Strategies to Minimize Resistant Internal Parasites on your Farm

J.E. Miller

Louisiana State University

American Consortium for Small Ruminant Parasite Control

Background To The Problem

- Gastrointestinal worms are major pathogens of small ruminants
- Worm control has relied almost exclusively on the frequent use of anthelmintics (dewormers)
- Dewormer resistance is now common
  - A fresh approach to control is needed
- American Consortium for Small Ruminant Parasite Control Group Formed (2001)

Gastrointestinal Worms of Small Ruminants

Abomasum:

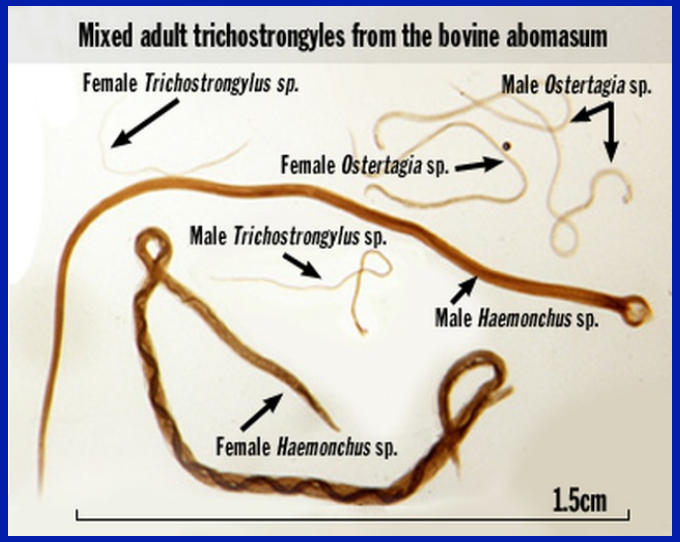
- ***Haemonchus contortus**** *(southeast US)*
- ***Teladorsagia circumcincta***
- ***Trichostrongylus axei***

Small intestine:

- ***Trichostrongylus colubriformis***
- ***Cooperia***
- ***Nematodirus***

Large intestine:

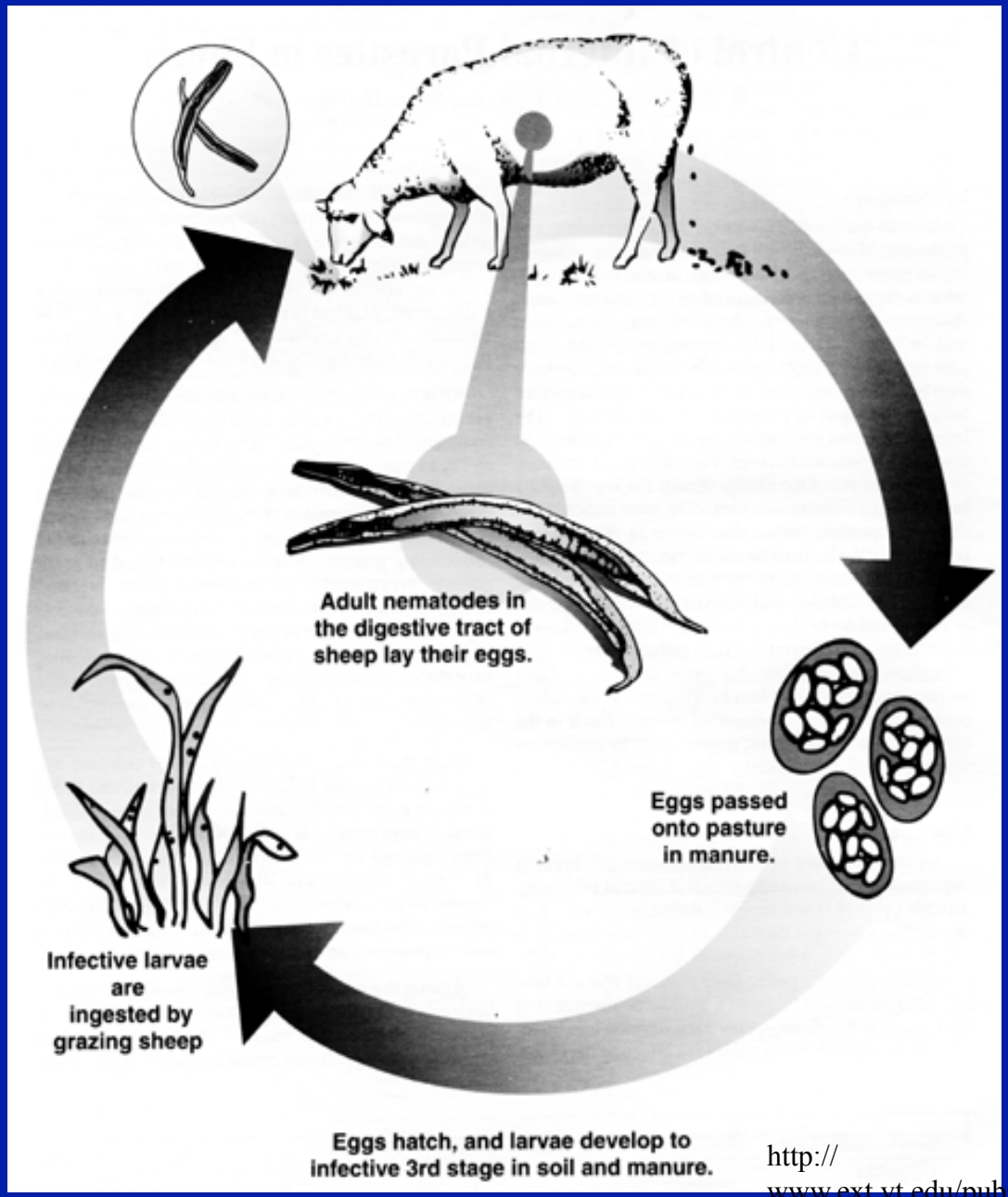
- ***Oesophagostomum***
- ***Trichuris***

