UF | IFAS Extension
UNIVERSITY of FLORIDA

NORTH FLORIDA
LIVESTOCK AGENTS GROUP

2019 Small Ruminant Workshop Agenda

Saturday, September 21st, 2019

8:45-9:00 Welcome (Classroom)

9:00-10:00 Grazing Management (Classroom)

10:00-10:15 Break

10:15-11:00 Concurrent Sessions- Pick one

A. Weed Management (Outside)
B. Cool Season Forages (Main Hall)
C. Pesticide Safety and Selection (Classroom)

11:00-11:45 Concurrent Sessions- Pick One

A. Weed Management (Outside)
B. Cool Season Forages (Main Hall)
C. Pesticide Safety and Selection (Classroom)

11:45-12:15 Lunch

12:15-1:15 Herd Health Management (Classroom)

1:15-1:30 Break

1:30-2:15 Concurrent Sessions- Pick one

A. Sheep and Goat Udder Care (Outside)
B. Sheep and Goat Quality Assurance (Outside)
C. Hands-on Fecal Egg Counts (Classroom)

2:15-3:00 Concurrent Sessions- Pick one

A. Sheep and Goat Udder Care (Outside)
B. Sheep and Goat Quality Assurance (Outside)
C. Hands-on Fecal Egg Counts (Classroom)

3:00-3:30 Closing Comments and Evaluations (Classroom)

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FORAGE TEAM

PASTURE SYSTEMS FOR SHEEP AND GOATS

MARCELO WALLAU
Assistant professor – UF agronomy
Forage extension specialist

Gainesville, FL, Sep 21, 2019

Outline

Sheep and goat nutrition and grazing habits

Pasture choices

Pasture and grazing management

Herd management

Foto: SDSU Extension

Dietary preferences – grazers and browsers

Animal Species	Type of Diet (%)		
	Grasses	Legumes	Browse
Cattle	65-75	20-30	5-10
Horses	70-80	15-25	0-5
Sheep	45-55	30-40	10-20
Goats	20-30	10-30	30-50
White-tailed deer	30-60	40-50	10-30

Slide: Dennis Hancock - UGA

Intake and nutrient demand

Physical limited

- Cannot consume as much volume per body weight as cattle

Require nutrient-dense feed

- Energy and protein

Short grass ≈ regrowth → high nutrient concentration

High nutritive value pasture → give the animals opportunity to match their nutrient requirements

Nutrient requirements

Very variable

- Breed
- Category
- Physiological stage
- Target productivity

Check Alabama Cooperative Extension – **Nutrient Requirements of Sheep and Goats**

- https://www.aces.edu/blog/topics/livestock/nutrient-requirements-of-sheep-and-goats/

Sheep nutrient requirement	Protein (CP)	Energy (TDN)
*Rams (220 lb, maintenance)	7%	53%
*Dry ewe (132 lb)	7%	53%
Late gestation (twins) 2.75% BW	10%	66%
Early lactation (twins) 3% BW	15%	67%
Weanling (4 mon, 66 lb, max ADG)		
Early maturing - 5% BW	12%	79%
Late maturing - 3% BW	19%	66%
*Yearling ewes (88 lb)	8%	66%

*Based on dry matter intake of *around* 2% of body weight (NRC, 2007) unless otherwise noted; from Dr. Niki Whitley, Fort Valley State University

Slide: Dennis Hancock - UGA

Goat nutrient requirements	Protein (CP) (40%UIP)	Energy (TDN)
Bucks (110-220 lb) 2% BW	7%	54%
Dry doe (88 - 154 lb) 2% BW	7%	53%
Late gestation (twins) 2.5% BW	13%	66%
Early lactation (twins) 3% BW	13%	53%
**Growing kid (30 lb; 0.44 lb/day)		
Boer (4.0% BW)	25%	90%
Local (3.6% BW)	21%	89%
Yearlings (66 lb Boer, avg growth, 2.5%BW)	15%	66%

*% BW is all feed/forage eaten on dry matter basis as % of their body weight (NRC, 2007)
**Kids gaining less than 0.44 lb/day would require less; from Dr. Niki Whitley, Fort Valley State University

Slide: Dennis Hancock - UGA

Sheep like grazing short grass…

Looking for quality forage

Sources of feed

Forages

- Variable quality, generally low passage rate and low nutrient density
- High intake required but might be limited
- Many choices – year-round production in Florida

Concentrate, grain, by products

- High nutrient density
- Cost depends on product
- Excellent for flushing, supplementing, finishing
- Sheep can consume whole corn or soy hulls

Changes in diet - be aware of adaptation phase

Pasture choices

SUMMER FORAGES

Perennials

Bahiagrass
Bermudagrass
Perennial peanut
Lespedeza

Annuals

Millets
Sorghums
Sunn hemp
Cowpea
Buckwheat
Aeschynomene
Alyce clover

COOL SEASON FORAGES

Annuals

Small grains (rye, oat, triticale)
Annual ryegrass
Clovers (crimson, arrowleaf, ball, …)
Other legumes (winter peas, vetch,
Brassicas (chicory, turnips, rapeseed)

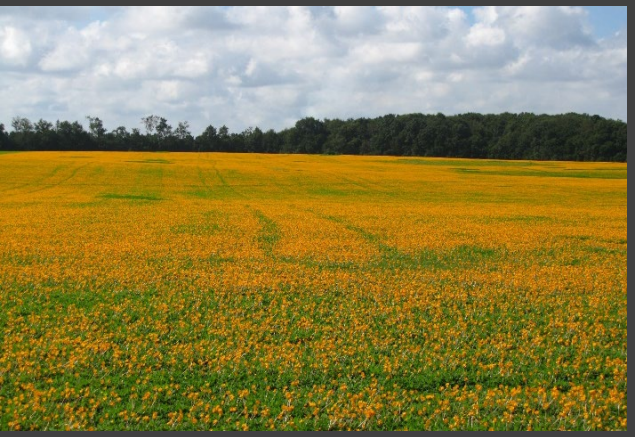
Perennials

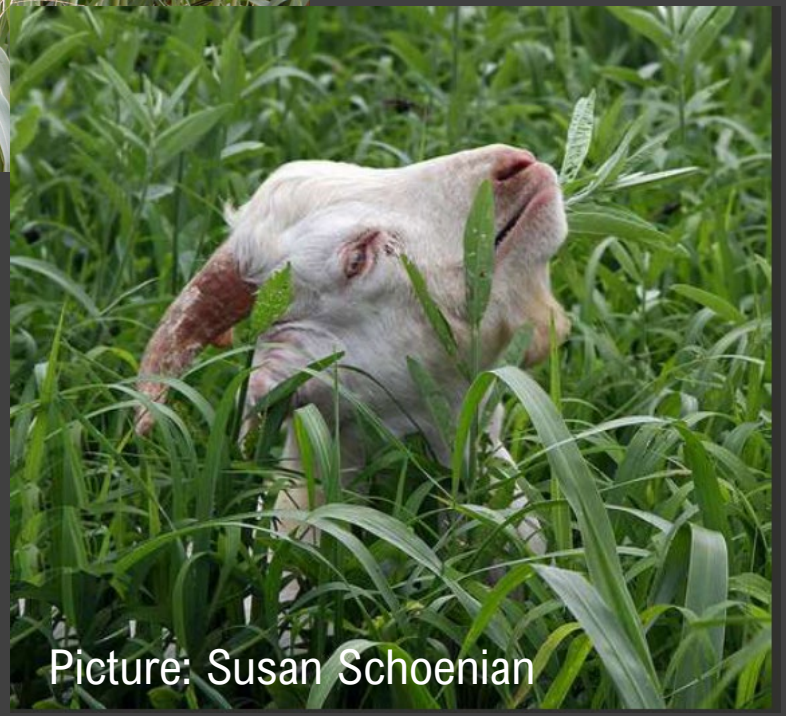
Red and white clover


Picture: Dennis Hancock

Pearl millet, sunn hemp, cowpeas and velvet bean

Summer


Perennial peanut


Picture: Susan Schoenian

Many other “mixed choices” although bermudagrass and bahiagrass still the base


Photo: Barenburg


Lynn Sollenberger

Winter

Many options for high-quality forage

Goat Grazing Preference Trial

UK Robinson Station

2006

(Most to least)

Sorghum Sudan
White clover
Turnip
Red clover
Chicory
Sericea Lespedeza
Tall Oatgrass
Alfalfa
Warm Season Grasses
(EGG, Swtich, BB, Indian)
Reed Canarygrass
Orchardgrass
Annual Lespedeza
Novel Endophyte TF
Endophyte Free TF
Infected TF
Bluegrass
Bermudagrass

Bahiagrass?

