




KNOW YOUR WEAPONS




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We Made Parasite Problems


- Most parasites part of an animal's natural world
- Usually become a primary problem because of our management practices
 - High density grazing on permanent pastures



<http://www.lhnet.org/mouflon/>
<http://www.pirsa.gov.au>

Know Your Weapons

- What are the weapons?
 - Dewormers
 - Monitoring
 - Pasture Management and Forages
 - Genetics



What Are the Weapons?

- Dewormers
 - For most of us they aren't going away



Dewormer Drugs—Anthelmintics

- Victory for Science!
- Since 1960's have had fantastic drugs for treatment of sheep and goat GI nematodes
 - Highly effective against adults and larvae (>95%)
 - Safe
 - Nonprescription
 - CHEAP

Available modern dewormers fall into in 3 groups

Benzimidazoles	Macrocyclic Lactones (Macrolides) A-ivermectin M-milbemycin	Nicotinic Agonists
fenbendazole (Safeguard®, Pancur®)	ivermectin-A (Ivomec®, Noromectin®)	levamisole (Prohibit®)
albendazole (Valbazen®)	eprinomectin-A (Eprinex®, Longrange®)	Pyrantel (Strongid®)
Oxfendazole (Synanthic®)	doramectin-A (Dectomax®)	morantel (Rumatel®, Goat Care®, Positive Pellets®)
Oxibendazole (Anthelcide®)	moxidectin-M (Cydectin®)	

Available modern dewormers fall into in 3 groups

Benzimidazoles

- fenbendazole (**Safeguard[®], Pancur[®]**)
- albendazole (**Valbazen[®]**)
- Oxfendazole (Synanthic[®])
- Oxibendazole (Anthelcide[®])

- Activity against adults and larvae, including arrested larvae of GI nematodes
- Tapeworms
 - Albendazole regular dose
 - Fenbendazole double dose
- Liver flukes
- All forms oral
- Generally very safe, do not use albendazole in the first third of pregnancy

Available modern dewormers fall into in 3 groups

Macrocyclic Lactones (Macrolides)
A-avermectin
M-milbemycin

- ivermectin-A (**Ivomec[®], Noromectin[®]**)
- eprinomectin-A (Eprinex[®], Longrange[®])
- doramectin-A (**Dectomax[®]**)
- moxidectin-M (**Cydectin[®]**)

- Highly effective against larval (including arrested larvae) and adult nematodes
 - Some efficacy against insects
- Used for preventive meningeal worm treatments
- Oral treatments preferred in small ruminants
- Avermectins and milbemycins have some differences

Available modern dewormers fall into in 3 groups

Nicotinic Agonists

- levamisole (**Prohibit[®]**)
- Pyrantel(**Strongid[®]**)
- morantel (**Rumatel[®], Goat Care[®], Positive Pellet[®]**)

- Belong to two different groups, but work in the same way
 - Levamisole --Prohibit, Tramisol
 - Morantel—Positive Pellet Goat Dewormer, Rumatel
 - Pyrantel—Strongyid
- Effective against adult GI nematodes, less efficacy against larvae
- Oral forms for small ruminants
- Lower safety margin than other 2 groups

Dewormer Withdrawals—Labelled Dewormers

Anthelmintic	Sheep Meat	Milk	Goats Meat	Milk
Valbazen [®] suspension (albendazole)	7 days	Not est.	7 days	Not est.
Safe-guard [®] Suspension (fenbendazole)	Not approv.	Not approv.	6 days	Not est.
Prohibit [®] drench (levamisole)	3 days	Not est.	NA	NA
Rumatel [®] (morantel)	Not approv.	Not approv.	30 days	0
Ivomec [®] drench (ivermectin)	11 days	Not est.	NA	NA
Cydectin [®] drench (moxidectin)	7 days	Not est.	NA	NA

NA= Not Approved Not est.= Not Established

Macrolide Withdrawal Times—Macrolides not approved for goats

Food Animal Residue Avoidance Databank (www.farad.org)

Drug	Route	Milk	Meat
Moxidectin sheep drench	Oral (0.4 mg/kg)	14 days	17 days
Moxidectin sheep drench	Oral (0.5 mg/kg)	18 days	20 days
Moxidectin cattle pour-on	Oral (0.5 mg/kg)	NA	23 days
Moxidectin cattle pour-on	(0.5 mg/kg)	1	1
Ivermectin	Oral (0.4 mg/kg)	9 days	14 days

Extra Label Use of this drug is permissible under AMDUCA only if such use is by or on the lawful written or oral order of a licensed veterinarian within the context of a valid veterinarian-client-patient relationship.

