

Topics

- The problem
- The parasites; where we are and why
- Biology of important GI Parasites
- Dewormers – a quick review
- What can we do?
 - “Smart Drenching”
 - FAMACHA

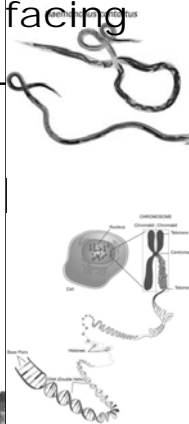
The Big Problem facing producers

- **Anthelmintic** (dewormer) resistance is considered a major threat to the current and future control of parasites of ruminants and horses
 - Worldwide phenomena
 - The prevalence of **multi-drug resistant** worms is extremely high in many areas of the world

The Big Problem facing producers


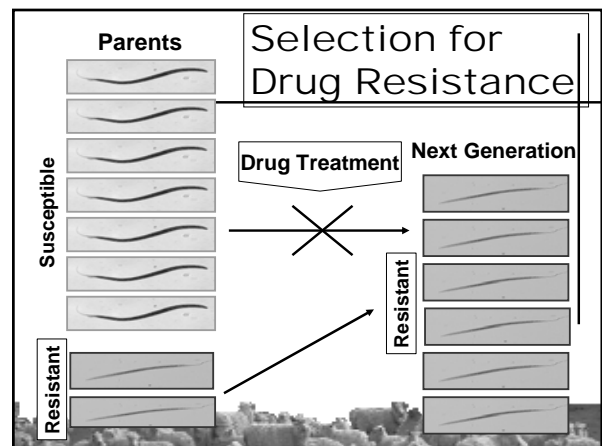
Resistance – The ability of certain worms in a population to survive drug treatments that are generally effective against the same worm species and stage of infection

- Cause:
 - Changes in levels of “resistance” genes carried by worms in a population
- Results from:
 - Drug treatment that produces genetic selection of resistant worms in a population of worms

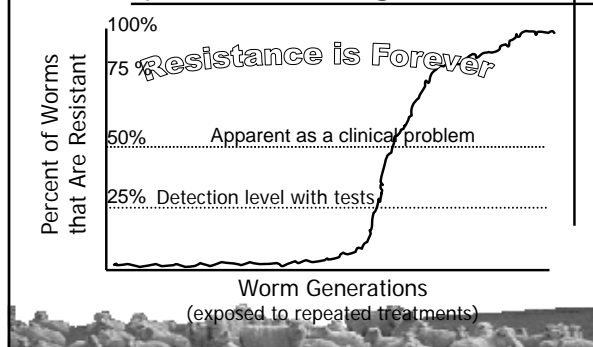


Dewormer Resistance History of the Problem

- Age of **modern dewormers**
 - Effective, broad-spectrum, cheap, safe
- Over-reliance on dewormers
 - Addiction to drugs, improper use of dewormers
 - Loss of common sense approaches
 - Belief there will always be a new drug
- **No new drug classes introduced since 1981**
 - We have what we have !!!!

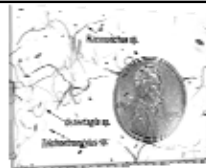
Changes in "Resistance" Genes in Response to Drug Selection



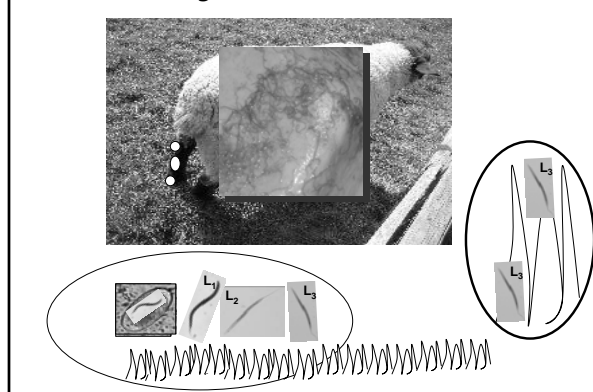
Gastrointestinal Nematodes (Worms) of Sheep and Goats

Most Important Species:

