

A scenic view of a green field with sheep grazing, pink flowering trees, and a large tree trunk in the foreground. The field is lush green, and the sheep are scattered across it. In the background, there are several pink flowering trees and a line of trees. A large tree trunk is visible on the left side of the image. The sky is blue with some clouds.

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Latest Recommendations for Internal Parasite Control



Topics

- Targeted Selective Treatment
- Combination Treatments
- Copper Oxide Wire Particles
- BioWorma®
- Genetic Selection
- The Periparturient Egg Rise

Targeted selective treatment (TST) (or non-treatment)

- Only treating those animals which need treated or would benefit most from deworming; leaving some animals untreated.
- Reduces number of animals that are dewormed.
- Reduces amount of dewormer that is used.
- Increases refugia: worms that have not been exposed to dewormer(s); thus, remain susceptible to future deworming(s).
- Prolongs effectiveness of dewormers; delays development of resistant worms.





Decision-making tools for TST

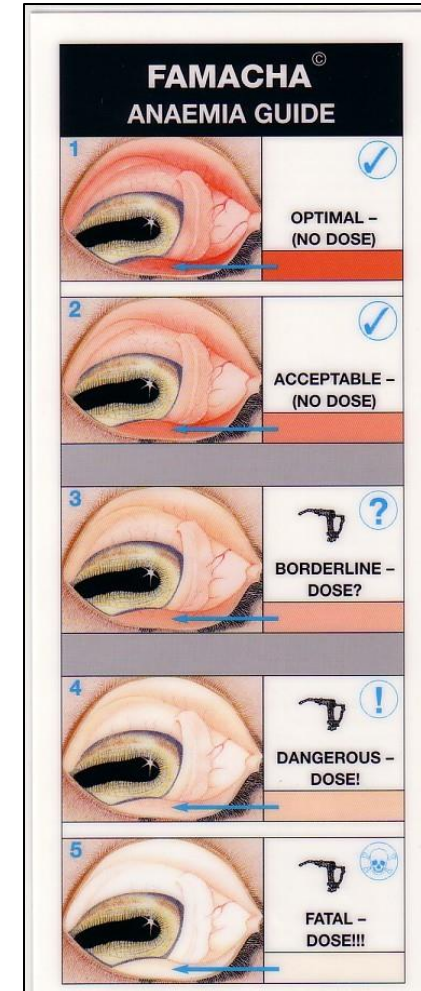
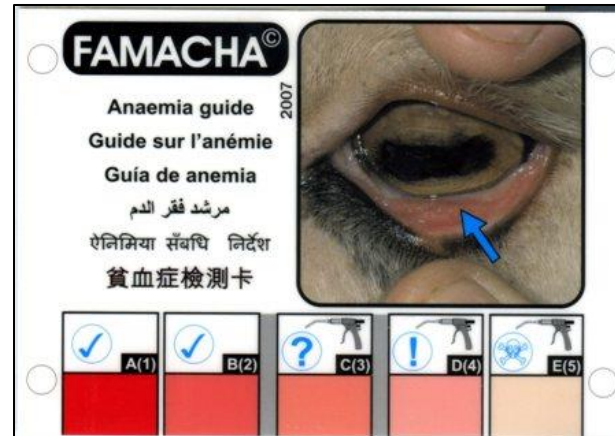
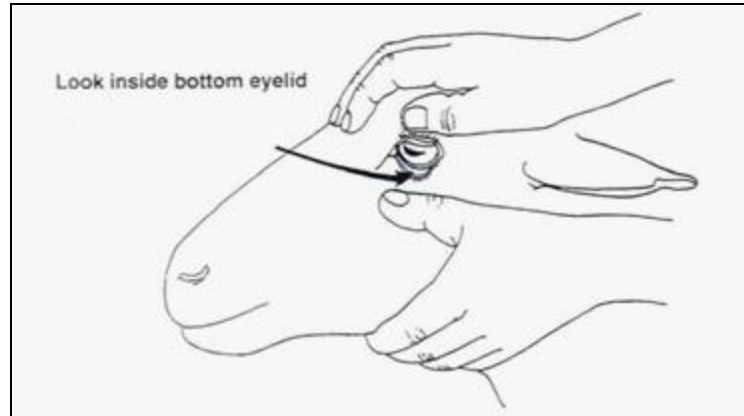
- FAMACHA© eye anemia system
- Five Point Check©
- Performance indicators
- Other: combination of criteria

