

Current Concepts in the Control of Small Ruminant Parasites – 2006:

**Addressing The Challenges Posed By
Multiple-drug Resistant Worms**

Ray M. Kaplan, DVM, PhD, dipEVPC

Department of Infectious Diseases

College of Veterinary Medicine

University of Georgia

Athens, Georgia USA



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

- Resistance is relative
 - Not all worms on farm are resistant
- Killing some worms will relieve disease symptoms
 - Removing 50% of worms will result in clinical improvement
 - It appears that the treatment was effective
 - Animals require treatment again very soon
- Eventually most worms become resistant and treatment fails – animals may die

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

- Anthelmintics can no longer be thought of as a cheap input to maximize productivity
 - Extremely valuable and limited resources
- Control of *Haemonchus* must be practiced with an eye to the future
- **Reality** = effective long-term control of *Haemonchus* will only be possible if anthelmintics are used intelligently with prevention of resistance as a goal

Rotation of Dewormers

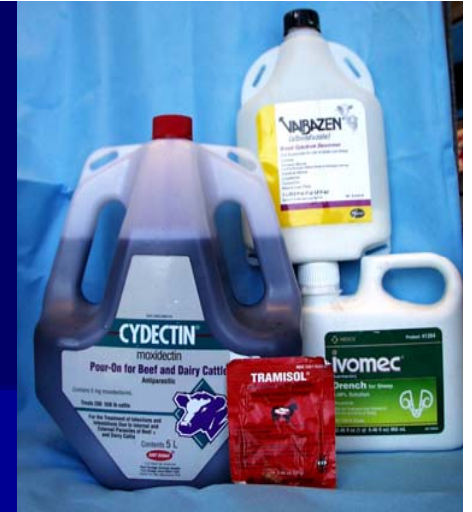
Is This A Good Idea ???

- Has been promoted for many years
- Old drugs were not broad spectrum
 - Rec'd developed to rotate with each Tx
- Then for resistance prevention
- On many farms, rotation is not possible because of resistance

Why I Think 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
- Must determine which drugs are effective on a particular farm

Anthelmintic Choices For *Haemonchus*



- Ivermectin -- least effective of all available drugs on most farms in SE
 - Very high prevalence of resistance
 - Be careful -- Do not use in southern US unless 1st proven effective
- Albendazole – resistance highly prevalent
 - Withhold feed & re-dose for improved efficacy
 - Not in first 3 weeks of pregnancy
 - More effective than FBZ

Anthelmintic Choices For *Haemonchus*



- Levamisole -- lowest prevalence of resistance
 - Not used much so less resistance
 - *Haemonchus* does not develop resistance as easily to LEV as compared to other drugs
 - Weigh goats -- Watch out for toxicity
 - Good choice for 1st line Tx if R-status unknown
 - Not in debilitated animals
 - Not in goats in last 3 weeks of pregnancy
 - Be careful in sheep in summer heat

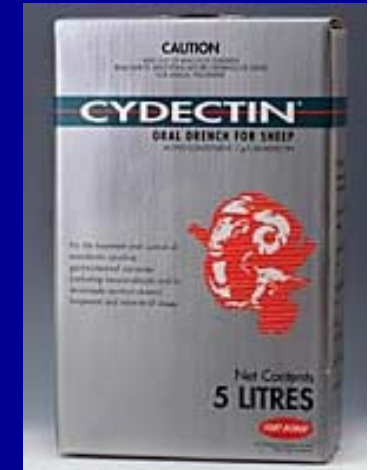
Anthelmintic Choices For *Haemonchus*



- Moxidectin -- resistance becoming common where used frequently
 - MOX kills IVM-resistant *H. contortus*
 - Same mechanism of killing -- Potency issue
 - IVM-R worms ARE also MOX-R
 - How drug is used det how long it remains effective
 - Resistance may be present even if never used
- TOC for severely clinically ill animals
 - Unless suspect resistance to MOX on farm
 - Safe, quick-acting
 - Good choice for 1st line Tx of anemic animals if R-status unknown

Rec'd for Moxidectin Use in Sheep and Goats

- DO NOT USE CYDECTIN POUR-ON ORALLY
- Sheep
 - Use sheep oral drench (200 ug/kg)
- Goats
 - Use cattle injectable (200 ug/kg)
 - Much improved PK when injected
- Must be used with prevention of resistance as a goal