Slide: Dennis Hancock - UGA

Also known to like…

Many weed species:
- Chinese privet
- Pigweeds
- Thistles
- Stinging nettle
- Blackberry/dewberry
- Plantain
- Curly dock
- Multiflora rose
- Sweet gum

Many forage species:
- Bahiagrass
- Chicory
- Pearl millet

Slide: Dennis Hancock - UGA

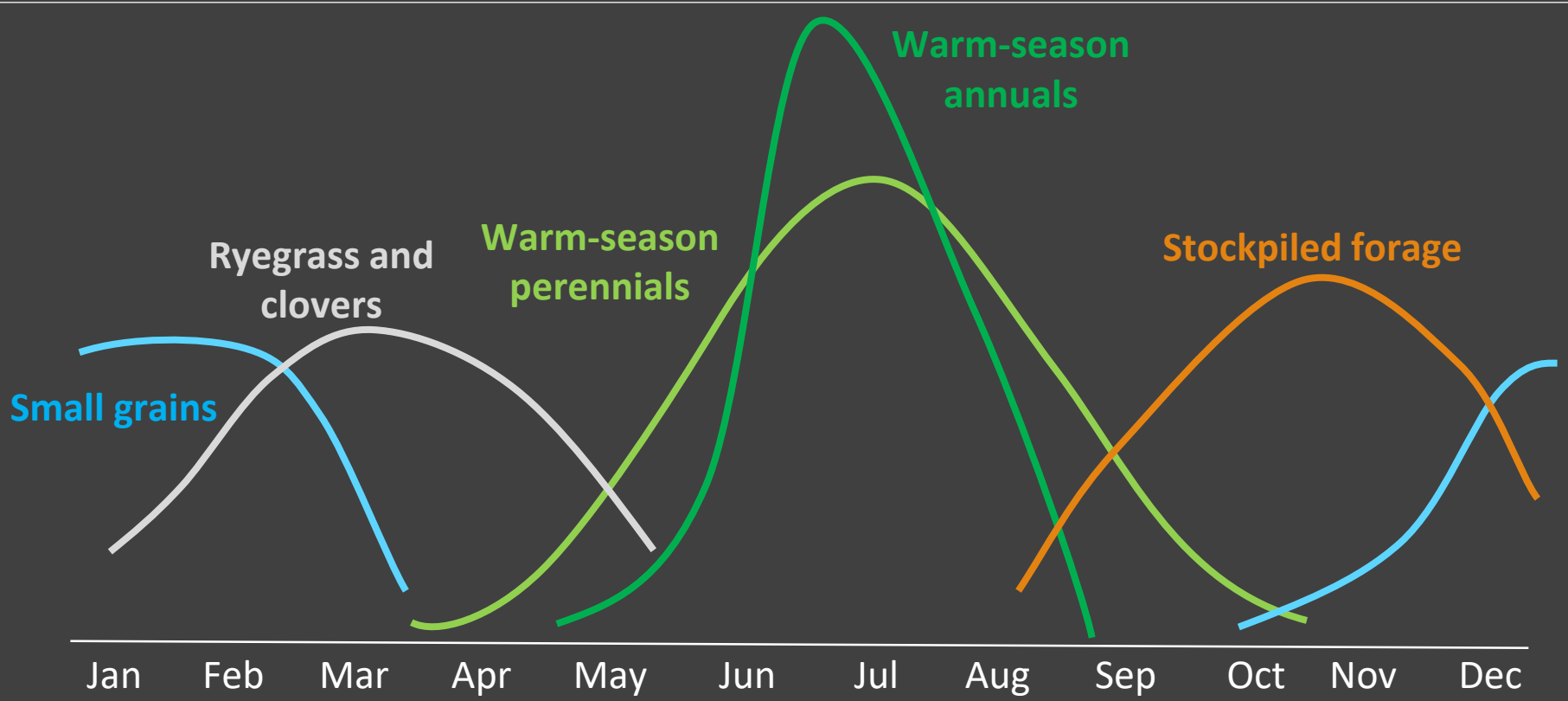
Pasture diversity

LOOKING FOR THE “RIGHT” FORAGE

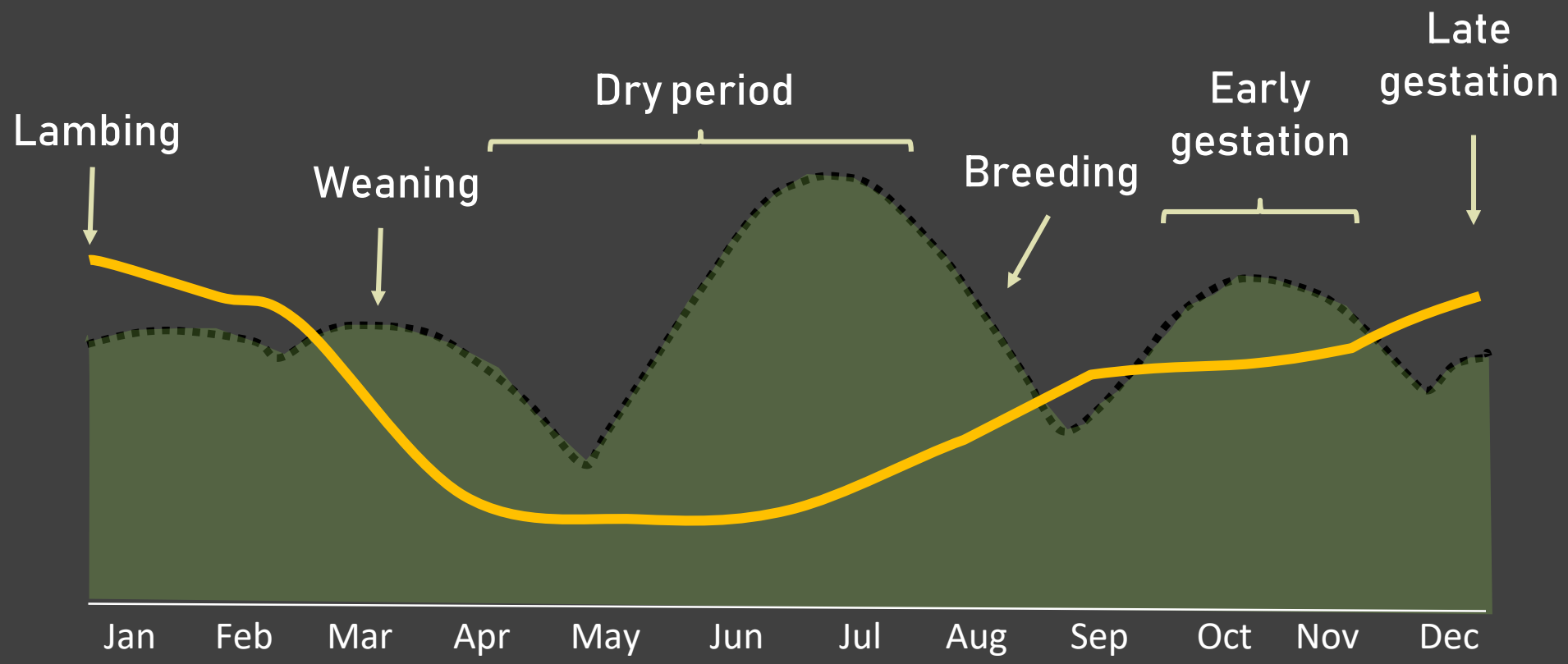
Forage species	J	F	M	A	M	J	J	A	S	O	N	D	Productivity* (lb DM/acre)
Limpograss													9000-12000
Pensacola Bahiagrass													3000-10000
Argentine Bahiagrass													5000-14000
Hybrid Bermudagrass													7000-14000
Pearl Millet													5000-12000
Rye													3000-7000
Oat													3000-7000
Annual Ryegrass													2000-10000
Alfalfa													5000-8000
Arrowleaf clover													2000-4000
Crimson Clover													2000-4000
White clover													2000-4000