Anthelmintic Resistance

- Assume if a worm population resistant to 1 drug in a group, resistant to all in group
- Ivermectin and moxidectin in same group but different subgroup
 - Moxidectin may work for some time after ivermectin resistance detected

Benzimidazoles	Macrolides A-avermectin M-milbemycin	Nicotinics
Fenbendazole (Safeguard Pancur)	ivermectin-A (Ivomec etc.)	levamisole (Prohibit)
albendazole (Valbazen)	eprinomectin-A (Eprinex)	pyrantel(Strongid)
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Oxibendazole (Anthelcide)	moxidectin-M (Cydectin)	

Resistance in Georgia Goat Farms (2001)

- Albendazole (Valbazen) & Ivermectin (Ivomec)
 - > 90%
- Levamisole (Tramisole)
 - ~ 30%
- Moxidectin (Cydectin)
 - none detected in 2001
 - 40% of farms in 2003 (where MOX was used as predominant dewormer)

Evaluation of prevalence and clinical implications of anthelmintic resistance in gastrointestinal nematodes of goats. Mortensen, et al., JAVMA, 223(4):495-500 (2003)

But that was Georgia.....

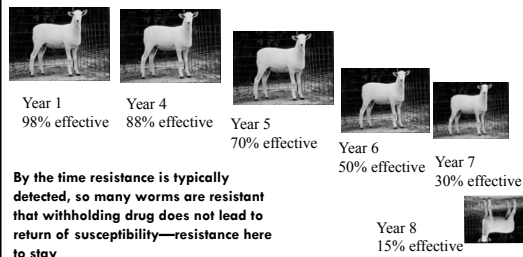
- Results of SARE project (Petersson URI) 2010-2014
 - Half of the herds/flocks we could test accurately showed some level of resistance to drug currently being used

Drug Resistance--What happened?

- Resistance—Inherited change in a parasite population produced by drug use so that the drug no longer works as well as it did
 1. Some worms with a genetic ability to resist a drug always exist at low levels because of random gene mutation
 2. Use of a drug gives those worms an advantage
 3. Gradually the number of resistant worms increases

DRUG RESISTANCE

- What does it look like to producer? (fictional example—could develop faster or slower)



What management practices would speed up development of drug resistance?

- Frequent treatments
- Treating all the animals at once
- Underdosing
- Using persistent drug formulations: injectables, pour-ons
- Treating and moving to clean pastures
- Treating when there aren't many worms on pasture (drought, end of winter)
- All these decrease the REFUGIA on your farm

Refugia

- Portion of the parasite population not exposed (=unselected) when a drug is administered
 - Worms on pasture
 - Worms in untreated animals
- Refugia good—trying to keep susceptible worms in the population



Refugia—why does it matter?

- The higher the refugia, the greater the chance that there will be susceptible worms around to reduce the chances of 2 resistant worms mating



Dewormers



- Goals of rational dewormer use are to prevent disease/loss and minimize rate of development of resistance
 - Reduce treatments
 - Maintain refugia
- Drug use in goats
 - Sheep and goats metabolize drugs differently
 - Effective dose of dewormer drenches in goats is two times the sheep dose except
 - Levamisole (1.5 times)
 - See dosing charts

Drugs

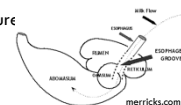


- Organic sheep operations
 - Ivermectin, moxidectin and fenbendazole (prescription only) allowed for limited use
 - Prohibited in slaughter stock sold as organic
 - Emergency treatment of dairy and breeder stock when all else fails
 - Milk or milk products can't be labeled organic for 90 days following treatment
 - Lambs can't be sold as organic if ewes treated in last 1/3 of gestation or during lactation
 - Must treat in humane situation

Use Dewormers Wisely



- Use the correct dose
 - Dose for the heaviest animal in each category if no scale
- Give dewormers by mouth only
 - Pastes hard to dose accurately, easier to spit out
 - Injectable macrolides speed up drug resistance
- Place in back of mouth
 - Harder to spit out
 - Prevents esophageal groove closure



Use Dewormers Wisely




- Increasing drug activity early in resistance
 - increasing dose works for a while (**NOT** levamisole)
- Maximize absorption—benzimidazoles and macrolides
 - Restrict feed intake for 12 hours before treatment
 - Slows passage through animal, maximizes drug efficacy
 - Don't restrict feed in late pregnancy
- Multiple treatments
 - For BZDs repeat dose 12 hours after first dose

What About Drug Combinations?