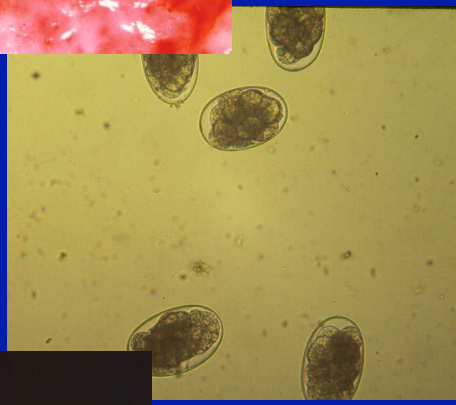


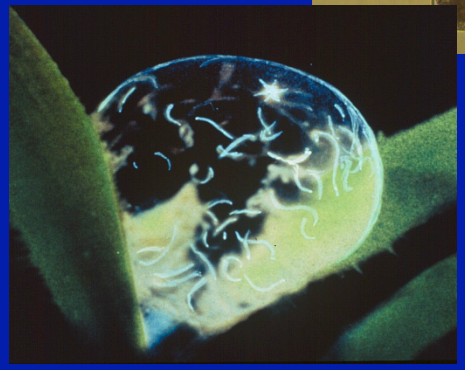
Haemonchus contortus (Barber Pole Worm)

- **Blood-sucking worm**
  - Highly pathogenic
  - Hypoproteinemia - “bottle jaw”
  - Anemia → Death
- **Most important worm parasite** in small ruminants raised in warm/wet environments
  - Southeastern US year round
  - Seasonal summer – rest of US

Life Cycle of *H. contortus*







http://www.ext.vt.edu/pubs/sheep/410-027/

Why is *H. contortus* such a problem?

- **Long transmission season - southeastern US**
- **Very fecund - 5-10,000 eggs per day**
- **Short life cycle**
  - **– 4-5 weeks**
  - **Immunity wanes – ewes parturition/lactation**
  - **Spring = pasture contamination**
- **Immunity is slow to develop – lambs**
  - **– 4-6 months of age**

Teladorsagia/Trichostrongylus (Bankrupt Worms)

- Abomasum/Small intestine
- Thrives in cool/wet climates
- Short transmission season – Summer, most of US
- Destroys mucosal cells and disrupts function
- Anorexia, diarrhea, reduced weight gain or weight loss
  - Decreased production not necessarily death = "bankrupt"
- Immunity wanes – ewes parturition/lactation
  - Spring = pasture contamination
- Immunity is slow to develop – lambs