Recommendations for Treatment of Clinical Dz



- Use any **effective** dewormer
 - Must know effectiveness of drugs before treating
- If animal is severely anemic or drug resistance status of farm is unknown -- then use MOX
 - Unless history of frequent MOX use
- If a large percent (>10%) of animals are clinically affected then:
 - If returned to the same pasture, frequent Tx may be needed to keep sheep/goats alive
 - 2 - 3 week intervals
 - Consider move to safe pasture, barn, or drylot

"Smart Drenching"

- An approach whereby we use the current state of knowledge regarding:
 - host physiology
 - anthelmintic pharmacokinetics
 - parasite biology
 - dynamics of selection for resistance
 - resistance status of worms on the farm
- To develop strategies that **maximize the effectiveness of treatments** while also **decreasing the selection of drug resistance**

Components of a Smart Drenching Program

- Know the resistance status of the herd or flock
- Sound pasture management
- Keep resistant worms off the farm
- Administer the proper dose
- Utilize host physiology
- Selective treatment -- FAMACHA

Know the Resistance Status of the Herd or Flock

- Perform FECRT or DrenchRite
- Repeat every 2 years
- When resistance is recognized in early stages
 - Drug can still be used
 - Must be managed appropriately



Recommendations For Pasture Management

- Decrease stocking rates
- Build fences
 - provide safe pastures
- Provide browse-type forage
- Use dilution strategies
 - mix 2 or more species on same pasture (sheep/goats with cattle or horses)
 - rotate pastures between different species



Do Not Buy Resistant Worms

- All new additions should be quarantined and aggressively dewormed upon arrival
- Deworm with 3 anthelmintics from different drug classes
 - moxidectin, levamisole, and albendazole upon arrival
- Should remain in quarantine for 10 - 14 days
 - Perform FEC to confirm that no eggs are shed



Proper Drug Dosage and Administration

- Ensure proper dose is delivered
- Goats metabolize anthelmintic drugs much more rapidly than other livestock
 - Rule of thumb -- goats should be given a dose **1.5 to 2 times higher** than for sheep or cattle
 - levamisole 1.5 X, All others 2X (except mox inj)
- **Administer drugs orally (except mox in goats)**
 - Bioavailability of pour-ons is poor
- Drugs should be stored properly



Use Proper Technique



- Proper technique when drenching ruminants is very important

- critical that the full dose lodges in the rumen
- **drench should be delivered over the tongue into the pharynx/esophagus**

- if drench is delivered to the mouth the esophageal groove can be stimulated to close