- Combination=2 or 3 drugs from different groups (regular dose, same time)
 - new animals (plus quarantine)
 - clinically affected animals where drug efficacy questionable
 - in a targeted (selective) treatment program like FAMACHA if individual drugs don't work
- Don't use routinely in old-fashioned program (treat all the animals at regular intervals)
 - May lose all drugs faster

Dewormer Alternatives

- Copper bolus
 - Form now available for sheep and goats over 25 lb/5 weeks
 - Copper wire particles have specific effect on *Haemonchus*
 - Other forms of copper not effective
 - Check with veterinarian before using
 - Resource: <http://www.acsrpc.org/Resources/COWP.html>



Do not administer to Lambs or Kids of unknown copper status or those supplemented with other sources of copper. Veterinary advice should be sought before treating breeds such as North Ronaldsay, Texels or Lleyns known to be copper sensitive.

Dewormer Alternatives

- Herbal dewormers
 - Plants produce compounds that can affect parasites
 - May have some use but commercial herbal preparations not sold as drugs so have no mandated testing for efficacy or safety
 - Don't use as basis of parasite control program
- Diatomaceous earth
 - No experimental evidence that it works

Know Your Weapons

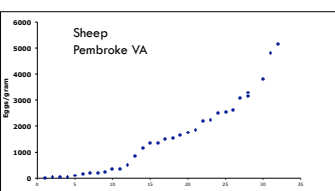
- Parasite Monitoring
 - Fecal Egg Counts
 - FAMACHA®
 - Technique for the assessment of *Haemonchus contortus* and need for treatment by estimating anemia
 - a reduction below normal in the number or volume of red blood cells in the blood
 - Use in a targeted selective deworming program

Selective (Targeted) Deworming Programs

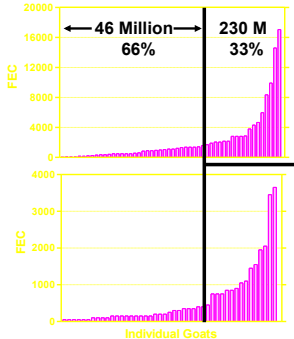
- Targeted programs identify individual animals for treatment
 - Fecal Egg Counts
 - FAMACHA® system
 - Technique for the assessment of *Haemonchus contortus* and need for treatment
 - Estimates level of anemia
 - a reduction below normal in the number or volume of red blood cells in the blood

Targeted Selective Deworming Programs

- Targeted programs identify individual animals for treatment
- Desirable because they maintain refugia
- They work because of the way worms behave in populations of animals



Distribution of FEC in Goat Herds



Treating high 33% Greatly Reduces Daily Pasture Contamination With Eggs

33% of Goats
80% of Eggs

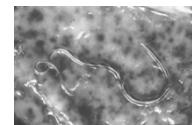
Treating 1/3 of goats gives just as good control as treating the entire herd

The FAMACHA® system

- Named for its originator in South Africa
 - ▣ Dr Francois “Faffa” Malan
 - ▣ Faffa MALan CHArT
- Dr Jan van Wyk, Professor Gareth Bath
- Dr. Adriano Vatta, Dr. Tami Krecek
- Jørgen Hansen, FAO

FAMACHA System

- Works only where *H. contortus* predominates
- Indirectly measures number of *Haemonchus* (and treatment need) by measuring anemia
 - ▣ Heavy burden can result in the loss of ½ cup or more of blood per day



FAMACHA System

- FAMACHA great for identifying animals needing treatment, but always good to consider other tools as well
 - ▣ Body condition score
 - ▣ Haircoat
 - ▣ Diarrhea

The FAMACHA® System

- Eye color chart with five color categories
- Compare chart with color of mucous membranes of sheep or goat
- Classification into one of five color categories:



