Parasite Management

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AGRICULTURE, NATURAL RESOURCES AND EXTENSION

University of Alaska Fairbanks

Hour 1

IPM project

Why parasite management is important

Hour 2

Parasites

Dewormers

Resistance

Hour 3

Management practices

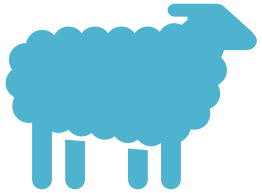
Troubleshooting

United States Department of Agriculture
National Institute of Food and Agriculture

Alaska Agricultural Pest Project

Integrated Pest Management (IPM) Grant

Questions we want to answer



Are parasites a major problem in Alaska?

What parasites are here?

What is the worm burden in the animals?

Is there resistance to dewormers?

How are producers making decisions regarding parasite management?

Why do we care about internal parasites??

Small ruminants are much **more susceptible** to intestinal parasites than other farm animals

Resistance to current anthelmintics (dewormers) has hindered our ability to treat the problem

Development of new anthelmintics is **unlikely** due to cost

- $200 million to develop, test, and release new drug

Economic losses to producers

- Loss of milk
- Decreased rate of gain
- Poor fiber
- Death

What we know

Adequate pasture

+

Low stocking rate

=

Healthy animals

+

Minimal parasite issues

How do parasites become a problem?

Traditional Deworming Strategy

Spring

Fall

Why traditional deworming doesn't work

Dewormer doesn't always match the parasites on the farm

Twice a year deworming will never solve the problem

- Allows for pastures to accumulate large numbers of parasite larvae

    - It's not a deficiency of dewormer
    - It's not even a primary animal problem
    - IT IS A PASTURE PROBLEM

The life cycle of the average parasite

21 DAYS UNTIL PROBLEM BEGINS….

Review of Common Nematode Biology

In the feces

Eggs

L1

free - living microbivorous

L2

free - living microbivorous

In the Environment

L3

Infective form
Encased in sheath or “cuticle”

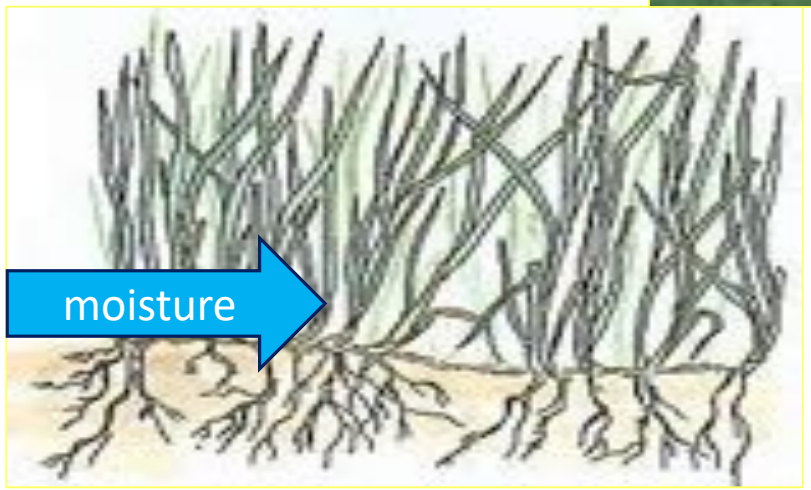
Infective to animals:
3rd Stage Larvae, or L3s

L3s cannot take in nutrients or water...

they "carry their rations" within in their cuticle

Dryness, direct sunlight can be toxic to L3s because it forces expenditure of stored water and nutrients

Where do L3s survive?



Review of Common Nematode Biology

Eggs

L1

free - living microbivorous

L2

free - living microbivorous

L3

Infective form
Encased in sheath or "cuticle"

Ingested by animal

Fecal – oral contact

L4

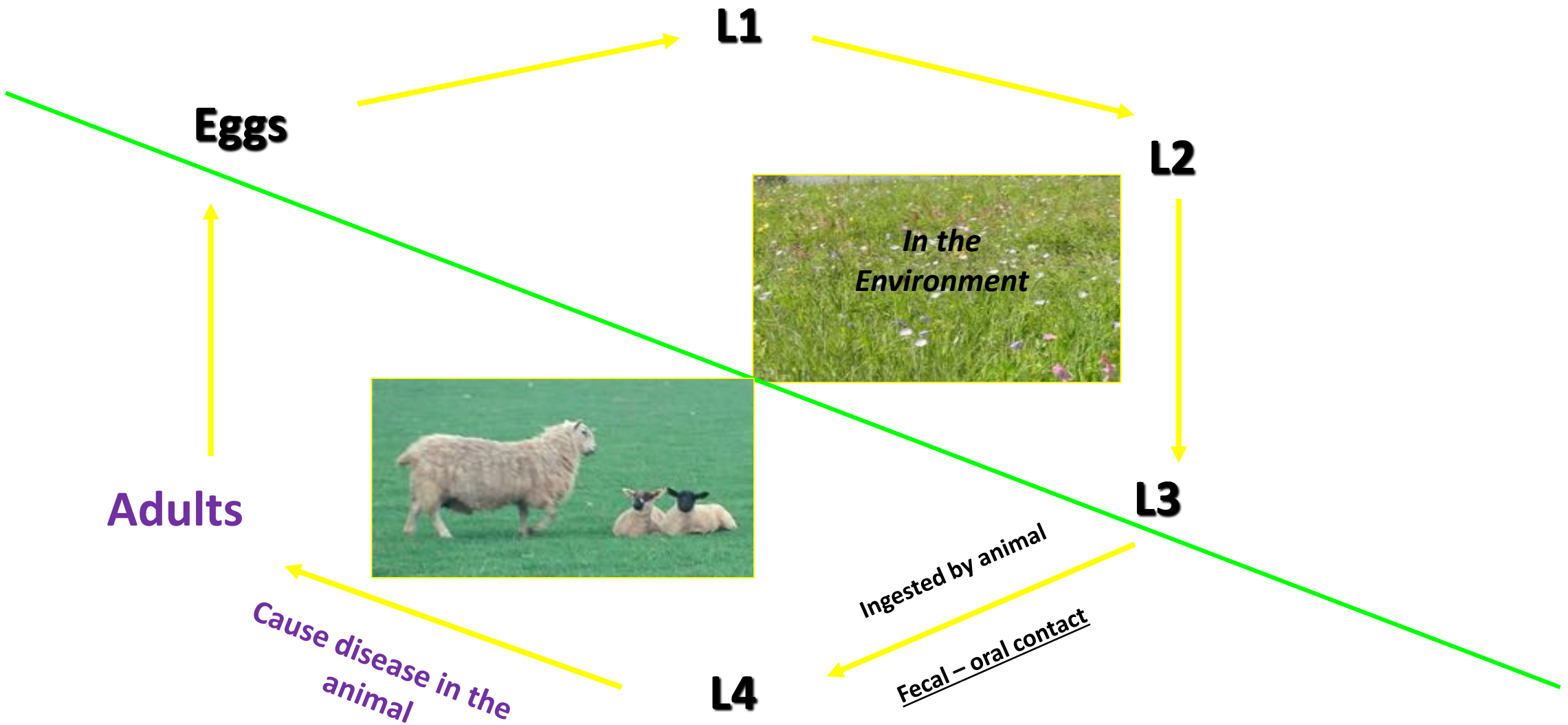
Certain species can undergo *hypobiosis*

Hypobiosis

L4s undergo arrested development (hibernation) inside the host

Allows larvae to reside in arrested state within host during times of hostile environmental conditions

21 days to complete cycle



Once parasites become established in a population, 90% of the parasite biomass is in the environment, and only 10% is in the animals.

PASTURE MANAGEMENT

L1

Eggs

L2

90%

L3

Adults

10%

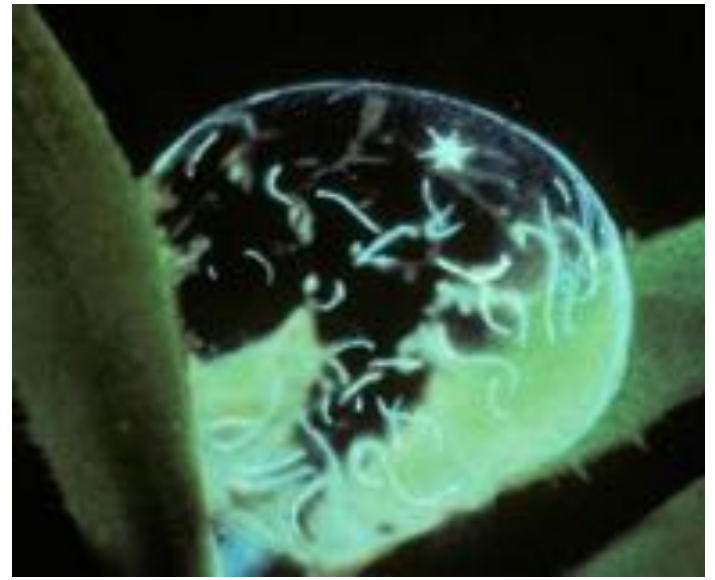
L4

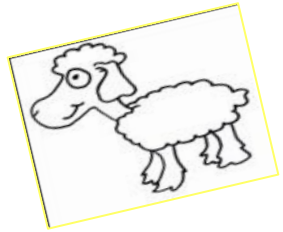
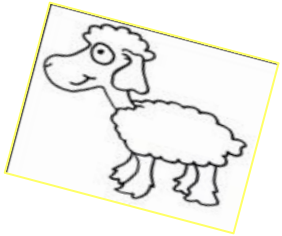
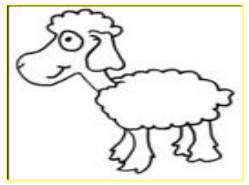
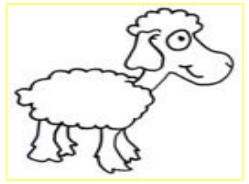
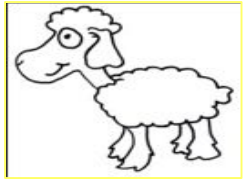
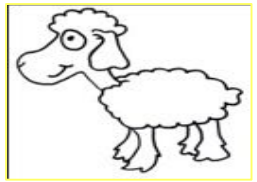
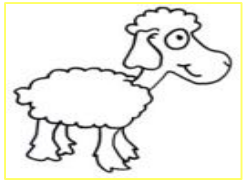
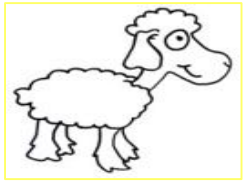
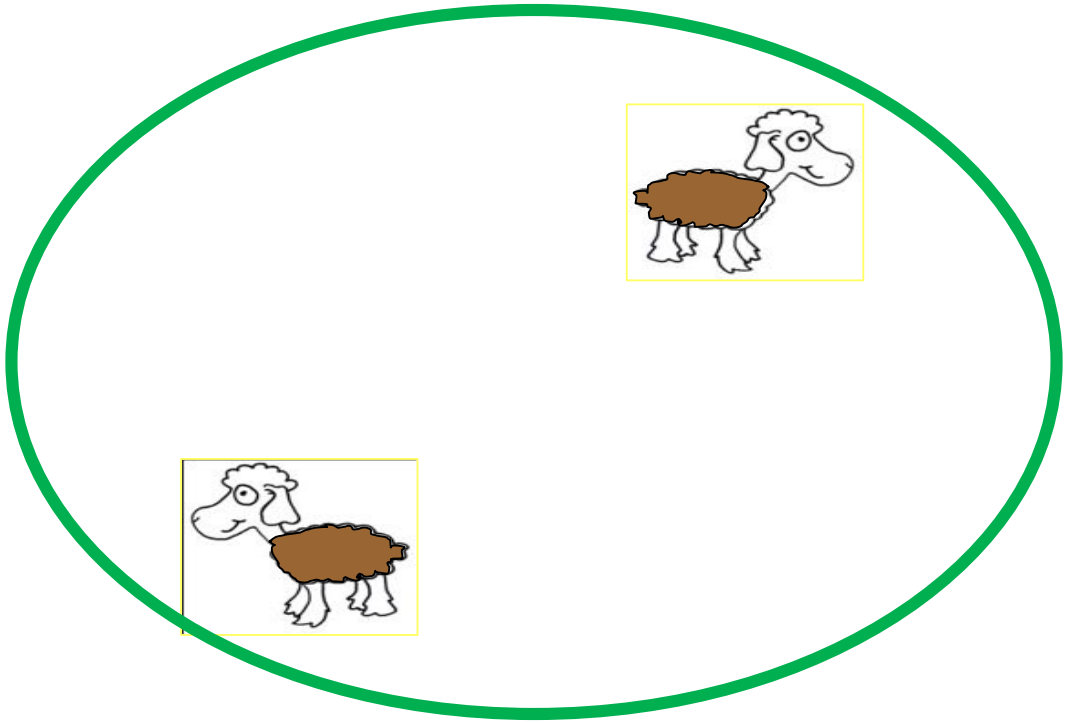
MEDICATIONS

It’s all about percentages…

90% of the problem is in the pasture, 10% of the problem is in the animal

20% of the animals carry 80% of the worms!



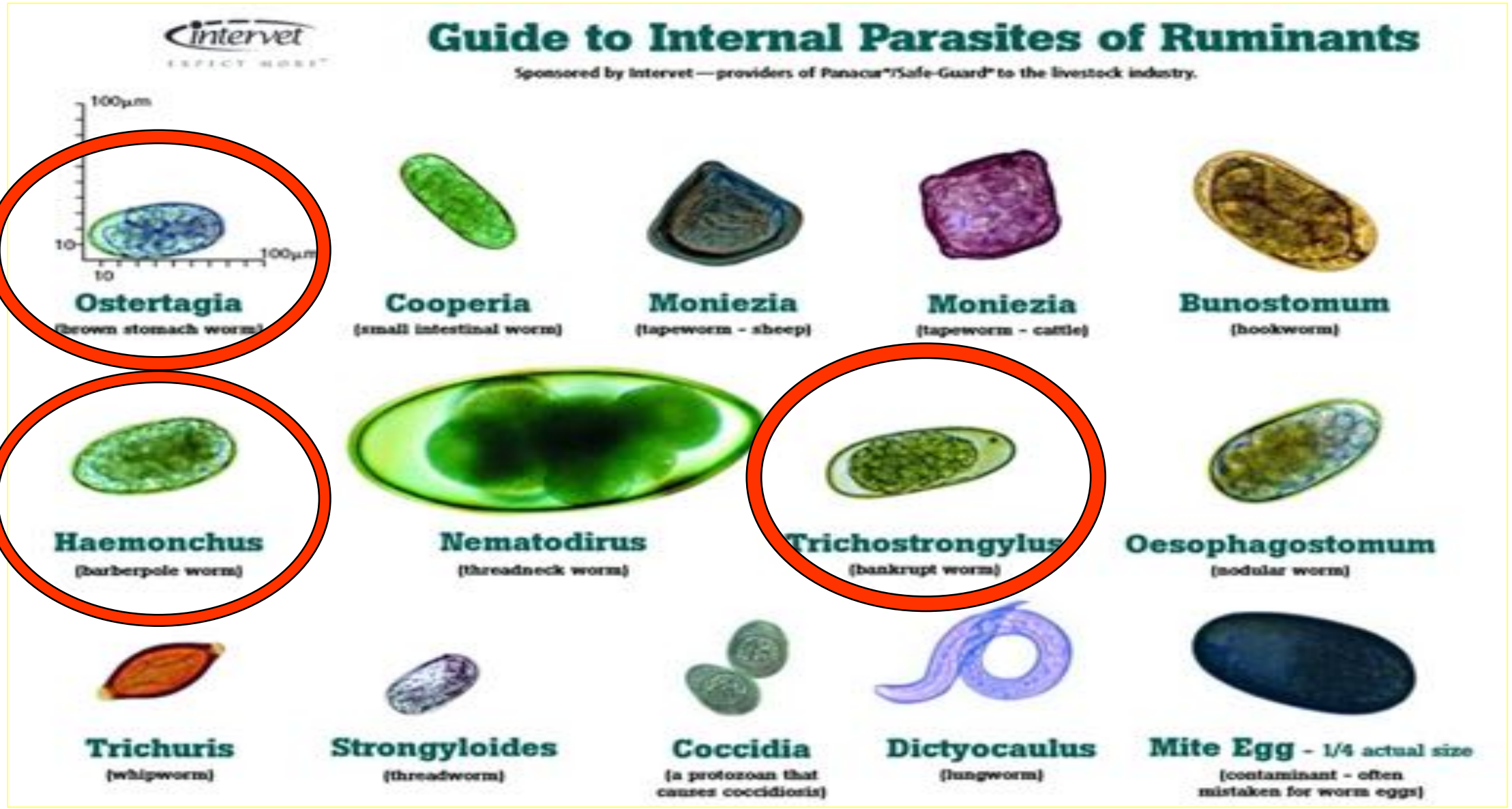










Have most (80%) of the parasites.
Most likely to develop clinical signs.