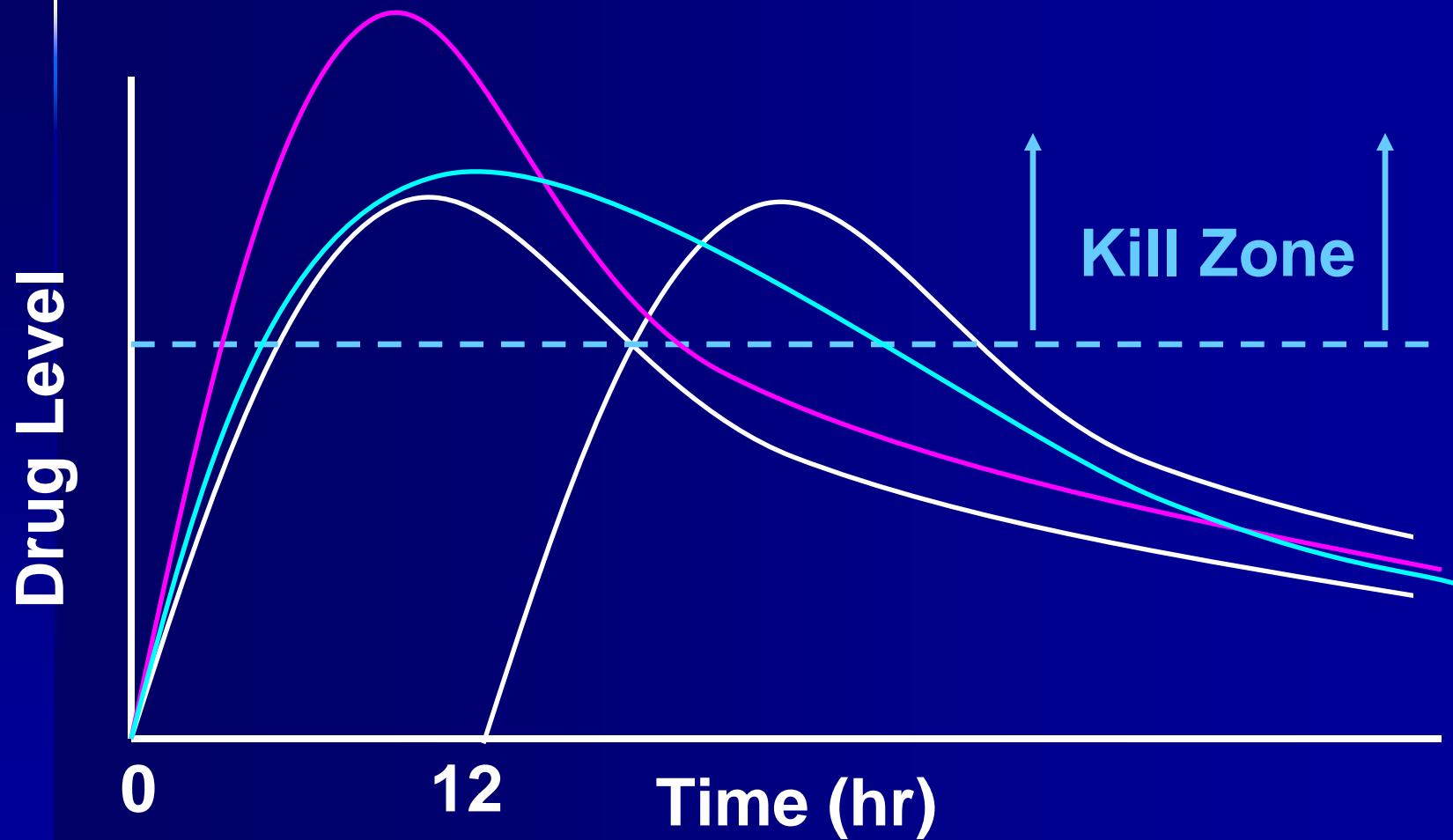
- significant drench bypasses the rumen
- faster drug absorption, shorter duration
- efficacy is reduced



Utilize Host Physiology to Maximize Drug Efficacy

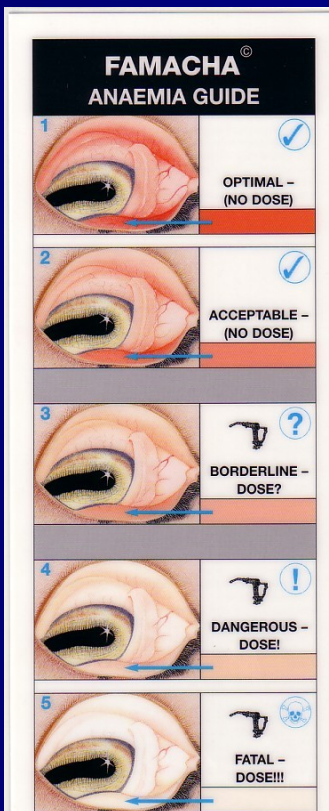
- Once in the rumen, the duration of drug availability is largely dependent on the flow-rate of the digesta
- Decreasing digesta transit leads to an increase in drug availability and efficacy
 - Restrict feed intake for 12 - 24 hours prior to treatment (BZ, IVM)
 - Repeat dose in 12 hours (BZ) or 24 hr (LEV)

