

Managing Parasite Pedigrees to Maximize Deworming Impact

Brian Vander Ley, DVM PhD DACVPM
Great Plains Veterinary Education Center

Gastrointestinal Parasitism in Goats

- A critical problem facing the goat industry
- Rapid Loss of Dewormer Efficacy
 - 30% of worms resistant to levamisole
 - 50% resistant to moxidectin
 - 90% resistant to avermectins
 - 100% resistant to benzimidazoles
 - (Ray Kaplan, Personal Communication)

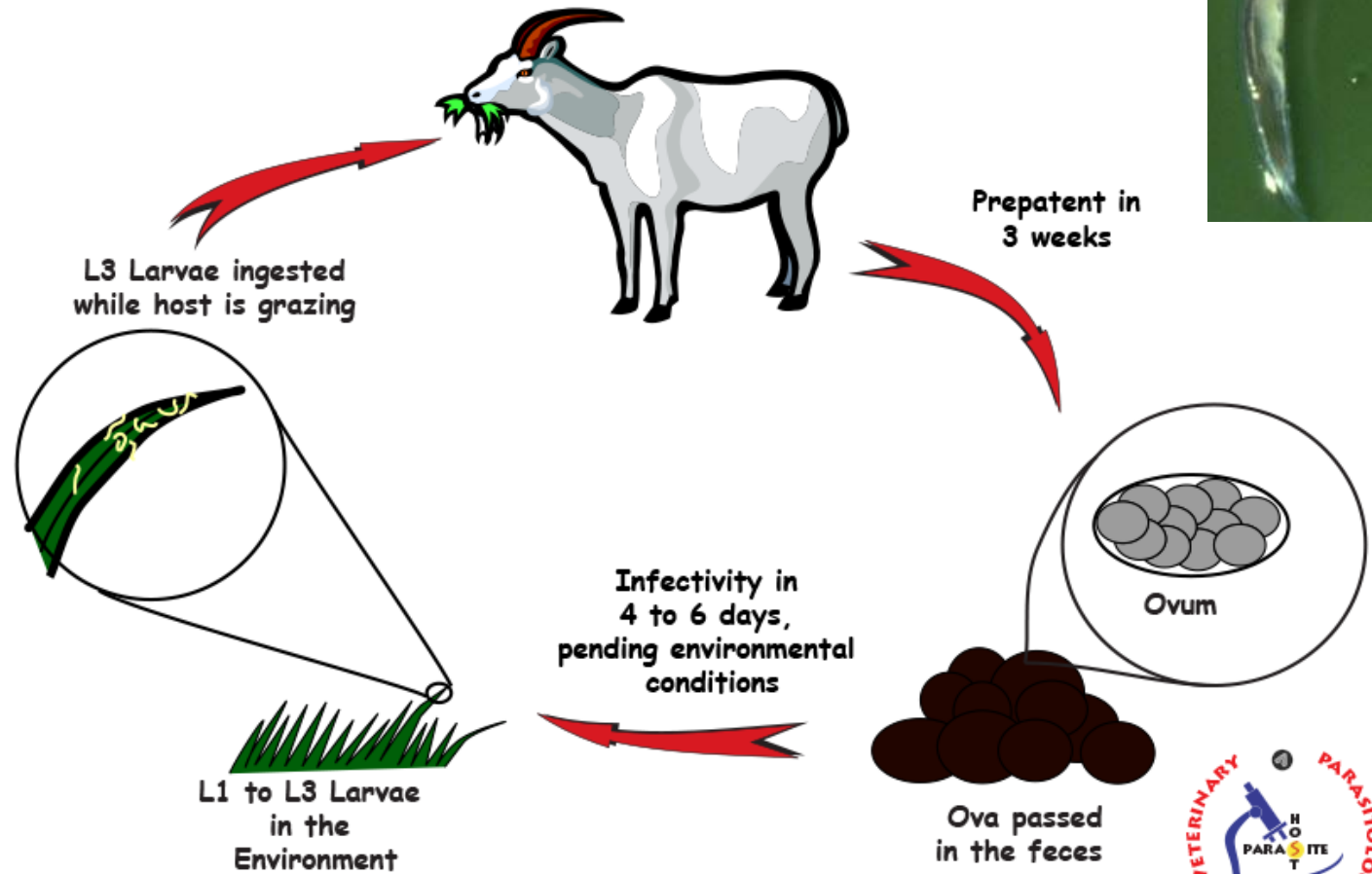


<https://attra.ncat.org/attra-pub/viewhtml.php?id=215>

The Villain(s)

