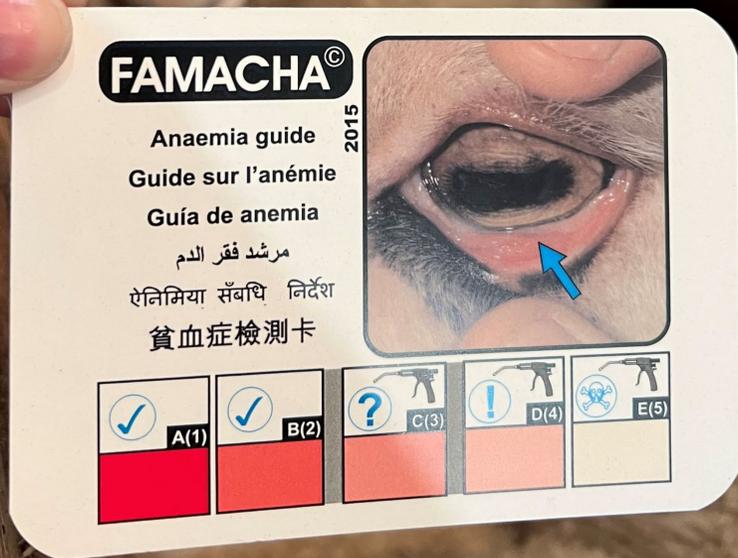


FAMACHA[®] Certification



Internal Parasites of Small Ruminants

Primary health problem affecting sheep and goats in warm and humid climates



Sheep And Goats Can Be Infected Simultaneously With Many Different Kinds Of Internal Parasites!!!

- 1. Barber Pole Worm (*Haemonchus contortus*)**
- 2. Black Scour Worm- Bankrupt worm (*Trichostrongylus spp.*)**
- 3. Brown Stomach Worm (*Teladorsagia- Ostertagia*)**

Barber Pole Worm

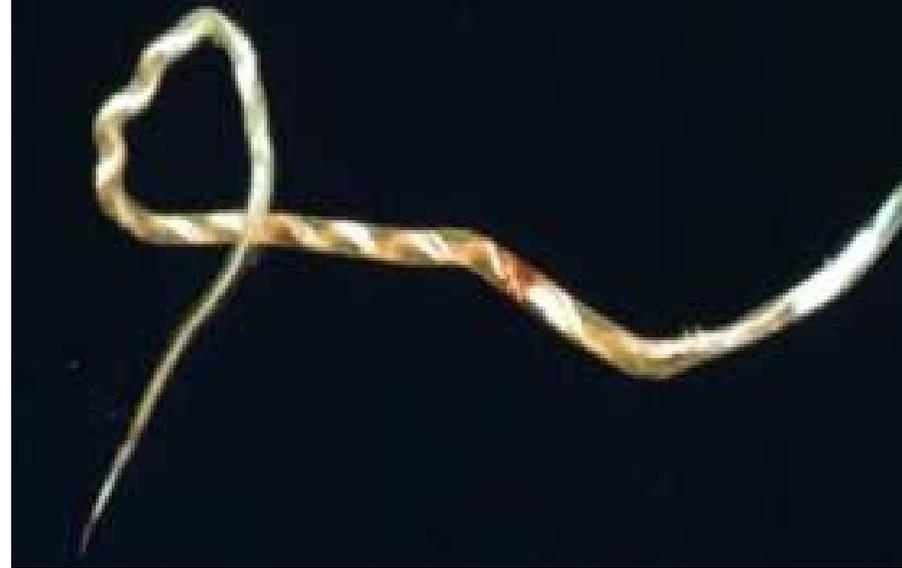
Parasite of primary concern in the U.S.

- Barber pole, wire worm, large stomach worm
- Blood-sucking roundworm that pierces the mucosa of the abomasum
- Cause **blood and protein loss** to the host.



Barber Pole Worm

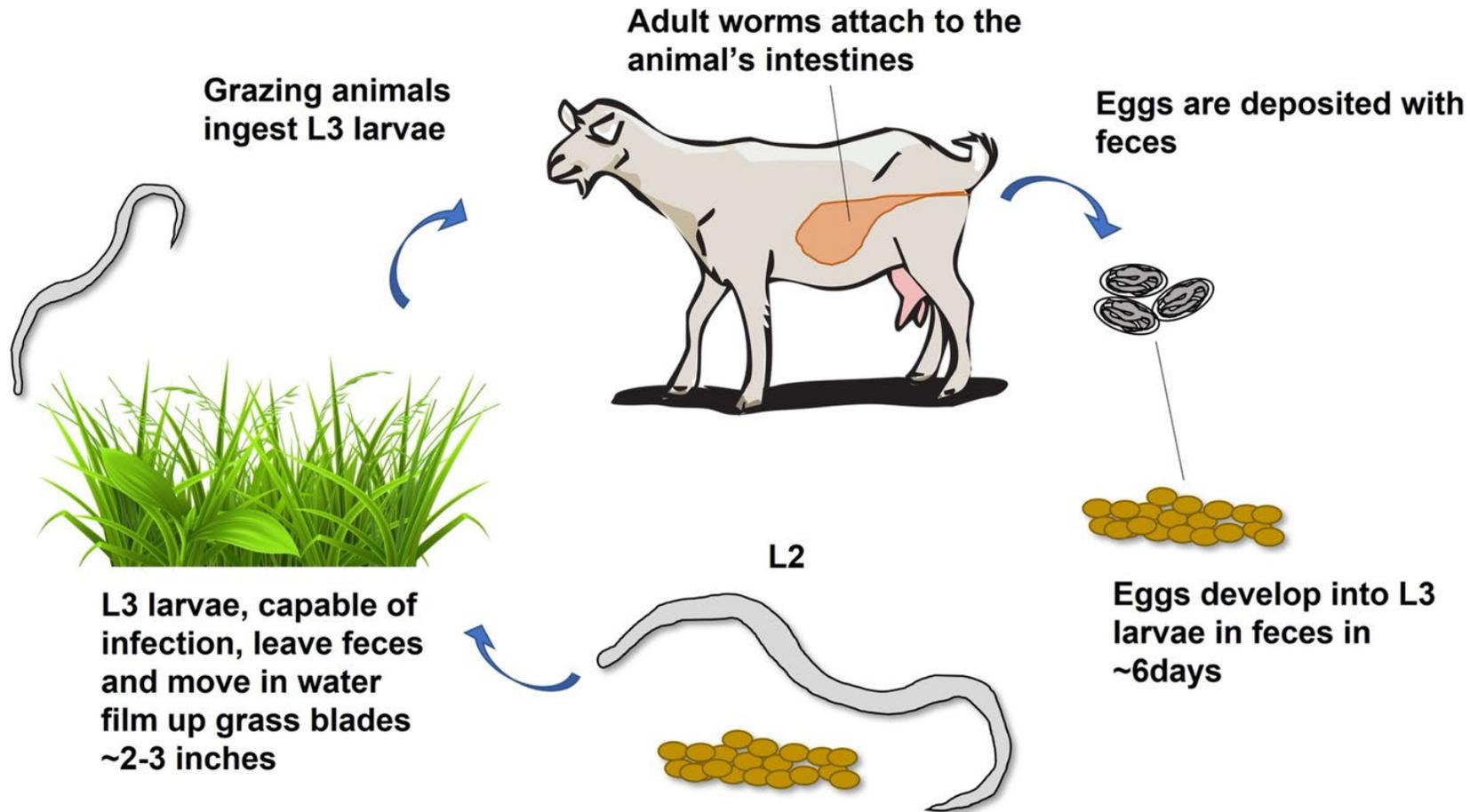
- Thrive in warm and moist conditions
- Pasture is the primary mode of transmission
- Young, weak, pregnant, lactating and stressed animals are most vulnerable to infections