FAMACHA score	Color class	Hematocrit (%)
1	Red	≥28
2	Red-pink	23-27
3	Pink	18-22
4	Pink-white	13-17
5	White	≤12

Examining Your Animals With FAMACHA

- Identify an area in direct natural light where animals can be examined
 - ▣ Not in the barn, except where light directly entering near door
 - ▣ Not under an overhang or in the shade



Examining your animals with FAMACHA®

- **COVER** the eye by rolling the upper eyelid over the eyeball
- **PUSH** down on the eyeball
- **PULL** down on the lower eyelid
- **POP!** The mucous membranes will pop into view
- Match the color of the pinkest portion of the mucous membranes to the card



Examining Your Animals With FAMACHA

- Match color of the pinkest portion of the membranes to the nearest color on the card
 - Some eyes may seem to have patches of color
 - Don't hold eye open for long
- Repeat the process with the other eye

Using FAMACHA® - Recap

- Direct natural light
- Always use score card
- Correct technique
 - **COVER, PUSH, PULL, POP!**
- Be quick
- Score both eyes
- Treat based on score



FAMACHA® System “rules”



- When to start and how often to score?
 - Worm season (warm and moisture)—every 2 weeks or when <10% of herd or flock scores as 4 or 5
 - In northeastern U.S. July and August
 - In Virginia late June through September/October
 - Other times of year can spread out based on experience
 - Not needed when snow on the ground, except good to do in periparturient animals

What Do I Do With The Results?

- Always treat goats and sheep in categories **4 and 5**
- Don't need to treat 1's and 2's
- When should you treat the 3's?

Animals in Category 3

- Consider treatment
 - Lambs and kids
 - Pregnant or lactating ewes/does
 - Animals in poor body condition
 - If concerned about animal's general health and well being —FAMACHA scores are not 100% accurate
 - >10% of the herd scores in categories 4 and/or 5
 - Recheck in 1 week

What if I Have Lots of Animals?

- Use most vulnerable as your sentinals
 - Lambs/kids
 - Last ones to come up to eat, etc
- Don't dismiss FAMACHA as unusable

Precautions

- FAMACHA® only applicable where *Haemonchus* is the main worm causing clinical disease
- Conjunctival redness can be caused by eye disease, environmental irritants, and systemic disease
- FAMACHA works as primary source for deworming decisions but always be aware of the whole animal
 - *Trichostrongylus* occasionally causes diarrhea fall/winter
 - Five point check® from South Africa
 - Eyes
 - Jaw (for bottle jaw)
 - Back (condition score)
 - Tail (diarrhea)
 - Nose (bots, pneumonia)

The FAMACHA® Card



- Store in dark place when not in use
 - Can keep a spare card in a light protected place
 - Compare with one in use
- Replace card after 12 months' use

Keep Herd and Individual Records

FAMACHA ANEMIA RECORD

Date	Herd				Individual			
	1	2	3	4	1	2	3	4
Jan 15	1	2	3	4	1	2	3	4
Jan 22	1	2	3	4	1	2	3	4
Jan 29	1	2	3	4	1	2	3	4
Feb 5	1	2	3	4	1	2	3	4
Feb 12	1	2	3	4	1	2	3	4
Feb 19	1	2	3	4	1	2	3	4
Feb 26	1	2	3	4	1	2	3	4
Mar 5	1	2	3	4	1	2	3	4
Mar 12	1	2	3	4	1	2	3	4
Mar 19	1	2	3	4	1	2	3	4
Mar 26	1	2	3	4	1	2	3	4
Apr 2	1	2	3	4	1	2	3	4
Apr 9	1	2	3	4	1	2	3	4
Apr 16	1	2	3	4	1	2	3	4
Apr 23	1	2	3	4	1	2	3	4
Apr 30	1	2	3	4	1	2	3	4
May 7	1	2	3	4	1	2	3	4
May 14	1	2	3	4	1	2	3	4
May 21	1	2	3	4	1	2	3	4
May 28	1	2	3	4	1	2	3	4
Jun 4	1	2	3	4	1	2	3	4
Jun 11	1	2	3	4	1	2	3	4
Jun 18	1	2	3	4	1	2	3	4
Jun 25	1	2	3	4	1	2	3	4
Jul 2	1	2	3	4	1	2	3	4
Jul 9	1	2	3	4	1	2	3	4
Jul 16	1	2	3	4	1	2	3	4
Jul 23	1	2	3	4	1	2	3	4
Jul 30	1	2	3	4	1	2	3	4
Aug 6	1	2	3	4	1	2	3	4
Aug 13	1	2	3	4	1	2	3	4
Aug 20	1	2	3	4	1	2	3	4
Aug 27	1	2	3	4	1	2	3	4
Sep 3	1	2	3	4	1	2	3	4
Sep 10	1	2	3	4	1	2	3	4
Sep 17	1	2	3	4	1	2	3	4
Sep 24	1	2	3	4	1	2	3	4
Oct 1	1	2	3	4	1	2	3	4
Oct 8	1	2	3	4	1	2	3	4
Oct 15	1	2	3	4	1	2	3	4
Oct 22	1	2	3	4	1	2	3	4
Oct 29	1	2	3	4	1	2	3	4
Nov 5	1	2	3	4	1	2	3	4
Nov 12	1	2	3	4	1	2	3	4
Nov 19	1	2	3	4	1	2	3	4
Nov 26	1	2	3	4	1	2	3	4
Dec 3	1	2	3	4	1	2	3	4
Dec 10	1	2	3	4	1	2	3	4
Dec 17	1	2	3	4	1	2	3	4
Dec 24	1	2	3	4	1	2	3	4
Dec 31	1	2	3	4	1	2	3	4