NC STATE UNIVERSITY

Haemonchus contortus



http://nematode.net/NN3_frontpage.cgi?navbar_selection=speciesstable&subnav_selection=Haemonchus_contortus

- *Haemonchus*
- *Ostertagia*
- *Trichostrongylus*
- *Teladorsagia*



Where do the Worms Live?

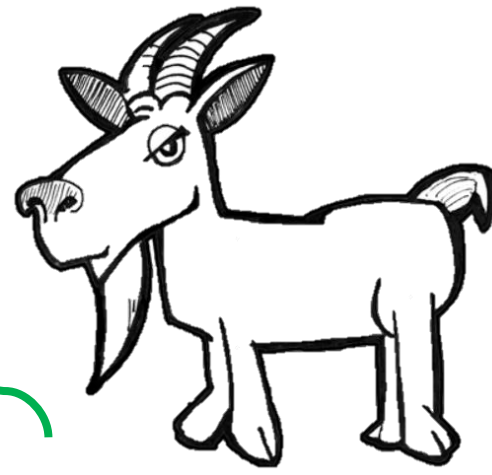
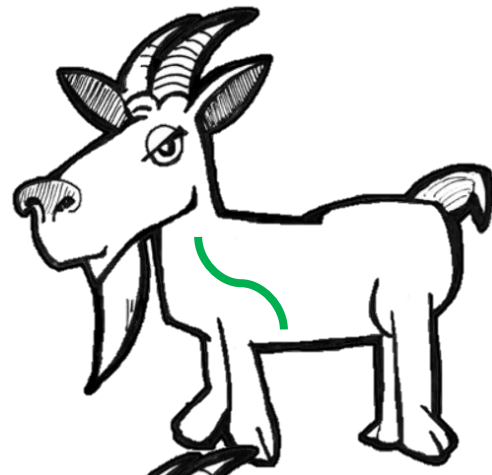
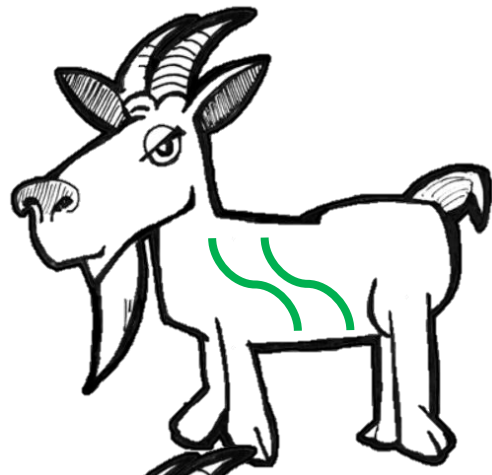
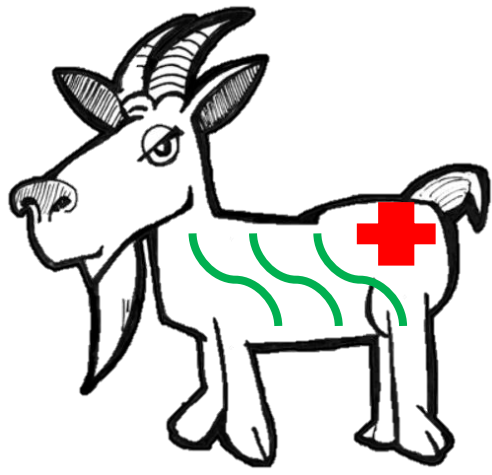


Definitions

- Resistance
 - Anthelmintic resistance is defined as the inability of a deworming product to reduce fecal egg counts by at least 95%
- Resistant worms
 - Parasites, usually *Haemonchus contortus*, that are unaffected by deworming products
- Refugia
 - A population of parasites that remains unexposed to deworming products