1. ***Haemonchus contortus* *****
– Barberpole worm
2. *Teladorsagia (Ostertagia) circumcincta*
– Brown stomach worm
3. *Trichostrongylus colubriformis*
– Bankrupt worm
4. +/- *Nematodirus*



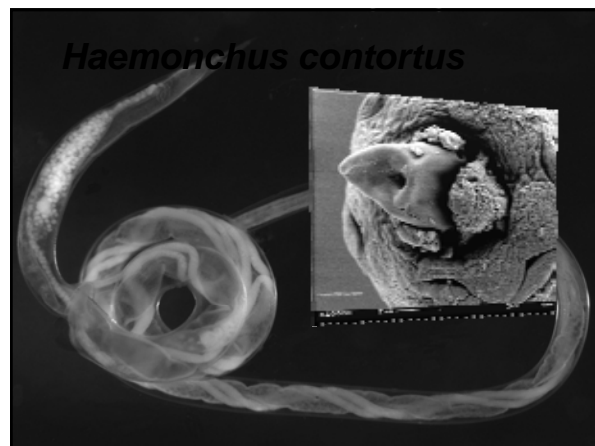
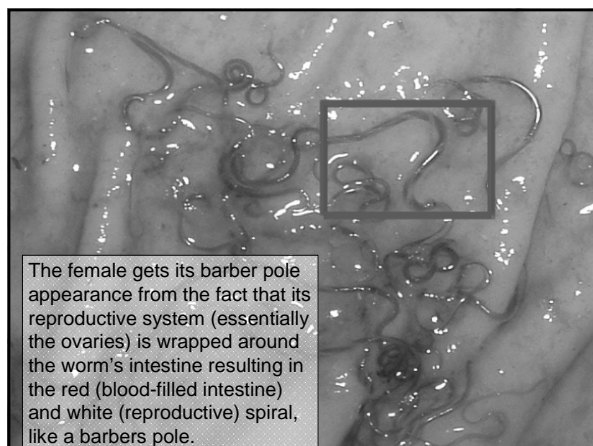
Life Cycle of GI Worms



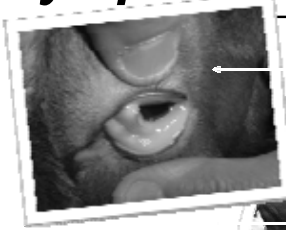
Haemonchus contortus (Barber Pole Worm)

PUBLIC ENEMY NUMBER ONE for small ruminant farmers

- Literally a blood sucking worm
- Adult females – **5000 eggs per day**
- Short life cycle – about 3 weeks from time of infection until eggs are produced
- Preys on:
 - Weak
 - Young
 - Pregnant
 - Lactating animal
- Developing resistance to all classes of dewormers



Symptoms



Anemia

Bottle Jaw



Why is *H. contortus* Such a Problem ???

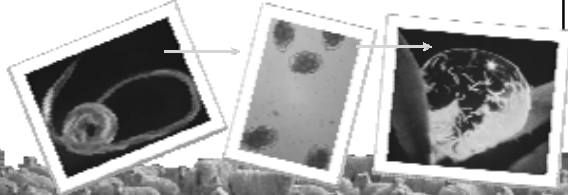
1. Evolved in tropics
 - Thrives in warm/wet climates
2. Long transmission season in the South
3. Immunity - around time of kidding/lambing
4. Short life cycle
 - Kids and Lambs are highly susceptible
 - Goats - partial immunity
 - Sheep - slow



Why is *H. contortus* Such a Problem ???

Very prolific – each female worms produces ~ 5,000 eggs per day

- 500 worms → 2.5 million epd per animal
- 50 goats → 1 billion eggs per week



Goats Were Never Intended to Live (and Graze) in a Warm Humid Climate



So, How did we get here?



So, How did we get here?

- Treated entire herd
- Dewormed by the calendar
- Rotated dewormers regularly
- One Pasture – may be only option
- Over crowding/grazing
- If multiple pastures, dewormed at move to new pasture
- Unknowingly purchased resistant worms




What Causes Resistance To Dewormers ???