– 4-6 months of age

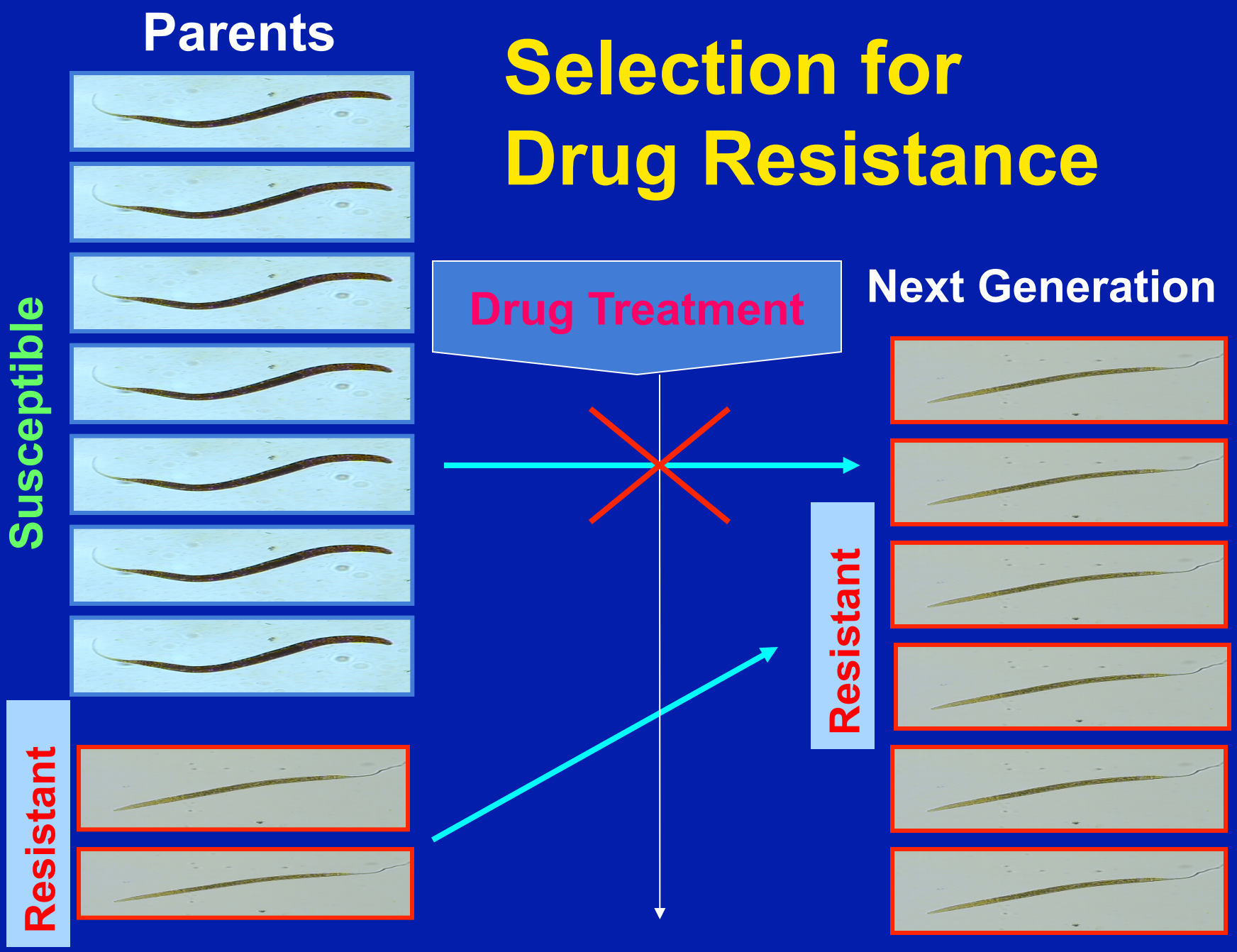
Background to the Problem

- Age of modern anthelmintics
- Parasitologists recommended strategi
  that maximized benefits of treatment
  - Ignored resistance issues
- Over-reliance on anthelmintics
  - Therapeutic vs. prophylactic
  - Loss of common sense management-based approaches

Anthelmintic Resistance

- The ability of worms to survive treatments that are generally effective at the recommended dose rate
- Treatment eliminates worms whose genotype renders them susceptible
  - Worms that are resistant survive and pass on their "resistant" genes
- Resistant worms accumulate and finally treatment failure occurs
  - Natural biological consequence of drug treatment