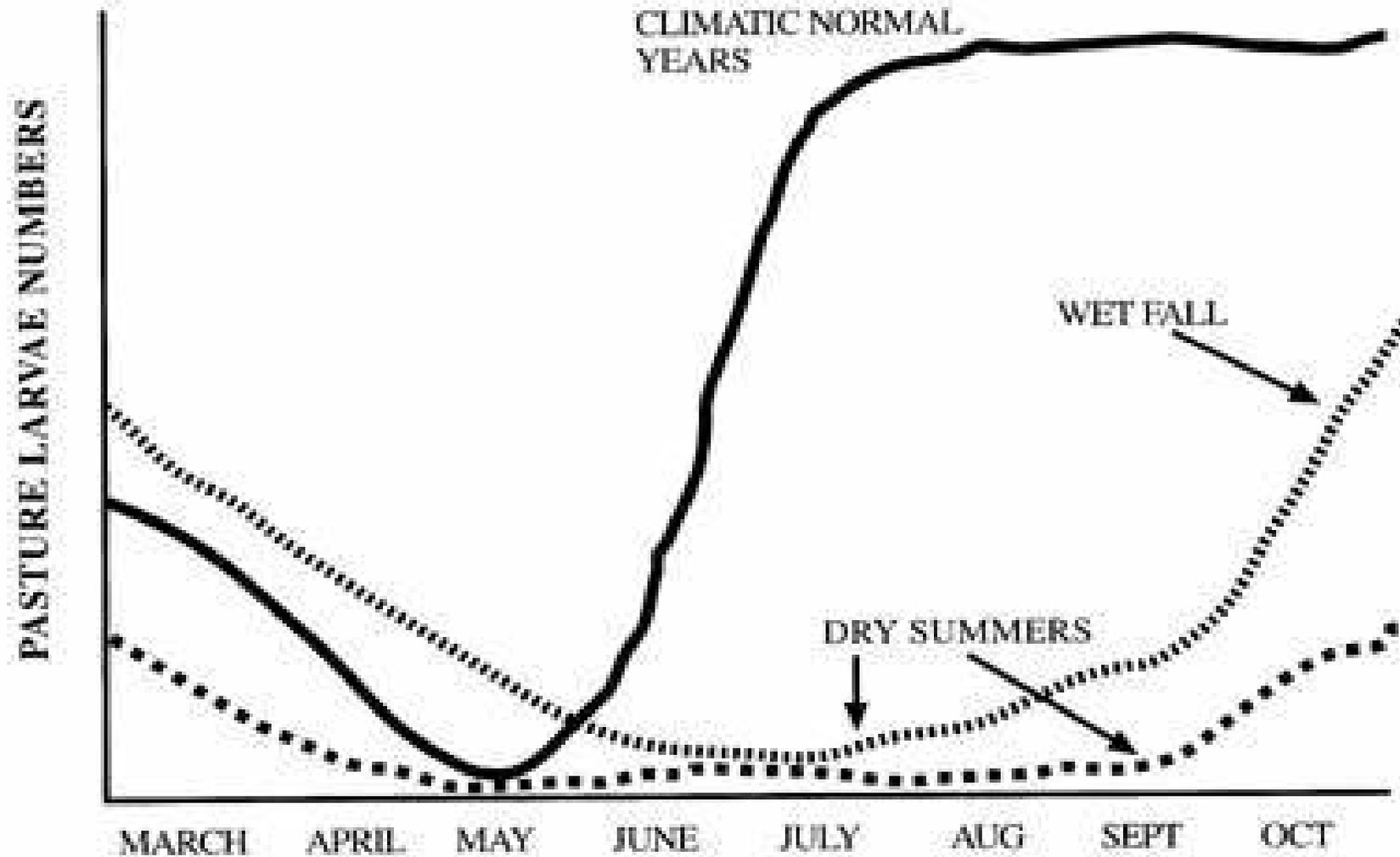
Barber Pole Worm Life Cycle

* **Short life cycle: 2-3 weeks**

* **No intermediate hosts**



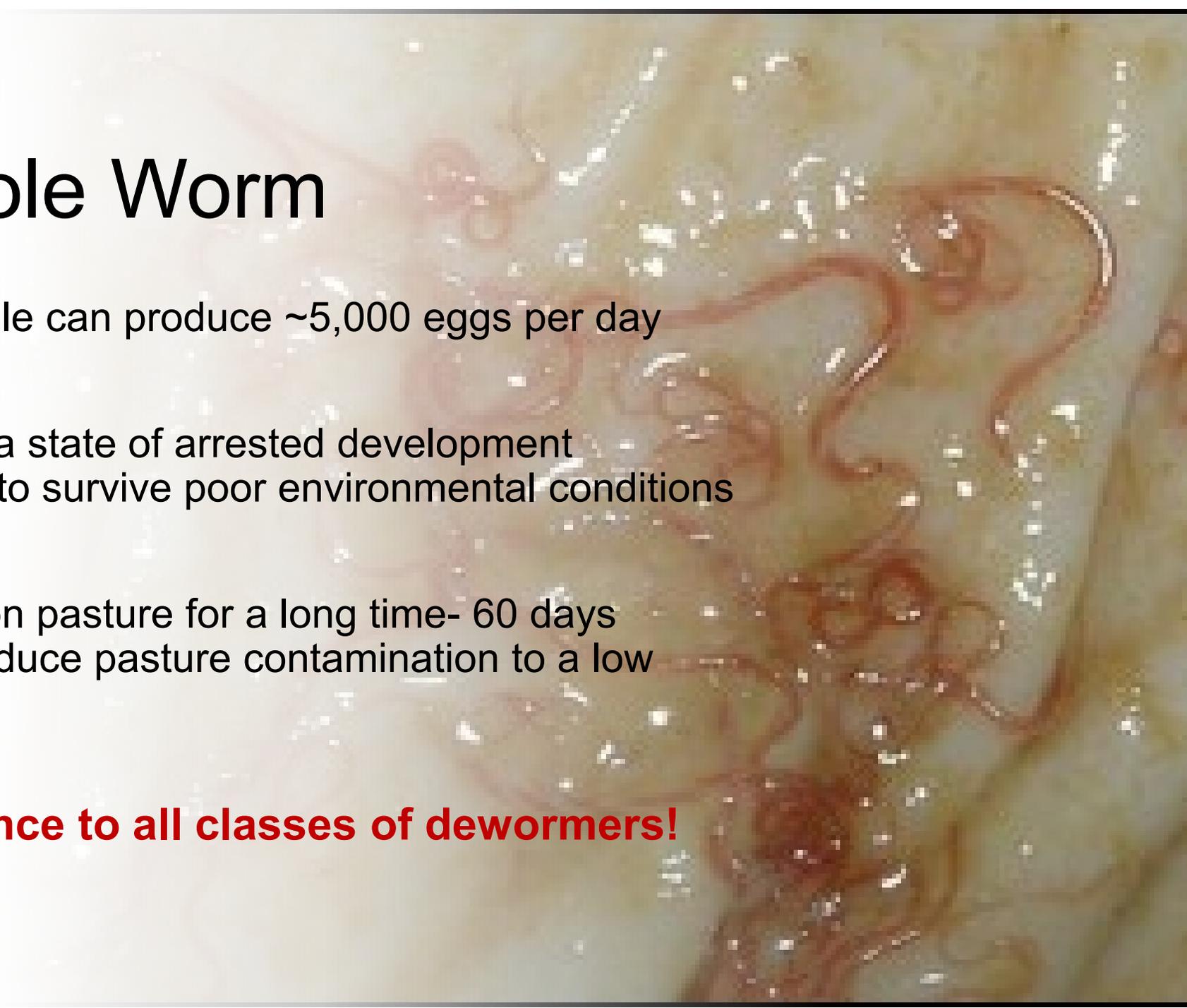
Barber Pole Worm



Barber Pole Worm

- Very prolific- one adult female can produce ~5,000 eggs per day
- Have the ability to undergo a state of arrested development (**hypobiotic**) in the animal, to survive poor environmental conditions
- Very resilient! Can survive on pasture for a long time- 60 days pasture rest is needed to reduce pasture contamination to a low level

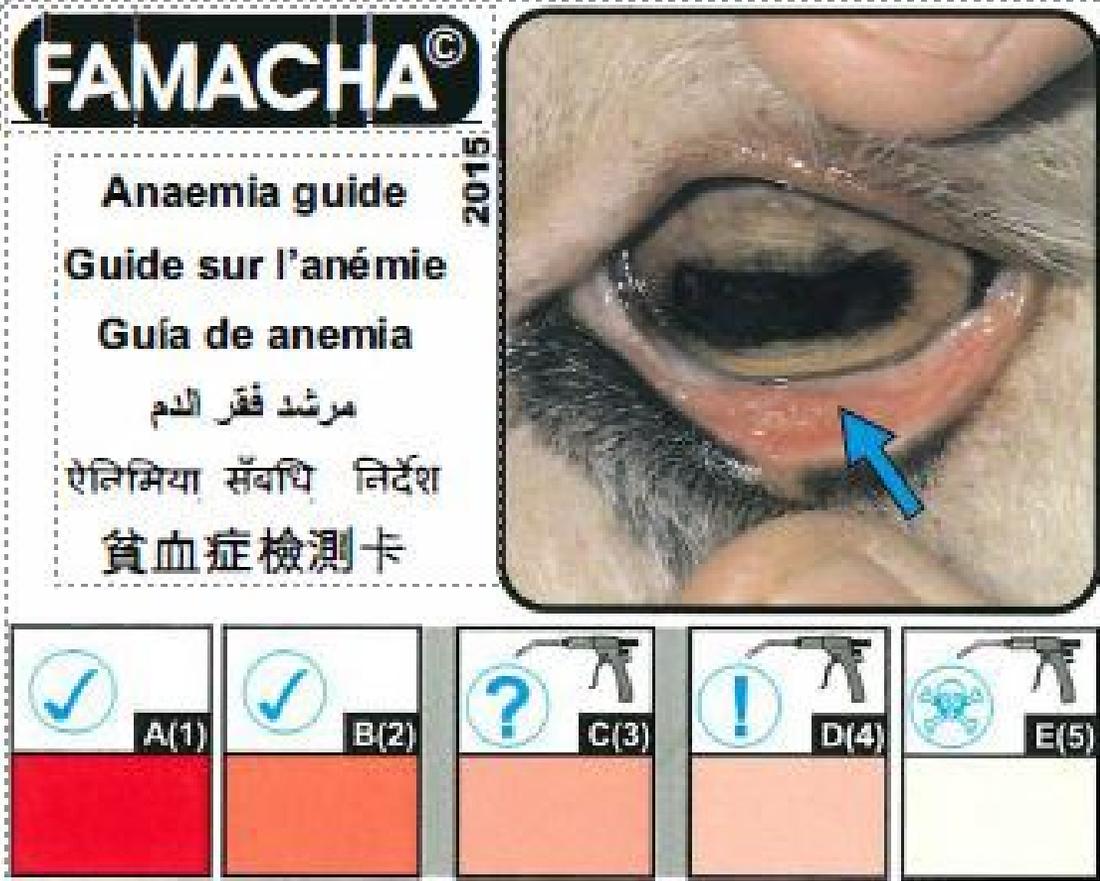
Has developed resistance to all classes of dewormers!



Barber Pole Worm Signs and Symptoms

- **Anemia**
 - Blood and protein loss-
 - Pale mucous membranes
- **“Bottle jaw”**
 - Sub-mandibular edema
 - Swelling directly under jaw
- Loss of weight and body condition
- Weakness
- Anorexia
- Death





The FAMACHA[©] System

- Developed in South Africa
- Eye chart for evaluating anemia caused by barber pole worm infection
- Enables selective deworming to minimize the development of drug resistance

How to use the FAMACHA[®] Card

- **Step 1:** Cover the eye by rolling the upper eyelid down over the eyeball.
- **Step 2:** Push down on the eyeball.
- **Step 3:** Pull down the lower eyelid.
- **Step 4:** The mucous membranes will pop into view. Hold the score card near the eye and match the color of the pinkest portion of the mucous membranes to the FAMACHA[®] card
- **Step 5:** Repeat the process for the other eye.



How to use the FAMACHA[©] Card



How to Interpret FAMACHA[®] Results

Animals in FAMACHA category 1 and 2:

- Do not deworm animals in these categories unless there is other evidence of parasitic infection, such as poor body condition score, loss of appetite, presence of diarrhea and dull hair coat.

Animals in FAMACHA category 4 and 5:

- **Always** deworm animals in these categories.