*estimate range or total productivity, in lb of Dry Matter/acre; actual values depend on cultivar, environment and management; consider using 50% for perennials and 60% for annuals

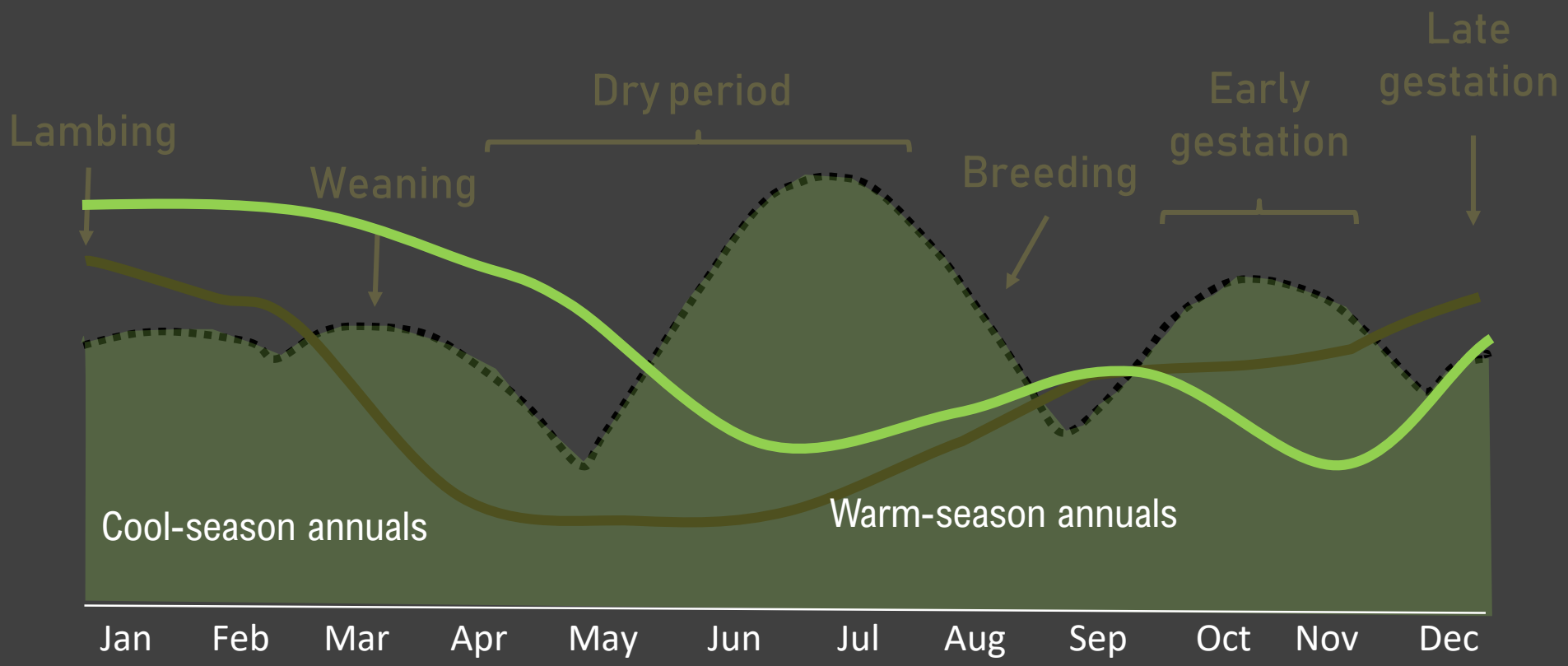
Think about your forage production chart



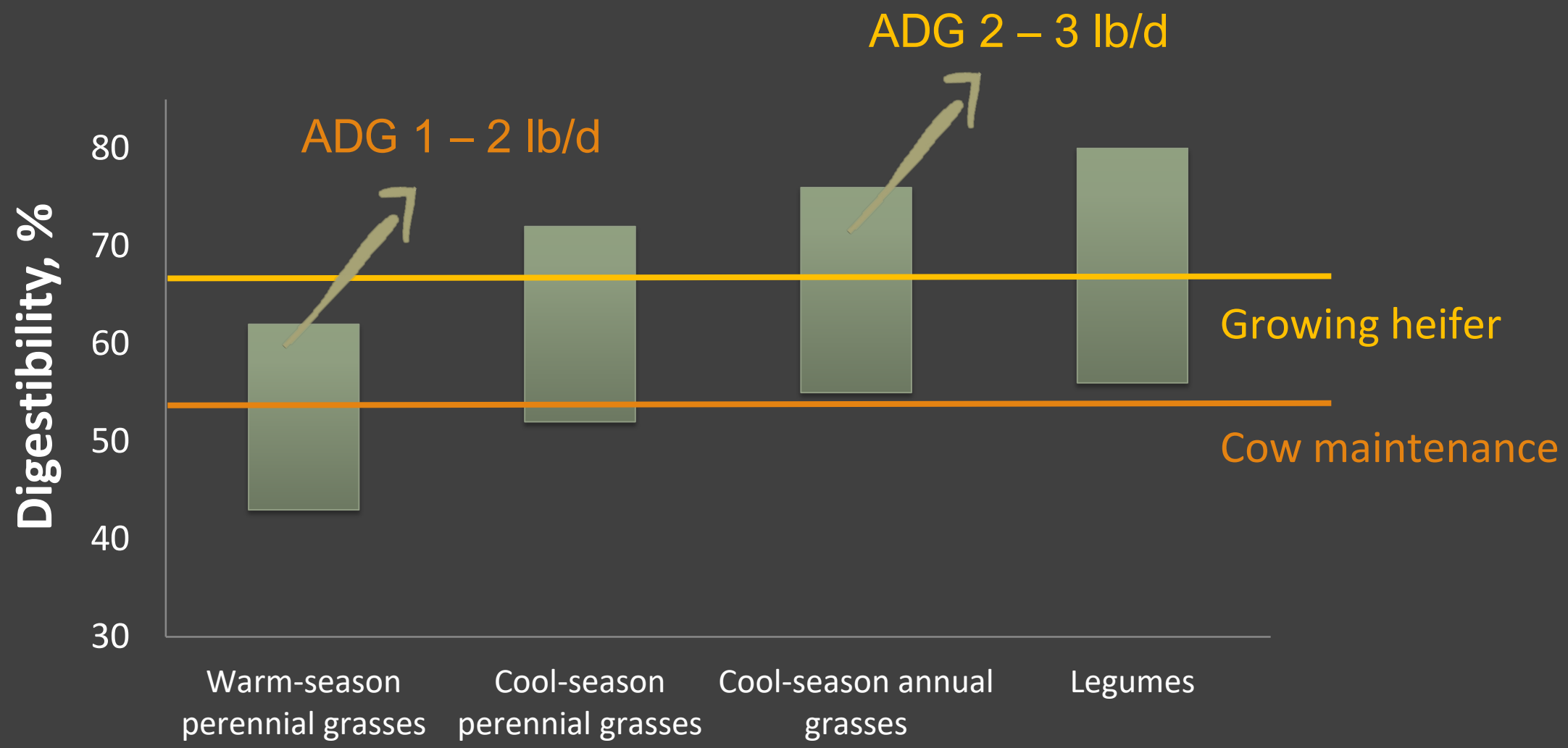
Plan your herd management around your forage production chart