Defining the Problem

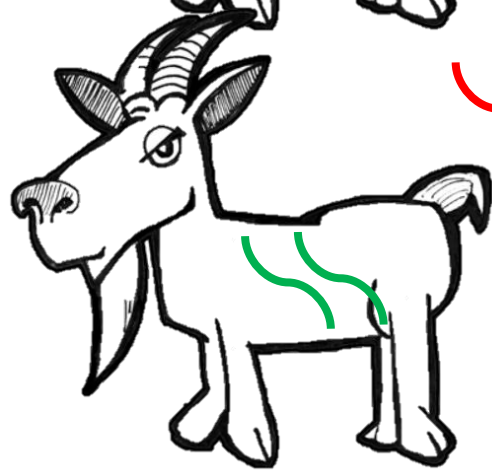
- After a deworming event, who is left?

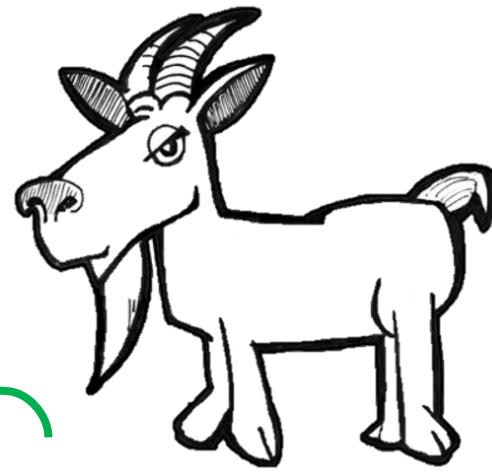
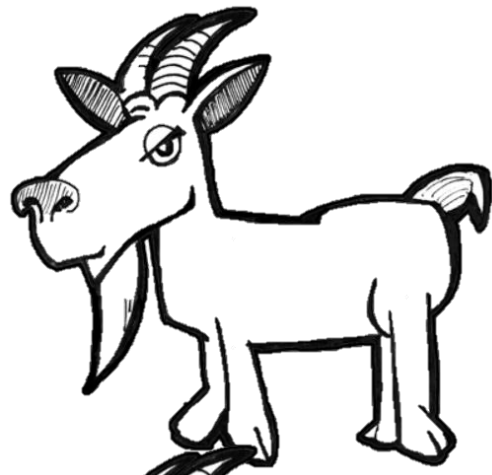
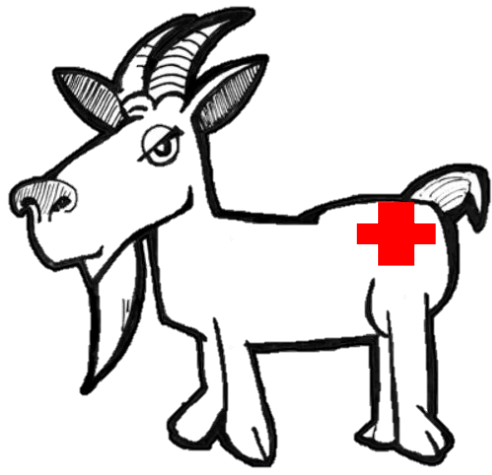