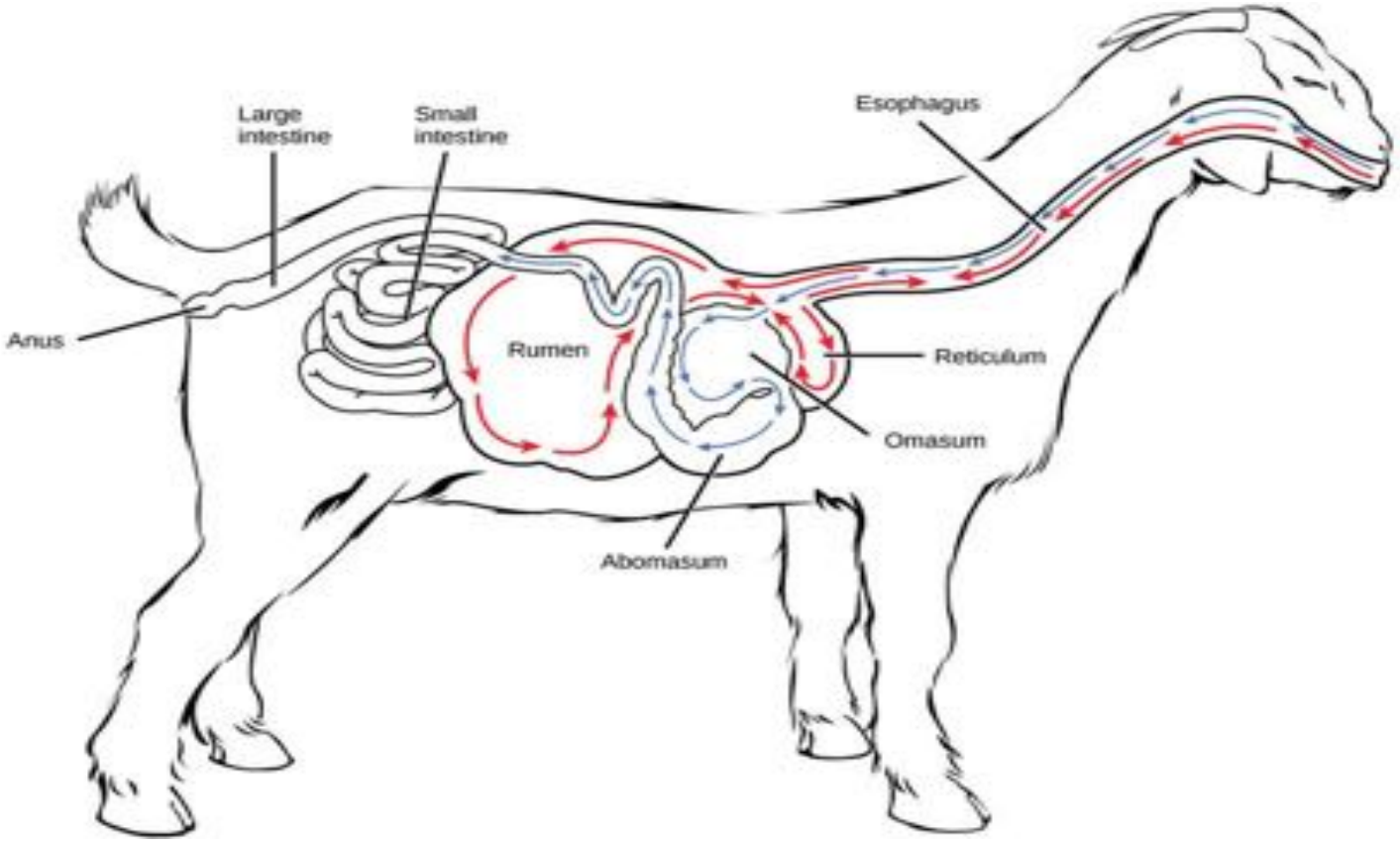
THE ENEMY

STOMACH WORMS AND INTESTINAL WORMS

Lots Of Parasites



Stomach Worms - Abomasum



Haemonchus contortus

“Barber Pole Worm”

Clinical signs

- Weight loss
- Severe anemia
- Protein loss

Very prolific

Produces approximately 5000 eggs per day!!

Do the math!!

Average worm shedding 5000 eggs per day

x

Average animal harboring 300 worms

=

1.5 million eggs per day per animal

So…100 goats can produce

1 Billion eggs per week!!

Fecal Egg Count (eggs/gram)	Estimated Worm Number	Estimated Blood Loss
100	20	1 ml
500	100	5 ml
1000	200	10 ml
2000	400	20 ml
3000	600	30 ml
5000	1000	50 ml

Ostertagia/ Teladorsagia

"Brown Stomach Worm"

Ostertagia/ Teladorsagia "Brown Stomach Worm"

Type 1

- Classic form of disease
- Young animals on pasture for first time

Type 2

- Yearlings as a result of larvae that were ingested in previous season
- Larvae underwent hypobiosis
- Resumed development in following year results in clinical signs

Destroys gastric glands

Disrupts HCl acid secretion

Clinical igns

- Weight loss
- Diarrhea

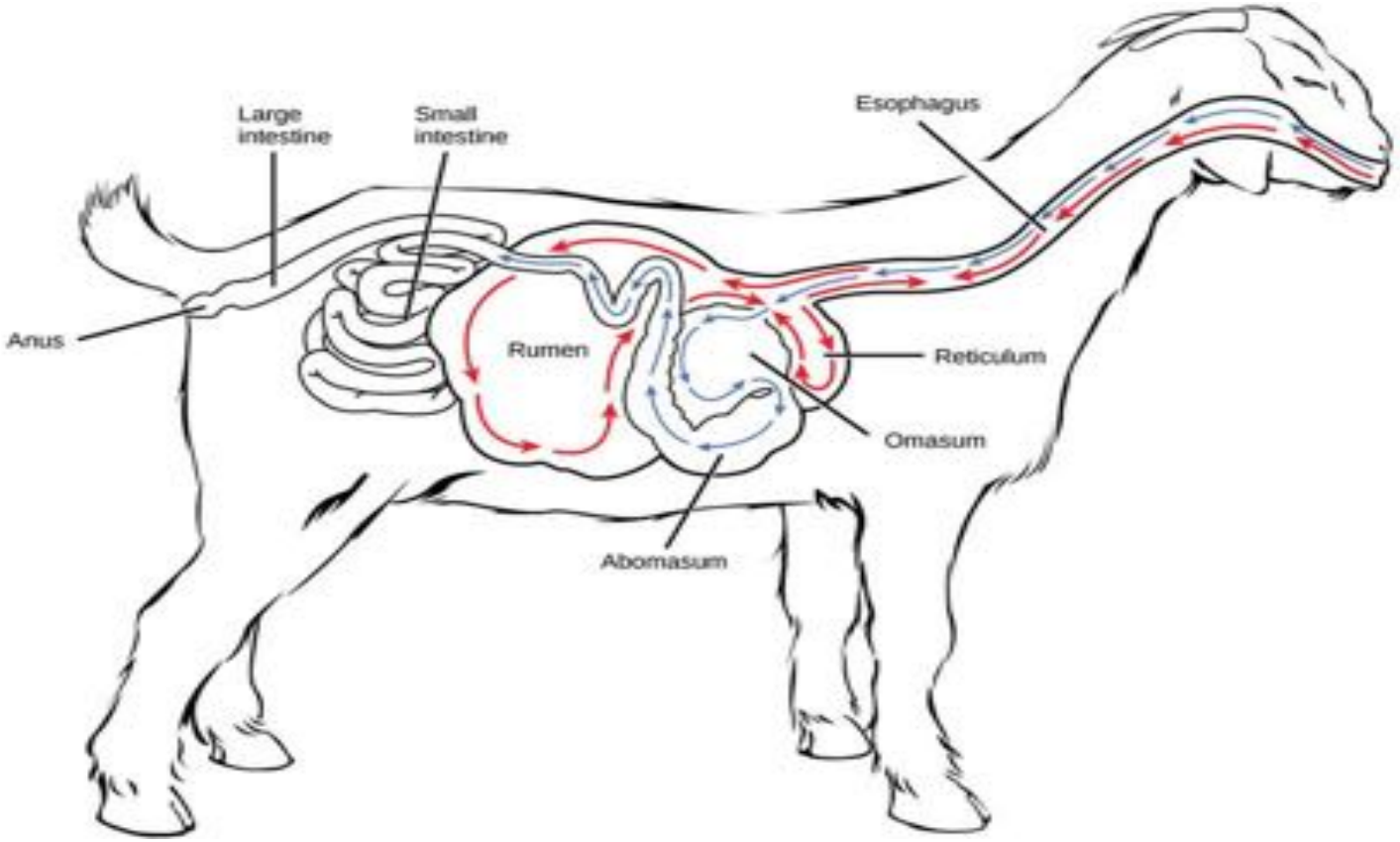
Trichostrongylus

“Bankrupt worm”

Clinical signs:

- Diarrhea
- Bottle jaw
- Emaciation in stressed animals

Intestinal Worms – Small Intestine



Strongyloides

“Threadworm”

Has free living form outside of body

Larvae penetrate skin between toes

- Produces scald lesion in some animals

Clinical signs

- Diarrhea
- Can act like foot rot

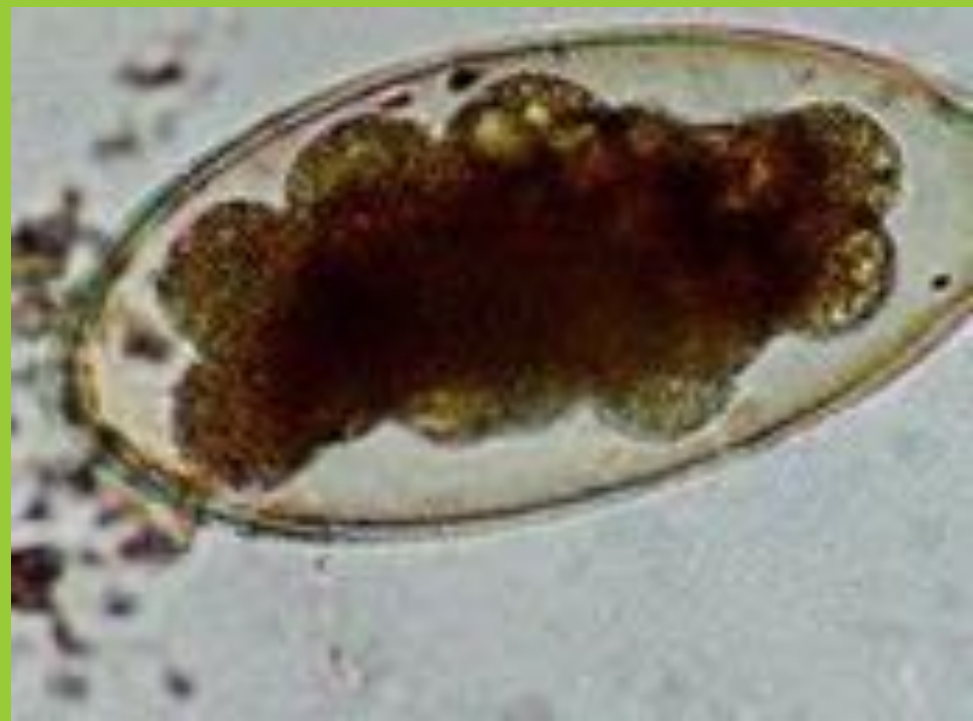
Nematodirus

Becoming a problem in herds that overuse Ivermectin products

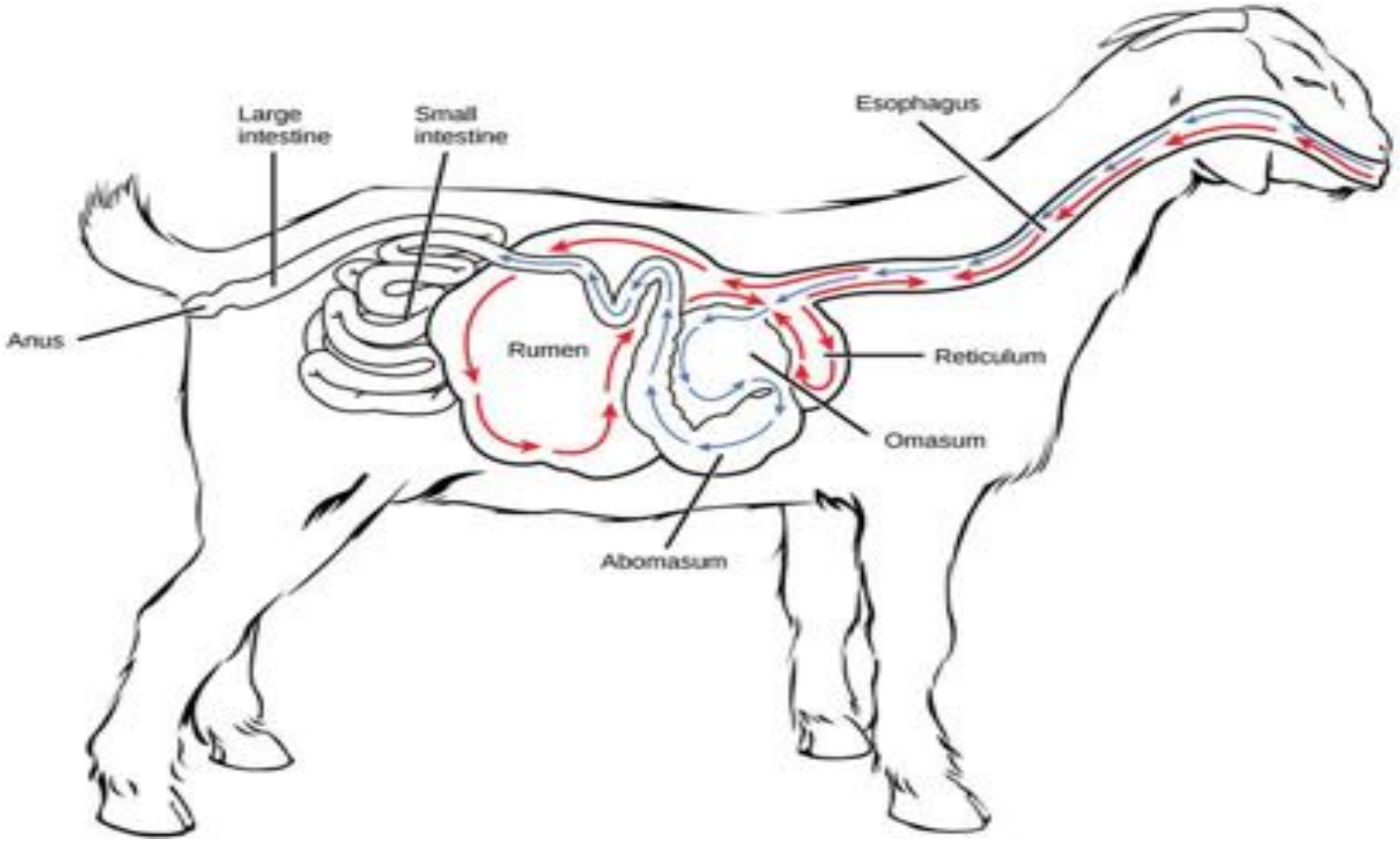
Clinical signs

- Diarrhea
- Can be fatal in neonates

Not prolific egg producers; few eggs on fecal is significant



Intestinal Worms – Large Intestine/ Cecum



Trichuris
“Whipworm”