● Checked
● Checked and Treated
● Both Jaw Treated

Ray M. Kaplan, DVM, PhD FAMACHA Anemia Record ©2005

FAMACHA® Dos and Don'ts

- Dos
 - Use FAMACHA® as aid in assessing worms
 - Use every 2 weeks in *Haemonchus* season
 - Keep card out of direct light when not in use
- Don't
 - Score animals inside or in shade
 - Score only the eyelid margin
 - Score just one eye

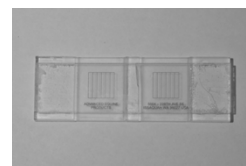
Weapons



- Monitoring—Fecal egg counts
 - See how effective your dewormers are
 - Evaluate relative susceptibility of individuals strongylid worms like barber pole work
 - Use with other information to design and evaluate parasite control programs
- Fecal exams can be helpful in diagnosis but are not a reliable way to diagnose parasitic **disease** in **individual** animals

Fecal Egg Counts

- Most common way and the best way to get fecal egg counts for sheep and goats (horses too) is McMaster test



McMaster Test (Modified McMaster Test)

- A type of flotation test
- Flotation tests separate eggs from debris based on density
- Mix manure with flotation solution
 - Most debris sinks to bottom
 - Eggs float to top

Fecal Egg Counts

- McMaster test uses special slide with a grid to make counting easier and more efficient
 - Measure manure and flotation fluid so know exactly the quantity of manure in the test, eggs float in the chambers
 - Count eggs, then can calculate back to yield eggs/gram manure

Which Parasites Do You See in Fecal Test?

- Coccidia (*Eimeria*)
- Strongylids (GI worms including *Haemonchus*, *Trichostrongylus*)
 - May also be called trichostrongyles or strongyles
 - Several species produce identical eggs
- Tapeworm (*Moniezia*)
- Whipworm (*Trichuris*)
- Threadworm (*Strongyloides*)

Parasites in a Fecal Egg Count

- As an example, results from 4 month old lambs
- Recognize that if one sheep infected with parasites below, they are all exposed
 - ns doesn't mean they are not infected

Sheep	Strongylids	Coccidia	Tapeworm	Whipworm	Threadworm
1	3000	500	ns	150	400
2	600	10,000	150	ns	ns
5	150	2000	8000	50	200
6	1500	200	ns	ns	100
7	500	900	15,000	ns	ns
8	400	ns	ns	100	750

Other parasites?

- Lungworms
 - A different test is better for lungworms
- Deer (meningeal) worm
 - Not in manure because worms never become adult

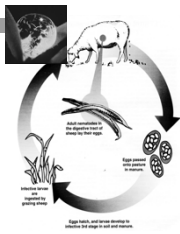
What To Do With FEC Results?

- This will tell me if animal needs treatment—NOT NECESSARILY
- FEC provide an estimate of parasites
- Numbers affected time of year, parasite species
- FEC never intended to be sole determinant of disease status of an animal
 - Resistance vs resilience
 - Interpret with further information
 - Are there signs of disease?
 - Anemia, diarrhea
 - Treatment history, time of year
- Get idea of normal!