Starting Goat and
Worm Populations
20% Resistant Worms

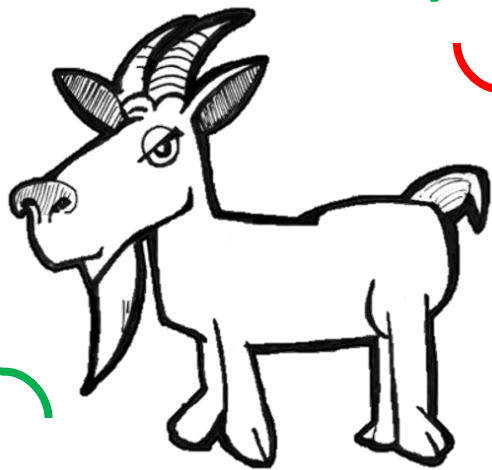


80-20 Rule: 80% of
the eggs come from
20% of the
population

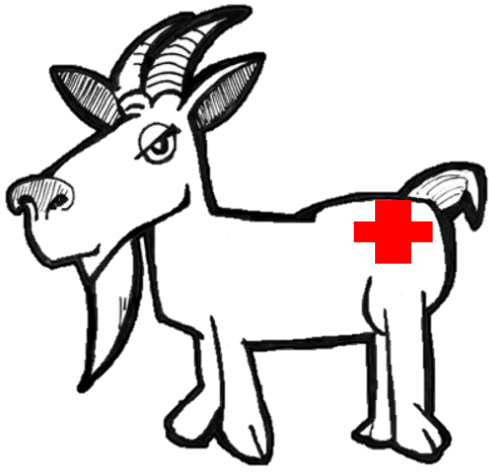




Deworm entire herd
and leave on the same
pasture



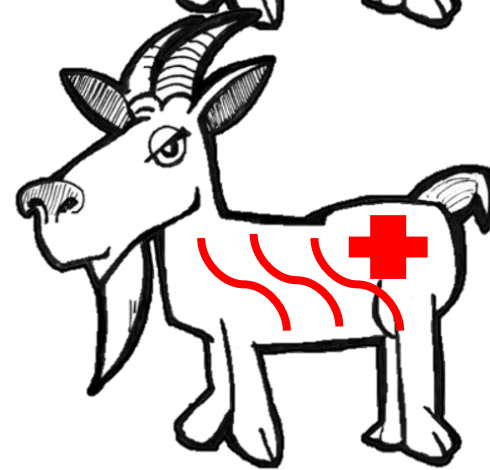
End Result:
100% Resistant worms in
Goats
20% Resistant worms on
pasture



Deworm and move to
new pasture



100% of Eggs
produced will be
from resistant
worms!



Unavoidable Facts

- Parasite resistance is here to stay
- Goats cannot be cured of parasites
 - Only way to kill all parasites is to kill the host
- Very few truly “clean” pastures
 - Cattle, sheep, goats, llamas, alpacas all share parasites to some degree
- We have almost no hope that new drugs will be developed and licensed in the U.S. for small ruminant parasite control
- Historic approaches to deworming have only increased the speed at which we approach the “total resistance” cliff



PESSIMISM

Anything that can go wrong, and doesn't go wrong,
is just waiting for a much worse time to go wrong.

Is there hope?

- Definitely
- Short Term: The solution to pollution is dilution
 - In this case, we need to dilute resistant worms (and their genes) with lots of susceptible worms (and their genes)
- Long Term: Goats are not all equally sensitive to parasitism
 - Selection for parasite tolerant goats will reduce the need to rely on dewormers

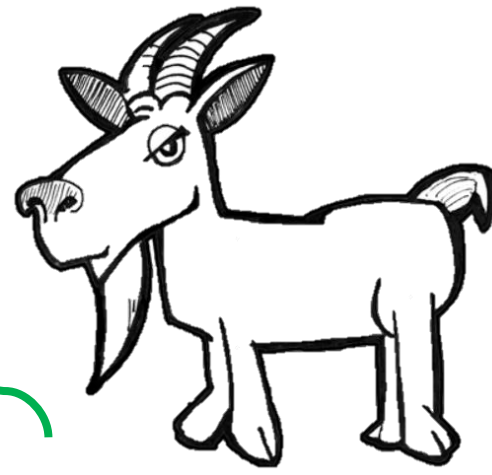
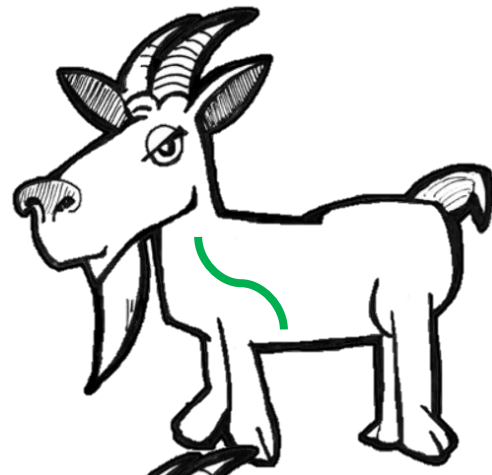
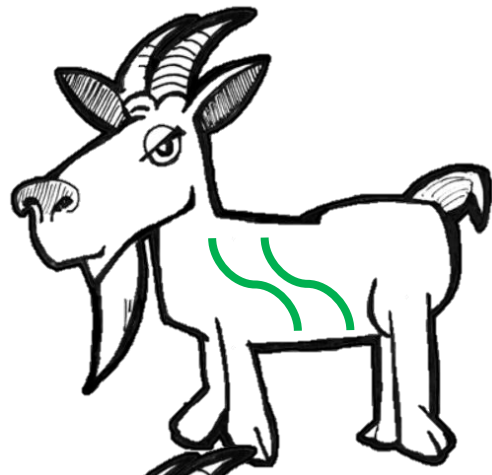
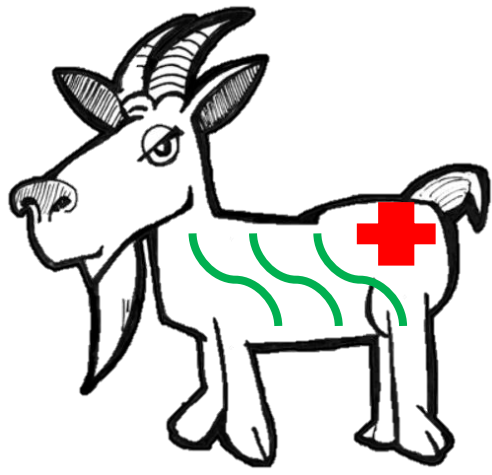