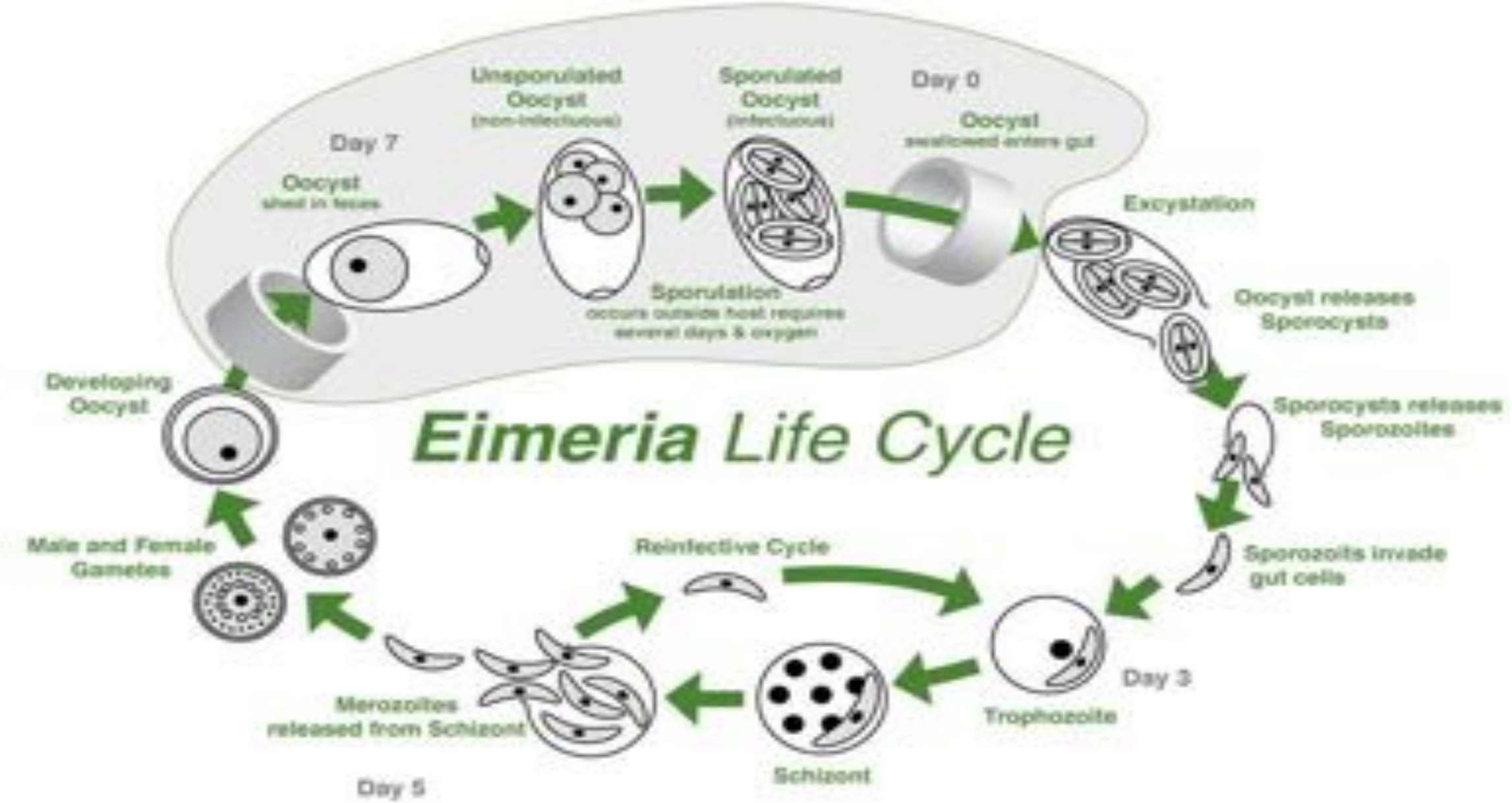
Live in cecum

Eggs are very resistant to winter freeze

Long pre-patent period
- 60 days

Clinical signs
- Loose stool
- Hemorrhage in feces

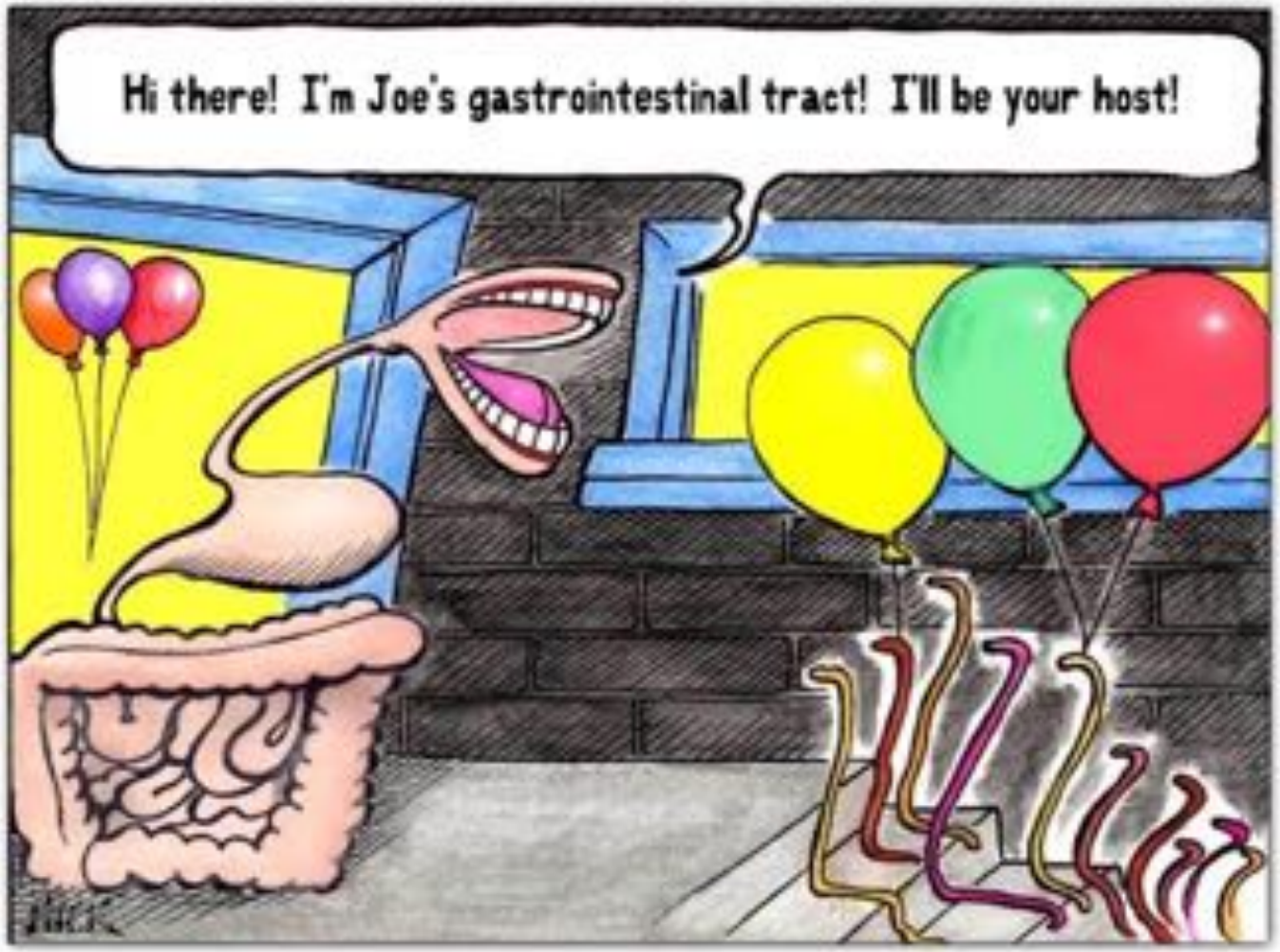
COCCIDIA…protozoa, not a worm
Traditional anthelmintics WON’T treat it!


Unsporulated Oocyst
(non-infectious)
Sporulated Oocyst
(infectious)
Day 0
Oocyst
swallowed enters gut
Day 7
Oocyst
shed in feces
Excystation
Sporulation
occurs outside host requires
several days & oxygen
Oocyst releases Sporocysts
Developing Oocyst
Sporocysts releases Sporozoites
Eimeria Life Cycle
Male and Female Gametes
Reinfective Cycle
Sporozoits invade gut cells
Merozoites released from Schizont
Day 3
Trophozoite
Schizont
Day 5

The Army

You must not fight too often with one enemy, or you will teach him all your tricks of war.

Napoleon Bonaparte



Great tapeworm parties

Anthelmintic = Dewormer

We don’t “worm” animals, we “deworm” them.

Giving an animal worms is just mean ☺

New thoughts on anthelmintics…

PRECIOUS RESOURCE

Once resistance emerges in a nematode population, it is permanent!

LEGALITIES OF DRUGS

FDA has very specific rules regarding use of drugs in food animals!

Follow the label!!

Drug must be labelled for the type of animal and specifically how it is to be used

OWNER: legally has to use drug exactly as written on label

- FDA violations are liability of OWNER

VET: can make decisions for “extra-label” use…

- 1. MUST establish new withdrawal time
- 2. MUST have valid VCPR (veterinarian/client/patient relationship)

Food Animal Residue Avoidance Databank : www.farad.org

Anthelmintic Classes

Paralyze or starve worm, leading to death

Benzimidazoles

- Albendazole (Valbazen)
- Fenbendazole (Panacur, Safe-guard)
- Oxfendazole (Synanthic)

Cholinergic Inhibitors

- Levamisole (Tramisol, Prohibit)
- Morantel (Rumatel, Positive Pellet)
- Pyrantel

Macrocyclic Lactones

- Doramectin (Dectomax)
- Ivermectin (Ivomec)
- Moxidectin (Cydectin)

Benzimidazoles

"White Dewormers"

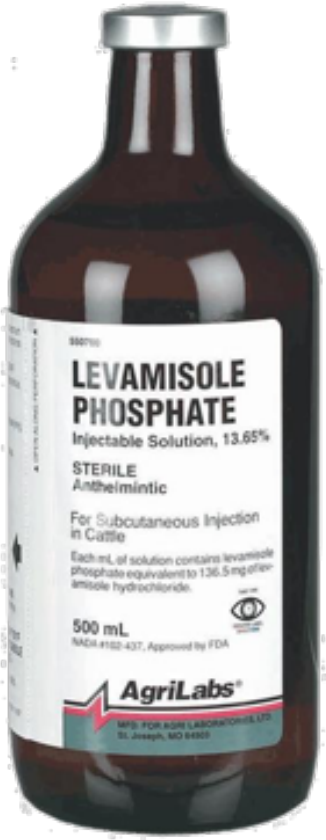
Kills eggs, larvae, adult worms

Some will get hypobiotic larvae

Lots of resistance in some herds

NO Valbezen in early pregnancy!

Cholinergic Inhibitors - Imidazothiazoles



Only gets adult worms

CAN EASILY OVERDOSE!!

Know the animal's weight

If you don't use it for a few years, can become effective on your farm again…for a while.

Macrocyclic Lactones - Avermectins

Kills adult worms, hypobiotic larvae

Can treat sucking lice

LOTS of resistance!!

Pour-ons don’t work

Injectable not effective in small ruminants

Internal Parasite Control - Approved

	Sheep	Goat
Panacur/SafeGuard	N	Y
Valbazen	Y	Y
Levamisole	Y	N
Morantel	N	Y
Ivomec	Y	N
Dectomax	N	N
Cydectin	Y	N
Deccox	Y	Y

Best way to administer

Oral Drench	Medicated Pellet	Injectable	Pour-On
✸FDA-approved ✸Most effective ? ✸Shorter withdrawal ✸Easier to administer ✸Safer 	✸FDA-approved ✸Easy to administer ✸Sick animal won't eat ✸Accurate dosage??? 	✸**Not** FDA-approved ✸Stays in system longer, accelerating drug resistance ✸Longer withdrawal ✸Potential for abscesses 	✸**Not** FDA-approved ✸**Not** formulated for sheep and goats ✸Accelerates drug resistance 

Oral Paste/Gel

- **Not** FDA-approved
- Hard to calibrate
- Hard to administer over tongue
- Most expensive

Choose . . .
1- Sheep/Goat Products
2- Cattle Products
3- Horse Products

Adjust cattle dose for small ruminants!

Copper Oxide Wire Particles (COWP)

Only works on Haemonchus

Wire particles attach to abomasal mucosa – acid slowly dissolves

Makes abomasum not favorable for worm to live?

Can cause Cu toxicity in sheep

Natural “anthelmintics”

Diatomaceous earth
- Good for external, NOT internal!

Garlic

Tobacco

Others

So far, efficacy of natural “anthelmintics” has not been proven under controlled, scientific experimentation. Experiments are continuing.

TREAT THE INDIVIDUAL…

OR THE ENTIRE GROUP?

Mass Treatment – Entire Group

Prior to parturition

Young animals at 1-3 months of age

Young females prior to breeding

Why are young animals more susceptible??

Periparturient rise in egg shedding in spring

- Dam's immune system inhibited for several weeks around the time of parturition

Hypobiosis ends in spring

- Larvae mature in host and start shedding eggs

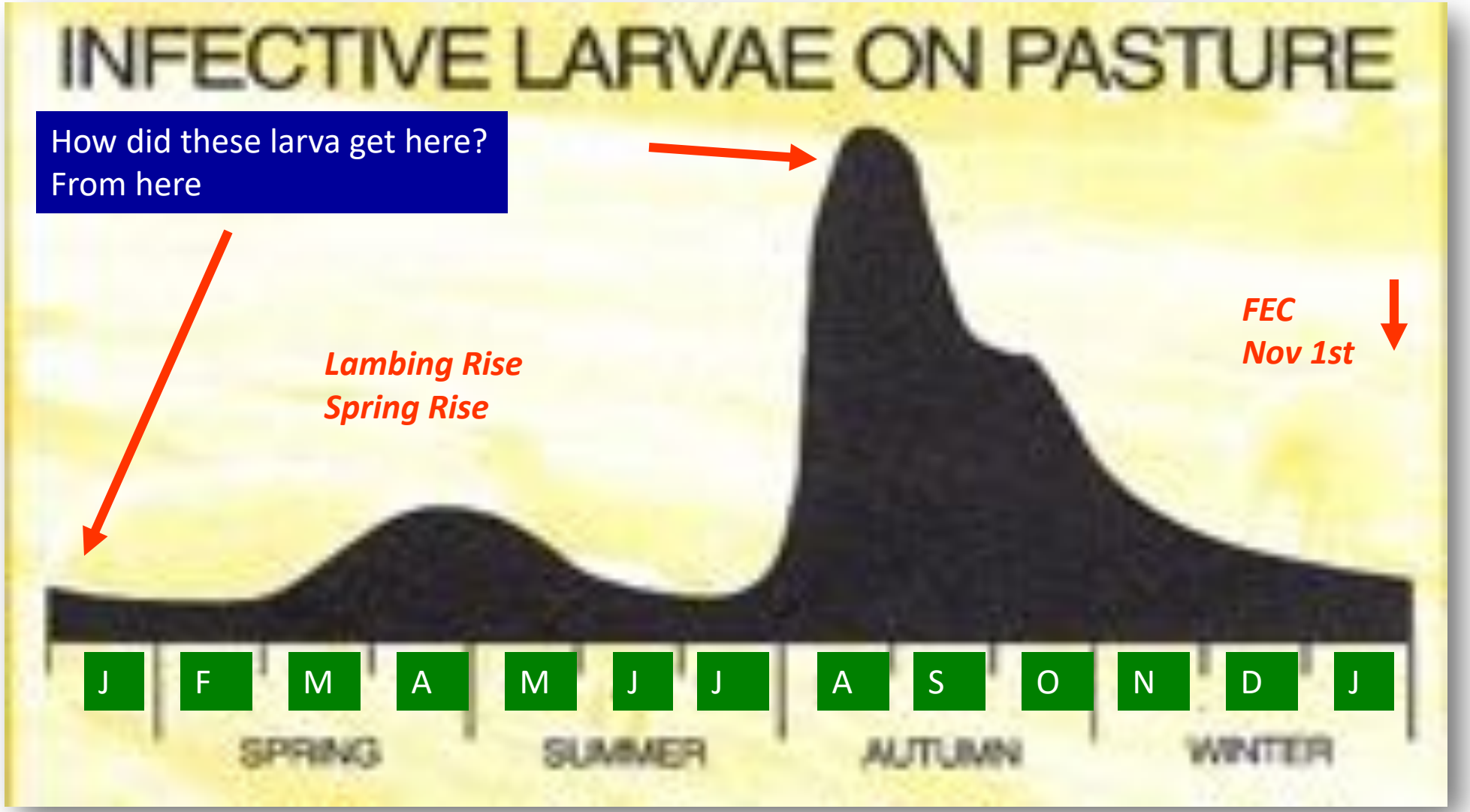
Pastures that were affected last year contribute to egg access