And keep in mind forage quality

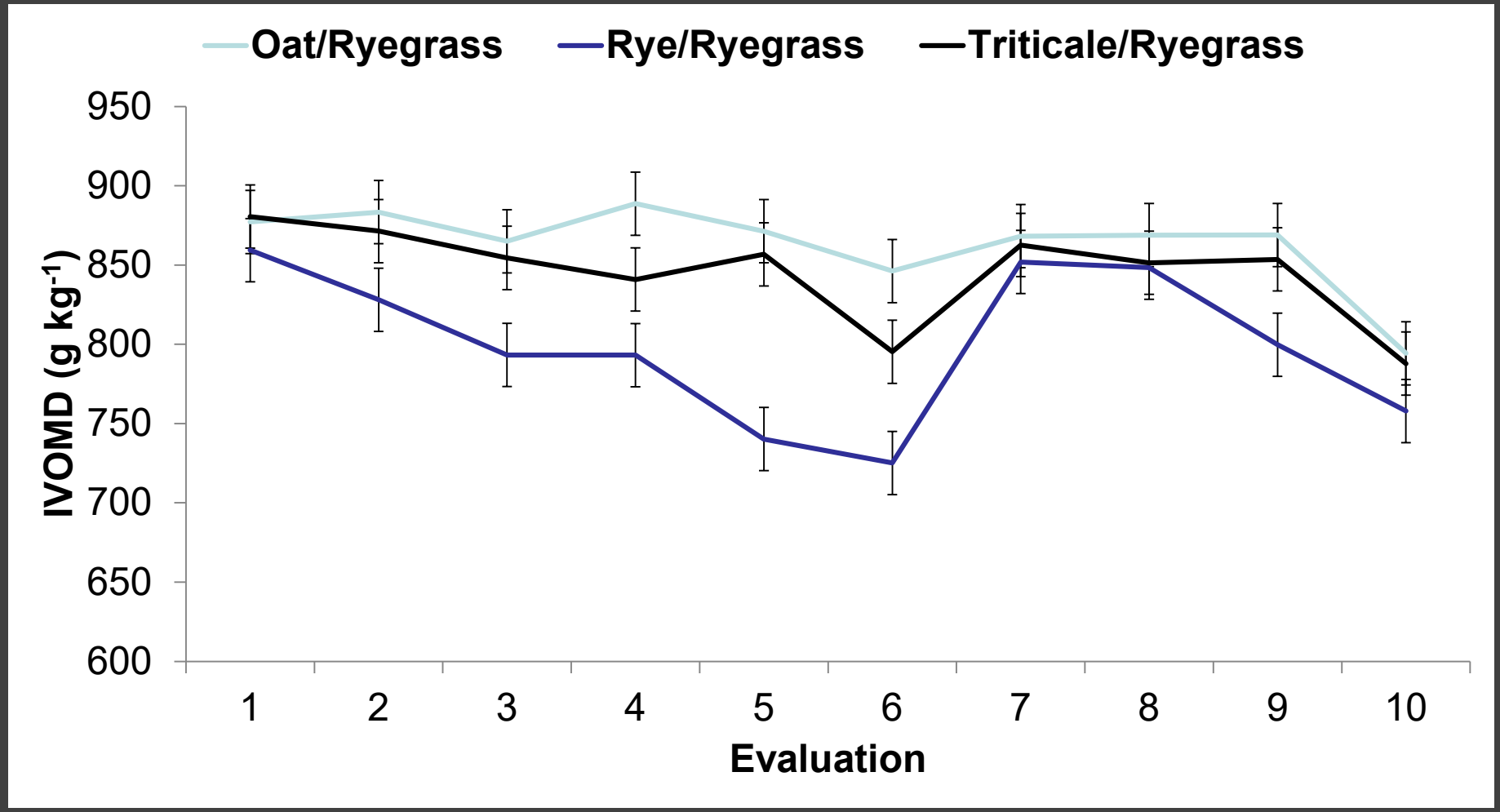


Setting production goals



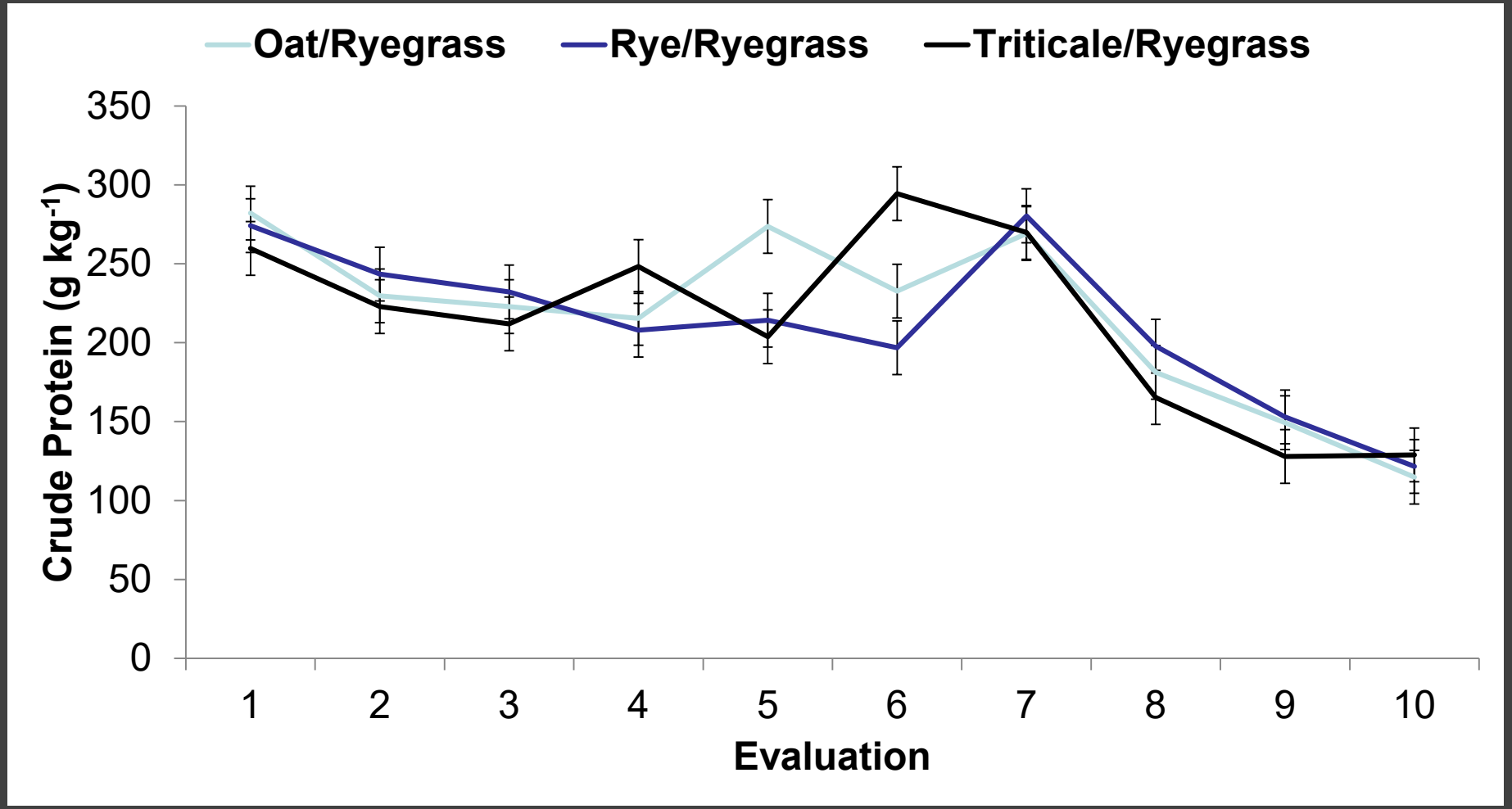
Adapted from Lippke and Riewe (1976) and Ball et al. (2015)