Managing Parasite Resistance-Breeding the Perfect Worms

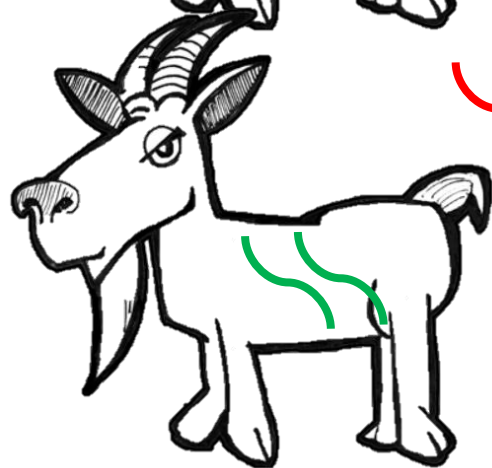
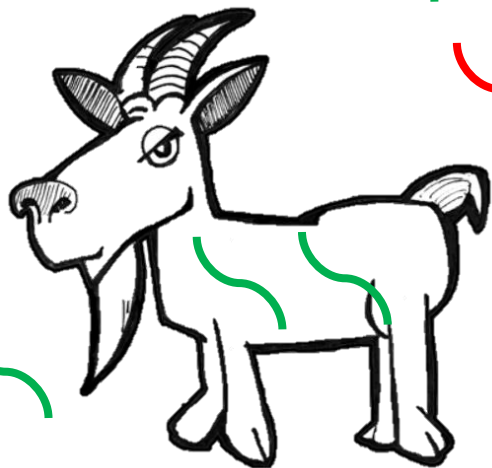
1. You must keep track- “You cannot manage what you do not measure”
2. Maintain refugia like your goat’s lives depend on it, because they do
3. Deworm to maximize efficacy, minimize selection of resistant worms
4. Identify and retain animals that are parasite tolerant

Keeping Track

- Ability to track treatments=success
- Many methods available
 - Written records
 - Special tags
 - Ear notches
- Tracking provides critical information
 - Estimates anthelmintic efficacy
 - Estimates parasite tolerance of individual animals
 - Estimates parasite challenge to the herd



Maintain Refugia



Strategies to Maintain Refugia

- Strategic Deworming
 - FAMACHA is the gold standard
- Never blanket deworm the herd
 - Never ever blanket deworm and move to “clean” pasture

Deworm to maximize efficacy, minimize resistance selection

- Don't wound the worms, kill the worms
- Choose deworming products based on data
 - Fecal Egg Count Reduction Test
 - Drench-Rite Test
- Administer dewormers correctly
 - Right dose
 - Right duration
 - Right Route
 - NEVER EVER INJECTABLE OR POUR ON IN GOATS
- Administer dewormers in combination with each other