Lack of Refugia

The proportion of the worm population that is not selected by drug treatment

- Worms in untreated animals
- Eggs and larvae on pasture
- Large pool of sensitive genes
- Small pool of resistant genes
- Most important factor in the development of drug resistance



What Causes Resistance To Dewormers ???

- Treatment strategies that ↓ refugia**
 - Examples:
 - Treating and moving to clean pasture
 - Treating when few larvae are on the pasture (drought)
 - Treating all animals at same time
- Frequent Treatments**
 - 3 or more treatments per year
- Under dosing**

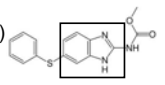

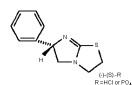


What Causes Resistance To Dewormers ???

- Resistance** — natural consequence of drug treatment
- Rate of development** — within our control.
 - Can be greatly reduced
- Goal = Preserve drug efficacy for as long as possible**
 - Increase refugia
 - Selective treatment




Classes of Anthelmintics (Dewormers)

- Benzimidazoles (BZ)**
 - fenbendazole (FBZ; Panacur, Safeguard)
 - albendazole (ABZ; Valbazen)
- Avermectin / Milbemycins**
 - ivermectin (IVM; Ivomec)
 - moxidectin (MOX; Cydectin)
- Imidazothiazoles / Tetrahydropyrimidines**
 - levamisole (LEV; Tramisol, Levasole), morantel (MOR; Rumatel, Golden Blend, others)


Resistance Occurs Within Classes of Anthelmintics

- Resistance to one drug in a class confers resistance to all others
 - same mechanism of action
- Exceptions to this are due to differences in potency and are only temporary



Resistance Occurs Within Classes of Anthelmintics

- 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)

Prevalence of Resistance on Sheep & Goat Farms (SE USA)

(Accumulated Data from 2002-2006)

Dewormer	Prevalence of Resistance
Benzimidazole	98
Levamisole	54
Ivermectin	76
Moxidectin	24
MDR – all 3 classes	48
MDR to all 3 classes + Moxidectin	17

Prevalence of Anthelmintic Resistance in Sheep: New Zealand and Australia

- | | |
|---|---|
| <ul style="list-style-type: none"> • Australia (WA) <ul style="list-style-type: none"> – IVM – 60% – ABZ – 99% – LEV – 99% | <ul style="list-style-type: none"> • New Zealand <ul style="list-style-type: none"> – IVM – 25% – ABZ – 41% – LEV – 24% – Triple resistant – 7% |
|---|---|

Moxidectin (Cydectin) resistance still is relatively uncommon (but it is being increasingly reported)

Total Anthelmintic Failure

- A near-term possibility on many sheep and goat farms in many areas
 - Many farms are down to their last drug
- First case in USA diagnosed in 2005 – now seeing more cases
 - → Total Anthelmintic Failure
 - (7% of farms in SE)
 - Future viability of small ruminant industries is threatened

Why Doesn't it Seem As Bad As it Sounds ???



1. Your neighbor may be worse off than you
2. Resistance as defined is a population measure
 - Not all worms on farm are resistant
3. Killing some worms will relieve disease symptoms
 - Removing 50% of worms gives clinical improvement
 - This gives the appearance that treatment was effective
 - Animals will require treatment again very soon
4. Obvious treatment failure only recognized once resistance is severe

What Does This Mean For The Small Ruminant Industry ???

- Dewormers can no longer be thought of as a cheap input to maximize productivity
 - Extremely valuable and limited resources
 - Requires a medically-based approach to treatment
- **Reality** = long-term control of *Haemonchus* will only be possible if dewormers are used intelligently with prevention of resistance as a goal
 - Reduced-chemical and non-chemical approaches are needed

Slowing down "Resistance"

- Reduce genetic selection pressure (parasite)
- Maintaining a pool of sensitive genes – **REFUGIA**
- Treat individuals, not herds
- Concept known as.....

