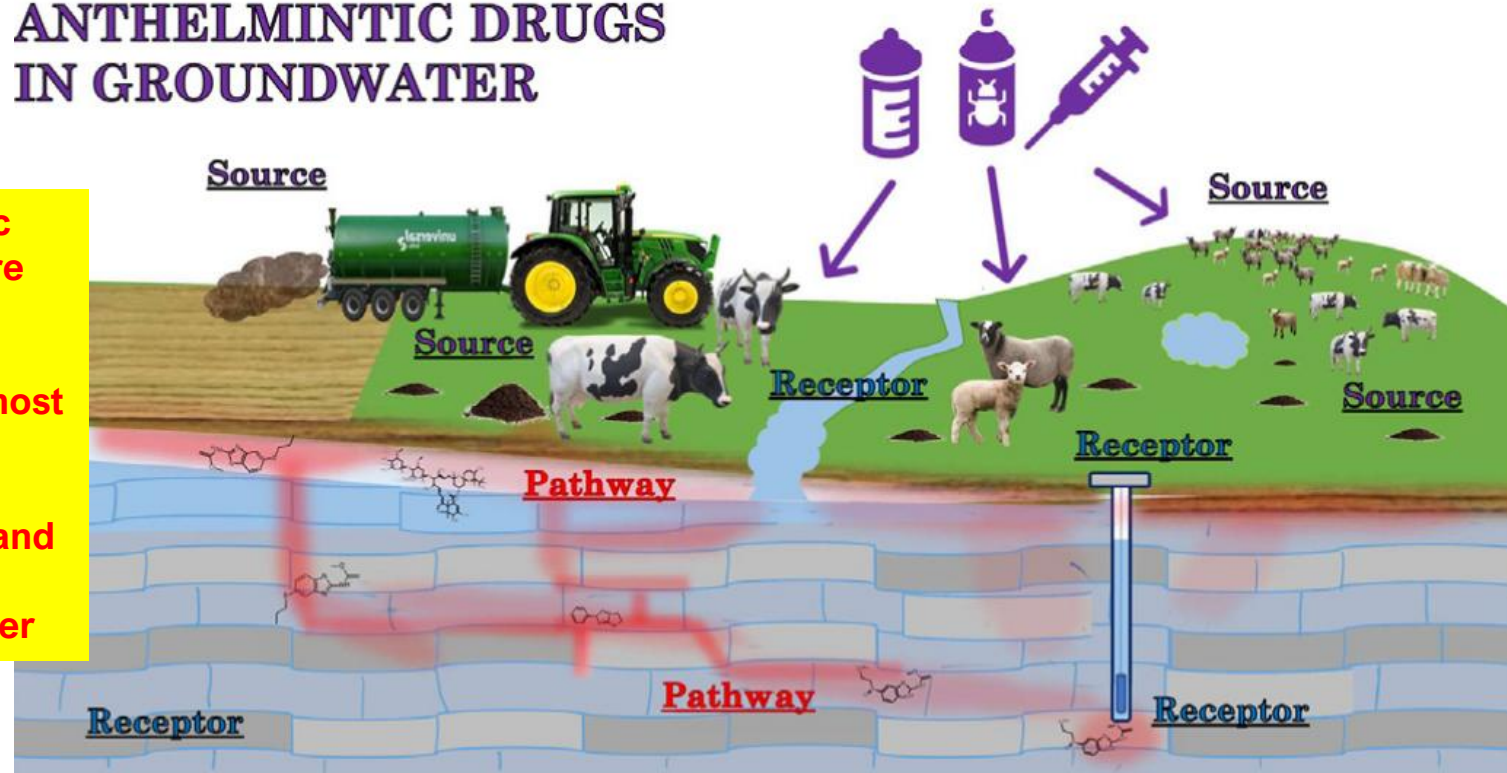
- **In fresh water?** *Chen et al, (2021)*: Benzimidazoles were found in water and sediments from Tuojiang River (China).
- **In groundwater?** *Mooney et al, (2021)*: Albendazole the most frequent anthelmintic found (Ireland).
- **In the soil?**
- **In our food?** *Yoo, et al. (2021)*: No residues in meat (chicken muscle, pork, beef, milk, and egg) (China). *Lourenco et al. (2020)*: No anthelmintic drug residues above the reporting limit were found in raw milk, milk filters, curd, and cheese (Ireland).