Testing Dewormer Efficacy-FECRT

- Fecal Egg Count Reduction Test
 - Collect pre-treatment fecal samples on at least 10 animals
 - Have to be able to associated an ID with a sample
 - Administer dewormer(s)
 - 2 weeks after treatment, collect fecals from the **SAME** 10 animals that were sampled the first time
 - Quantitative fecal egg counts must be done both times
 - 95% reduction=efficacious dewormer

Animal ID	Sample 1	Sample 2	Difference	Percent kill
101	2500	250	2250	$2250 \div 2500 \times 100$ = 90%
203	1900	300	1600	$1600 \div 1900 \times 100$ = 84%
155	2450	450	2000	$2000 \div 2450 \times 100$ = 82%

The average percent kill would be $(90 + 84 + 82) \div 3$
= 85%.

<https://www.uaex.edu/publications/pdf/FSA-9608.pdf>

Testing Dewormer Efficacy-Drench Rite Test

- Sophisticated assay to determine which dewormers are effective on your operation
- Collect feces from a number of animals
- The eggs are hatched, speciated and the worms are exposed to different dewormers
- Only offered at University of Georgia

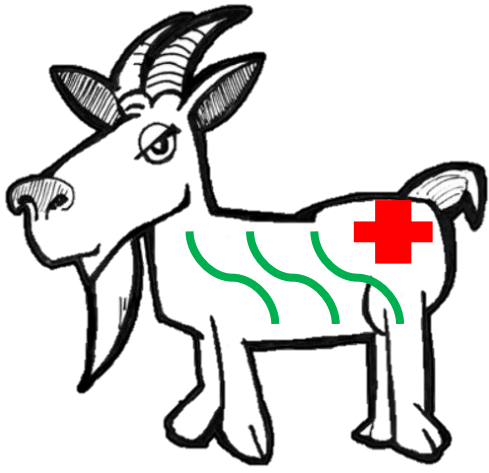


Administering Dewormers

- Right dose
- Right duration
- Right Route
- NEVER EVER INJECTABLE OR POUR ON IN GOATS
- Extra-label use is likely
- Cannot be done legally without a veterinarian's prescription and oversight
- Consequences of extra-label drug use can be profound and expensive

Dewormer Combinations

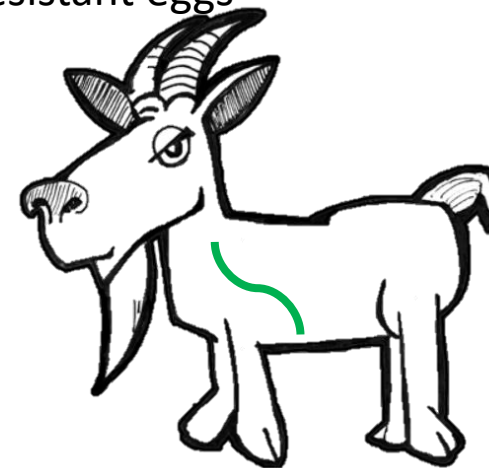
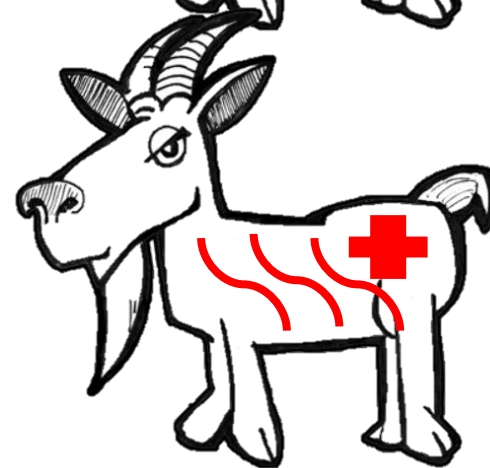
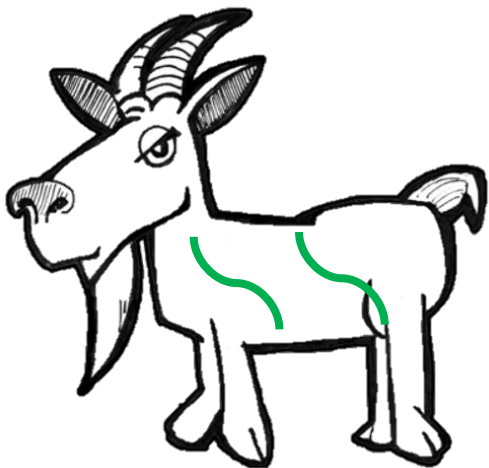
- Must be used in the context of strategic deworming and refugia maintenance
- Remember, dilution is the solution to pollution
 - Maximize the dilution rate
- The math
 - 2 dewormers
 - Dewormer A-80% Fecal Egg Count Reduction
 - Dewormer B-80% Fecal Egg Count Reduction
 - Worms would be considered Resistant to both
 - Together could result in a FECR of as much as 96%