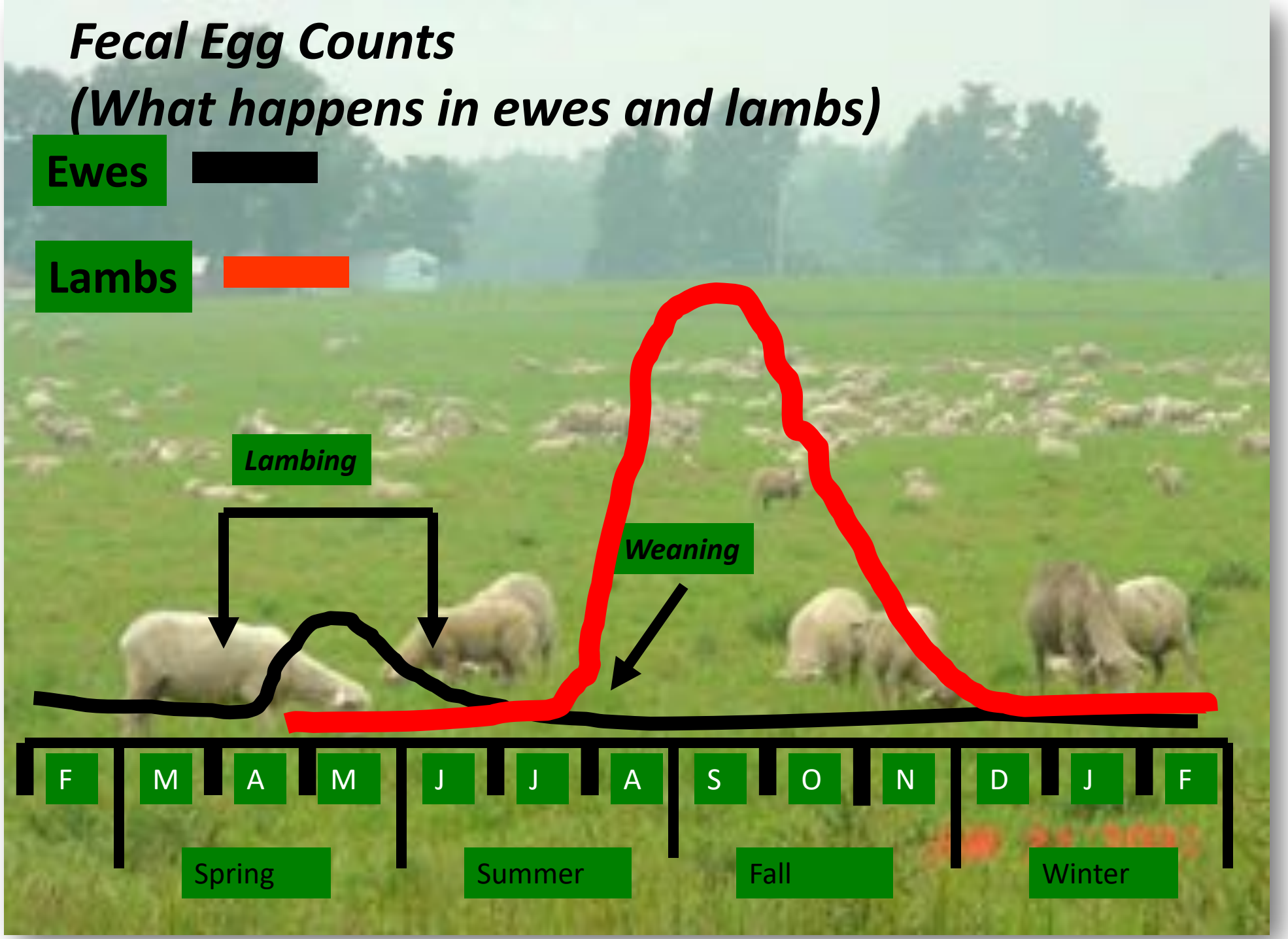
Neonates have no host immunity

- Must be exposed to parasites in first year

When Are Larva On Pasture A Problem?
Why & How Do Seasonal Increases Occur?

(If No Treatment)




Fecal Egg Counts
(What happens in ewes and lambs)
Ewes
Lambs
Lambing
Weaning
F
M
A
M
J
J
A
S
O
N
D
J
F
Spring
Summer
Fall
Winter

What if we don’t want to treat the entire herd/flock?

Targeted Anthelmintic Treatment

Unrestricted use of dewormers can lead to resistance in the parasites

The parasite resistance is permanent!

And remember…there are not many dewormers on the market…and no hope for any new products in the near future

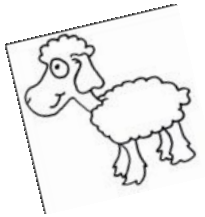
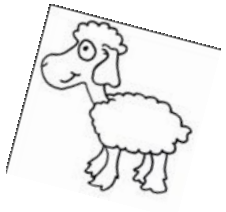
So, we need to be cautious with dewormers

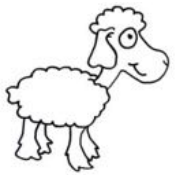
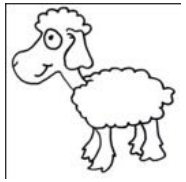
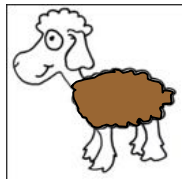
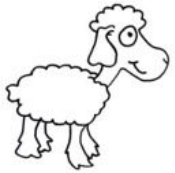
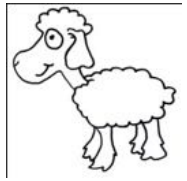
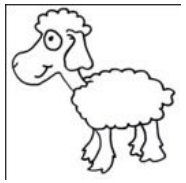
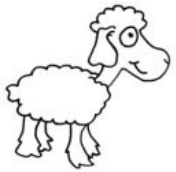
OK, where resistance is problematic, who should be treated?

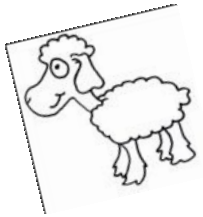
80-20 rule

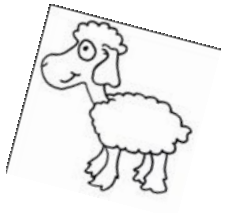
Of the parasites *in the animals*, 80% of these parasites are harbored by 20% of the animals

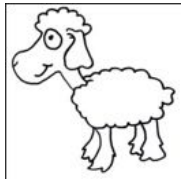
….most of the parasites are shed from a minority of the animals

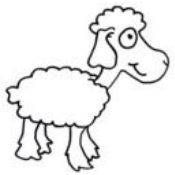



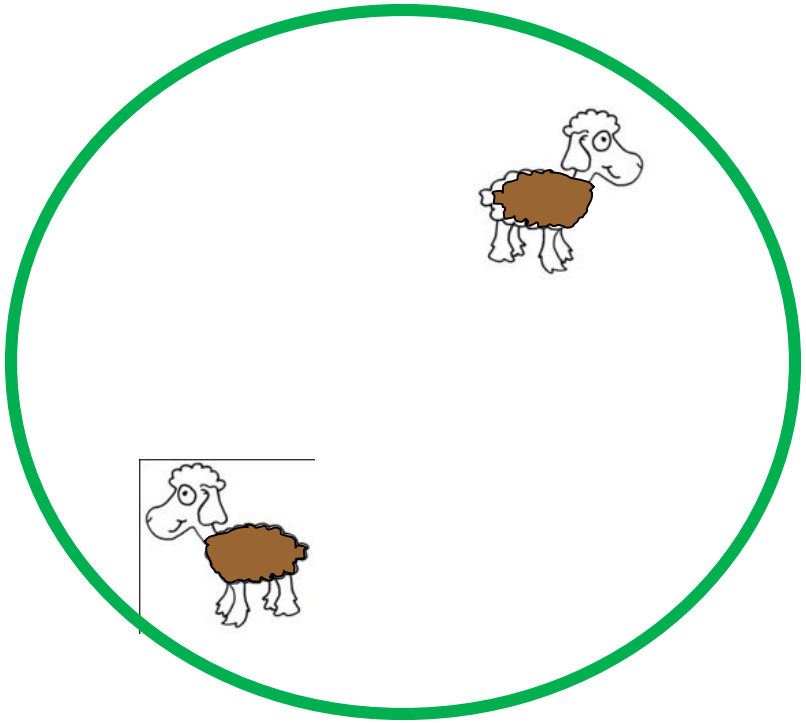










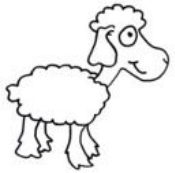


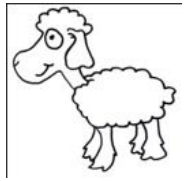


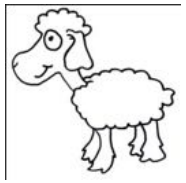


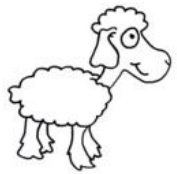


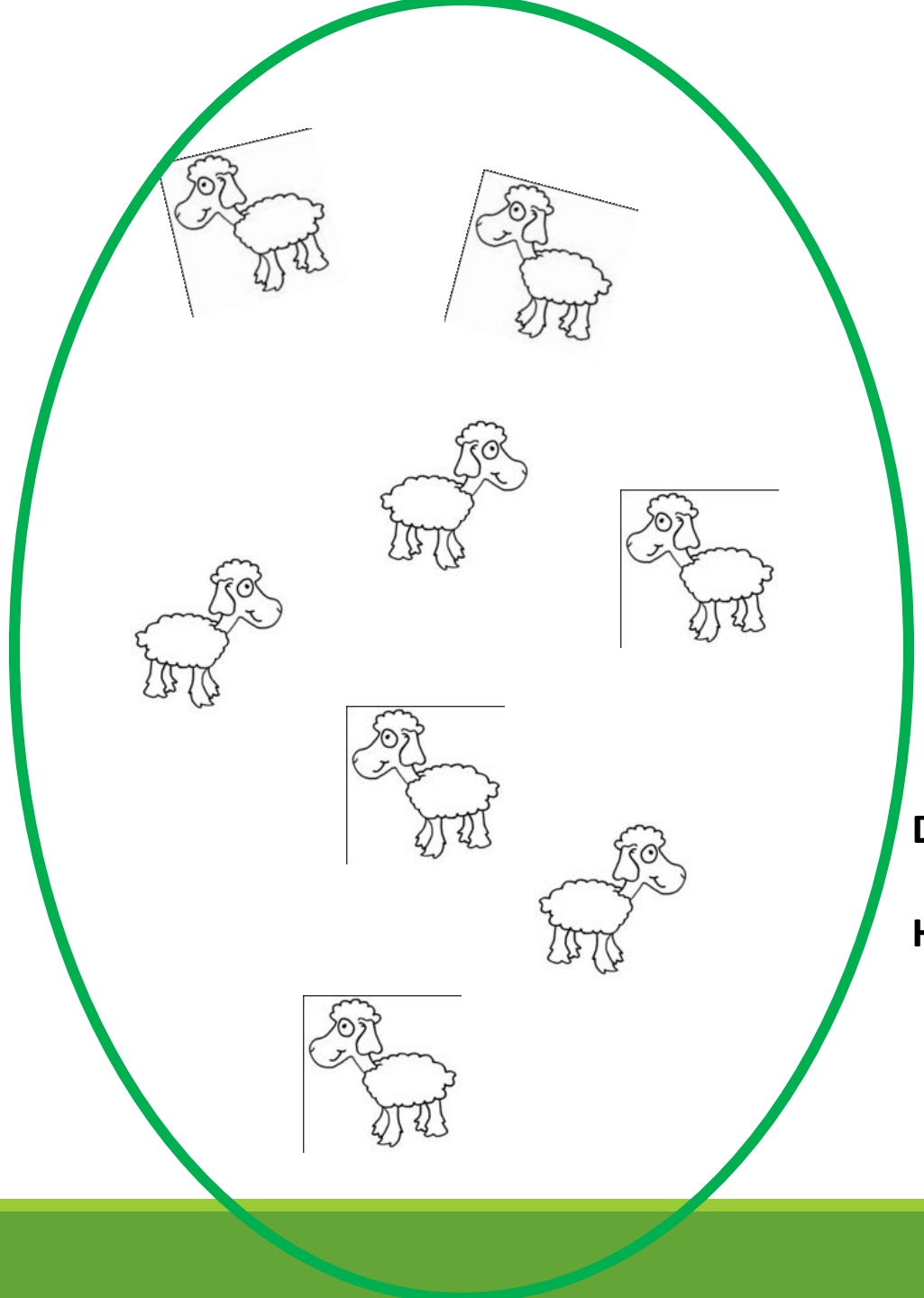
Have most (80%) of the parasites
Most likely to become diseased

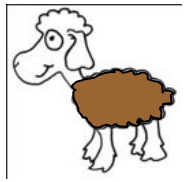












Don’t need the treatment as badly.

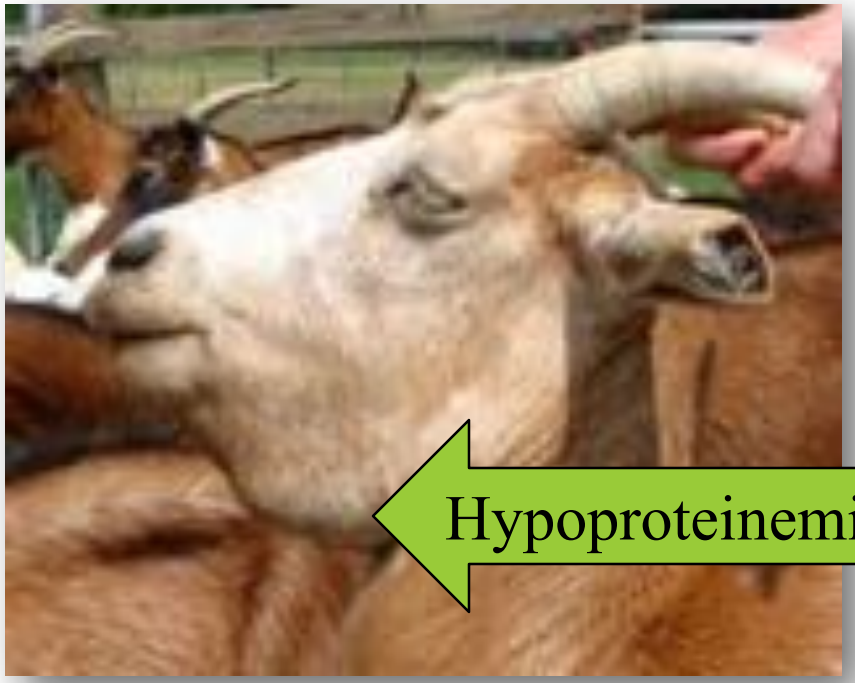
Harbor fewer parasites per animal.

What we need is targeted anthelmintic treatment for the “brownies”

Treat based on severity of anemia
- FAMACHA

Treat based on physical exam findings
- Weight loss, anemia, hypoproteinemia

Treat based on fecal analysis



Loss of Body Condition

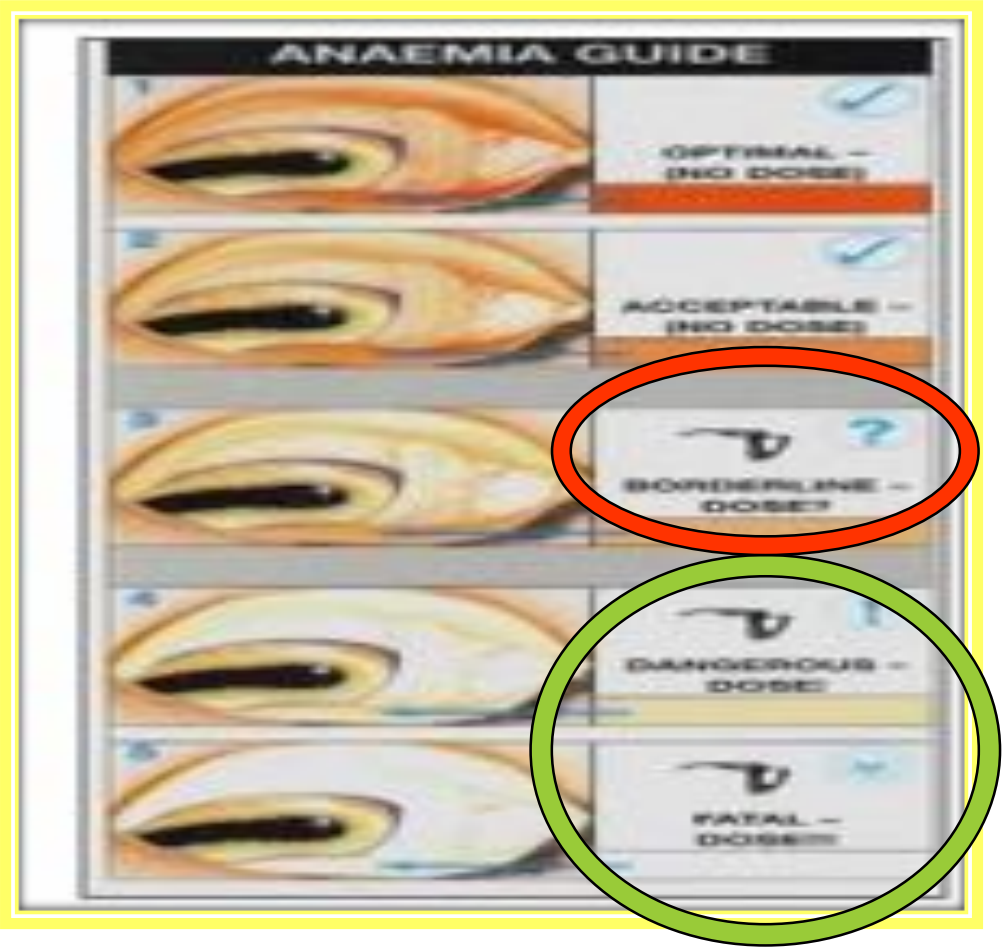
5 Point Check 5.✓

1. FAMACHA
2. Body Condition Score
3. Dag Score
4. Nasal Discharge
5. Bottle Jaw

FAMACHA

ARE THE PARASITES CAUSING ANEMIA??