Quality - digestibility



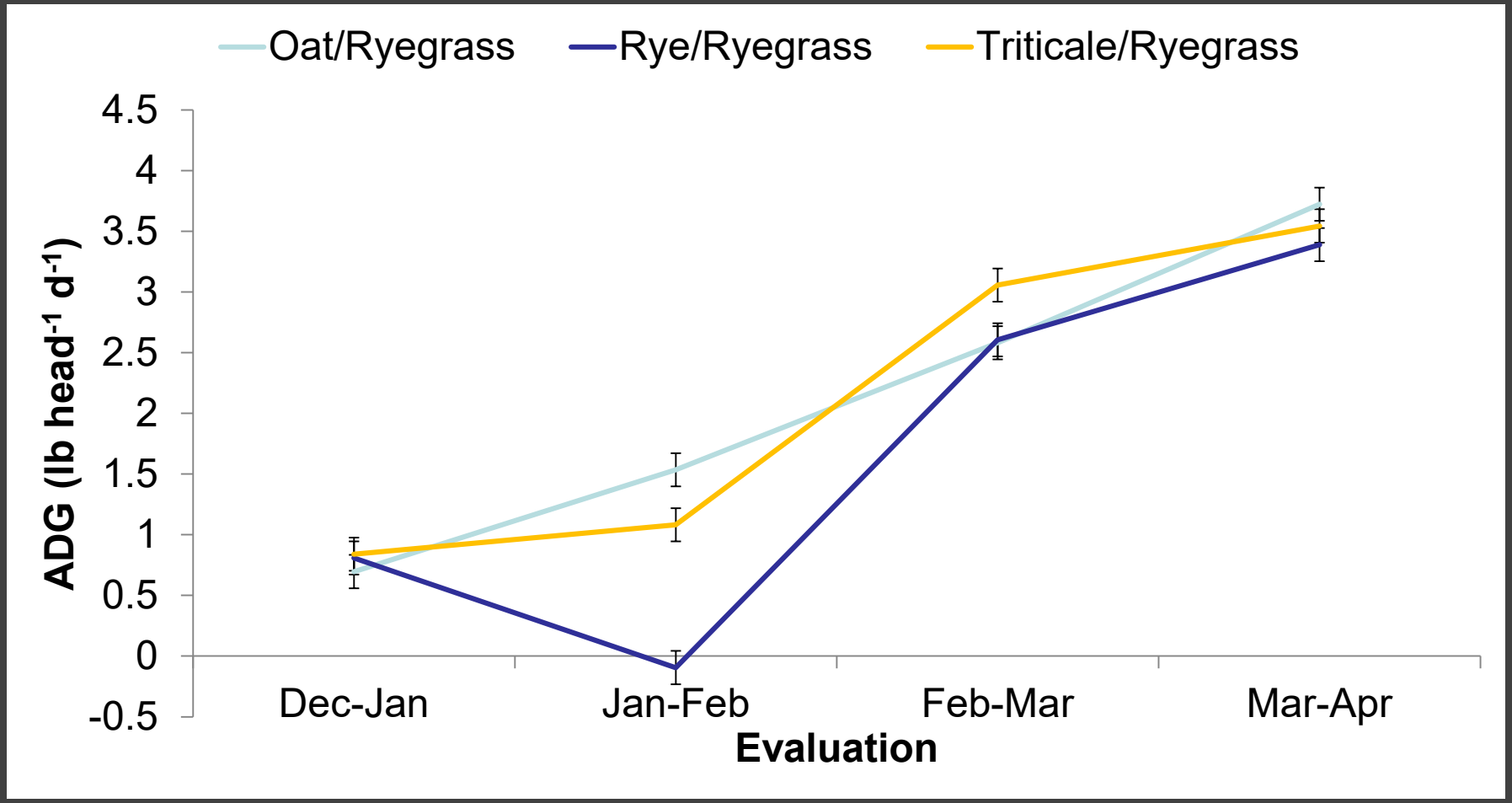
Dubeux et al 2016

Quality - protein



Dubeux et al 2016

Animal performance



Before planting your pasture

Set the stage

- Soil test, herbicides, soil preparation
- Method of planting – prepared seedbed, overseeding, no-till
- Fence the area off – give your pasture time to establish!

Choose species and cultivars adequate for your region, soil, management, etc.

Consult with your local extension agent

- And check EDIS publications

Have several sources of forage

A 15% prepared ground for Sorghum and oat/ryegrass

Main forage crop bahiagrass

Bermudagrass hayfield

Wet area with limpograss for stockpiling

Grazing management

Principles of grazing management

Carrying capacity and stocking rate — Make sure you have enough!

Defoliation management — Will influence pasture production and animal performance

Stocking management — Pasture and herd management

Carrying capacity

Maximum number of animals or animal units that your pastures can support in order to achieve a targeted animal performance without compromising the pasture (Allen et al., 2011)

This will determine your stocking rate

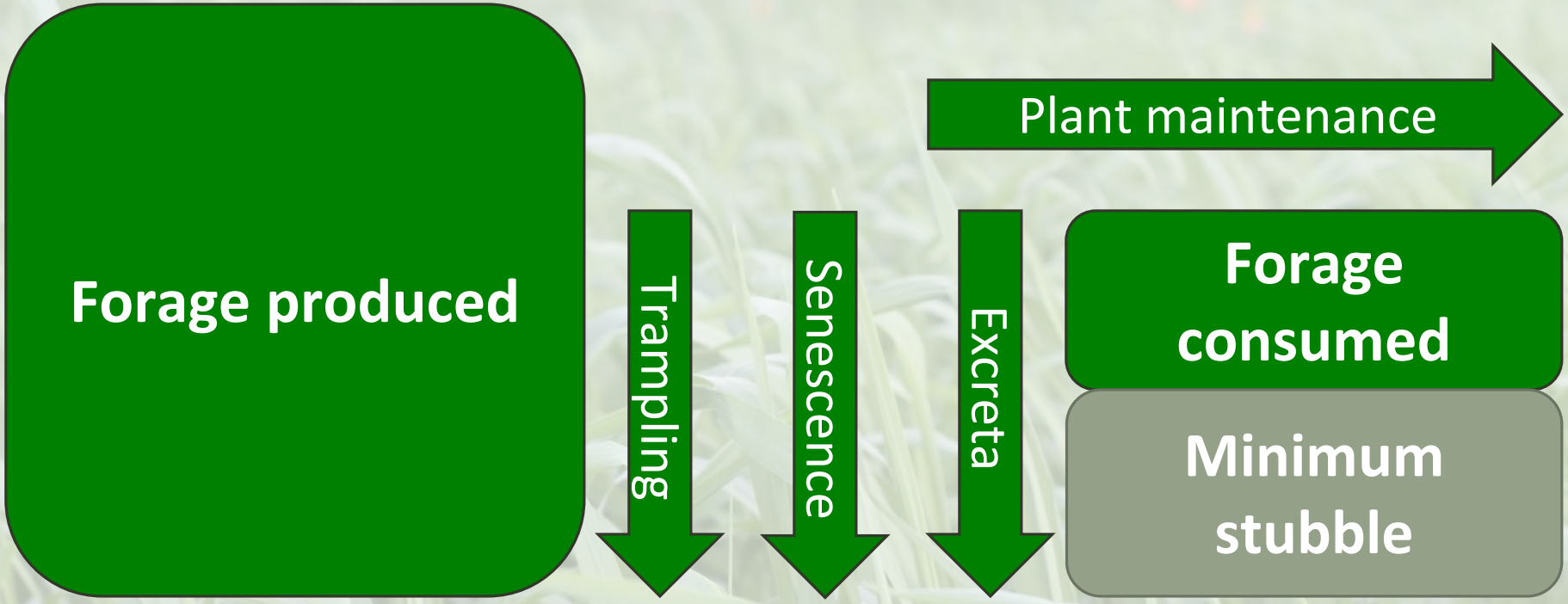
How to know your carrying capacity?

How much forage can you produce?

Assume your animals can eat around 3% of the body weight

Double that amount and you will see how much forage you need available

How much forage can I count on?