Sheep	Strongylids	Coccidia
1	3000	500
2	600	10,000
5	150	2000
6	1500	200
7	500	900
8	400	ns

Strongylid worms

- Number of eggs in manure will vary seasonally
- Population of adult worms in gut lower in winter months
 - Many larvae in a dormant state (arrested or hypobiotic)
 - No disease, no eggs in feces



What are FEC Good For: Testing Drug Efficacy

- Fecal Egg Count Reduction Test (FECRT) for sheep and goats
 - Usually compare pre and post treatment samples from animals (should have 10-15)
 - Need minimum 150-200 epg before treatment, higher is better
 - Give the right amount of drug—weigh animals preferably
 - If not weighing, dose for heaviest animal
 - Use oral form of drug
 - Collect second sample 10-14 days after treatment (not later)
 - Calculate the % reduction in fecal egg counts (FECR)

FECRT Example

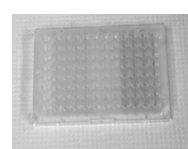
Animal #	Pretreatment	After Treatment	Reduction
1	1000	100	90%
2	600	50	92%
3	200	0	100%
4	3000	250	92%
5	150	50	67%
6	1500	0	100%
7	500	100	80%
8	400	0	100%
Average	919	69	90%

CALCULATE FECR 100 (1-{Post/Pre}) for each animal, calculate mean

One sheep is not enough; what if you picked #5?

Drenchrite® Test

- Alternative to Fecal Egg Count Reduction Test
 - Offered by University of Georgia
 - Easier for producer because can collect one composite sample and send it off
 - Provides information on all drug classes from one sample




What are FEC Good For: Testing Drug Efficacy

- In general, look for efficacy (egg count reduction) greater than 90%
- If efficacy less indicates presence of resistant worms
 - 80-90% harder to interpret—watch closely
 - <80% probably resistant population of parasites
 - The lower the reduction the greater the number of resistant parasites
- Always consider confounding factors:
 - Were animals given the right dose?
 - Was the drug expired?
 - Might egg counts change on their own?
 - Did you have enough animals

Fecal Egg Counts in Making Selection Decisions

- FAMACHA (anemia) scores or other disease scores help identify most susceptible animals
 - Tells you who not to use for breeding,
- Since most animals should not develop disease, FAMACHA not so good for identifying the sheep with the best immunity
 - This is where fecal egg counts come in



Use FEC Counts in Selection

Lamb #	Eggs/g June	Eggs/g July	
101	50	ns	More resistant
110	3000	6000	More susceptible
192	500	400	
64	600	1150	
105	800	750	
120	500	1650	
89	350	1050	
95	1000	4050	More susceptible
116	300	850	
100	500	1900	
75	150	100	More resistant
88	100	1050	
108	400	900	

- Test young rams/bucks twice
- Do tests when egg counts will be higher (summer, not spring)
 - Small differences not meaningful
- May not tell you the BEST one, but can narrow it down

Basing Selective Deworming on FEC

- We want everyone to deworm only the animals that need it—selective deworming
- You could use fecal egg counts
 - In general, sheep with higher egg counts at higher risk of disease
- FAMACHA generally easier for worm season, will give you same basic result
- Could refine decisions with combined information
 - Example: FEC on lambing ewes, which ones have biggest increase in fecal egg counts?

Should You Do Your Own FEC?

- Commercial labs vary in charge
 - Try and find one that does bulk rate
- Worth doing your own if you will be doing lots
 - Active selection program, drug testing
 - Strong interest
- If only doing a small number every year may not be worth investment and may not be easy to do them well

Need Good Sample Collection

- Need fresh samples
 - Use samples that you have seen hit the ground or rectal fecal samples
 - Best information from individually identified animals
- Rectal fecal samples
 - Most productive if sheep not recently exercised!
 - Wear glove, use water, KY jelly, etc. to lubricate finger
 - Insert 1 or 2 fingers into rectum, animal often stimulated to push feces out or cup fingers and pull out
 - Turn glove inside out and label
 - Not babies!--no need to sample really young animals
- Store samples in fridge up to a week before examination
 - Put in plastic bag, press out excess air so eggs don't develop