FAMACHA



Measures blood loss to estimate worm burden

- Only useful for Haemonchus

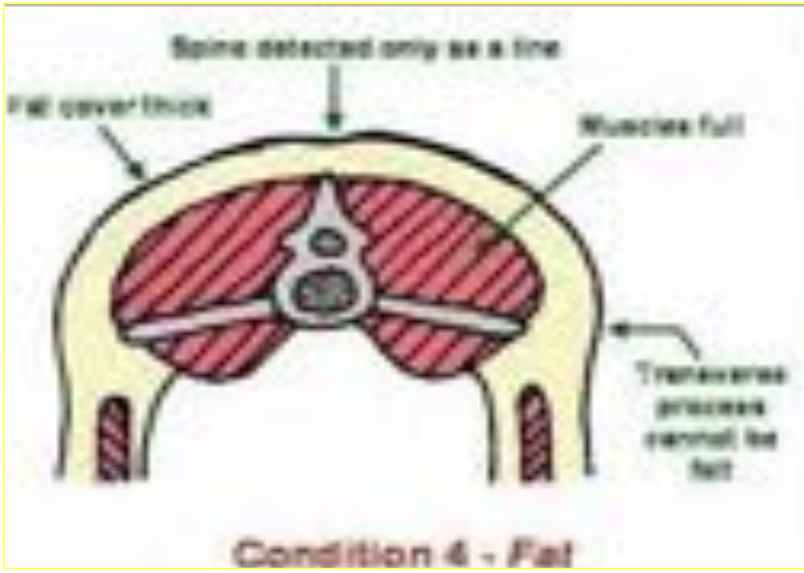
Need to replace card frequently

- Colors fade!

FAMACHA

Clinical Category	Eye Lid Color	Packed Cell Volume	Treat?
1	Red	≥ 28	No
2	Red-Pink	23-27	No
3	Pink	18-22	?
4	Pink-White	13-17	Yes
5	White	≤ 12	Yes

Body Condition Score (BCS)



ARE THE PARASITES CAUSING WEIGHT LOSS??

Body Condition Score

SCORE 1-5

Dairy Cattle

Sheep

Goats

SCORE 1-9

Beef Cattle

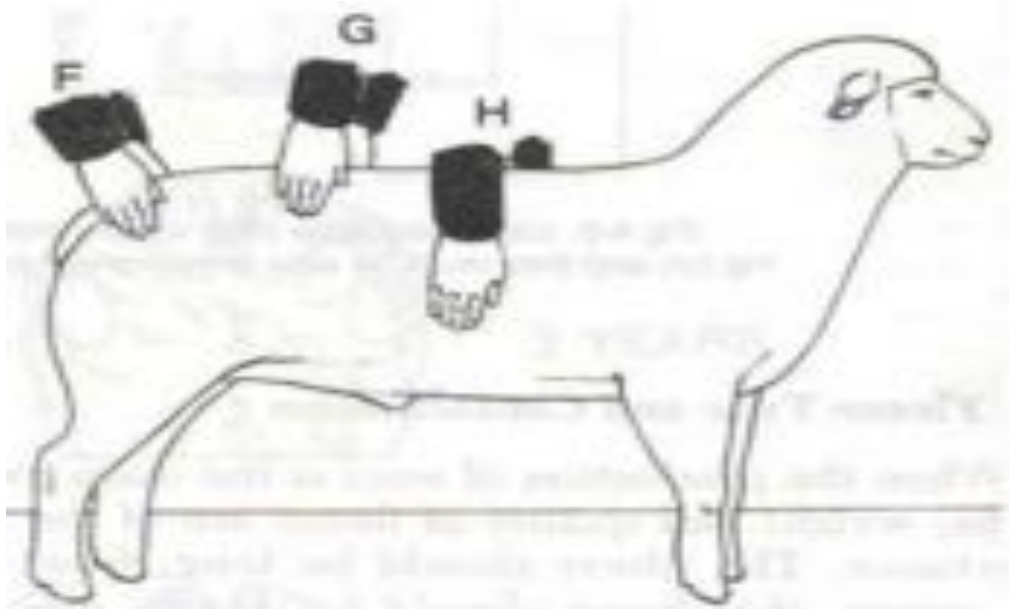
Camelids

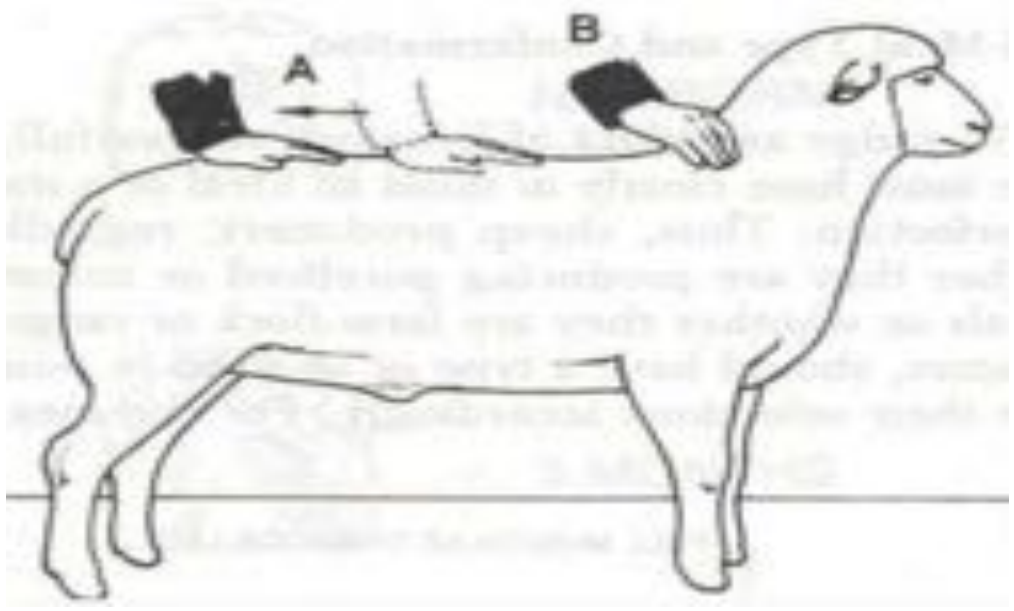
https://www.youtube.com/user/UAFExtension

Hands On!!

Areas to palpate:

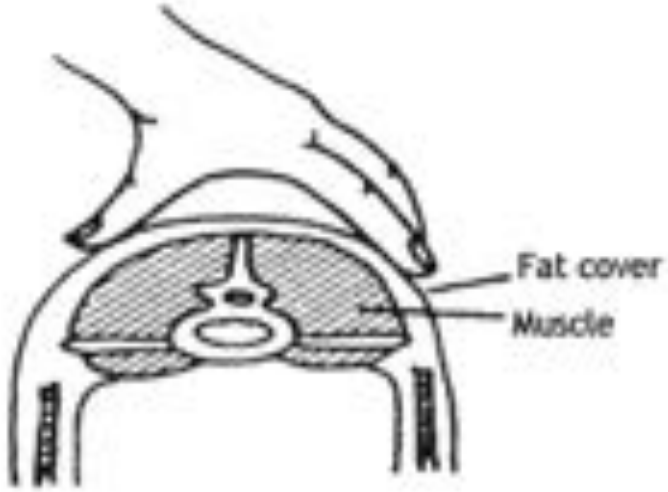
- Ribs, Short Ribs, Topline, Rump, Tailhead



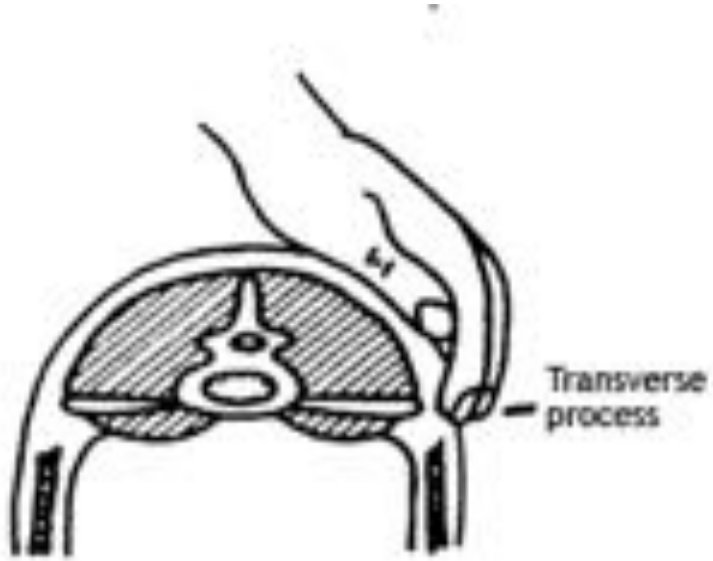


Where to palpate

Bone along topline

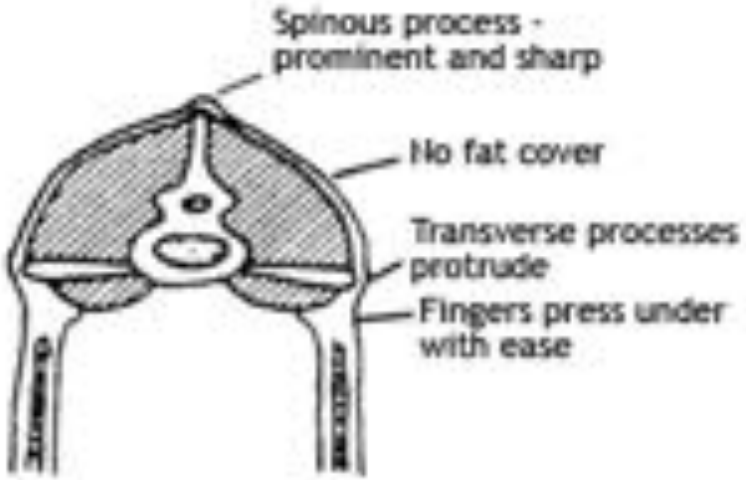


Fatness over back muscles



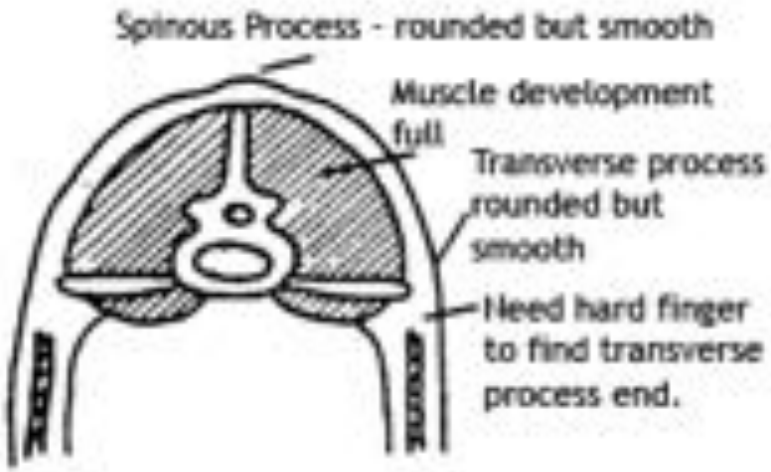
Bones between ribs and hip bone

Not fat shaming, just documenting ☺



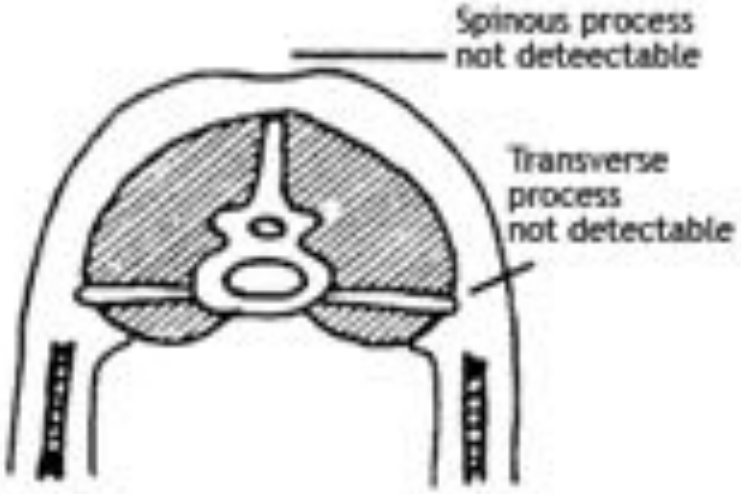
BCS 1

Too thin!



BCS 3

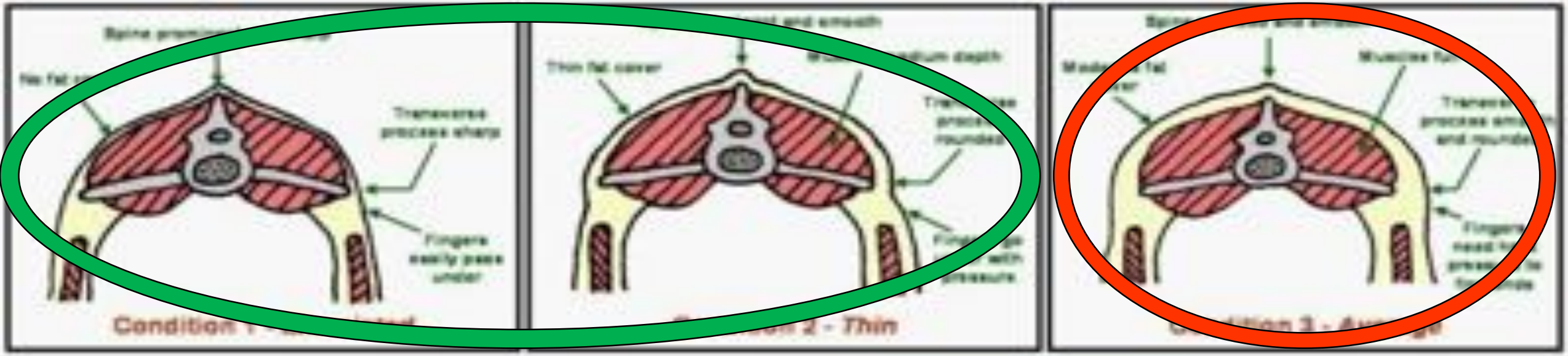
Just right



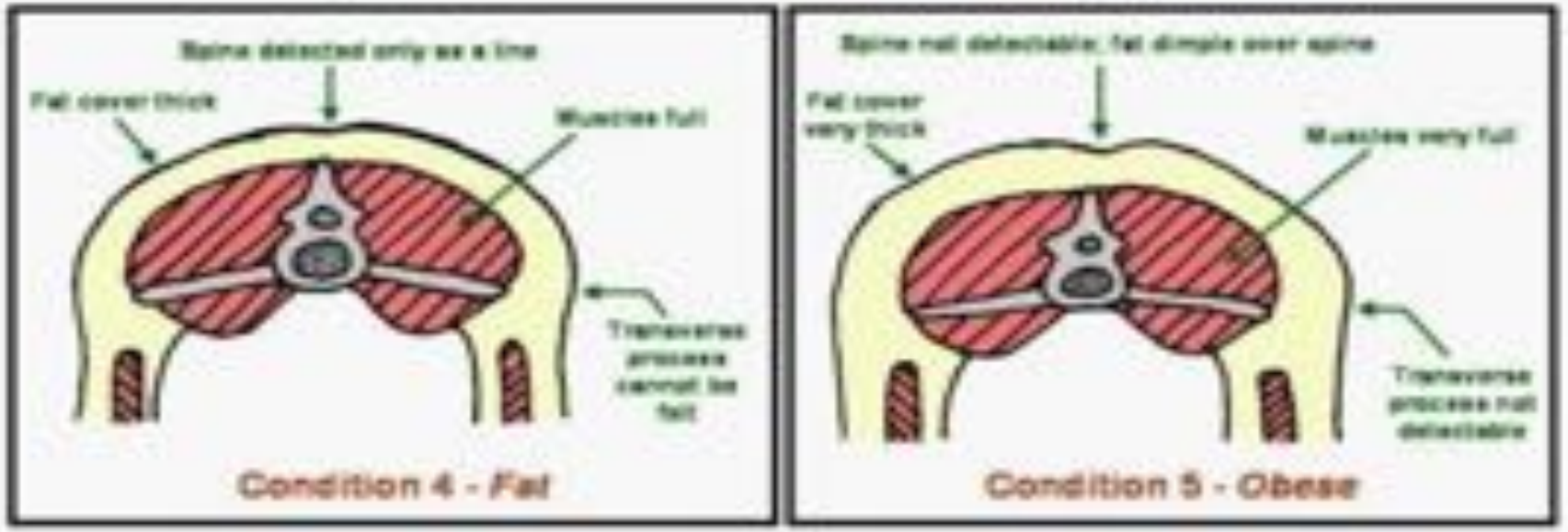
BCS 5

Too fat!

Body Condition Scores – Sheep/Goats



Condition 2 - *Thin*



Condition 4 - *Fat*

Condition 5 - *Obese*

When in doubt, make a fist ☺

Dag Score

ARE THE PARASITES CAUSING DIARRHEA??