Pharmacokinetics of Repeat Dosing And Withholding Feed



Selective Treatment

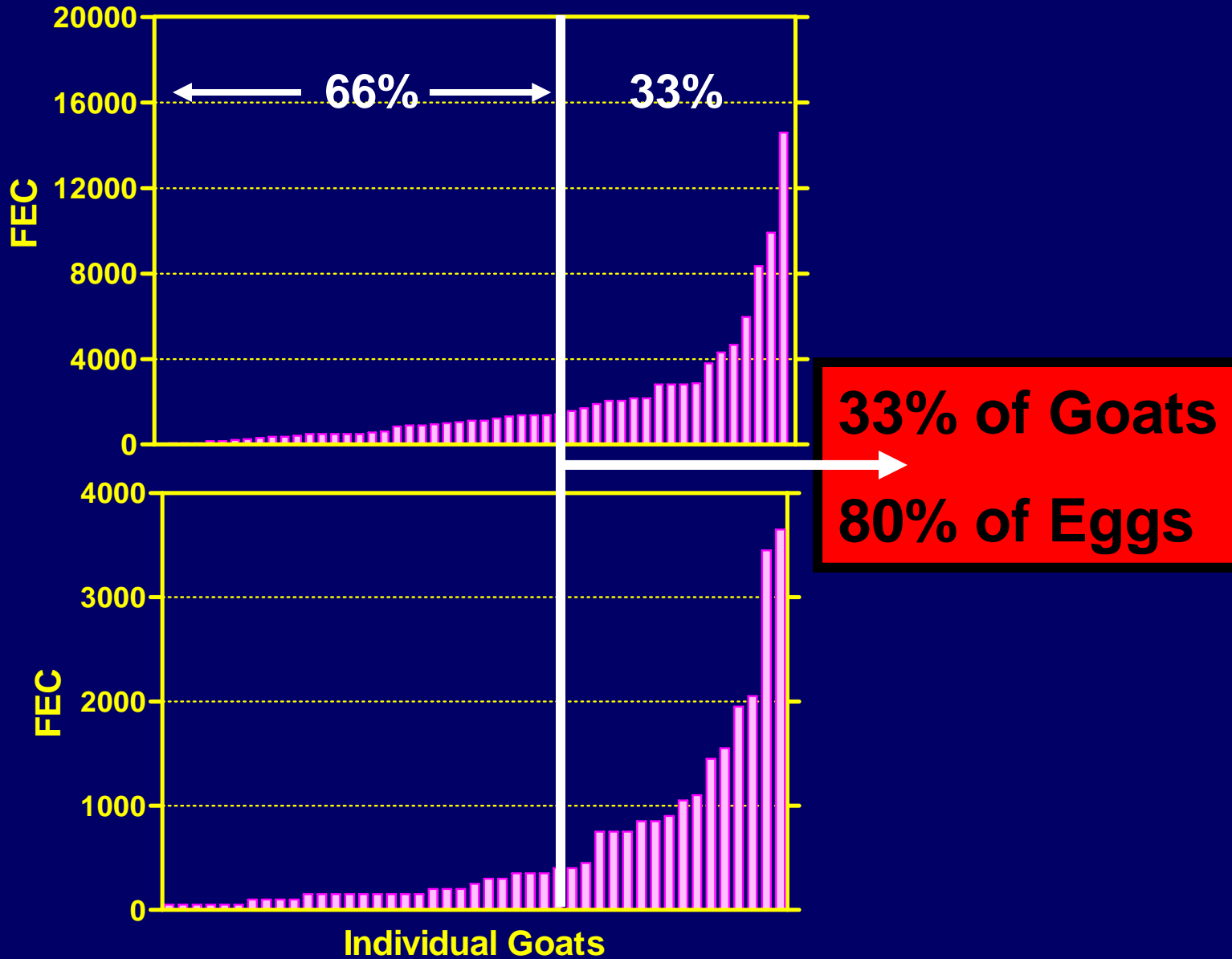
FAMACHA



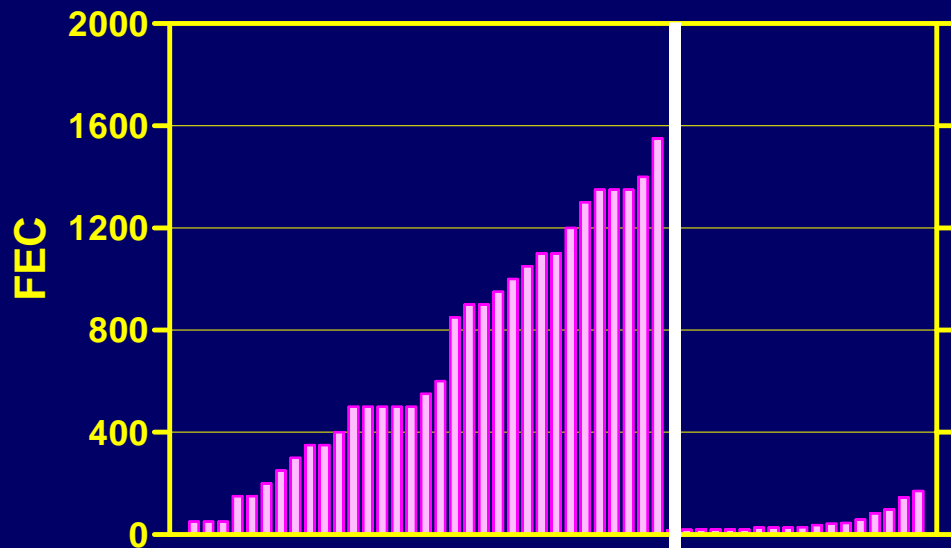
Concept Behind Selective Treatment

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

Distribution of FEC in Goat Herds

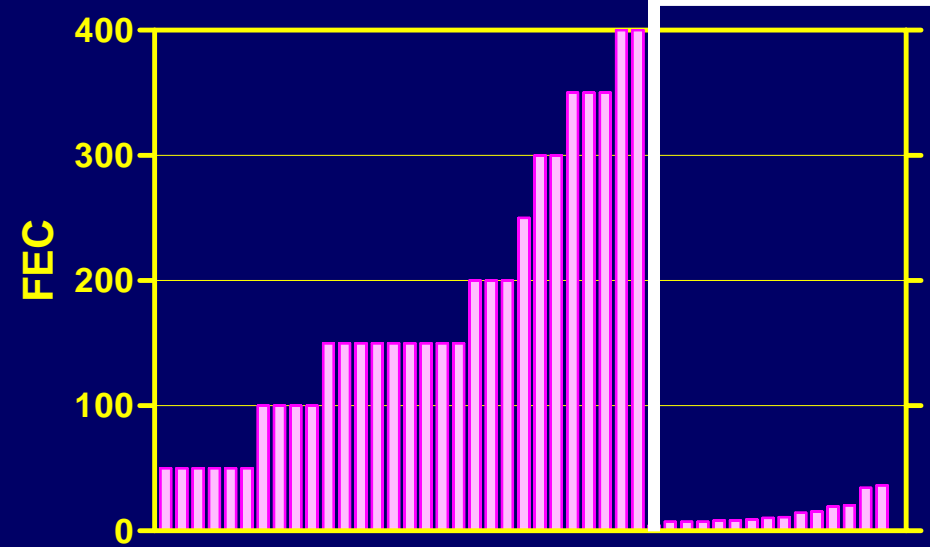


What Happens If We Treat Only the High 33% ???



Treating high 33% with a drug that causes a 99% FECR reduces daily pasture contamination with eggs by 80%

33% of Goats
→
< 5% of Eggs



Following treatment
> 95% of eggs are being shed by untreated goats = REFUGIA

Individual Goats

How Do We Achieve Selective Treatment ???

■ The FAMACHA[©] system

- Novel technique for the assessment of *Haemonchus contortus* and need for Tx
- Developed in response to emergence of severe AR in South Africa
- Method of selective chemotherapy
 - leads to a large reduction in anthelmintic Tx
- Significantly decreases the rate of development of anthelmintic resistance