The benefit of
combination
deworming

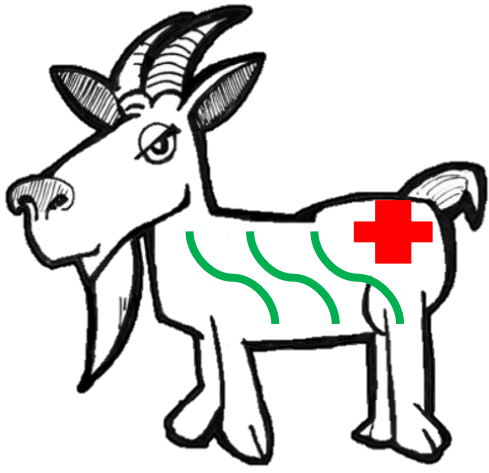


12 Susceptible worms x
10,000 eggs/day=
120,000 susceptible eggs
on the pasture each day
3 resistant worms x
10,000 eggs/day= 30,000
resistant eggs

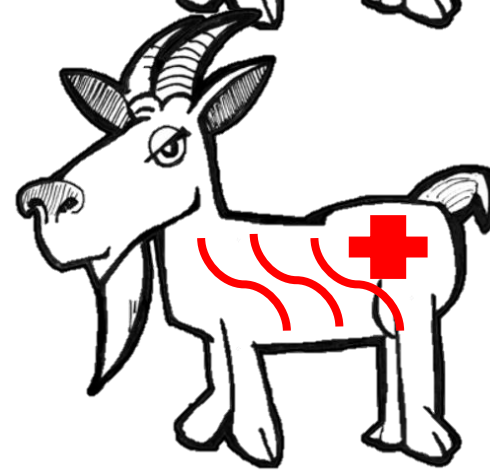
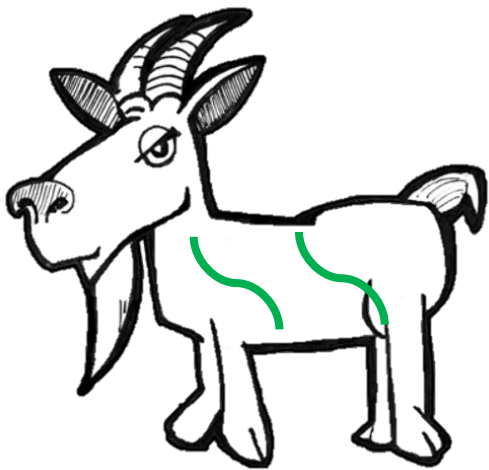


Dilution Calculated

Susceptible=95% FECR Resistant=80% FECR	Untreated	All Treated	Famacha-1 Product	Famacha-2 Products
Suceptible Eggs/Day Produced b/f Deworming	120,000	120,000	120,000	120,000
Resistant Eggs/Day Produced b/f Deworming	30,000	30,000	30,000	30,000
Susceptible Eggs Post Deworming		0	90,000	90,000
Resistant Eggs Post Deworming		12,000	7,500	1,275
Susceptible eggs for each resistant egg	4	0	12	71



Identify and remove
susceptible genetics



Putting it all together

- Elimination of parasites is not possible and likely never will be
- New Goal: Maintain a population of parasites you can treat
 - Refugia is the key
 - Accepts parasite infections as a necessary reality of goat production
- Put as much selection pressure on parasite tolerance as you can
 - Long term solution is in the goats not in the drugs