Rule of thumb – use 50-60% of accumulation rate – respect minimum stubble

Temperate annual pastures can tolerate up to 70% harvest efficiency

Tropical rangelands between 20 and 25%

Stocking rate in general terms

For 2 – 2.5 acres

Pasture Type	Cows	Sheep	Goats	Cows + Goats
Excellent Pasture	1	5-6	6-8	1 + 1-2
Brushy Pasture	0.75	6-7	9-11	0.75 + 2-4
Silvopasture	0.5-0.75	4-6	6-8	0.5 + 2-4
Brush Eradication			9-15	0.5 + 6-8

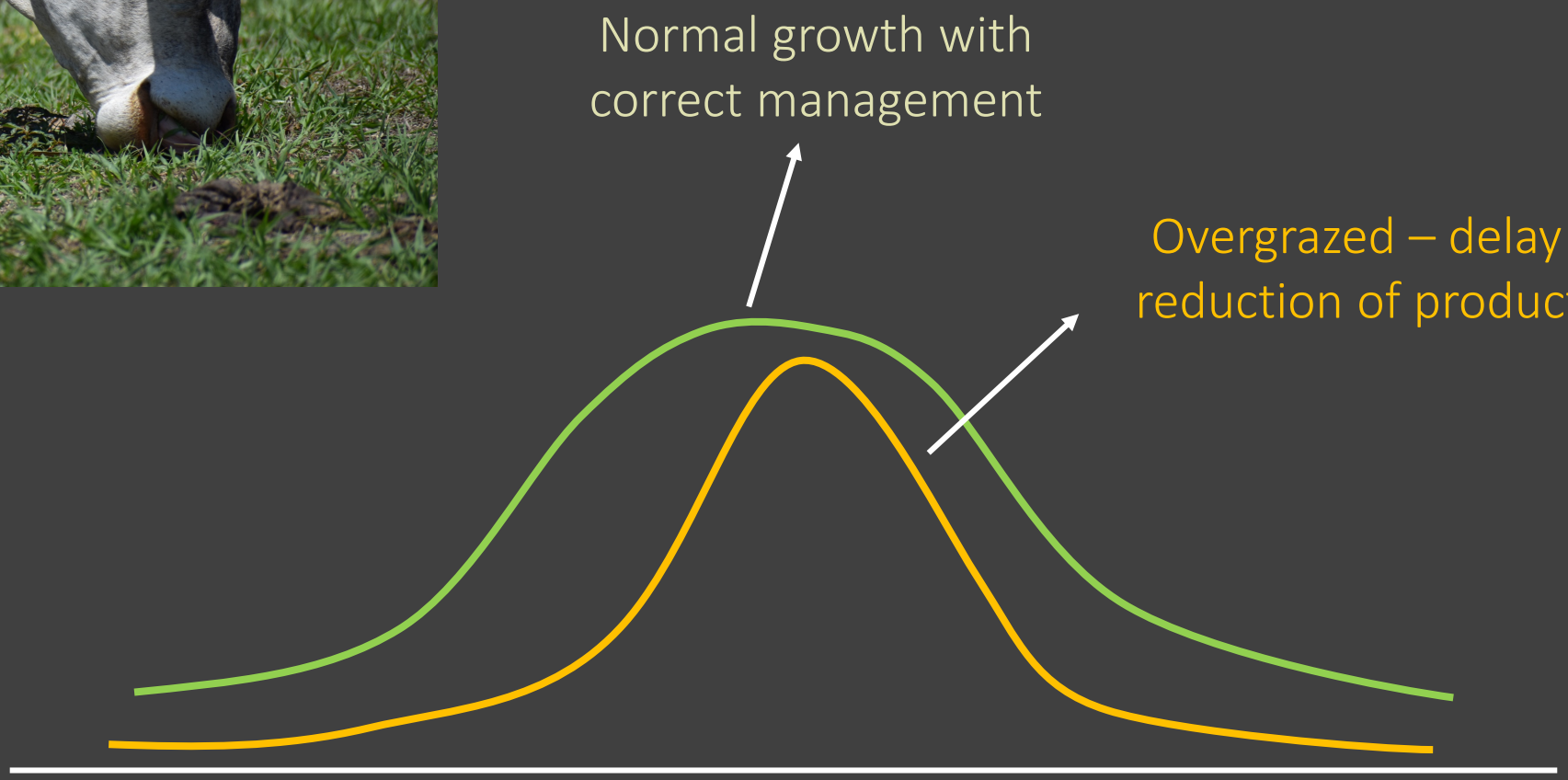
Slide: Dennis Hancock - UGA

Plant growth curve

phase
owth)

e

Time
(Biomass)


Normal growth with correct management
Overgrazed – delay and reduction of productivity

Heavy grazing

Moderate grazing

Light grazing

Source: Lynn Sollenberger

Starting

Residual

Average daily gain 153% greater
Gain per area 43% greater

Pictures and data from Savian, 2017

Long regrowth period = more stems = lower quality

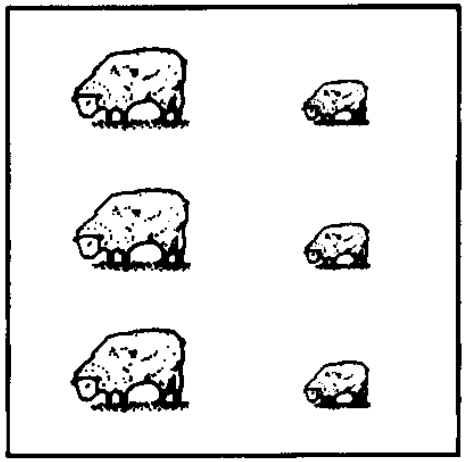
A mouth full of *grass*

Pictures: Jean Savian

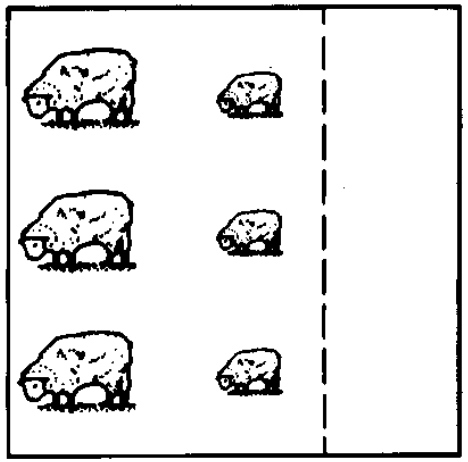
Stocking management strategies

Methods of grazing management.
(—) Permanent fencing; (– – –) temporary fencing.