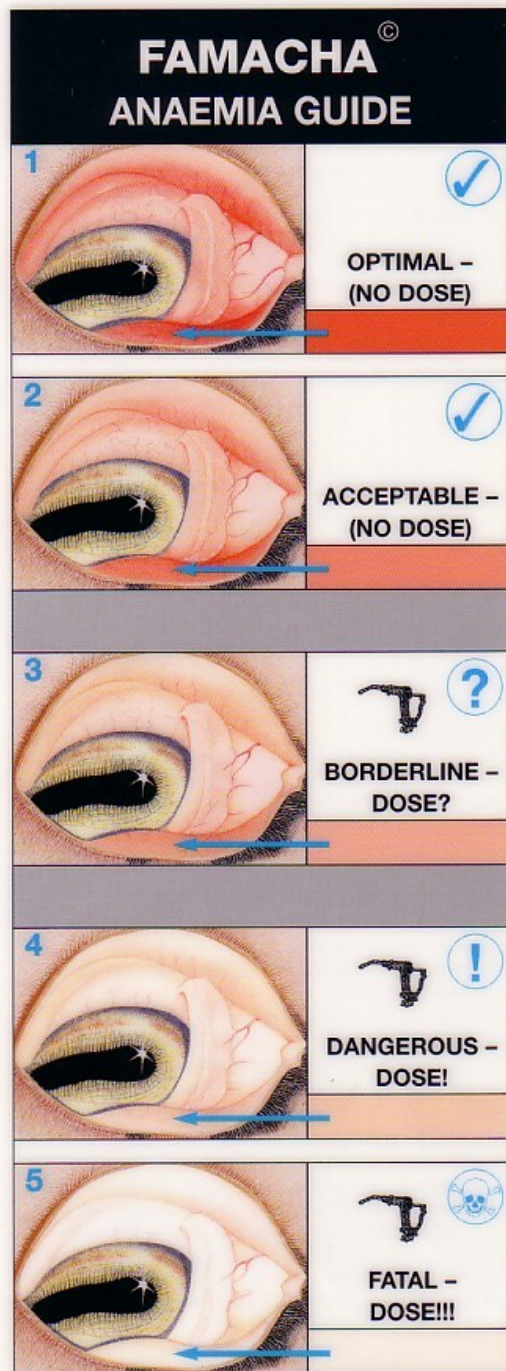
The FAMACHA[©] system

- Named for its originator
 - Dr Francois “Faffa” Malan
 - FAffa MAlan CHArt
- Dr Jan van Wyk, Professor Gareth Bath
- Dr. Adriano Vatta, Dr. Tami Krecek
- Dr. Jørgen Hansen, FAO

How Does FAMACHA Work ???

- Since primary impact of *H. contortus* is anemia, one can indirectly measure parasite burden (and need for treatment) by measuring anemia
- Only useful where *H. contortus* is the primary parasite species

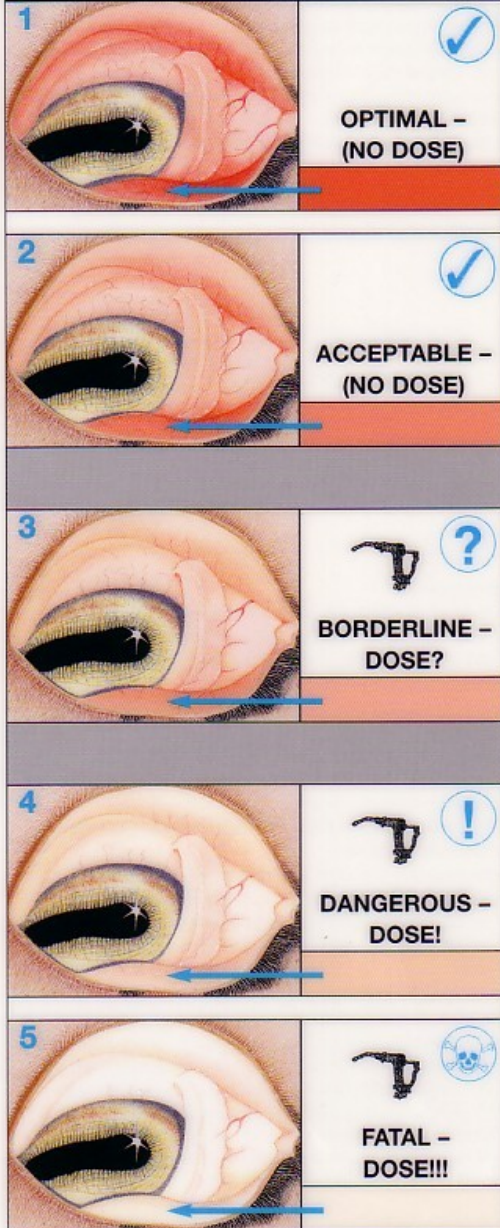




The FAMACHA[®] System

- 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

FAMACHA[®]
ANAEMIA GUIDE



Clinical Category	Color Classification	Hematocrit range (%)
1	Red	≥ 28
2	Red-pink	23 - 27
3	Pink	18 - 22
4	Pink-white	13 - 17
5	White	≤ 12

1) Place gentle downward pressure on eye with upper thumb

3) Read color of eye on mucous membranes of lower eyelid

2) Pull down lower eyelid with other thumb





- Examine in sunlight
- Open as shown - for a short time only
- Look at color inside lower eyelid
- Check both eyes

Keep records !!!!