How to Interpret FAMACHA[®] Results

Animals in FAMACHA category 3:

Consider deworming animals in this category if:

- More than 10% of the flock/herd have scores of 4 or 5;
- Lambs and kids;
- Pregnant or lactating ewes/does;
- Animals with poor body condition score
- Animals with additional health problems
- Animals with compromised immune system





What FAMACHA[®] Does

- Identifies susceptible and resistant animals
- Helps decrease the use of dewormers by identifying potentially infected animals
- Allows selective treatment
- Assists with selection and culling decisions



What FAMACHA[®] Does

- Adds values to breeding stock
- Saves money
- Reduce selection for resistant worms by increasing **REFUGIA** (worms, in animal or pasture, not exposed to drugs, thus remain susceptible),

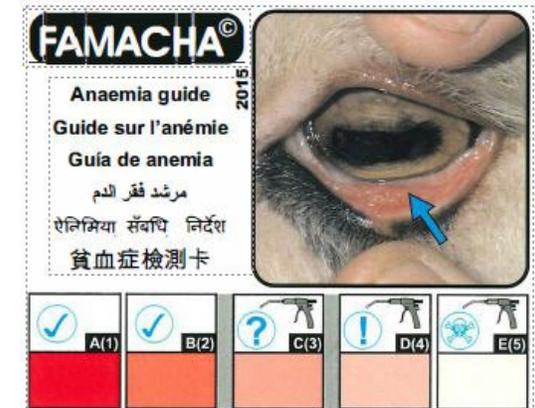
Prolongs effectiveness of dewormers

How Often to Perform the FAMACHA[®] Test

- Consider the lifecycle of the parasite

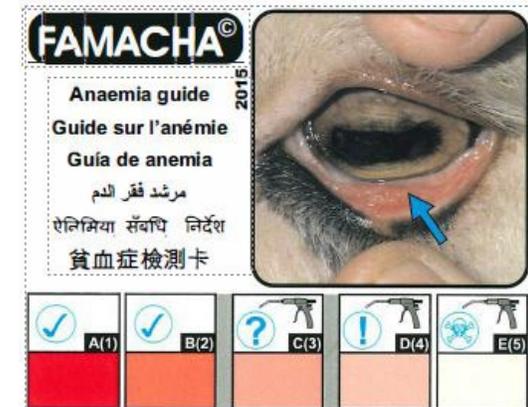
It is recommended that the FAMACHA[®] scoring is performed every 2-3 weeks, depending on the season!

- During high worm transmission periods: warm and humid weather: FAMACHA[®] score animals every 7-10 days



Ensuring Proper Use of the FAMACHA[®] System

- **Always** use the original FAMACHA[®] card
- Store the cards in a dark place to avoid color fade
- Replace the card after 12-24 months of use
- Use proper animals handling techniques when performing the test



Ensuring Proper Use of the FAMACHA[©] System

- Keep accurate records of the animals
- Check animals for other symptoms and signs:
 - “Bottle jaw”
 - Weight and BCS loss
 - Weakness
 - Anorexia

***Have a good and integrated management program!**





Effective Deworming for Strategic Parasite Control

Prevention!!



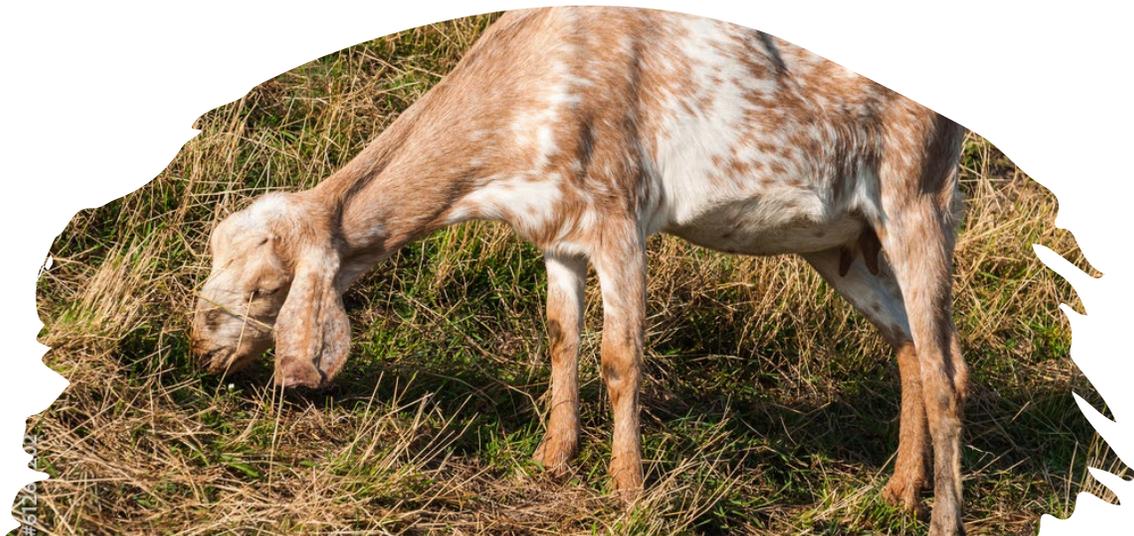
**Reduction or elimination of
environmental contamination**



Effective Deworming for Strategic Parasite Control

Key goals:

- All animals should be free of parasites during periods of reduced nutrition- winter
- Females should be free of parasites during kidding/lambing/lactation
- Young animals should be free of parasites
- Eliminate recontamination of spring pastures for the first 3 months of the grazing season



Classes of Dewormers

GROUP 1 Benzimidazoles (BZ)	GROUP 2 Macrocyclic lactones (ML)		GROUP 3 Nicotinic agonists	
	Avermectins	Milbemycins	Imidazothiazoles	Tetrahydropyrimidines
Fenbendazole SafeGuard®	Ivermectin Ivomec®			Morantel Rumatel® Positive Goat Pellet
Albendazole Valbazen®	Doramectin Dectomax®	Moxidectin Cydectin® Quest®	Levamisole Prohibit® Leva-Med® Tramisol® Levasol®	
Oxfendazole Synanthic®	Eprinomectin Eprinex®			Pyrantel Strongid®

Anthelmintics FDA-approved for sheep

	1 Benzimidazoles Albendazole Valbazen®	2a Avermectins Ivermectin Ivomec® sheep drench	2b Milbimycins Moxidectin Cydectin® sheep drench	3 Levamisole Prohibit® Leva-Med®
Adult worms	X	X	X	X
Larvae (L4)	X	X	X	Limited
Hypobiotic larvae	X	X	X	Limited
Lungworms	X	X	X	X
Tapeworms	X			
Liver flukes	Adult stage			
Coccidia				
External parasites		Some labeled for bot control	Some Not labeled	
Persistent activity		X	X	
Safety	10x pregnancy restriction	20x	5x	3x
Dosage	3 ml/100 lbs.	3 ml/26 lbs.	1 ml/11 lbs.	Depends on dilution
Meat withdrawal	7 days	11 days	7 days	3 days

Anthelmintics FDA-approved for goats

	1 Benzimidazoles		3b Morantel
	Fenbendazole SafeGuard®	Albendazole Valbazen®	Feed premix Rumatel
Adult worms	X	Not approved	X
Larvae (L4)	X	Not approved	sporadic
Hypobiotic larvae	X	Not approved	
Lungworms	X	Not approved	
Tapeworms	X	Not approved	
Liver flukes		Adult stage	
Coccidia			
External parasites			
Persistent activity			
Safety	wide	10x (sheep) pregnancy restriction	~20x (sheep)
Dosage	1.2 ml/50 lbs.	4 ml/100 lbs.	Varies by product
Meat withdrawal	6 days	7 days	30 days
Milk withdrawal			0 days