Dag Score (Dingleberries and runny stuff)

Fecal soiling

Evidence of diarrhea

Dag score		Description	Treatment recommendation
0		No fecal soiling	No indication for treatment
1		Very slight soiling on edge of tail	No treatment
2		Slight soiling on edge of tail and on each side	Usually no treatment
3		Moderate soiling of tail and wool Dag formation	Consider treatment
4		Severe soiling extending far into wool Severe dag formation	Treatment, crutching recommended
5		Very severe watery diarrhea extending to hocks	Treatment and crutching essential

Nasal Discharge

ARE NASAL BOTS A PROBLEM??

Nasal Discharge

Normal nose
- Moist but no discharge

Nasal bots
- Clear discharge
- Rubbing nose on ground
- Stomping feet
- Snorting noise

Environmental irritants
- Clear discharge
- Eye discharge

Pneumonia
- Starts clear
- Ends cloudy

Bottle Jaw

ARE PARASITES LEADING TO PROTEIN LOSS??

Bottle Jaw

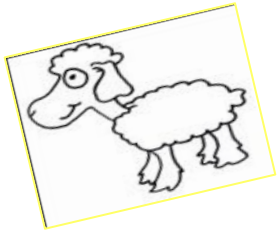
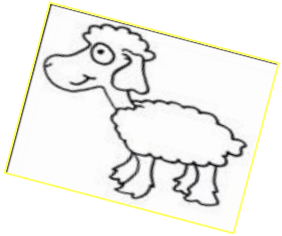
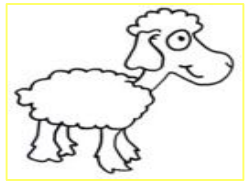
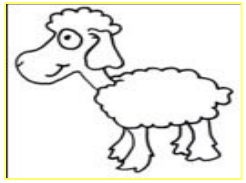
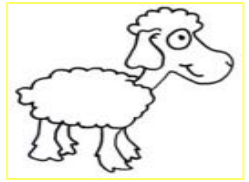
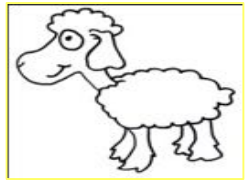
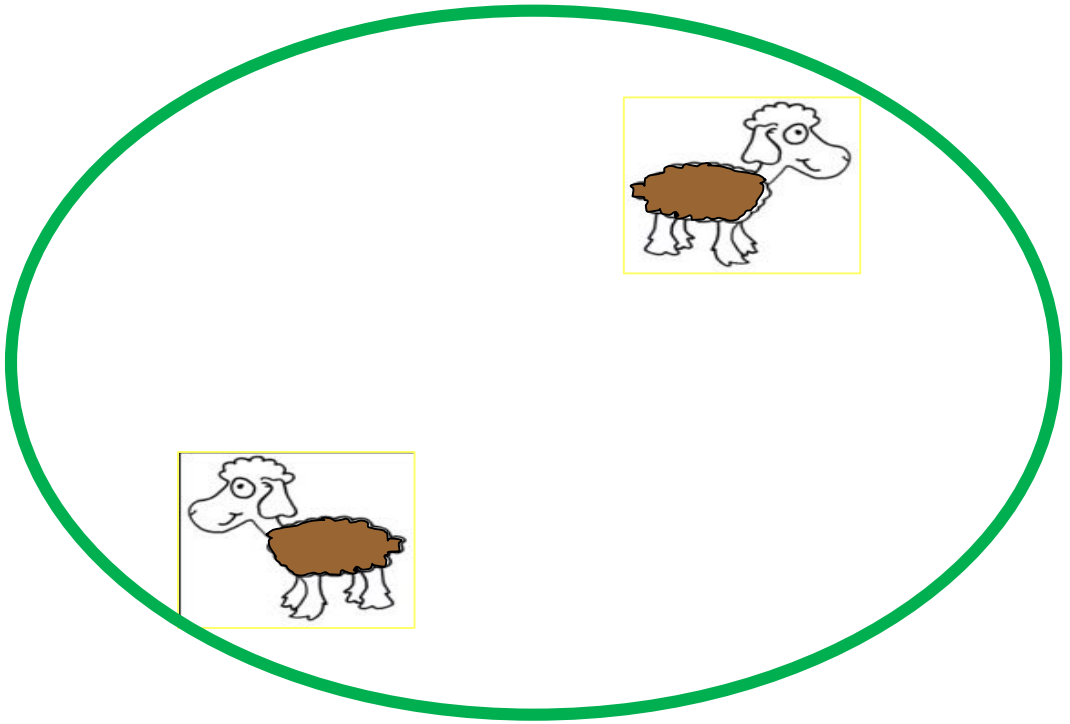
How does 5.✓ help us make decisions?

Look at the combination of scores

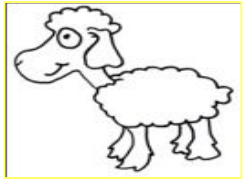
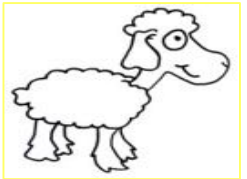
If all scores are in the danger zone… TREAT

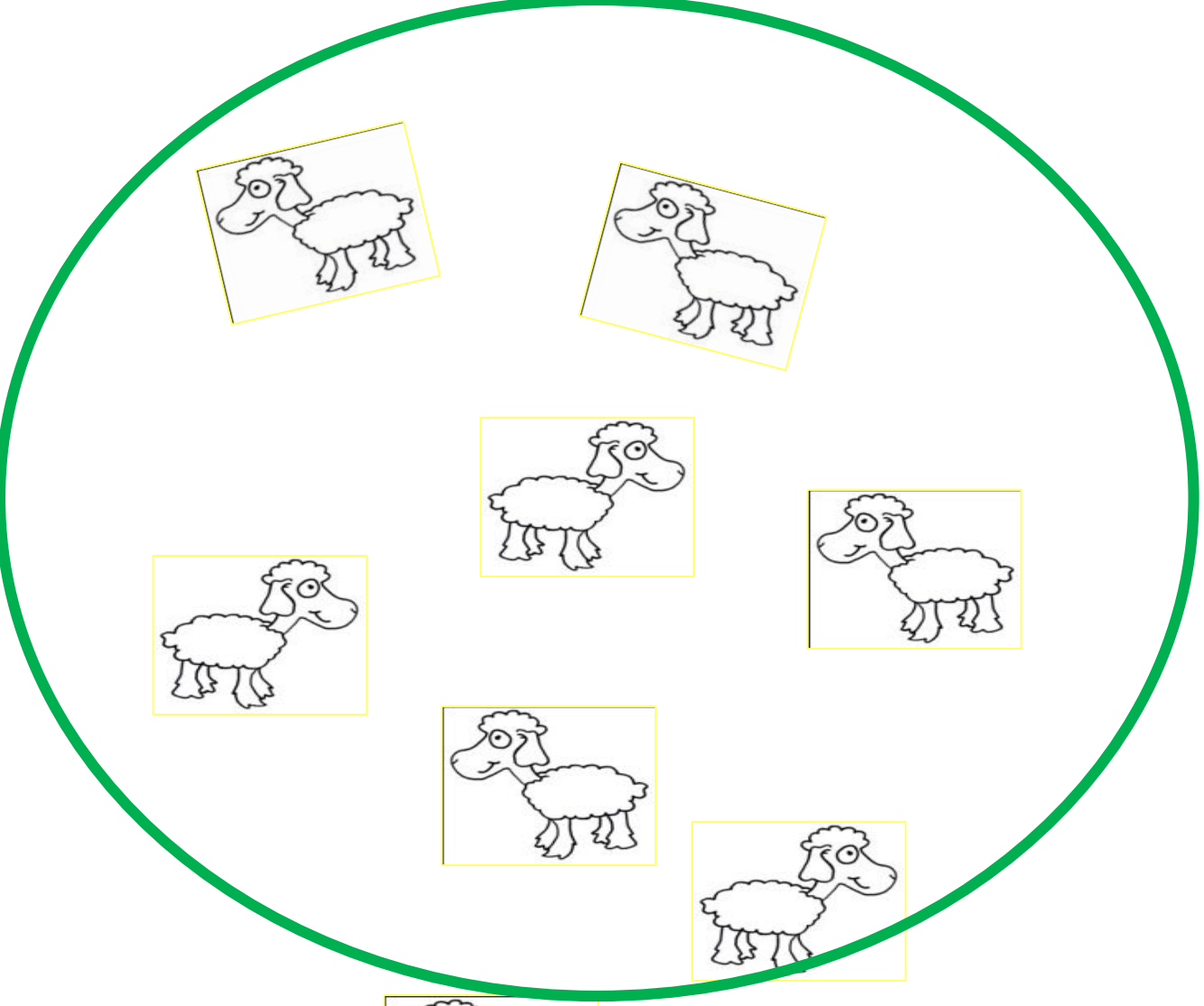
If some scores are in danger zone… May need to treat

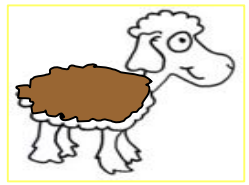
If all scores are in the good zone….NO TREATMENT NECESSARY

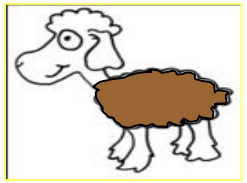








Have most (80%) of the parasites.
Most likely to develop clinical signs.

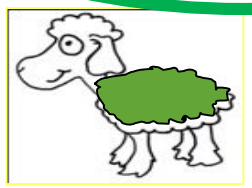







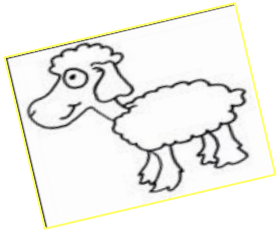
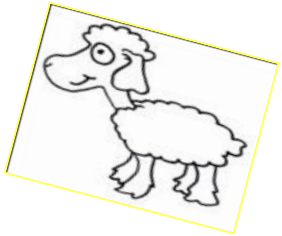
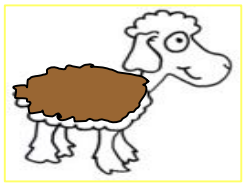
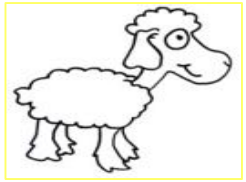
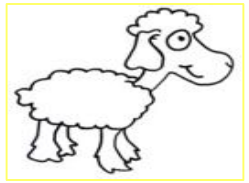
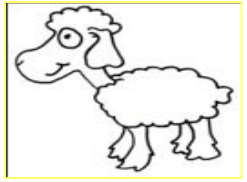
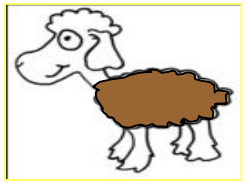
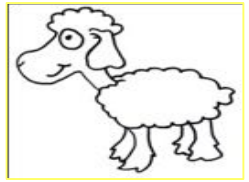
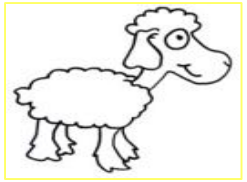
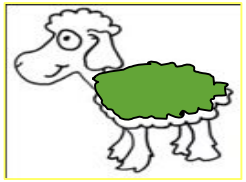


Good scores… Don’t need treatment



But what about this guy?

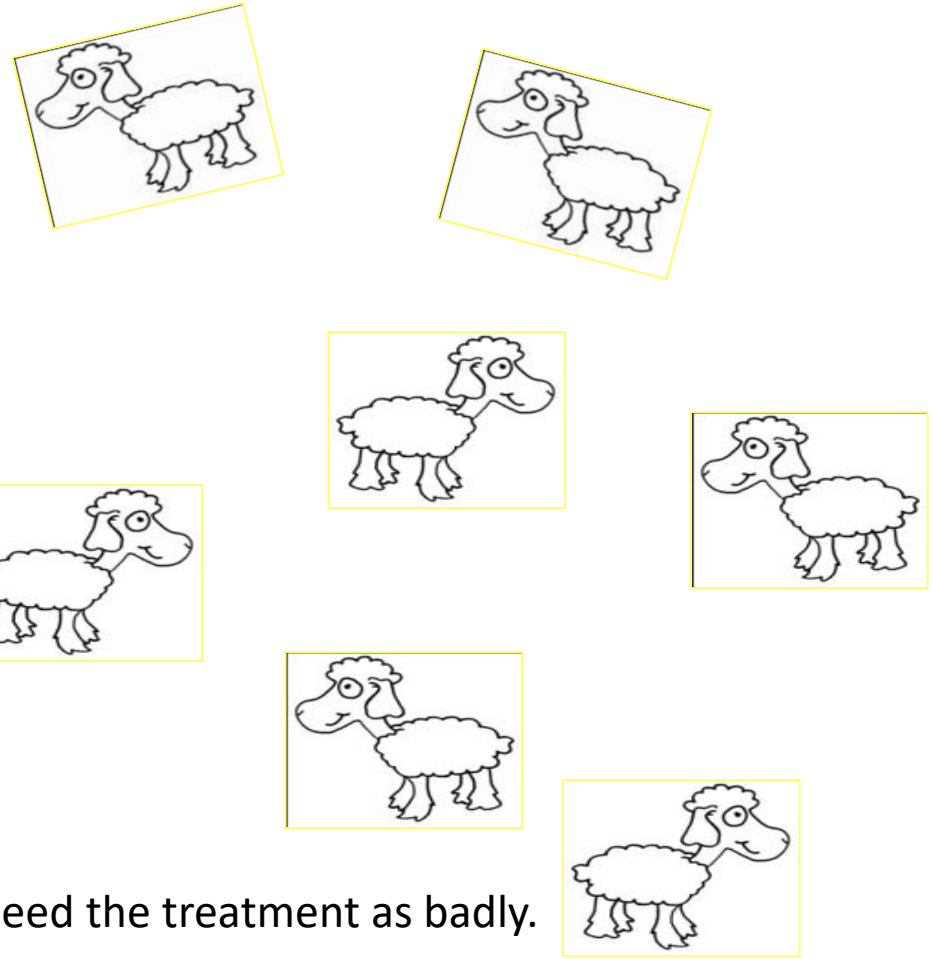
A mixture of dangerous and “ok” scores

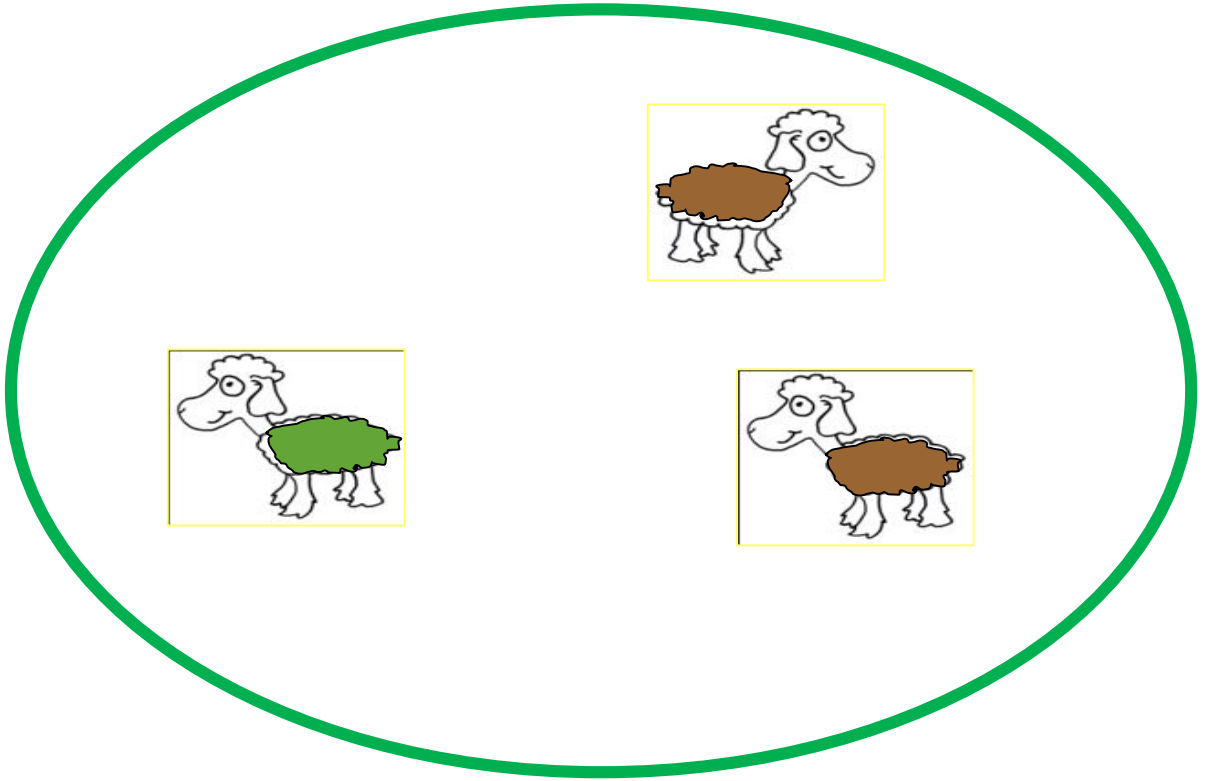











A mixture of dangerous scores in an animal that is less than herd average…

TREAT!