"Smart Drenching"

- Using deworming strategies that
 - Maximize the effectiveness of treatments while at the same time
 - Decreasing the rate at which we are creating drug resistance



Components of a Smart Drenching Program

1. Know the resistance status of the herd/flock
2. Sound pasture management
3. Prevention – keep resistant worms off the farm
4. Administer the proper dose
5. Utilize host physiology
6. Selective treatment -- FAMACHA

1. Know the Resistance Status of the Flock

- Perform
 - Fecal Egg Count Reduction Test (FECRT)
 - DrenchRite©
- Repeat every 2 years
- When resistance is recognized in early stages
 - Drug can still be used
 - Must be managed appropriately



2. Use Proper Technique

- Ensure proper dose is delivered
- Proper technique when drenching sheep and goats is very important
 - Drench **should** be delivered over the back of the tongue
 - Critical that full dose lodges in the rumen
 - Drench delivered to the mouth may stimulate esophageal groove to close
 - Significant drench bypasses the rumen
 - Efficacy is reduced



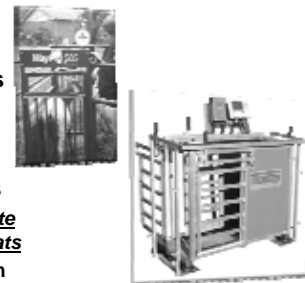
3. Dewormer Savvy Give the *Right* Dose

- Goats: 2X sheep dose
- **EXCEPTIONS**
 - Levamisole (1.5X)
 - Moxidectin injectable (1X)



4. Dose According to Weight

- **Best method:**
 - Weigh scales
- **2nd Best:**
 - Weight tapes
 - Only accurate for dairy goats
 - inaccurate in meat breeds



5. Utilize Host Physiology to Maximize Drug Efficacy

- Restrict feed intake for 24 hours prior to treatment (BZ and ivermectin)
 - Withholding feed decreases digesta flow rate leading to an increase in drug efficacy
 - Never in late pregnancy
- Repeat dose in 12 hours (BZ)
- These simple measures can substantially improve efficacy when resistance is present and can help to delay resistance if not yet present

5. Utilize Host Physiology to Maximize Drug Efficacy

Rotation of Dewormers:

Is this a Good Idea ???

- Has been promoted for many years
- Although recommended for many years there are new arguments against using rotation
 - **Rotation is NOT a replacement for proper resistance prevention measures**
- On many farms, rotation is not possible because of resistance

5. Utilize Host Physiology to Maximize Drug Efficacy

Rotation of Dewormers is a **Bad Idea**

- Creates a false presumption among vets and livestock owners that they have a bona-fide resistance prevention program
- **Rotation will mask resistance**
 - Resistance develops slowly to all drugs simultaneously
 - 1 effective drug will “cover” for another
 - Few livestock owners realize they have resistance problems – until it is too late

5. Utilize Host Physiology to Maximize Drug Efficacy

Drug Combinations

- Use of combinations of drugs simultaneously have been shown to
 - Decrease rate with which resistance develops
 - Increase the effectiveness of treatment
 - Drugs not useful on their own can achieve reasonable therapeutic results if combined
- **BUT – very dangerous if:**
 - Do not build refugia into system
 - Do not do efficacy testing to monitor resistance situation