Selection for Drug Resistance



Where Did We Go Wrong
What Actually Causes Resistance

- Treatment at frequent intervals
  - Many farms > 6 Tx per year
- Treating all animals at same time
  - No refugia
    - The proportion of the population that is not selected by drug treatment
    - Provides a pool of susceptible genes
      - Dilutes resistant genes in that population
    - Overlooked as the most important component of drug resistance selection
- Treating and moving to clean pasture
  - No dilution/refugia
- Under dosing
  - Worms with low-level resistance survive

When to Suspect Resistance

- When FEC remain high or clinical signs persist following treatment
  - One must also rule out other possibilities
    - An inadequate dose of drug was administered
      - Underestimated weight
      - Drug was spilled/spit-out
    - Activity of the drug is reduced
      - Beyond its expiration date
      - Stored improperly

Diagnosis of Resistance

- Laboratory – DrenchRite
  - Dr. Ray Kaplan's lab (UGA) - $450
  - Only one test needed per farm
  - One pooled fecal sample from 10 animals
  - All 3 major drug classes tested in assay
- Veterinarian in the field -- simple on-farm anthelmintic trial
  - Fecal egg count reduction test
    - FEC at treatment and again 7-10 days later

McMaster Fecal Egg Count

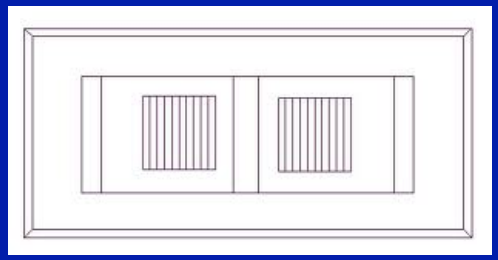
- Quick, easy to perform
- Should be part of routine services offered
- Slides available from:
  - Chalex Corp.

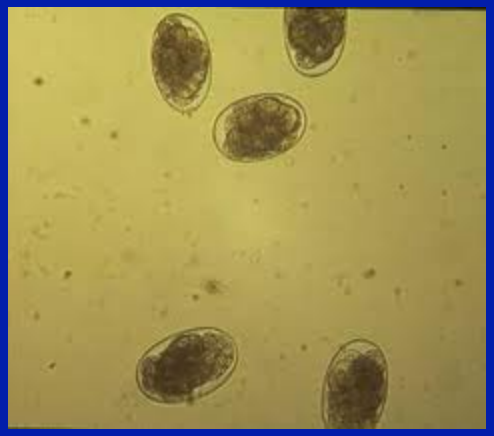
    5004 – 228th Ave. SE

    Issaquah, WA 98029

    425-391-1169

    FAX 391-6669





What Does All This Mean For The Small Ruminant Industry

- Anthelmintics can no longer be thought of as a management tool to be relied on to improve animal productivity
- Reality = effective long-term control of worms (specifically *Haemonchus)* will only be possible if anthelmintics are used intelligently with prevention of resistance as a goal

Anthelmintics

- Benzimidazoles
  - Albendazole (Valbazen)
  - Fenbendazole (Safegard, Panacur)
  - Oxfendazole (Synanthic)
- Imidazothiazoles
  - Tramisol, Levasol, Rumatel
- Macrocyclic Lactones
  - Ivermectin (Ivomec)
  - Doramectin (Dectomax)
  - Moxidectin (Cydectin)
  - Eprinomectin (Eprinex)
- 2 new classes coming (??)
  - Amino Acetonitrile Derivatives (AAD) - Monepantel (Zolvix)
  - Spiroindole - Derquantel (Startect)

Prevalence of Resistance

- *H. contortus*
  - Common
    - Benzimidazoles (Valbazen, Panacur, Safeguard), Ivermectin (Ivomec) and Doramectin (Dectomax)
  - Lowest level of resistance
    - Levamisole (Levisol, Tramisol)
      - Not available anymore
  - Becoming widespread rapidly
    - Moxidectin (Cydectin)
- *Teladorsagia/Trichostrongylus*
  - Drenchrite – *Trichostrongylus*, but small percentage of population
  - No documentation for *Teladorsagia*

“Smart Drenching”

- Use Proper Dose and Drenching Technique
  - Ensure proper dose is delivered over back of tongue
  - Critical that the full dose lodges in the rumen
  - If drench is delivered to the mouth rather than over the back of the tongue
    - Can stimulate closure of the esophageal groove with much of the drench bypassing the rumen
      - Faster drug absorption
      - Shorter duration
      - Efficacy is reduced