Extra-label anthelmintics for goats

	1 Benzimidazoles		2a	2b	3a
	Fenbendazole SafeGuard®	Albendazole Valbazen®	Avermectins Ivomec® sheep drench	Milbimycins Moxidectin Cydectin® sheep drench	Levamisole Prohibit® Leva-Med®
Adult worms	X	X	X	X	X
Larvae (L4)	X	X	X	X	Limited
Hypobiotic larvae	X	X	X	X	Limited
Lungworms	X	X	X	X	X
Tapeworms	X	X			
Liver flukes		Adult stage			
Coccidia					
External parasites			Some label for bot control	Some Not labeled	
Persistent activity			X	X	
Safety	wide	10x pregnancy restriction	20x	5x	3x
Dosage	1.1 ml/25 lbs.	2 ml/25 lbs.	6 ml/25 lbs.	4.5 ml/25 lbs.	Depends on dilution
Meat withdrawal	16 days <small>(1 day for each additional day used)</small>	9 days	14 days	17 days	4 days
Milk withdrawal	4 days <small>(1 day for each additional day used)</small>	7 days	9 days	8 days	3 days

Dewormer Resistance

- Major threat to the current and future control of parasites
- High prevalence of multi-drug resistant worms
- It is affected by geographic location, individual farm and prior deworming practices

Resistance:

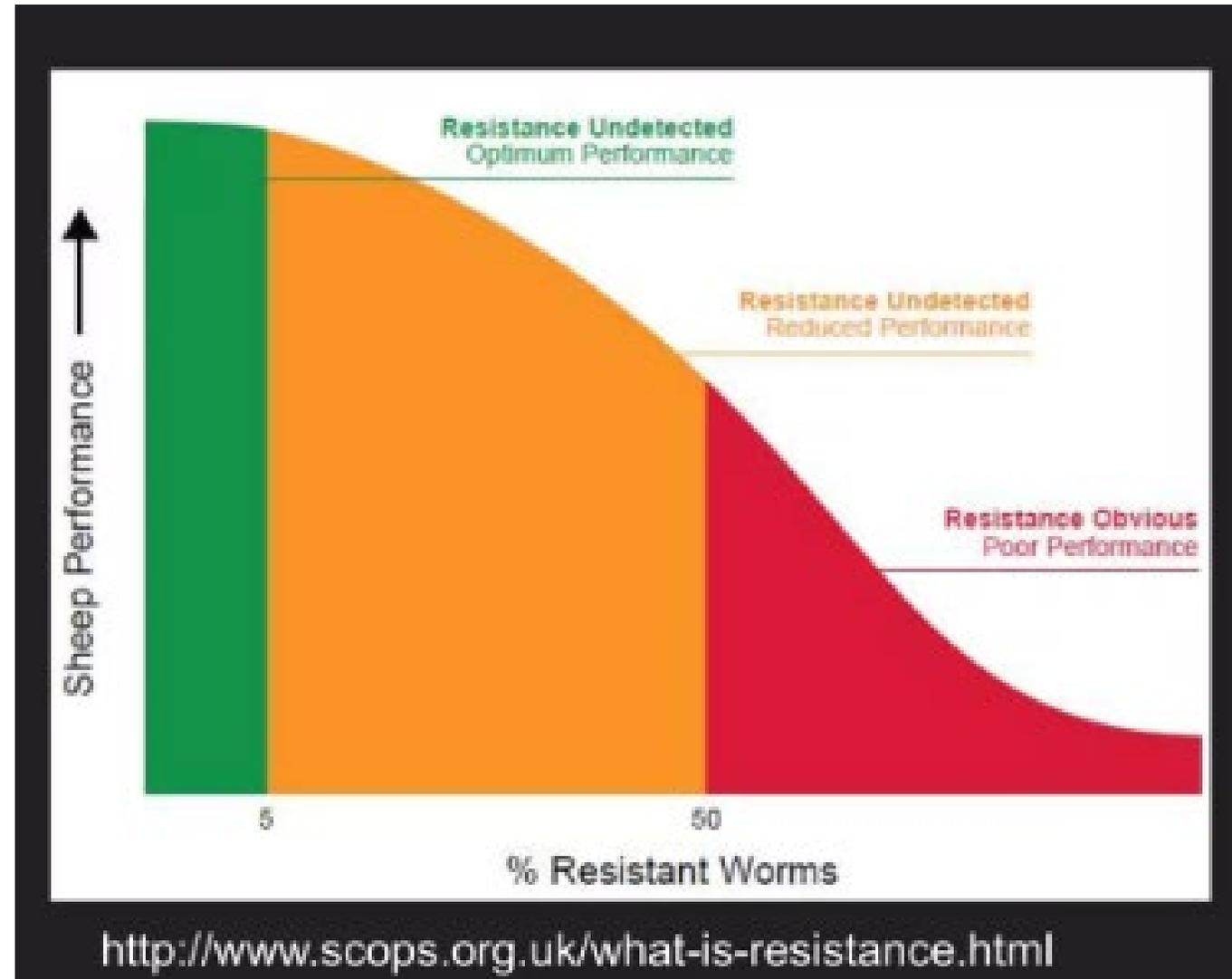
The ability of a certain population of worms that survive drug treatments that are generally effective against the same worm species and stage of infection