- Record numbers of animals in each category on the block histogram score sheet provided
 - An easy visual record of situation in herd/flock
- On large farms animals can be tagged in a variety of ways

FAMACHA ANEMIA RECORD

Group ID: _____

Category						Totals				
	1	2	3	4	5	1	2	3	4	5
Date: Treatment:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Date: Treatment:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Date: Treatment:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Date: Treatment:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Date: Treatment:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					

● Counted

✓ Counted and Treated

✗ Bottle Jaw - Treated

FAMACHA ANEMIA RECORD

Group ID: _____

Category						Totals				
	1	2	3	4	5	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:										

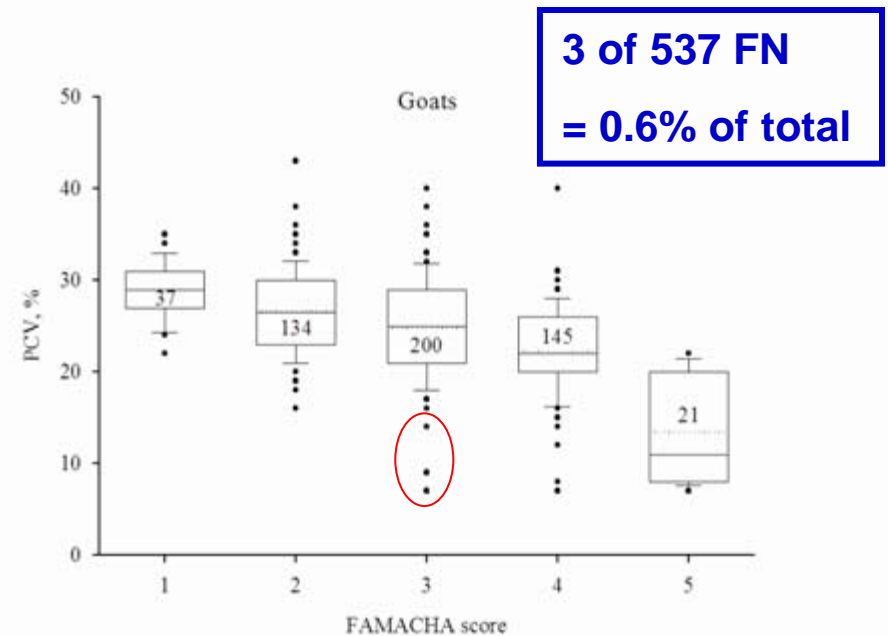
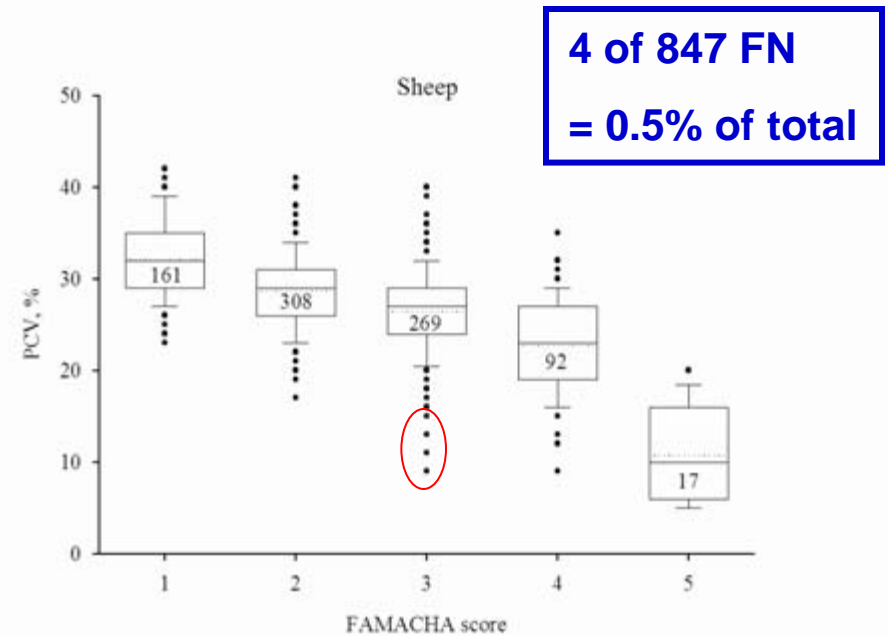
● Counted

✓ Counted and Treated

✗ Bottle Jaw - Treated

Validation of FAMACHA[®]