Sheep and Goat Dewormer Charts

Dr. Ray Kaplan, University of Georgia

American Consortium for Small Ruminant
Parasite Control (<http://www.acsrpc.org/>
or)(<http://www.wormx.info>)

Website contains lots of excellent information
on all aspects of parasite control

SHEEP Dewormer Chart

Important --Please read notes below before using this chart

1 ml = 1cc	Valbazen (albendazole) <u>ORALLY</u>	SafeGuard (fenbendazole) <u>ORALLY</u>	Ivomec Sheep Drench (ivermectin) <u>ORALLY</u>	Prohibit (levamisole) <u>ORALLY</u>	Cydetin Sheep Drench (moxidectin) <u>ORALLY</u>
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

Valbazen Suspension (11.36 % or 113.6 mg/ml): 7.5 mg/kg orally; approved in sheep with meat withdrawal time of 7 days. Do NOT use in pregnant ewes in the first trimester of pregnancy.

Safe-Guard/ Panacur Suspension (10% or 100 mg/ml): Note that SafeGuard is not approved for use in sheep. Sheep dose is 5 mg/kg orally; meat withdrawal time of 6 days.

Ivomec Drench for Sheep (0.08% or 0.8 mg/ml): 0.2 mg/kg orally; approved in sheep with meat withdrawal time of 11 days. Protect from light.

Prohibit Soluble Drench Powder (Sheep): (Note that this drug is also sold as Levasol and Tramsiol) 8 mg/kg ORAL dose. Approved for use in sheep with meat withdrawal of 3 days. Solution prepared by dissolving a 52 gram packet in 1 quart (943 ml) of water. This yields a solution with 49.6 mg/ml. Always make sure to follow directions on packet when preparing.

If dosing lambs, it is safer to dilute further (1 packet in 2 quarts of water), and then administer twice the amount listed on the chart. The larger volume administered will provide a wider margin for safety if there are small errors in dosing.

Cydetin Sheep drench (1 mg/ml): 0.2 mg/kg orally; approved in sheep with meat withdrawal time of 14 days.

NOTE for Guideline for Dewormer (Anthelmintic) Dosages in Sheep

This chart was developed by Ray M. Kaplan, DVM, PhD and Lisa Williamson, DVM, MS (University of Georgia). It is provided as a possible guideline for anthelmintic (deworming) dosages for sheep. Producers should always consult their veterinarian for advice on their specific management situation for determining which dewormer(s) are best to use in their flock, and the proper dosages for their flock. Meat withdrawal times should always be strictly adhered to.

Note that drug resistance in parasites of sheep is extremely common. The effectiveness of a particular dewormer should always be tested before being used by performing either a Fecal Egg Count Reduction Test (FECRT) or DrenchRite larval development assay (contact Dr. Kaplan's laboratory [706-542-0742] for more information about the DrenchRite test).

Updated September 2014

Dewormer Chart for Goats

Important --Please read notes below before using this chart

1 ml = 1cc	Valbazen (albendazole) <u>ORALLY</u>	SafeGuard (fenbendazole) <u>ORALLY</u>	Ivomec Sheep Drench (ivermectin) <u>ORALLY</u>	Prohibit (levamisole) <u>ORALLY</u>	Cydetin Sheep Drench (moxidectin) <u>ORALLY</u>	Rumatel (morantel) Feed Pre-mix <u>ORALLY</u>
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

Valbazen Suspension (11.36 % or 113.6 mg/ml): 20 mg/kg orally; withdrawal time is 9 days for meat and 7 days for milk Do NOT use in pregnant does in the first trimester of pregnancy

Safe-Guard/ Panacur Suspension (10% or 100 mg/ml): the label dose in goats is 5 mg/kg, but a 10 mg/kg dosage is recommended. At 10 mg/kg, withdrawal time is 16 days meat and 4 days for milk. Add 1 day for each additional day the drug is used (e.g. if administered 2 days in a row then withhold milk for 5 days after 2nd dose).

Ivomec Sheep Drench (0.08% or 0.8 mg/ml): 0.4 mg/kg orally; meat withdrawal time is 14 days and milk withdrawal is 9 days.