It is defined as deworming treatment failure to reduce fecal egg counts by 95%

***Severe resistance exist when deworming treatment reduces egg count by less than 60%**

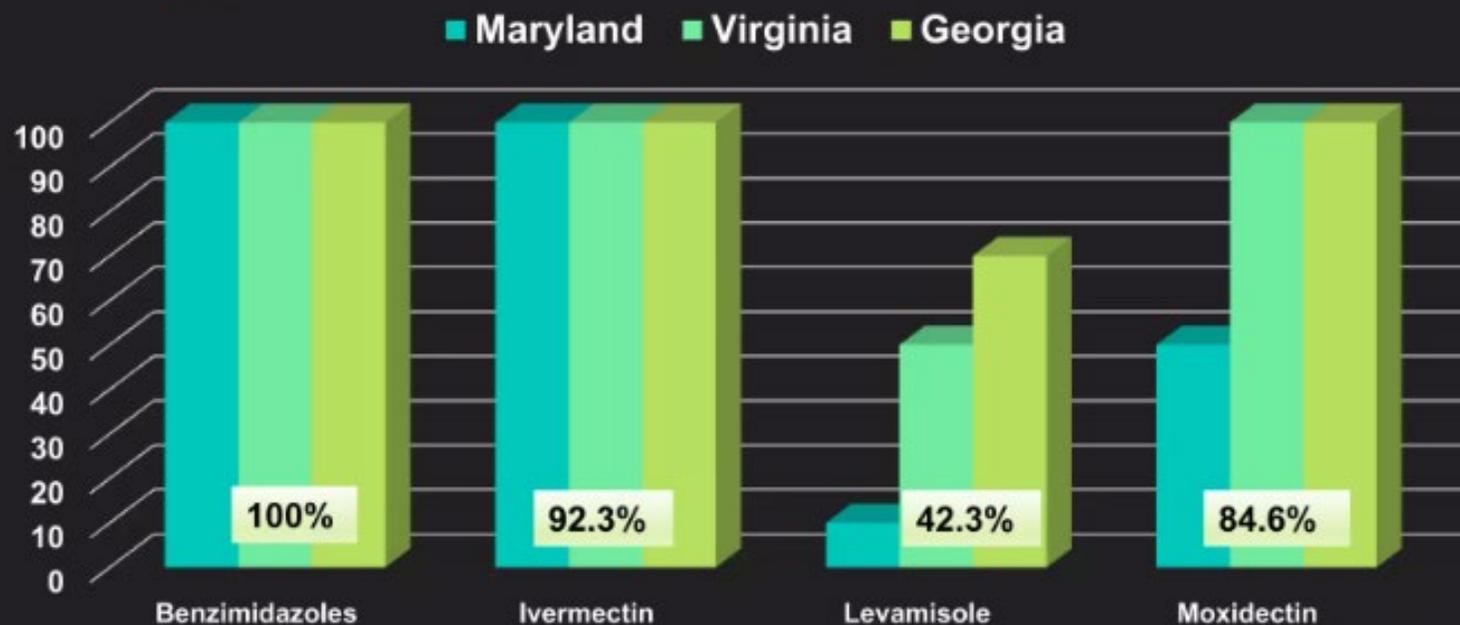
Dewormer Resistance

- Caused by changes in levels of “resistance genes” carried by worms in a population
- Result of drug treatment that produces genetic selection of resistant worms
- Resistant parasites survive and pass on the “resistant genes” to their offspring
- Animal movement spread resistant worms



Dewormer Resistance

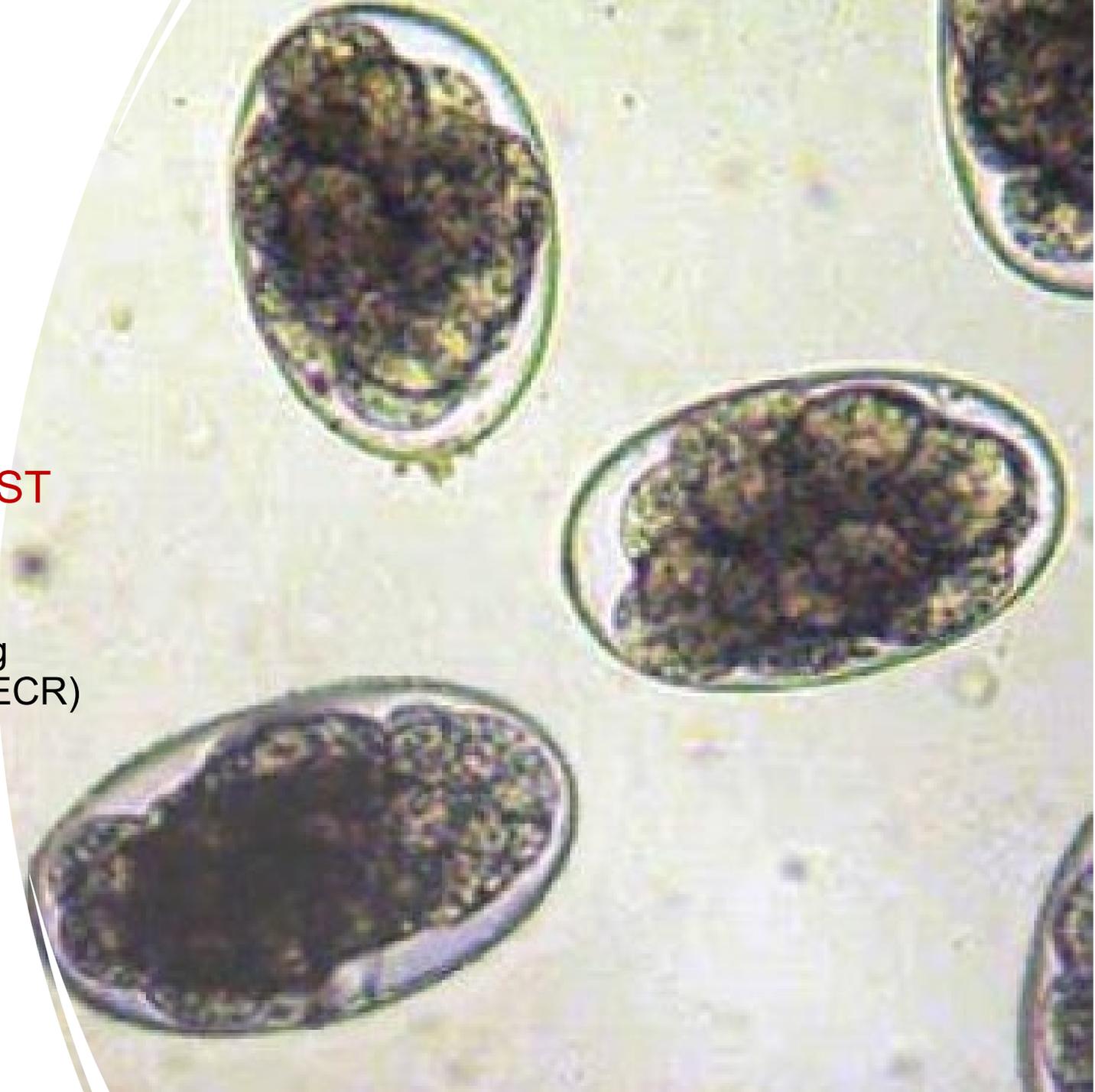
Percent farms with anthelmintic resistance
Less than 95% FECR (2016, ASI Let's Grow)



How to Determine Dewormer Resistance?