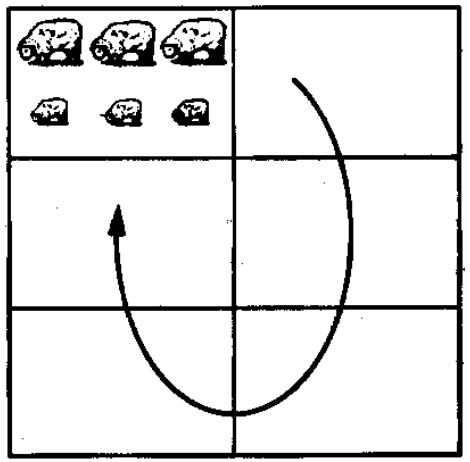
Set stocking



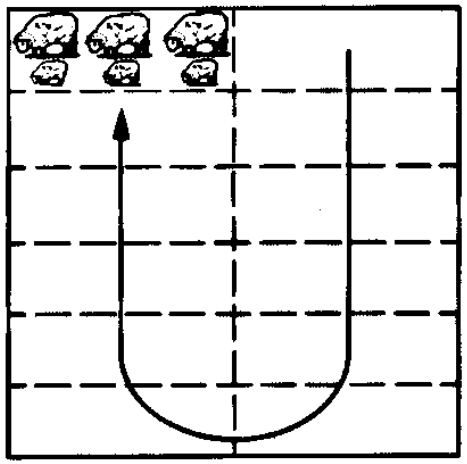
Continuous stocking



Rotational paddock grazing



Strip grazing



The importance of rotation

Matching needs – separate animal class

Allow plants to regrow

- especially because sheep will choose fresh forge

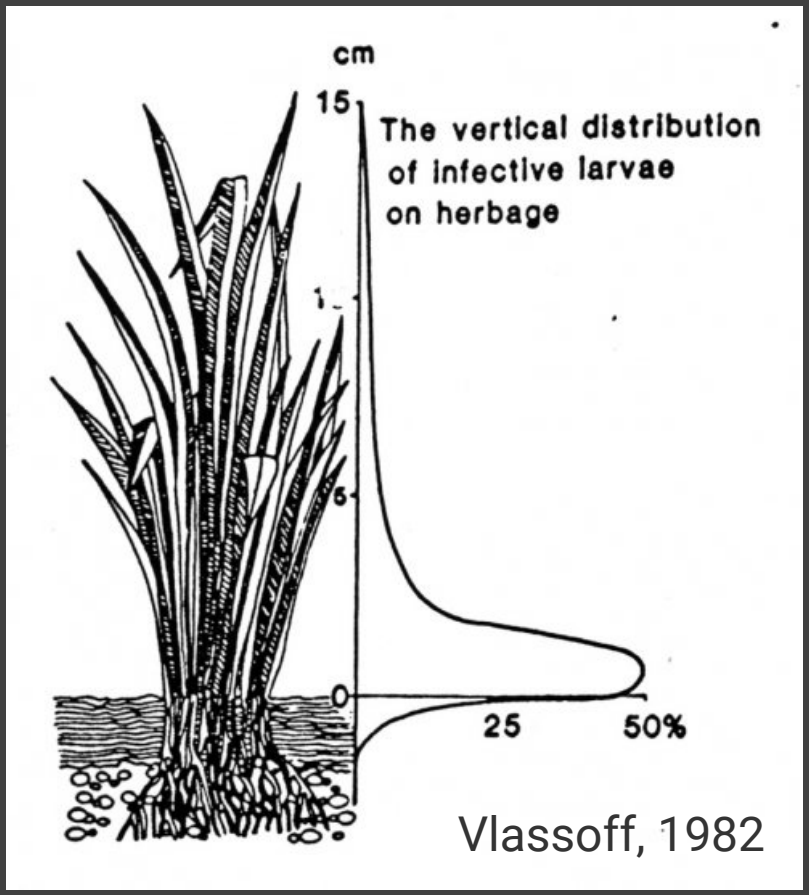
Parasites!

Parasite management

Primary cause is overstocking (and overgrazing)

Rotation
- Break cycles - ~45 – 60 days
  - Ideally longer – but will reduce nutritive value
- Graze top of the canopy only
- First and second grazers

Multi-species
- Of forages – tannins
- Of foragers – cattle & horses – non-host



Vlassoff, 1982

Haemonchus

FEMACHA

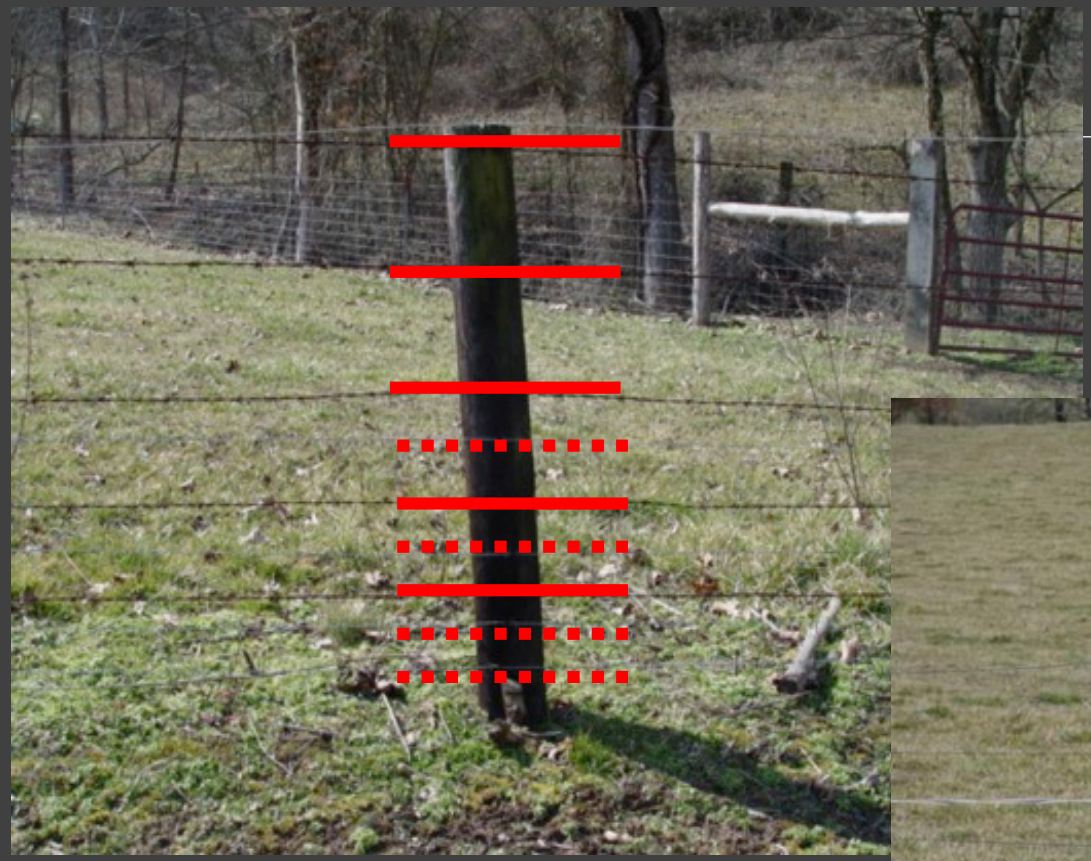
5-point check

Grazing management and parasites

Variable	Lenient rotational	Traditional rotational	P-value
Average daily gain (lb/day)	0.26	0.1	<0.001
Live weight gain per area (lb/A)	356	284	0.002
Stocking rate (lb/A)	756	1099	<0.001
Internal parasites (eggs/g of feces)	704	2472	<0.001

Greater parasite load in the bottom of the canopy

Fence



Slide: Dennis Hancock - UGA

Herd management

Match events (lambing, weaning, breeding) with pasture conditions

Reproduction control, cull unproductive animals, separate by production class

Raddle powder or marking harness

Bred ewes

Reproduction control – monitoring breeding season

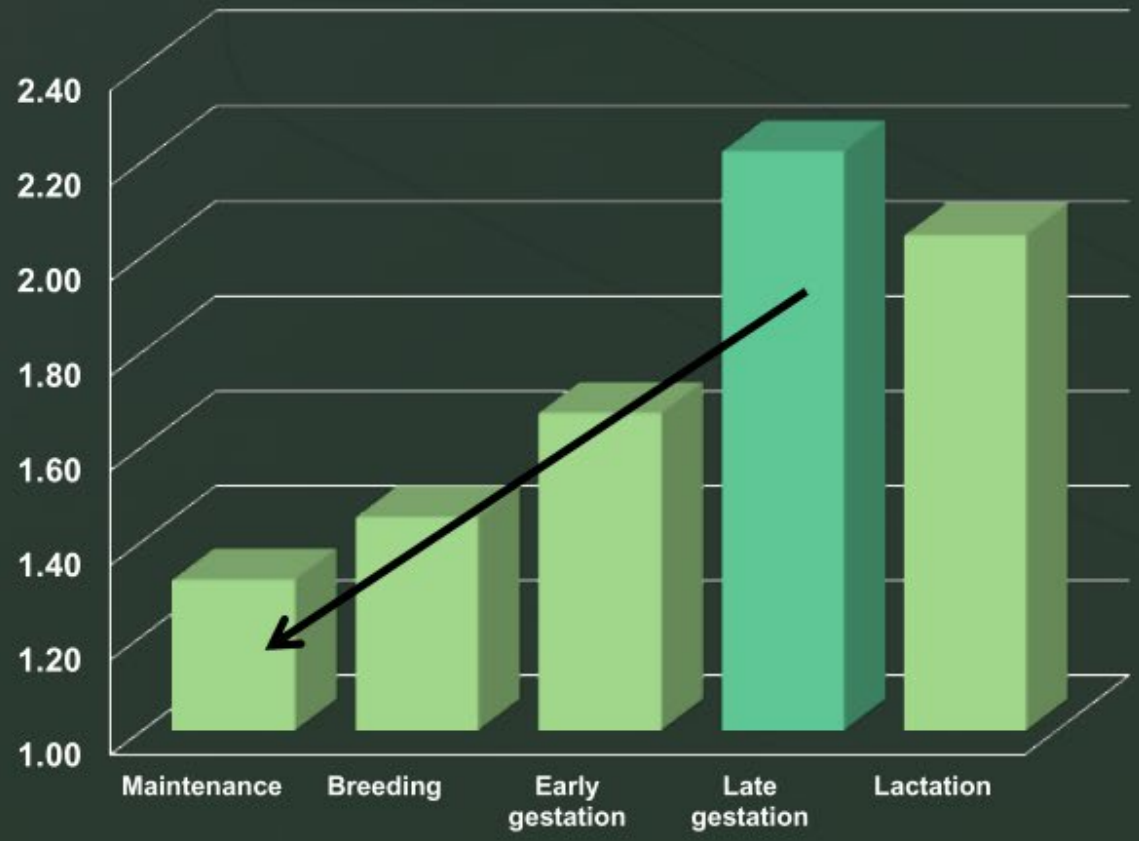
Why monitor breeding?