- 847 sheep
- 537 goats
- On 39 farms
- False Negative =
 - 1, 2, or 3 and PCV ≤ 15
- No false negatives if all 3s are treated



General Treatment Guidelines When Using FAMACHA

- Treat goats and sheep in categories 4 and 5 with an effective anthelmintic
- If in doubt, score at paler category
- Do not use in isolation – use FECs, rotational grazing, strategic or tactical treatments

Integrating the FAMACHA[©] System

- If there are none in categories 4 or 5, then safe
- Re-examine two weeks later if in *Haemonchus* "season"
- In dry or cool times of year every 4 -6 weeks may be sufficient
 - Gain experience
 - Be careful

Integrating the FAMACHA[®] System

- If there are < 10% in categories 4 or 5, then safe but remember to treat categories 4 and 5
- Re-examine two weeks later

Integrating the FAMACHA[®] System

- If >10% of flock/herd in categories 4 and 5, consider treating 3s as well
- Change pastures if possible
 - Do not treat all animals before move if to a safe pasture – “move then treat”
- Consider checking more frequently
 - 1X per week

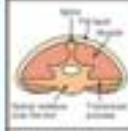




Recommended To Treat 3s When:

- >10% of herd or flock is in categories 4 or 5
- Young animals
- Ewes/does around the time of lambing/kidding
- Thin poorly conditioned animals
- If down to 1 effective drug, consider using less effective drugs in these animals

Integrating the FAMACHA[®] System

- 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
- Do BCS

Condition Scoring in Sheep

Spines	Individually clearly felt, sharp, obvious	Form a smooth line with deep indentations	Only slightly detectable indentations	Only detectable with firm pressure	Not detectable
Transverse processes	Fingers easily pass underneath	Smooth round edges	Well covered, have to push firmly to get finger's underneath	Cannot be felt at all	
Muscle	Very little Concave	Concave	Not concave Not convex	Maximally developed Convex	
Fat layer	No	Very thin	Moderate	Thick	Very thick to form a lip along top median
					
Condition score	1	2	3	4	5

Description:

- The condition scoring is performed over the lower back area.
- Cases which do not fit these categories properly i.e. fall between whole numbers, can be assigned half scores eg. 1.5, 2.5 etc.
- This scheme may be used in goats, but half a score is added to the score, since goats preferentially store fat intra-abdominally and not over the lower back.

ARC • LNR
University of Pretoria

Other Advantages of Selective Treatment (FAMACHA)

- Identify animals that need treatment most often
 - These are the ones contaminating the pasture for others in the herd/flock
 - Cull these and improve genetics of resistance of the herd/flock
 - Resistance/resilience to parasites is moderately heritable (0.3 – 0.4)
- Animals handled more frequently
 - Become tamer
 - Other health problems recognized earlier

Precautions

- Paleness or reddening of the eyes may have other causes
 - Other causes of anemia:
 - Other parasites
 - Nutritional deficiencies
 - Other diseases
 - Other causes of redness:
 - Environmental conditions
 - Other diseases
 - Infectious eye diseases

Precautions

- Only properly trained persons should apply the FAMACHA[©] system
- The card is an **AID** in the control of *Haemonchus* **ONLY**
- The system is best used by producers where back-up assistance is available from a veterinarian

Precautions

- FAMACHA is part of a total worm control program – not a replacement
 - Maintain integrated management-based worm control measures
- Lambs/kids and pregnant or lactating ewes/does need special attention
- **Replace card after 12 months' use**
 - Cards fade but you will not notice
 - Have new card to compare against – replace when needed always keeping a spare

Precautions



- System Sounds Simple
- If used improperly death of animals is a possibility
 - Cannot be used in a vacuum
 - Must take other factors into consideration in making treatment decisions
 - Must know if anthelmintic used is effective

Where Do I Get FAMACHA Cards ???

- By request of Professor Bath in South Africa, only properly trained lay individuals can purchase the cards
 - Training Workshop
- Through a veterinarian
 - Vets expected to train themselves before training others
- Through animal scientists and extension agents who have received training
- Information at famacha@vet.uga.edu

For More Information On Nematode Parasite Control in Small Ruminants:

- Smart Drenching
- Novel Approaches
- FAMACHA

- See www.scsrpc.org

Acknowledgement

- Dr. Adriano Vatta
- Onderstepoort Veterinary Institute, Pretoria, South Africa



Questions ???