FECAL EGG COUNT REDUCTION TEST

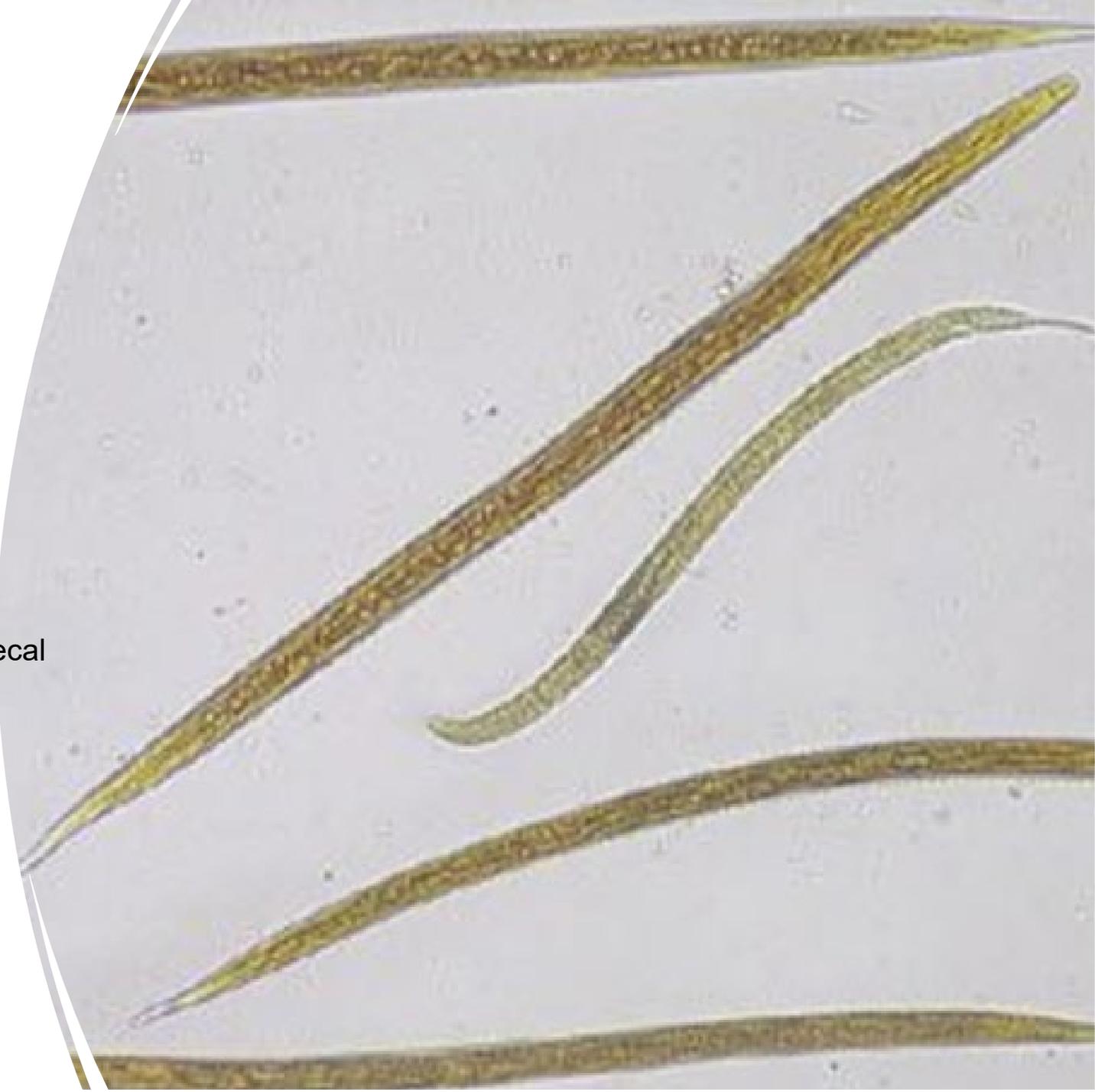
- Compare before and after (10-14 d) fecal egg counts- percent fecal egg count reduction (FECR)
- ~15 animals for each dewormer
- Minimum FEC >250 EPG
- Labor intensive
- Cost: \$5-\$20 per sample
- Can learn to do yourself



How to Determine Dewormer Resistance?

DRENCHRITE® LARVAL DEVELOPMENT ASSAY

- Lab test- determines resistance to all dewormers and dewormer classes simultaneously from a single pooled fecal sample. Also, larvae ID.
- Only need 8-10 animals to test all drugs
- Minimum FEC>500 EPG
- University of Georgia
- \$450/sample





Practices that Accelerate Dewormer Resistance

- Frequent deworming
- Whole flock/herd treatments
- Calendar-based treatments
- Underdosing
- Treating and moving to a clean pasture
- Improper deworming technique
- Use of persistent-activity dewormers



Practices that Accelerate Dewormer Resistance

- Use injectable dewormers
- Use pour-on dewormers
- Rotating dewormers
- Feeding dewormers to a group of animals
- Improper storage of dewormers

Combination Treatment: Deworming with More than One Drug at the Same Time

Research shows that combinations treatments are the best approach!

- Additive effect
- Higher efficiency: fewer resistant worms

Give most potent drug from each class!

***Combined with other best management practices, increase refugia, prevent resistance from developing further, and may result in a reversion back to susceptibility**

Drug 1	Drug 2	Drug 3	Combo12	Combo123
80%	80%	80%	96.00%	99.20%
90%	90%	90%	99.00%	99.90%
60%	95%		98.00%	98.00%
60%	60%	95%	84.00%	99.20%
99%	99%		99.99%	99.99%
60%	60%	60%	84.00%	93.60%
50%	50%	50%	75.00%	87.50%
40%	40%	40%	64.00%	78.40%
95%	80%	20%	99.00%	99.20%

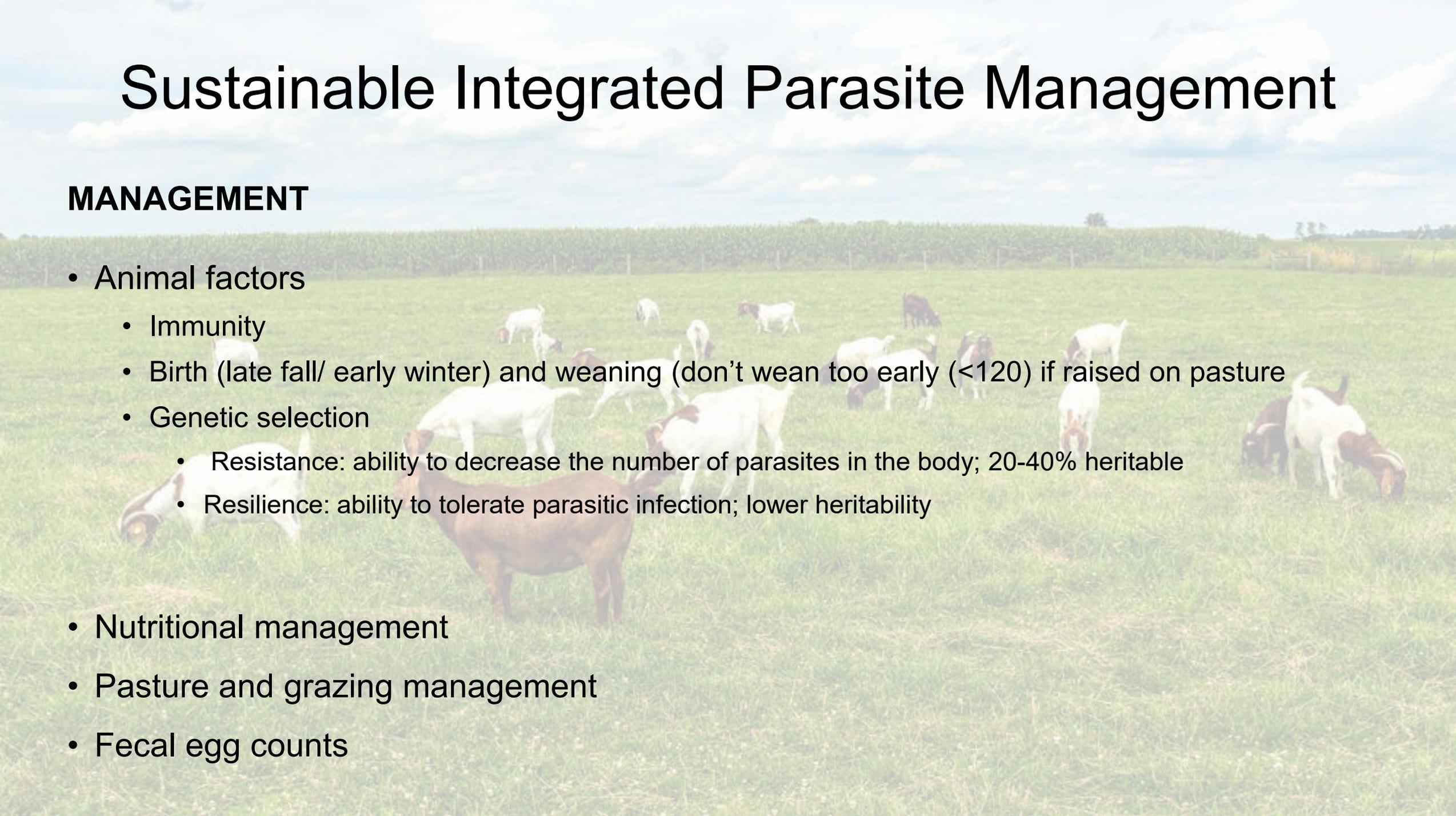
Combination Treatment: Deworming with More than One Drug at the Same Time