FAMACHA® system

- Developed in South Africa in response to dewormer resistance.
- Color eye chart used to assess level of anemia in sheep/goats.
- Anemia (blood loss) is the primary symptom of barber pole worm (*Haemonchus contortus*); also, liver flukes.



FAMACHA® eye anemia system



Clinical Category	Eye Lid Color	Packed Cell Volume/PCV	Deworm?
1	Red	≥ 28	No
2	Red-Pink	23-27	No
3	Pink	18-22	?
4	Pink-White	13-17	Yes
5	White	≤ 12	Yes



Using FAMACHA©

- Need to be trained in order to get FAMACHA© card, unless you are a veterinarian (online training available).
- Use proper technique
COVER-PUSH-PULL-POP
- Always use card to assign scores
- No half scores, always use higher score
- Store card in dark place; replace after a few years.
- Don't try to make your own card.



Five Point Check©

- Also developed in South Africa, as a follow-up to FAMACHA©.
- Addresses limitations of FAMACHA© which is only useful for assessing damage caused by blood-feeding parasites: barber pole worm (and liver flukes).
- Uses five checkpoints on the animal's body to make deworming decisions for the other parasites that can infect small ruminants.

Five Point Check©

Checkpoint		Observation	Possibilities
1	Eye	Anemia 1-5 (FAMACHA© card)	Barber pole worm (<i>Haemonchus</i>) Liver fluke Other diseases Undernourishment
2	Back	Body condition score 1-5	Brown stomach worm (<i>Teladorsagia</i>) Bankrupt worm (<i>Trichostrongylus</i>) Nodular worm Other worms and diseases Undernourishment
3	Tail	Fecal soiling 0-5 (dag score)	Brown stomach worm (<i>Teladorsagia</i>) Bankrupt worm (<i>Trichostrongylus</i>) Nodular worm (<i>Oesophagostomum</i>) Other worms and diseases
4	Jaw	Soft swelling “bottle jaw”	Barber pole worm (<i>Haemonchus</i>) Liver fluke Other diseases
5	Nose	Nasal discharge	Nasal botfly Lungworms Pneumonia Other diseases

Five Point Check®

the 5-POINT CHECK for internal parasites in sheep

1 Nose discharge (for nasal botfly)

2 Eye colour (FAMACHA) (for liverworm)

3 Bottle jaw (swelling) (for liverworm)

4 Condition Score (for bankrupt and brown stomach worms)

5 Dag Score (for bankrupt and brown stomach worms)

FAMACHA
Anemia guide
Guide for l'anémie
Guia de anemia
بريدة الدم
سويحة دفت دتخ
貧血指標測卡

Score	Substrate visible, not easily visible	Not a smooth eye, not deep protrusion	Only slight protrusion protrusion	On anterior with protrusion	Not protrude
1	Highly visible	Smooth	Not visible	Control for fat or oil	
2	Visible	Smooth	Not visible	Control for fat or oil	
3	Visible	Smooth	Not visible	Control for fat or oil	
4	Visible	Smooth	Not visible	Control for fat or oil	
5	Visible	Smooth	Not visible	Control for fat or oil	

DAG SCORECARD

1	No faecal soiling at all No indication for treatment / action	✓
2	Very slight soiling on edge of tail / on each side No treatment / action required	✓
3	Slight soiling on edge of tail and on each side rounded	✓
4	Moderate soiling of tail and wool Dag formation Consider treatment / action	?
5	Severe soiling extending far into the wool Dag formation Treatment / crutching recommended	!
6	Very severe, watery slushes extending to the crutching area	!