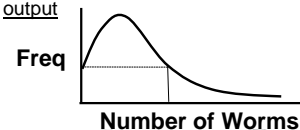
6. Selective Treatment

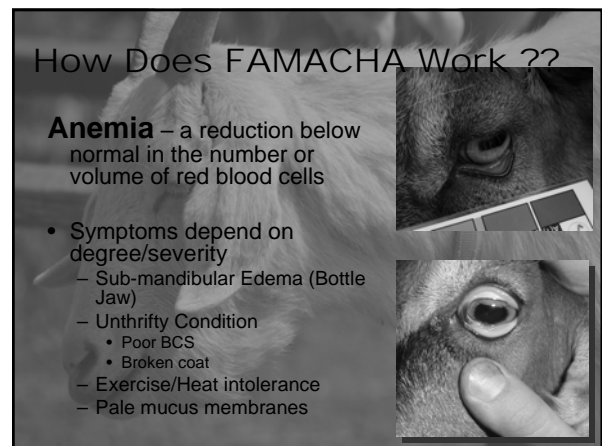
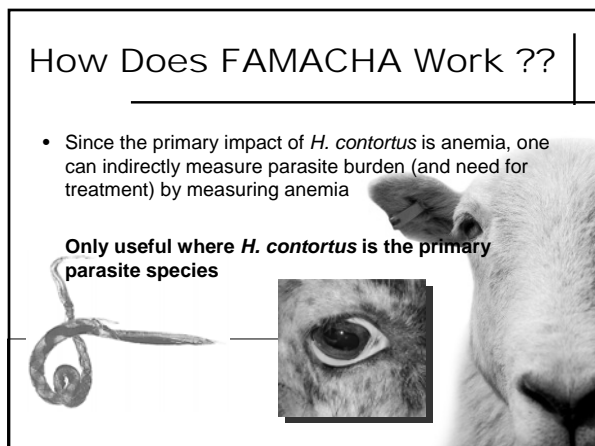
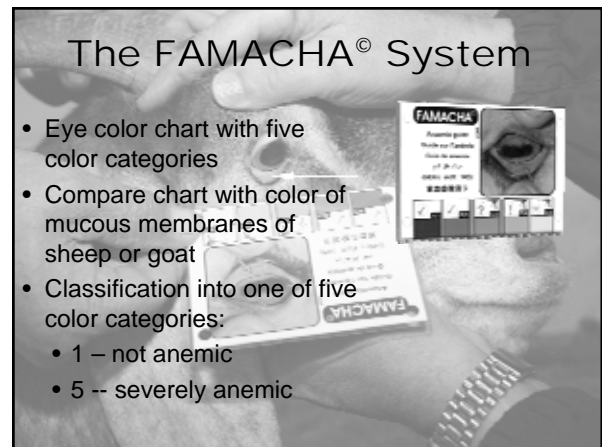
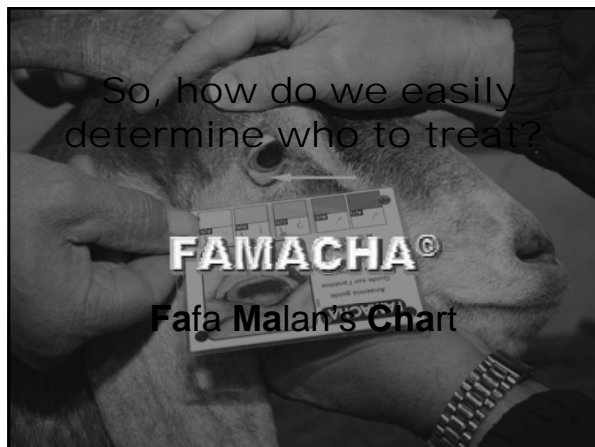
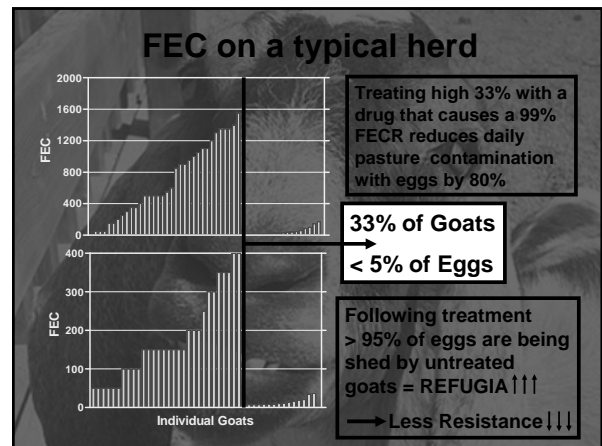
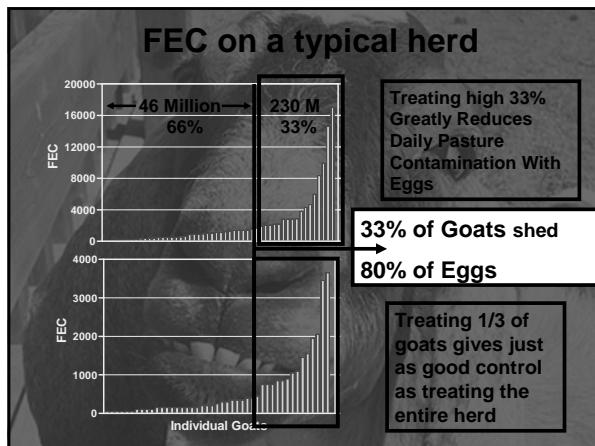
- **FAMACHA®**
 - For *H. contortus* only