- Give each drug separately in a different syringe
- DO NOT MIX DRUGS
- Give full dose of each drug- oral drenches
- Give drugs sequentially, one after the other
- Observe withdrawal period of drug with longest withdrawal period
- Selective treat



Sustainable Integrated Parasite Management

MANAGEMENT

- Animal factors
 - Immunity
 - Birth (late fall/ early winter) and weaning (don't wean too early (<120) if raised on pasture)
 - Genetic selection
 - Resistance: ability to decrease the number of parasites in the body; 20-40% heritable
 - Resilience: ability to tolerate parasitic infection; lower heritability
 - Nutritional management
 - Pasture and grazing management
 - Fecal egg counts
- 
- A herd of goats of various colors (white, brown, and spotted) is grazing in a lush green field. In the background, there is a line of trees and a fence. The sky is blue with scattered white clouds.

Sustainable Integrated Parasite Management

NURTITIONAL MANAGEMENT

- Protein supplementation improves resistance
- Low BCS increase susceptibility to the effects of parasites
- Energy supplementation helps with resilience
- Minerals should be supplemented when there are deficiencies
- Biocactive forages (anti-parasitic properties)

Sustainable Integrated Parasite Management

PASTURE AND GRAZING MANAGEMENT

- Clean pastures
 - Rotational grazing
 - Short-duration grazing
 - Long pasture rest periods
 - Multi-species grazing
 - Annual forage crops
 - Browsing
 - Minimum grazing height
- 
- A herd of goats of various colors (white, brown, and spotted) is grazing in a lush green field. In the background, there is a line of trees and a fence under a blue sky with scattered white clouds.

Sustainable Integrated Parasite Management

DEWORMING

- Target selective treatment (TST)
 - FAMACHA[®] system
 - Body condition score
 - Performance: ADG, milk production, number of offspring
- Proper use

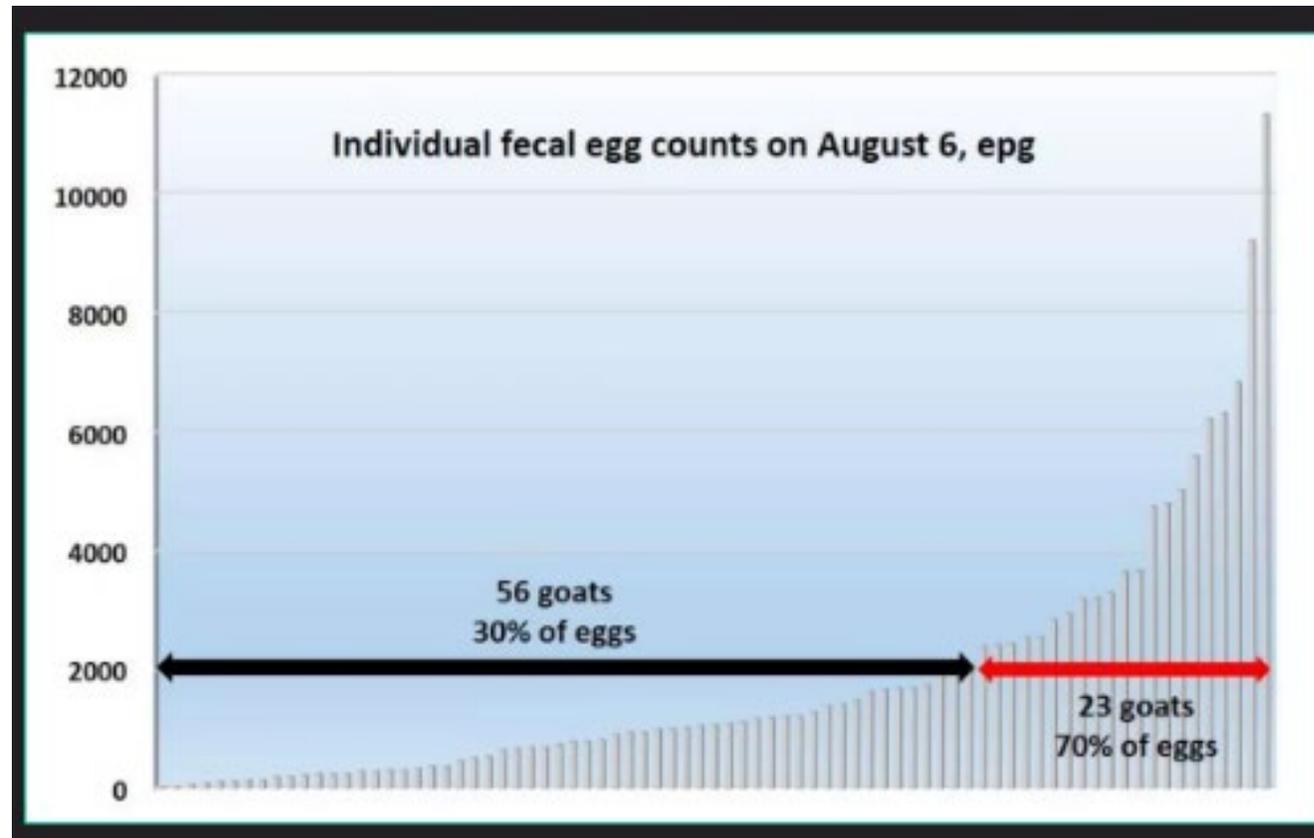
Sustainable Integrated Parasite Management

TARGET SELECTIVE TREATMENT

- Target selective treatment (TST)
 - FAMACHA[®] system
 - Body condition score
 - Performance: ADG, milk production, number of offspring
 - Helps identify susceptible and resistant animals
- Proper use

Fecal Egg Counts

- Approximately 20-30% of the flock/herd is responsible for 70-80% of the pasture contamination!



Other Factors to Consider when Deciding to Deworm an Animal

- Fecal consistency
- Scores of other animals
- Previous scores
- Risk of re-infection
- Nutrition
- Frequency of checking





When Deworming is not Enough

- Remove from contaminated pasture to avoid re-infection
- Give supportive therapy
 - Electrolytes
 - Protein/energy supplements
 - Vitamin/mineral supplements

Control and Prevention of Parasites

- Identify parasites
- Understand parasite life cycle
- Effective deworming drugs
- Most appropriate time to administer deworming drugs and use alternative control methods





Questions?