“Smart Drenching”

- Administer all drugs orally
  - Pour-ons are absorbed poorly
  - Injectable moxidectin (long withdrawal time)
- Combinations
  - Different classes (together/sequentially)
- Restrict feed intake for 24 hours prior to treatment
  - Once in the rumen, the duration of drug availability is largely dependent on the flow-rate of the digesta
    - Decreasing digesta transit leads to an increase in drug availability and efficacy

Do Not Buy Resistant Worms

- All new additions should be quarantined and aggressively dewormed upon arrival
  - Deworm with at least 2 anthelmintics with different mechanisms of action (different class)
    - Moxidectin and albendazole, for example
  - Should remain in quarantine for 10 - 14 days
    - Perform FEC to confirm minimal or no eggs are shed
  - If quarantine is not possible:
    - Treat with at least 2 anthelmintics and confine to pens for a minimum of 48 hours following treatment

Selective Treatment

Concept Behind Selective Treatment

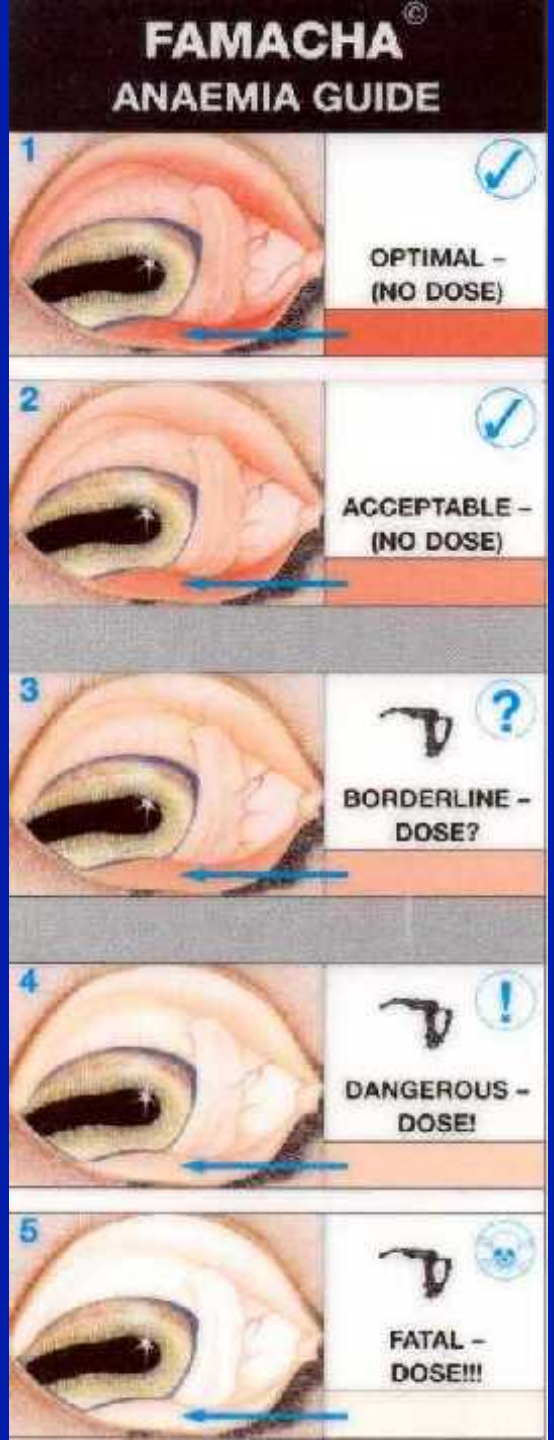
- Worms are not equally distributed in groups of animals
  - 20-30 % of animals harbor most of worms
    - responsible for most of egg output and thus pasture contamination

Impact of Selective Treatment on Refugia

- The more of the population that is in refugia, the slower the rate with which resistance develops
- Selective treatment significantly increases the percent of the population in refugia