Source: Gareth Bath



Performance as a deworming criteria



- Happy Factor™ (European/NZ model) - deworm animals which fail to reach targeted weights
- Average daily gain (ADG) - deworm animals with lower rates of gain (combine with FAMACHA© score)
- Milk production - deworm highest producing dairy females
- Number offspring - deworm females with 3 or more offspring



What about fecal egg counts?

Can help make deworming decisions but should not be used as the sole or main criteria.

- Not chute-side
- Not always a strong correlation with clinical disease.
- Many limitations, e.g., roundworm (strongyle- type) eggs look the same (need to hatch to identify from larvae)
- No agreed upon thresholds for treatment.



Better uses of fecal egg counts

- Before and after fecal egg counts to determine effectiveness of treatment (individual animals)
- Before and after fecal egg counts to determine level of dewormer resistance (10 or more animals).
- Monitor pasture contamination.
- Identify resistant and susceptible animals (e.g., EBVs).



Combination treatments

- Giving dewormers from different chemical classes to an animal at the same time
- Combination treatments have an additive effect on the worm population.
- They kill the maximum number of worms.
- Prolong effectiveness of drugs.
- Only effective if dewormers have at least 60% efficacy.



Three anthelmintic (dewormer) classes

GROUP 1 <u>Benzimidazoles</u> (BZ)	GROUP 2 <u>Macrocyclic lactones (ML)</u>		GROUP 3 <u>Nicotinic agonists</u>	
	Avermectins	Milbemycins	Imidazothiazoles	Tetrahydropyrimidines
THIABENDAZOLE FBZ®	IVERMECTIN* Ivomec®	MOXIDECTIN* Cydectin® Quest®	LEVAMISOLE* Prohibit® Leva-Med® Tramisol® Levasol®	MORANTEL** Rumatel® Positive Pellet® Goat Dewormer PYRANTEL Strongid®
FENBENDAZOLE** SafeGuard® Panacur®	DORAMECTIN Dectomax®			
ALBENDAZOLE* Valbazen® OXFENDAZOLE Synanthic®	EPRINOMECTIN Eprinex®			

*FDA approved for sheep
 **FDA approved for goats



Using combination treatments

- Use most potent drug from each chemical class, usually levamisole (Prohibit[®], Leva-Med[®]) + moxidectin (Cydectin[®]) + albendazole (Valbazen[®]) [extra label for goats].
- Give full dose of each drug, based on an accurate weight.
- Give sequentially, one after the other, preferably in separate syringes.
- Do not mix drugs: they are not chemically compatible.
- Oral dosing, all drench formulations
- Observe withdrawal period of drug with longest withdrawal, usually moxidectin.
- Don't give combination treatments to the whole group: use targeted selective treatment criteria.

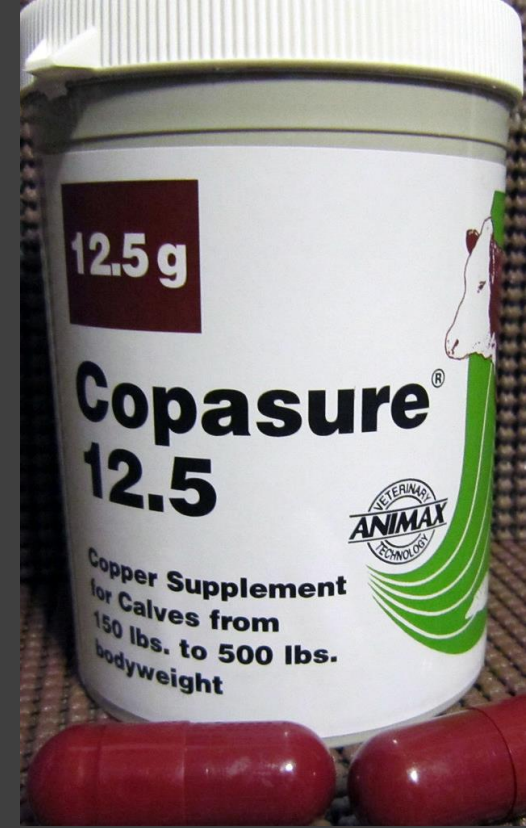
Copper oxide wire particles (COWP)