5.✓ can help identify the soon-to-be “brownies”





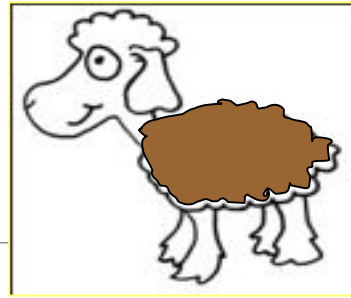
Treatment where treatment is needed!

Don’t need the treatment as badly.

Harbor fewer parasites per animal.

If we don’t deworm them, resistance will not build up!

Tool to identify the problem animals



Of the parasites *in the animals*, 80% of these parasites are harbored by 20% of the animals

Allows us to determine who may be in need of deworming

Allows for *targeted deworming*….hoping to reduce/eliminate resistance to dewormers

Running fecal exam will determine which dewormer is best!

Let’s talk fecal analysis…

HOW BAD IS THE PARASITE LOAD? QUANTITATIVE ANALYSIS

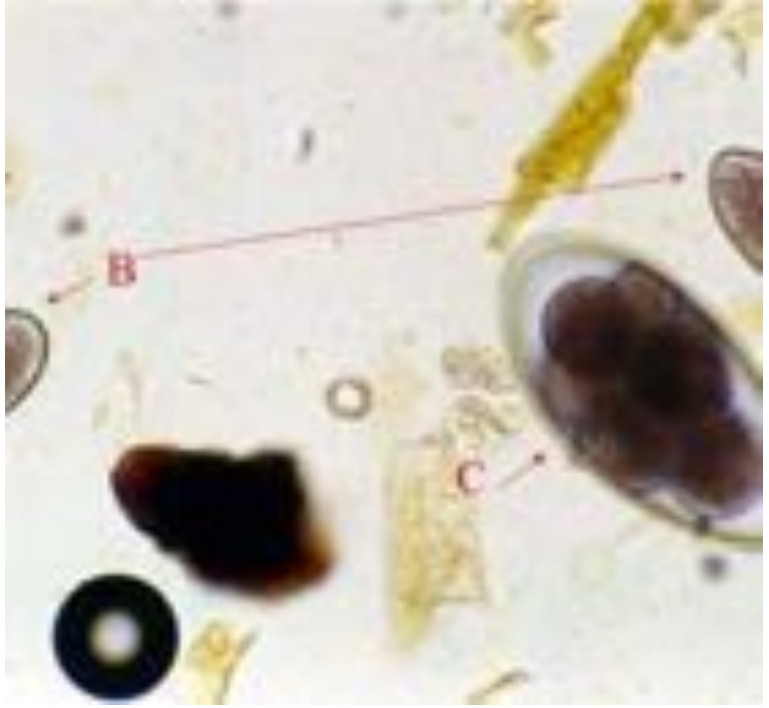
WHICH PARASITE(S) ARE PRESENT? QUALITATIVE ANALYSIS

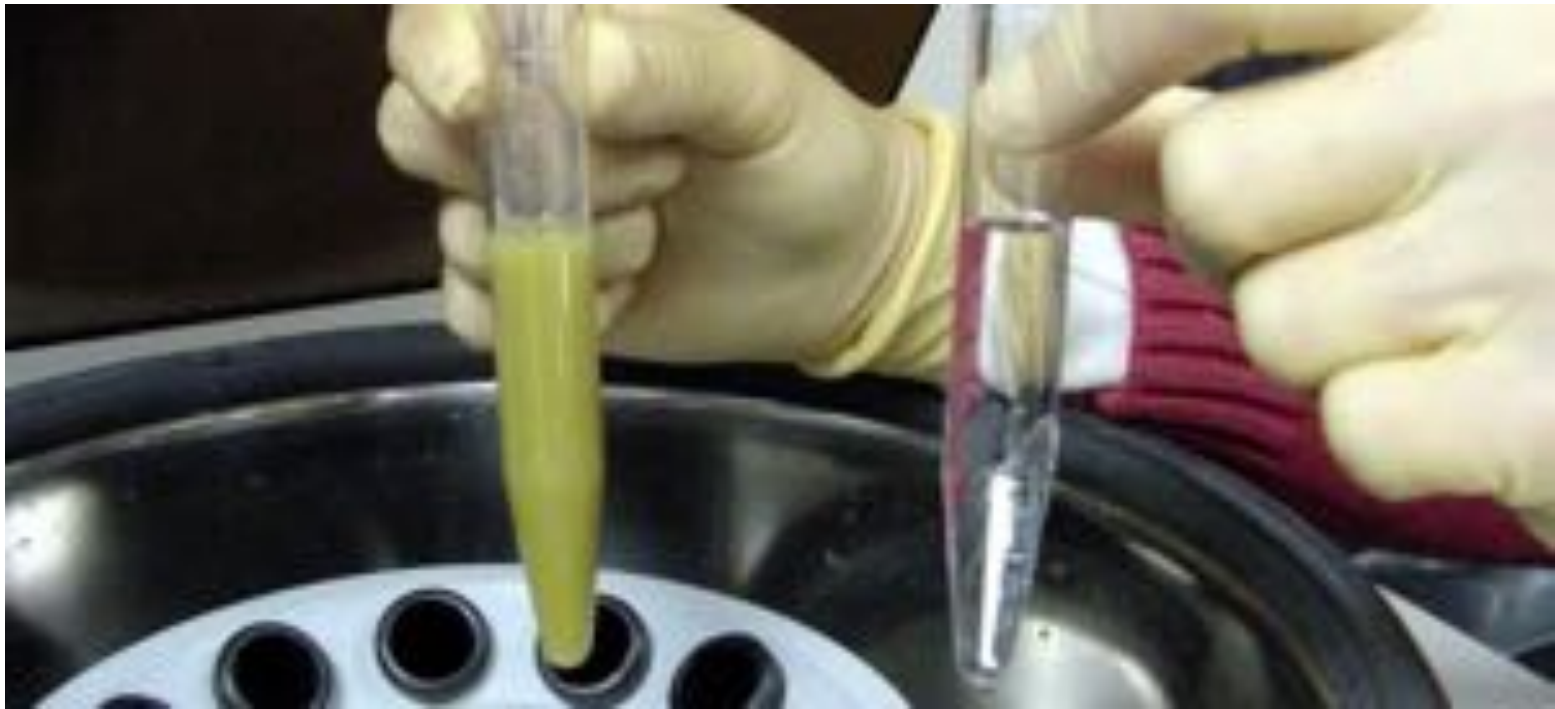
Which dewormer is right for the farm??

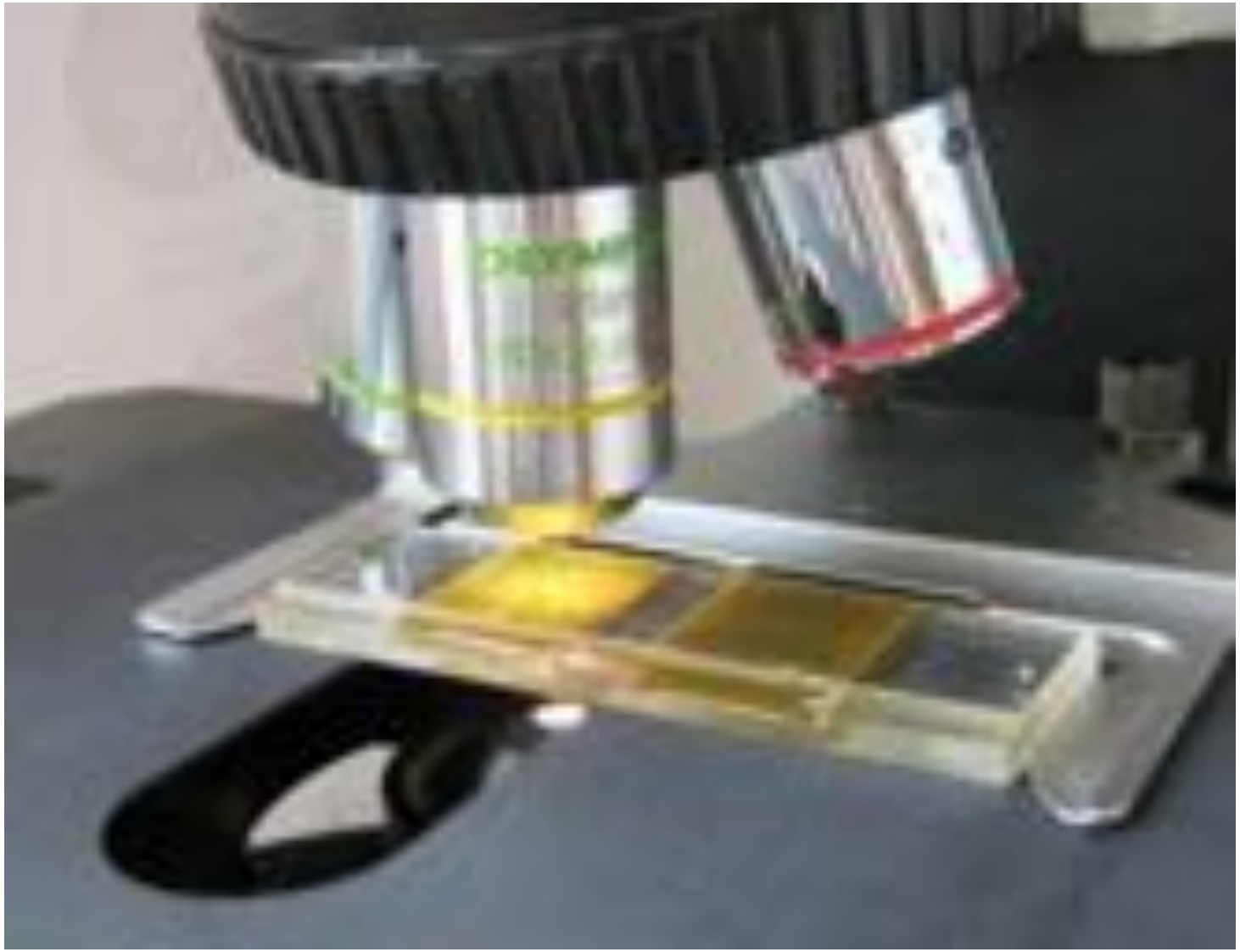
QUALITATIVE FECAL ANALYSIS

CENTRIFUGE METHOD

“FLOTATION METHODS” ARE ONLY ~ 30% ACCURATE FOR FARM ANIMAL PARASITE EGGS







How bad is the problem?

Quantitative analysis

Fecal Egg Count

eggs/gram feces

Fecal Egg Count Guidelines

Depends on worm species, time of year, susceptibility of animals

Haemonchus sheds lots of eggs

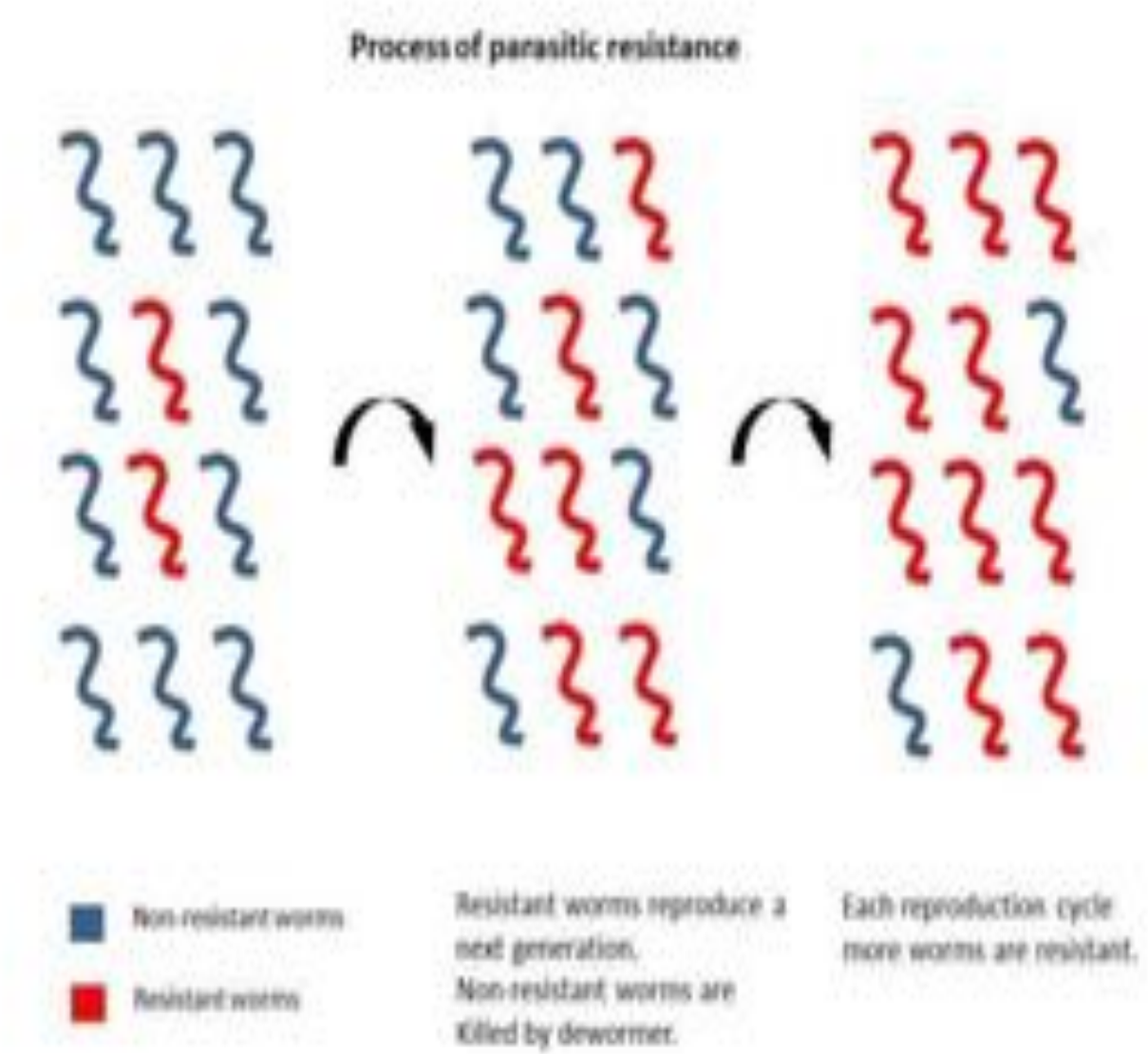
Use in combination with 5.√

General Guidelines:

< 250 eggs/gram = GOOD!

500 – 750 eggs/gram = if 5.√ scores are mixed or bad = TREAT

> 1000 eggs/gram = TREAT



How to measure resistance

Fecal egg count reduction test

- Perform fecal egg count before deworming
- Second fecal egg count 10 days after deworming

- Resistance to drug if <90% egg count reduction
- Severe resistance if <60% egg count reduction

Tips to slow down the development of resistance

Do not rotate dewormers after each treatment

- Research now demonstrates that rotation may ultimately be harmful
- Rotate annually?
- Rotate to next drug category
- Make sure you are using correct dewormer
  - Run a fecal!
  - Are you targeting arrested larvae?
  - Is it a coccidia problem?

Tips to slow down the development of resistance

You don’t have to treat all animals

- If they are not showing clinical signs, they are probably not shedding large numbers of eggs
- Not worth the risk of resistance

Isolate new animals (DON’T BUY PROBLEM!)

- Strategically deworm them and submit follow-up fecal before releasing into herd
- Many will treat with two classes of dewormers and isolate for at least 14 days
  - Vet has to decide that for it to be legal!