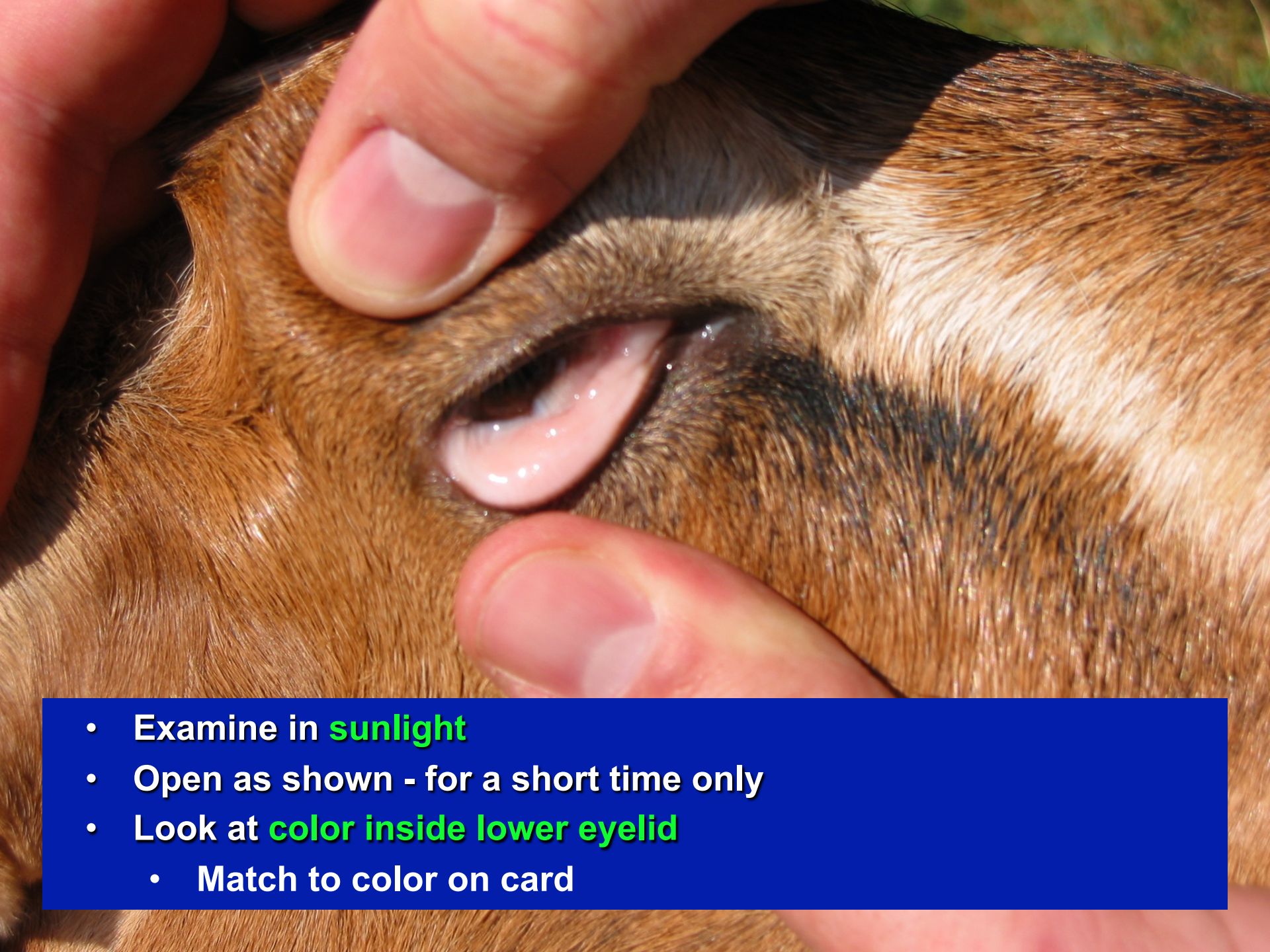
How Do We Achieve Selective Treatment

- **The FAMACHA© system**
  - **Technique for the assessment of *Haemonchus contortus* infection**
    - **Indirectly evaluate worm burden by level of anemia**