- Tiny metal rods of copper oxide (CuO).
- Poorly absorbed form of copper, so less risk of copper toxicity (esp. in sheep).
- Proven to have efficacy against barber pole worm infections in small ruminants, especially young animals.
- May be approved by organic certifiers.
- May increase treatment efficacy when given at the same time as an anthelmintic (e.g., COWP + albendazole [Valbazen[®]]).



Copper oxide wire particles (COWP)

- Available as copper supplements for goats (2, 4 g) and cattle (12.5, 25 g).
- Can be repackaged into smaller doses for deworming small ruminants: 0.5-1 g for lambs/kids; 1-2 g for mature animal.
- Can be repeated in 4-6 weeks, if necessary (can treat several times).
- Administer with plastic balling gun.
- Should determine/monitor copper levels, especially in sheep.



BioWorma®

- Feed product that contains *Duddingtonia flagrans*, a “nematode-trapping” fungus.
- Feed-through product that has no effect in animal.
- Fungus kills roundworm larvae in the manure of animals; thereby, reducing pasture contamination and ingestion of infective worm larvae (re-infection).
- Natural, but not organic.
- Feed daily when temperatures exceed 40°F
- Feed for at least 60 days to most susceptible animals: periparturient females, lambs/kids.



Two commercial products

Currently unavailable

BIOWORMA®

- Dosage is 0.1 oz. per 100 lbs.
- Needs to be mixed into a batch of feed.
- Distribution limited to veterinarians and EPA-certified feed mixers and manufacturers

LIVAMOL® with BIOWORMA®

- Nutritional supplement (20% CP) than contains 2.2% fungus.
- Dosage is 1.6 oz per 100 lbs.
- Ready-to-use product
- Mix or top dress in feed
- Anyone can purchase

BioWorma® research is on-going at several institutions.

- Determine efficacy of feeding BioWorma® and Livamol® with BioWorma®; results are preliminary.
- Determine if BioWorma® can be fed every other day or for two weeks out of the month and give similar results (reduce cost).
- Determine if BioWorma® can be incorporated into a free choice mineral mix and give similar results (reduce labor).
- Evaluate strategies for feeding BioWorma®: when and for how long.





Genetic Selection

Genetic resistance to gastrointestinal parasites is one of the most promising means to control worms in a flock/herd.



How to use genetics to manage parasitism

- Raise or cross with a more resistant breed: hybrid vigor + breed complementarity
- Select males that have the lowest FAMACHA[®] scores and/or fecal egg counts.
- Cull females that have the highest FAMACHA[®] scores and/or fecal egg counts but be careful not to discriminate against your most productive females.
- The 70:30 rule (or 80:20): 30% of animals deposit 70% of the worm eggs onto pasture and vice versa (find them and cull them).



More resistant sheep breeds

- Hair sheep native to the Caribbean (North Africa): St. Croix, Barbados Blackbelly
- Hair sheep composites (hair x wool): Katahdin, Royal White, St. Augustine, American Blackbelly, Dorper
- Wool breeds native to the Southeastern US: Gulf Coast Native, Florida Native, Louisiana Native, Florida Cracker
- Terminal sire breed: Texel

More resistant goat breeds



More resistant

- Myotonic Tennessee Fainting Goat
- Kiko
- Spanish
- Savanna (?)
- Dwarf goats (?)

More susceptible

- Boer
- Angora
- Dairy goats





How to select for parasite resistance

- Participate in a central performance test.
 - Buy males from flocks/herds that participate in central performance tests.
- Enroll your flock in the National Sheep Improvement Program (NSIP) and submit fecal egg count data to get fecal egg count EBVs.
 - Purchase males from flocks that have EBVs for fecal egg count (parasite resistance).
- On-farm selection – select the most resistant animals in your flock/herd (or get rid of the most susceptible).