Prohibit Soluble Drench Powder (Sheep): (Note that this drug is also sold as Levasol and Tramsiol) 12 mg/kg oral dose with meat withdrawal of 4 days and milk withdrawal of 3 days. Solution prepared by dissolving a 52 gram packet in 1 quart (943 ml) of water. This yields a solution with 49.6 mg/ml. If dosing kids, it is safer to dilute further (1 packet in 2 quarts of water), and then administer twice the amount listed on the chart. The larger volume administered will then provide a wider margin for safety if there are small errors in dosing.

Cydectin Sheep drench (1 mg/ml): use orally at 0.4 mg/kg orally; for a single dose the meat withdrawal time is 17 days and milk withdrawal is 8 days. Note that these withdrawal times are only applicable for the sheep oral drench at the dose given here. Higher doses will require a longer withdrawal time.

Morantel tartrate (Rumatel) recommended label dose for goats is 10 mg/kg, orally. There is 0 (zero) withdrawal time for milk in lactating cattle and dairy goats. Meat withdrawal time for goats is 30 days. Because of the large differences in morantel concentration among the various products, it is important to carefully read the label and make sure you are dosing correctly. The dosage on the chart above is for Durvet Rumatel. {With Durvet Rumatel, feed 0.1 lb (45 grams) per 100 lbs. BW; and with Manna Pro feed 1.0 lb per 100 lb. BW}. There is also a highly concentrated form called Rumatel 88, but this is meant for mixing into large volumes of feed (feed 0.1 lb (45 gram) per 2000 lb BW). Note that the 10 mg/kg dose used for the chart is the label dose; administering 1.5 – 2X this dose may improve efficacy. If an elevated dose is used then withdrawal times would need to be extended.

NOTE on Guideline for Anthelmintic Dosages in Goats

The attached chart was developed by Ray M. Kaplan, DVM, PhD, DACVM, DEVPC (University of Georgia) with subsequent contributions by Patty Scharko DVM, MPH (Clemson University). It is provided as a possible guideline for anthelmintic (deworming) dosages for goats. Producers should always consult their veterinarian for advice on their specific management situation, for determining which of the dewormers remain effective on the farm, and for determining the most appropriate dosages for their herd. Meat and milk withdrawal times listed in this document are based on the most current information available from FARAD as of it's writing. Be aware that these recommended withdrawal times may change over time as new pharmacologic information is obtained.

With the exception of fenbendazole administered at the 5 mg/kg dose, these drugs are **not** approved by the Food and Drug Administration (FDA) for use in goats, and when used in goats are considered extra label use. Fenbendazole at the recommended dose rate of 10 mg/kg is also considered extra-label usage. The FDA regards extra-label use of drugs as an exclusive privilege of the veterinary profession and is only permitted when a bona fide veterinarian-client-patient relationship exists and an appropriate medical diagnosis has been made. The following chart is intended to serve as a guideline for improving accuracy when dosing goats with an anthelmintic, but these drugs should be used in goats only when appropriate veterinary advice has been received. Cattle pour-on dewormers should NEVER be used in goats to treat internal parasites.

Drug resistance to multiple drugs and sometimes to all available drugs in parasites of goats is extremely common. The effectiveness of a dewormer should always be tested before being used by performing a Fecal Egg Count Reduction Test (FECRT) or DrenchRite larval development assay (contact Sue Howell in Dr. Kaplan's laboratory [706-542-0742; or drenchr@uga.edu] for more information about the DrenchRite test, current cost = \$450).

To improve the effectiveness of deworming treatments, multiple dewormers may be administered at the same time sequentially. It is important not to mix the different drugs together as they are not chemically compatible. They should be given separately, but can all be given at the same time, one right after the other. It is always recommended to treat goats selectively given their individual need for treatment based on FAMACHA score, fecal egg count, body condition score, and other health measurements as a guide. This recommendation is even more important when using drugs in combination. If all animals in the herd are treated, resistance to the dewormers will develop rapidly, and if using a combination there will be nothing left to use when this happens.

ADDITIONAL NOTE ON CYDECTIN: For a short period, it was recommended to administer Cydectin (moxidectin) by injection. However, new information suggests that the oral route is preferred. If the cattle injectable is used, FARAD recommends a 120-130 day meat withdrawal time. NOTE that the cattle pour-on formulation should NOT be administered to goats orally – this is not permissible under extra-label use law. ALWAYS use the sheep oral drench. Check <http://www.acsrpc.org/> website for more information on drug choice and drug resistance.