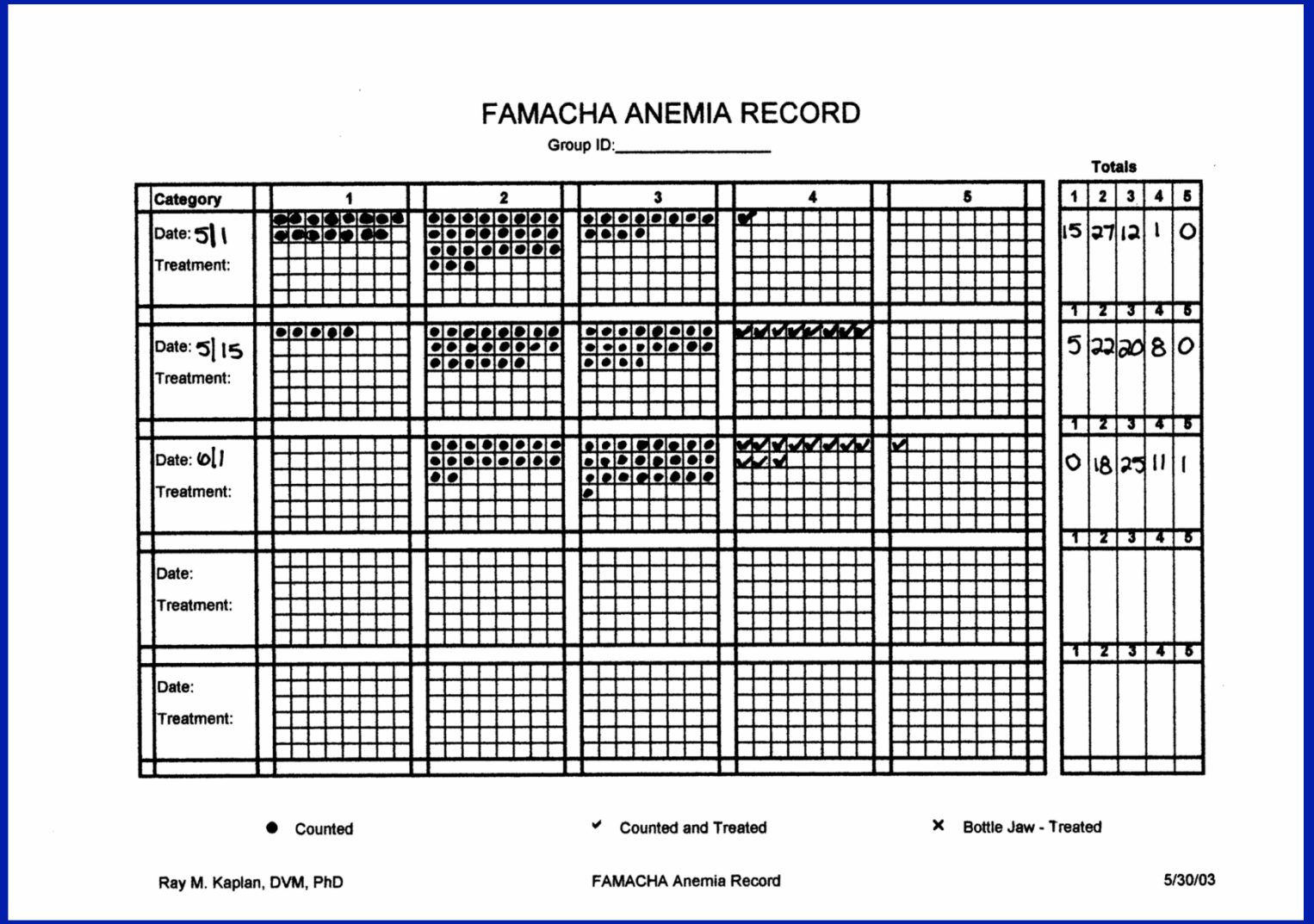
The FAMACHA© System

- 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:
  - 1 – not anemic
  - 5 -- severely anemic



- Examine in sunlight
- Open as shown - for a short time only
- Look at color inside lower eyelid
  - Match to color on card

Keep records



FAMACHA ANEMIA RECORD

Group ID:_____

Category	1	2	3	4	5	Totals 1	2	3	4	5
Date: 5/1 Treatment:	●●●●●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●●●●●	✔		15	27	12	1	0
Date: 5/15 Treatment:	●●●●●	●●●●●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●●●●●	✔✔✔✔✔✔✔✔		5	22	20	8	0
Date: 6/1 Treatment:		●●●●●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●●●●●	✔✔✔✔✔✔✔✔✔✔✔	✔	0	18	25	11	1
Date: Treatment:										
Date: Treatment:										