Selection criteria for parasite resistance

Criteria	Range of values	Selection
Deworming history	Yes-No	Selects more for resilience
Bottle jaw	Yes-No	Selects more for resilience
Body condition score	1-5	Selects more for resilience
FAMACHA© score	1-5	Selects more for resilience
Performance, ADG	Variable	Selects more for resilience
Fecal egg count (FEC)	0 to 25000 +	Selects for RESISTANCE

Resistance – ability of animal to prevent or clear infection

Resilience – ability of animal to tolerate infection

Even though they don't need dewormed, resilient animals may still be shedding a lot of eggs onto pasture.



Requirements for accurate on-farm selection for parasite resistance

- Individual animal ID
- Contemporary group(s) animals of similar age raised together
- Fecal egg counts from all animals in group, ideally at least 20
- Significant exposure to worms, group average of 500 epg or more
- Large enough spread in fecal egg counts, at least 1500 epg

Genetic selection is a marathon not a sprint.



When to select for parasite resistance

- Can select at various stages of life cycle.
- Most common to select young, growing animals.
- Most common to select post weaning at more than 90 days of age.
- Should select goats later, 6 months of age or older.
- May be able to select resistant breeds earlier.
- Can also select yearlings and periparturient females

Interpreting fecal egg count data

Animal	FEC	Keep-cull	Animal ID	FEC	Keep-cull	Animal	FEC	Keep-cull
A1	0	Unsure	B1	0	Keep	C1	750	Keep
A2	0	Unsure	B2	250	Keep	C2	2250	Maybe
A3	100	Unsure	B3	500	Keep	C3	2500	Maybe
A4	150	Unsure	B4	750	Maybe	C4	2750	Maybe
A5	200	Unsure	B5	1100	Maybe	C5	3750	Maybe
A6	250	Unsure	B6	2500	Cull	C6	4500	Cull
A7	250	Unsure	B7	3000	Cull	C7	6500	Cull
A8	450	Unsure	B8	3500	Cull	C8	8000	Cull
Avg. 175 epg			Avg. 1325 epg			Avg. 3875 epg		

Source: On-farm selection for parasite resistance, ACSRPC (2020).



Manage the periparturient egg rise (PPER)

- Relaxation of immunity (to worms and coccidia) around the time of parturition (2 weeks before to 8 weeks after).
- Increased egg and oocyte counts.
- More pronounced in susceptible breeds, first timers, and females with multiple births.
- Primary source of infection for lambs/kids that graze same pastures.

Manage the periparturient egg rise (PPER)

- Deworm females in late pregnancy; targeted selective treatment recommended.
- Keep females in confinement (zero grazing) during periparturient period.
- Increase level of protein in late gestation ration; bypass protein is most beneficial.
- Lamb/kid at a time of the year when parasites are less active.
- Manage females according to number of offspring they have or their level of milk production.



For more information, visit the web site of the American Consortium for Small Ruminant Parasite Control: wormX.info.



American Consortium for Small Ruminant Parasite Control

ACSRPC Home Consortium Topics Resources Training



FAMACHA® UPDATE

In North America, FAMACHA® cards are distributed by Louisiana State University. In order to receive a FAMACHA® card, you must receive training from a [certified FAMACHA® instructor](#). This includes [online FAMACHA® certification](#). Certified FAMACHA® instructors may purchase cards in batches. Veterinarians without FAMACHA® certification may currently purchase cards in batches for sale to producers, with the express understanding that they will train each producer individually. This may change in the future and veterinarians may be required to be certified to purchase batches of cards. Inquiries regarding FAMACHA® cards should be directed to famacha@lsu.edu or (225) 578-9710. To purchase a replacement FAMACHA® card, you must provide proof of training. You should have received a certificate of competence when you completed your training. If not, contact your instructor.



Thank you. Questions? Comments?



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