Concept Behind Selective Treatment

- Parasites are not equally distributed in groups of animals
 - Overdispersed / aggregated distributions
 - **20-30 % of animals harbor most of worms**
 - Few animals are responsible for most of egg output





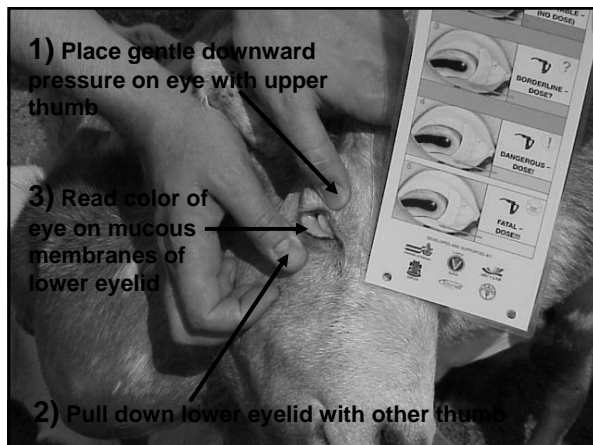
Haemonchus contortus

- Heavy burden can result in the loss of ½ cup or more of blood per day (1/12th its total body weight).
 - A 120 pound goat => 10 pounds of blood => 4.5 kg of blood => 4.5 liters or 4,500 ml of blood volume. 120 ml in ½ cup => 50% blood loss in 37 days



Conjunctiva color relationship to Anemia

Clinical Category	Color Classification	Hemoglobin Range (g/L)
1	Red	≥20
2	Reddish	18-20
3	Pink	16-18
4	Pink-white	13-16
5	White	≤13



FAMACHA® System “rules”

- Score using the chart
- Evaluate in bright light (sunlight)
- Be quick
- Score both eyes
- Use higher score if eyes differ



What Do I Do With The Results?

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



What Do I Do With The Results?

Treat 3s when:

- >10% of herd scores in categories 4 or 5
- Young animals
- Ewes/does (pregnant or lactating)
- Animals in poor body condition
- If any concern about animals general health and well being

Consider using less effective drugs

How Often Do I Monitor

If <10% of the herd/flock scores in categories 4 or 5:

- Re-examine in **2 weeks** if it is *Haemonchus* "season" (warm, moist conditions)
- In dry or cool times of year, every **4 -6 weeks** is probably sufficient
- More often at first to be safe – with **experience** you will learn what the proper intervals are for your farm

How Often Do I Monitor

If >10% of flock/herd scores in categories 4 or 5:

- Recheck weekly
- Treat the 3's
- Change pastures (if possible)

Precautions

- FAMACHA® only applicable where *Haemonchus* is the main worm causing clinical disease (Florida)
- Conjunctival redness can be caused by eye disease, environmental irritants, and systemic disease

Precautions

- **Don't use it as a sole criteria for whether or not to drench**
 - If you see other symptoms such as bottle jaw, you know you need to drench
 - Look at all available signs
 - Body condition score
 - Coat condition
 - Consistency of feces
 - Heat/exertion intolerance

The Famacha Card



- Store in dark place when not in use
- Replace card after 12 months' use
- Keep a spare card in a light protected place

Why use FAMACHA

1. Decreased Worm burdens
2. Creates "Refugia"
 - Decreased development of resistance
3. Saves money \$\$\$
4. Identifies animals that need less frequent deworming – keep for breeding
5. Identifies animals that need more frequent deworming – CULL



Keep Herd and Individual Records!!!!



Keep Herd and Individual Records!!!!

- Which parasites are present
- When they are being transmitted
- How they survive
- Which anthelmintics are effective
 - What dose is required for host species
- When is the most appropriate time to administer anthelmintics or use other alternative control methods

Small Ruminant Integrated Parasite Control

TAMACHIA

and Small Breeding

Southern Consortium for Small Ruminant Parasite Control