● Counted ✔ Counted and Treated ✕ Bottle Jaw - Treated

Ray M. Kaplan, DVM, PhD FAMACHA Anemia Record 5/30/03

Integrating the FAMACHA© System

- Start examining at two week intervals in the spring
  - Treat categories 4 and 5
- Go to one week intervals as necessary during *Haemonchus* "season"
- In cooler times of year every 4 to 6 weeks may be sufficient
- If >10% of flock/herd in categories 4 and 5, consider treating 3s as well
- Examine especially animals which lag behind the flock/herd
- Check for animals with "bottle jaw" and treat these, regardless of whether they look anemic or not

Selective Treatment *Teladorsagia/Trichostrongylus*

- FEC
  - Vet or do your own
  - Make sure it is quantitative technique
- Body condition score
- Dag (dirty butt) score
  - Diarrhea
- Reduced weight gain
- Weight loss
- Bottle jaw

Alternative Methods for Worm Control

Breeding for Resistance

- **Select resistant** individuals (FEC/PCV/ FAMACHA) and **cull susceptible** animals
- Use resistant breeds for crossbreeding (Commercial)
  - Sire effect
- **Long term process**, but will be rewarding

Copper-oxide Wire Particles

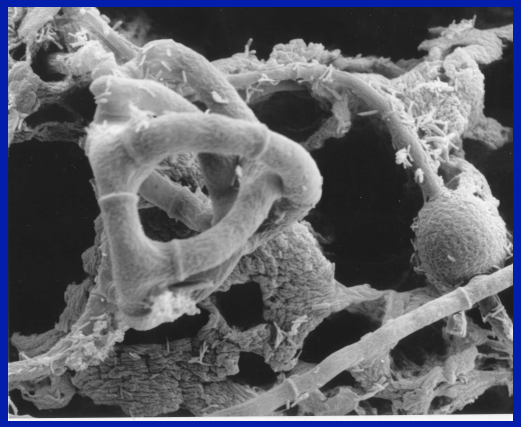
- *Haemonchus* only
- Marketed for copper deficiency
  - Copasure and Santa Cruz Animal Health
- Potentially toxic in sheep
- Selective treatment for individuals
  - FAMACHA
- Copper sulfate added to feed does not work
  - May work better as a drench

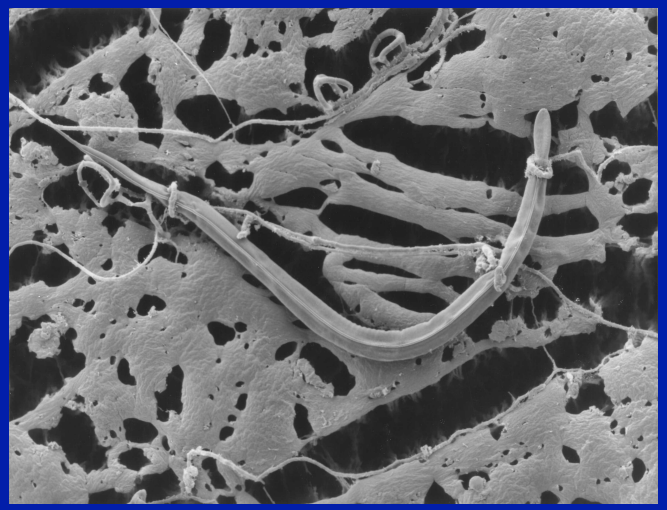
Condensed Tannin Plants

- Sericea lespedeza
  - Forage that grows relatively well in SE US
    - Establishment as pasture may fit some operations
    - Hay or pellets may be suited for many other operations
  - Has effect on *Haemonchus* and coccidia

Worm-trapping Fungi

- *Duddingtonia flagrans*
  - Affects all worm larvae in feces
  - Feed daily with supplement
  - Primary objective is to clean up pasture
  - Long term results
    - Maybe 2-3 years
  - US registration (??)





Integrated Strategy

- Use FEC, FAMACHA, etc. for monitoring infection level
  - Cull high infection individuals – resistance selection
  - Deworm individuals as necessary
    - Effective drug – smart drenching
    - Copper oxide wire particles
    - Sericea lespedeza
- Management
  - Stocking rate, mixed species grazing, dry lot, pasture spelling, etc.
- Weather conditions
  - Warm/wet = increased worm problems
  - Cold/dry = decreased worm problems
- Future (??)
  - Worm-trapping fungus

American Consortium for Small Ruminant Parasite Control

ACSRPC.org

Questions ???