# An analysis of the spatio-temporal occurrence of anthelmintic veterinary drug residues in groundwater

D.Mooney, K.G.Richards, M.Danaher, J.Grant, L.Gill, P.-E.Mellander, C.E.Coxon, 2021

## ANTHELMINTIC DRUGS IN GROUNDWATER



17 Anthelmintic compounds were found:

Albendazole the most frequent:

8% groundwater and

28% surface water



# Ethnoveterinary → Medicinal Plants



Hay & Forage  
Growers



MISSISSIPPI STATE  
UNIVERSITY

EXTENSION

Functional food / Bioactive forage: a conventional food or forage that is consumed as part of a usual diet, has physiological benefits, and/or reduces the risk of chronic disease beyond basic nutritional functions, i.e. plants containing secondary metabolites.



# Bioactive forages

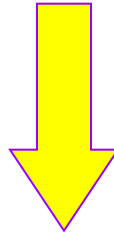
## Plant secondary metabolites (PSM)

Substances manufactured by plants that exert a wide range of effects on the plant itself and on other living organisms, induce flowering, fruit set or maintain perennial growth. PSM can act as antimicrobials, antifungal, antiparasitic, perform the role of attractants or repellents. Over 50,000 PSM have been discovered in the plant kingdom, i.e.:

- ☀ Tannins
- ☀ Alkaloids
- ☀ Saponins
- ☀ Lectins



# Use of PSM for parasite control



- Environmentally friendly
- Less parasite resistance
- Can reduce costs and animal death
- Ally for organic production



## Cool season perennials



Birdsfoot trefoil (*Lotus corniculatus*) Alfalfa (*Medicago sativa*)

Chicory (*Cichorium intybus*)

Clover (*Trifolium* sp.)

# USE OF BIOACTIVE FORRAGES

## Warm season perennials

Perennial peanut (*Arachis glabrata*)



Lespedeza (*Lespedeza cuneata*)



Kudzu (*Pueraria montana*)



# What plants with secondary metabolites do we have in the south or Bioactive Forages ?

<http://extension.msstate.edu/agriculture/forages/legumes>

## Select Your County Office

SELECT A COUNTY



## Your Extension Experts



**Dr. Rocky Lemus**

*Extension/Research Professor*



# Alternatives to dewormers

## Copper wire particles (COWP) and combinations with bioactive forages

Burke et al. (2010)

- COWP helped reduce FEC in periparturient ewes and does
- Sericea lespedeza hay reduced FEC compared bermudagrass hay.
- Sericea lespedeza + COWP improved reduction FEC in ewes and does



<https://www.wormx.info/copper-oxide-wire-particles>  
<https://www.ars.usda.gov/research/publications/publication/?seqNo115=204132>



MISSISSIPPI STATE  
UNIVERSITY

EXTENSION

Picture: By Dalgial - Own work, CC BY-SA 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=12343328>



# Alternatives to dewormers

# Alternatives to dewormers

## ***Duddingtonia flagrans* / Nematode trapping fungi**

- Now in the US as Bioworma®
- Active Constituents: *Duddingtonia flagrans*
- It is a natural fungi that can be found in soil / pasture
- Non-chemical or biological free-living nematode control that interrupts the life cycle of the worms
- The spores go in the feed, resist digestion and pass into the manure where germinate and traps and consumes the emerging larvae
- Spores are safe for animals, humans and environment



# Contact and Follow

**Leyla Rios**

*(662) 325-0123*

*[leyla.rios@msstate.edu](mailto:leyla.rios@msstate.edu)*



*[@msuextsheepandgoats](https://www.facebook.com/msuextsheepandgoats)*



*[msuext\\_sheepandgoats](https://www.instagram.com/msuext_sheepandgoats)*