Underdosing

Weigh each animal individually

Dose to the heaviest animal in group

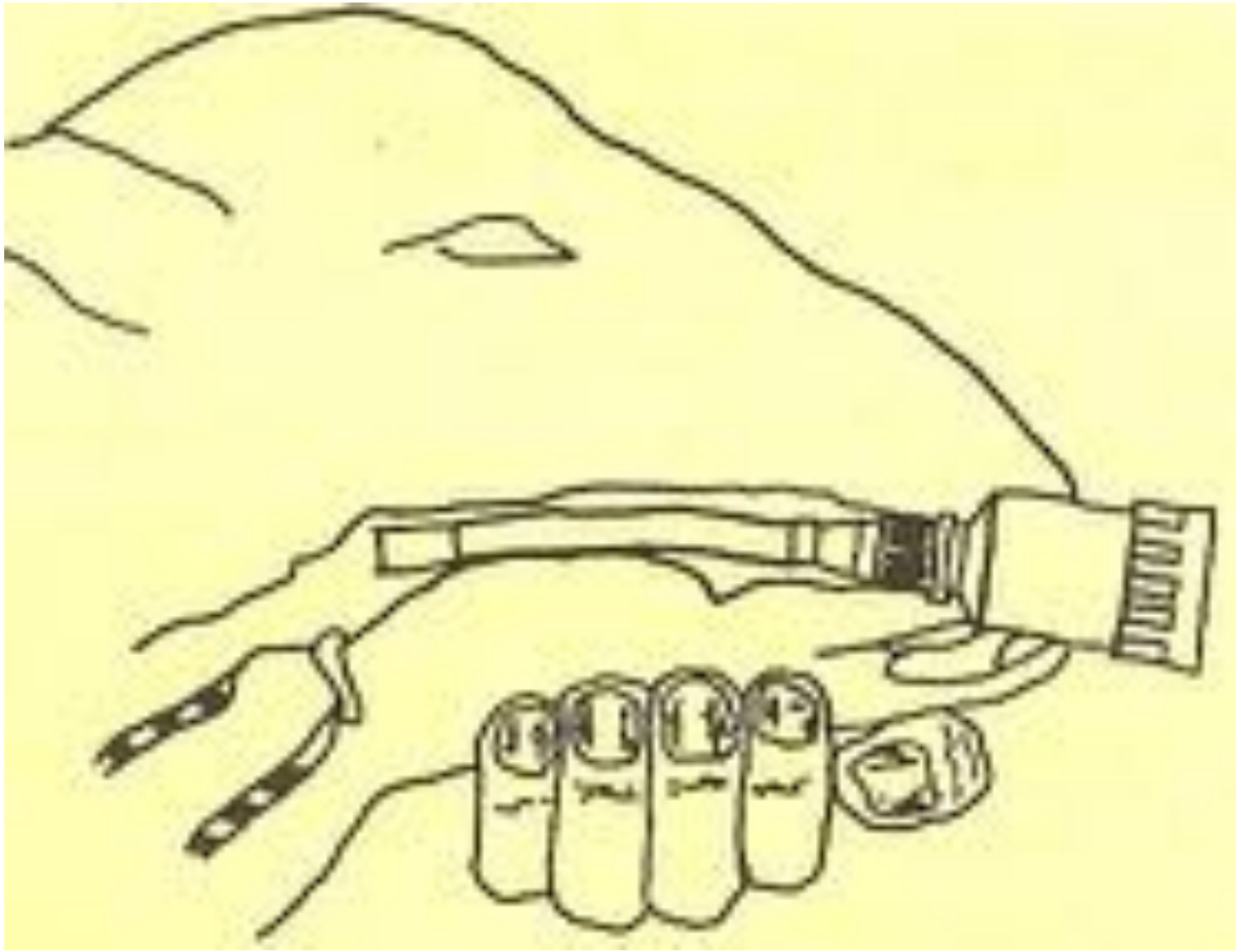
Weight tapes

Ensure that the drenching gun is working properly and calibrated

- Rubber seals can become brittle or “sticky”`

Goats metabolize anthelmintics more quickly and may need a higher dose

- 2x for most dewormers
- 1.5x for Levamasole



Improper dosing technique

Position drench gun over tongue and give slowly

- Placing dewormer in front of mouth will trigger esophageal groove and bypass rumen

Maximize drug efficacy

Restrict feed for 24 hours before treatment

- Will slow down rate of ingesta through GI tract, allowing for better absorption
- Not in late gestation
  - Can induce pregnancy toxemia

Repeat dose in 12 hours if using a benzimidazole

Protecting the Homeland

Friends come and go, but enemies accumulate.

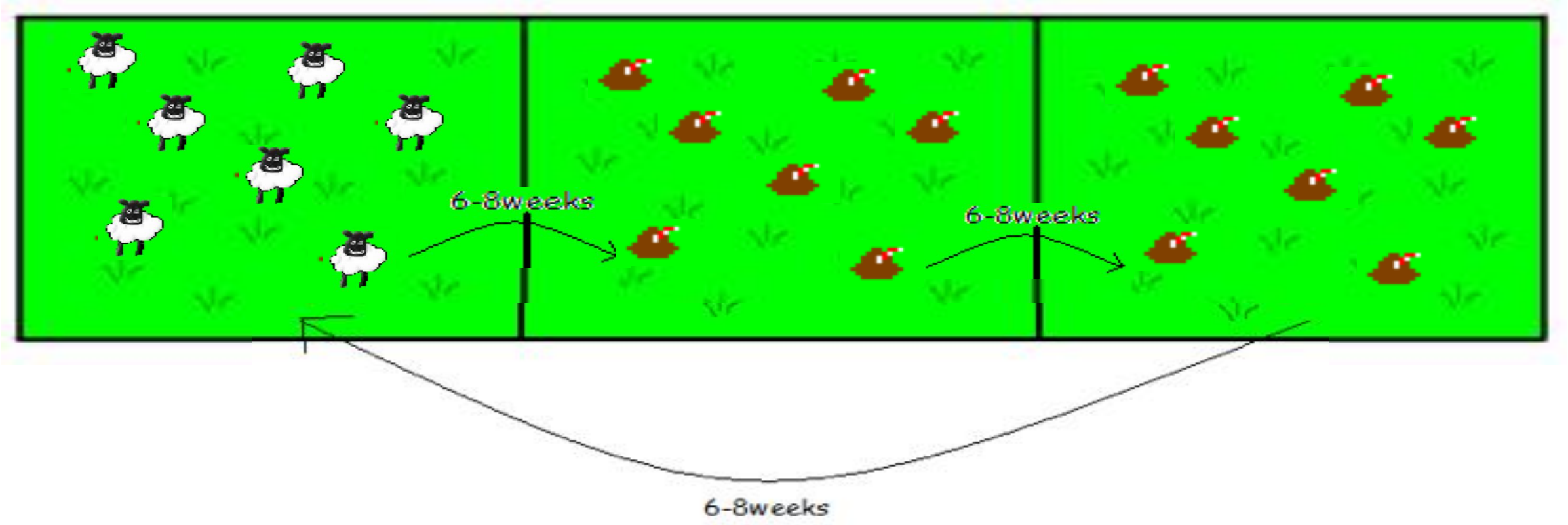
Anonymous

Factors that Determine Severity of Worm Burden

1. Stocking rate (animals per acre)

Pasture Rotation

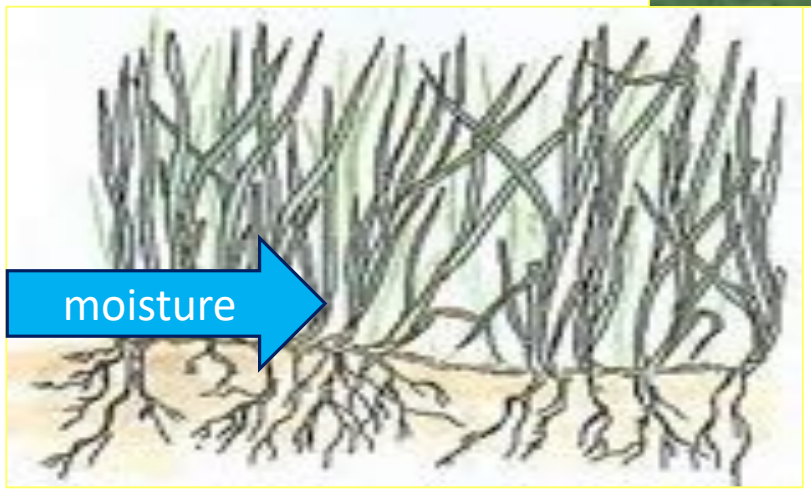
How would that work???



Factors that Determine Severity of Worm Burden

2. Grazing behavior

Where do L3s survive?



Graze mid shaft

Graze close to ground

Browsers

Factors that Determine Severity of Worm Burden

3. Separation of feed from feces

Separate feed from feces

Typical problem:

Small farm

Acquired too many animals for given pasture size

Fecal contamination

Coccidia problems in young stock

Solution: Create drylot, feed hay / grain from feeders

“Zero Grazing” will help worm problem, not coccidia problem

What’s wrong with this picture??


Animals eating off ground
No hay in feed bunk
Feces in the food

South American Camelids (llamas, alpacas)

Evolved in mountains of South America

Limited nutrient availability

Parasitism would be devastating

<u>Communal dung pile</u>

Adaptive behavior to limit parasite contact (fecal-oral transmission)

Factors that Determine Severity of Worm Burden

4. Age and Immunity

Grouped young stock are most often affected

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5. Species and Immunity

Sheep and cows develop good immunity

Goats and camelids do not!

Grazing by alternate species

Parasite Resistant Breeds

SHEEP

Barbados

St. Croix

Katahdin

GOATS

Myotonic

Pygmy

Factors that Determine Severity of Worm Burden

6. Environmental Conditions

Warmth and dryness cause L3s to lose nutrients and water

Hot summer conditions with dry grass help keep parasites at bay

Wet, lush pastures are primed for parasites

Reduce the larval numbers

Mow pasture

Must remove clippings for this to be effective

Allows sun exposure, drying at ground level

Can harvest as hay for other species

Pasture “resting” (no animals on it)

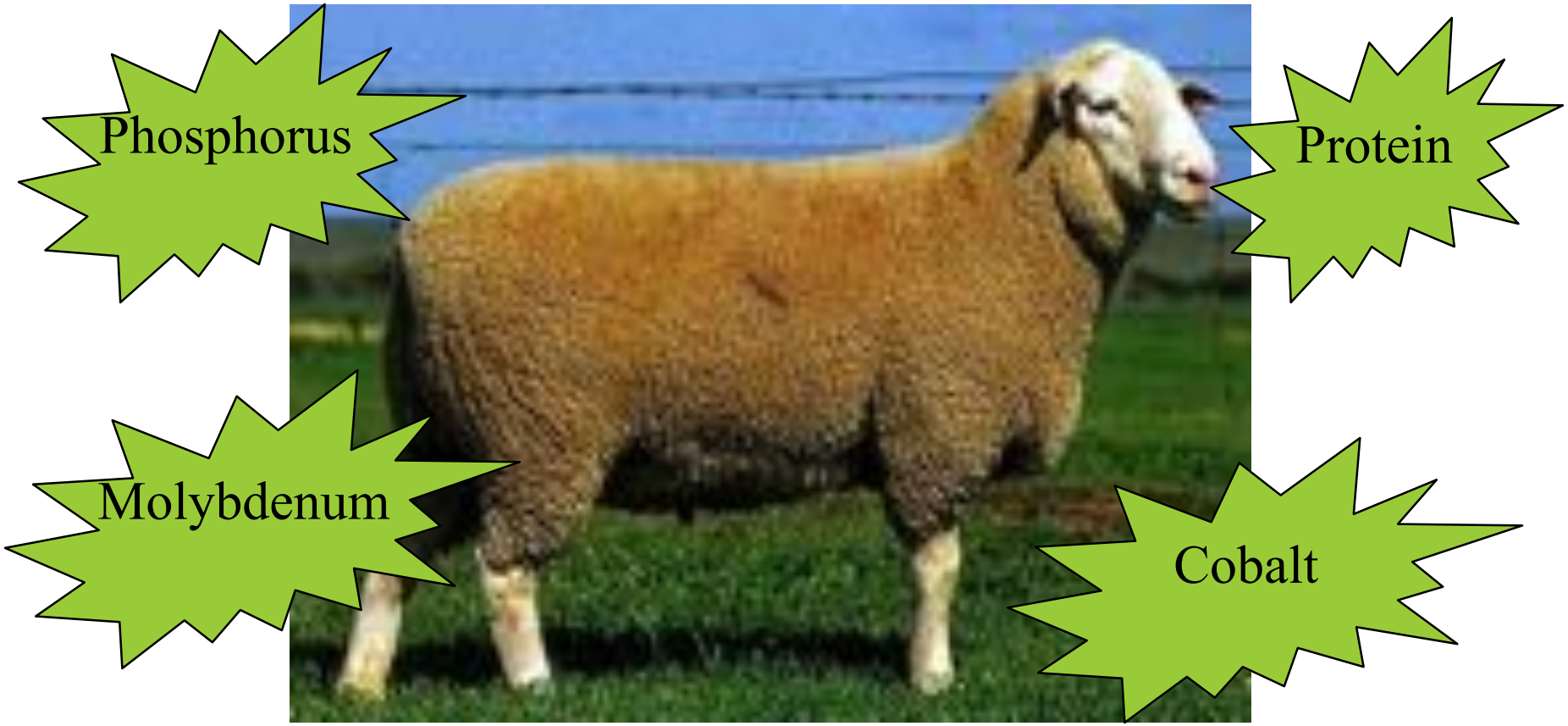
3 mo. in summer (2 mo. if hot and dry)

6 mo. in winter if cut short prior fall

Burn ‘em

Factors that Determine Severity of Worm Burden

7. Nutrition and Overall Health



Alternative forages

Browsing gets animals away from larvae

Tannin containing plants

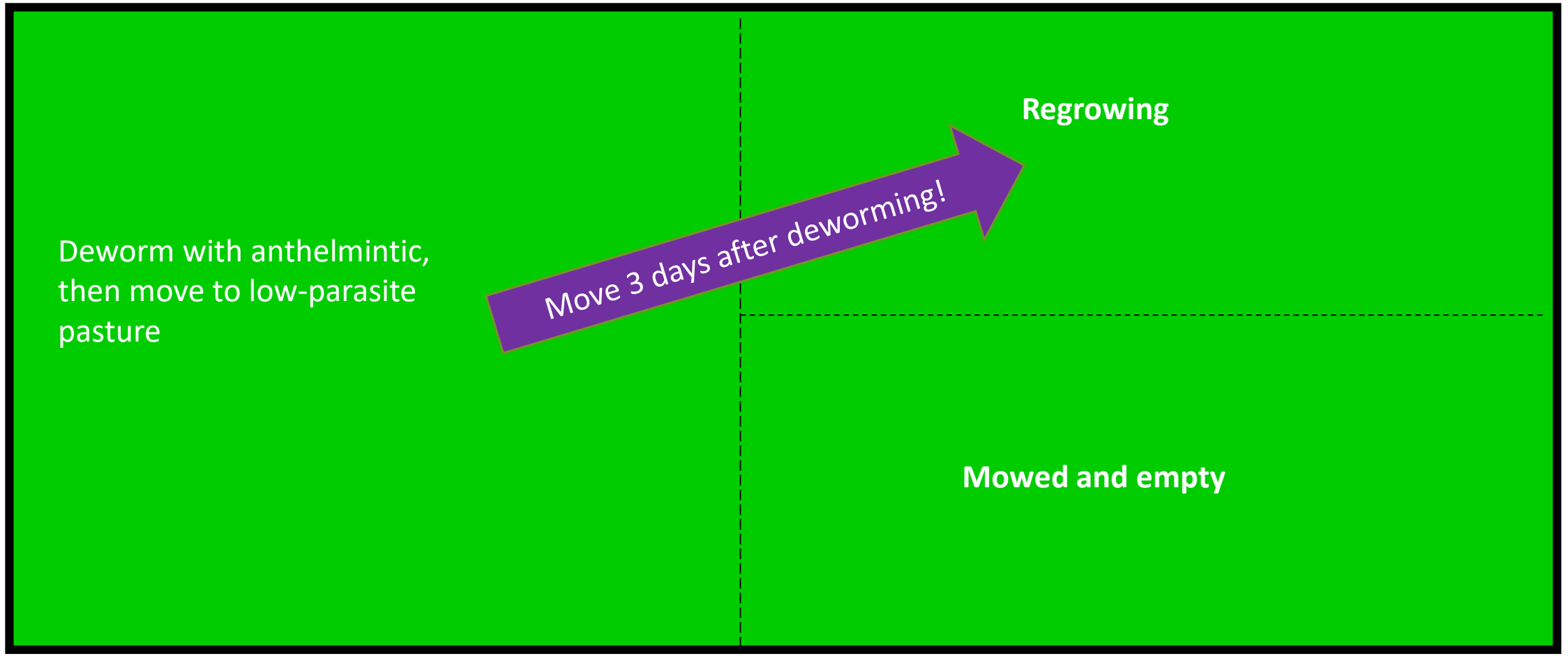
- Chicory
- Birdsfoot trefoil
- Sericea Lespedeza - Haemonchus

Factors that Determine Severity of Worm Burden

8. Anthelmintic Resistance

Most problematic when treatment is the sole management tool used in control programs

“Clean animals onto clean pasture”



Classical cornerstones of environmental management

1. Reduce the larval #

2. Reduce stocking rate

3. Keep feed and feces separate

4. “Clean animals onto clean pastures”…use anthelmintics wisely!

In closing…

Parasitism is not a deficiency of a dewormer; it is a pasture problem

Resistance begins when animals are dewormed without the benefit of fecal analysis and a strategic plan

A strategic plan can not be developed without knowledge of farm management, animal worm burden, and environmental larval burden

A veterinarian must be involved in all extra-label drug decisions

Any Questions???