Determine fertility, libido, estrus

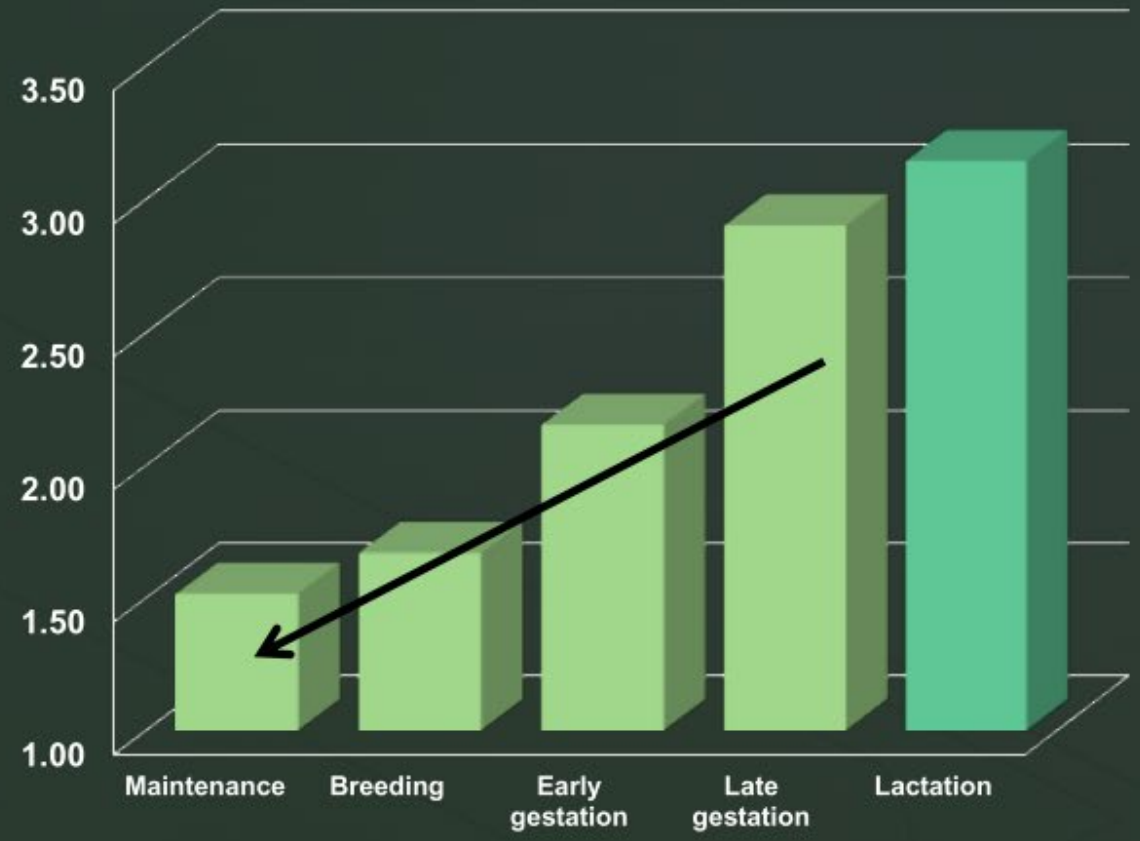
Cull unproductive animals

Large difference in nutrient requirement

Energy requirements, lb. TDN/day
132-lb. mature non-dairy doe (twins)



Energy requirements, lb. TDN/day
176-lb. mature ewe (twins)



After weaning, ewes can be placed on lower quality pasture because their nutritional requirements are low.

Lambs can be placed on clean, high-quality forage for improved performance and reduce parasite problems

Other nutrients and disorders

Balance your ration to complement your pasture

Minerals come from forage and water
- Soil in FL generally poor

Supplement – choose appropriate mineral mix
- Cu toxicity – problem especially in mixed grazing

Excessive grain
- Change in rumen environment can lead to metabolic disorders

Pregnancy toxemia – late gestation
- Low-energy diet, poor body condition score, ketosis

Summary

Make sure you have enough forage

Match forage production/quality and animal needs

- Supplement based on what is lacking in your pasture

Diversify your pasture base to have forage most of the year

Ram testing and nutrition specialist

DR. DIWAKAR VYAS

UF – ANIMAL SCIENCE

Ram testing

“ Internal parasites are among the leading health concerns for sheep, and potentially pose dramatic economic losses for many producers, especially those in the Mid-Atlantic and Southeast regions of the U.S. where forage-based production is an ideal management system for livestock”

Scott Greiner, Virginia Cooperative Extension Specialist

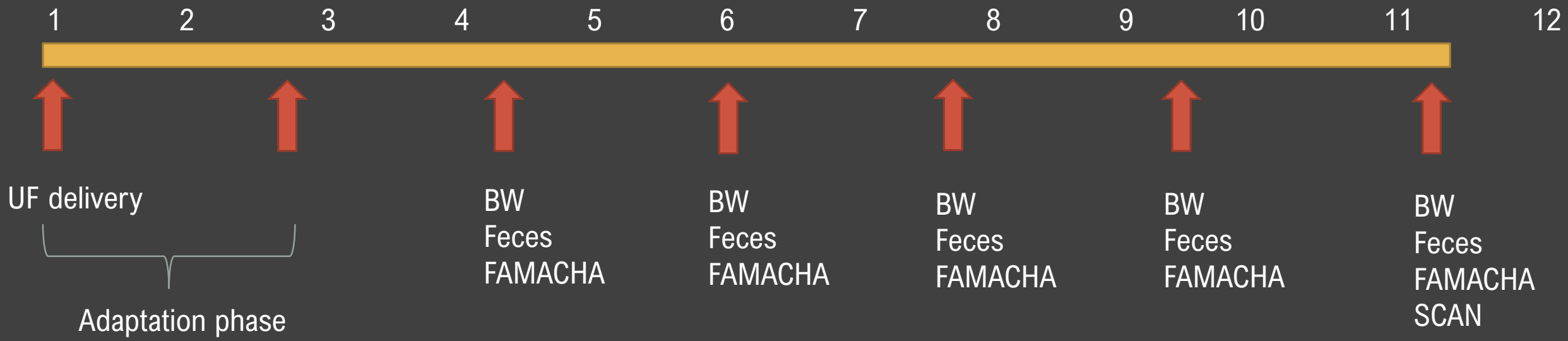
Ram testing

- Sheep producers will soon be allowed to bring their rams to the University of Florida to assess their performance for use in breeding programs.
- Forage based performance test designed specifically to quantify post-weaning performance and parasite resistance
- Ram lambs will be evaluated among peers from other flocks in standardized environment

Ram testing (Parameters)

- Body weight (10 weeks)
- Average daily gain
- Fecal egg counts
- Codon 170 (Scrapie resistance)
- Nutrient digestibility

Tentative schedule (Ram testing)



https://www.apsc.vt.edu/extensionandoutreach/Sheep-Extension/sheep-programs/swarec-ram-test.html

Thank you!

mwallau@ufl.edu

Weed Management

Courtney Darling
Ag and Natural Resources Agent
UF/IFAS Extension Suwannee County

UF IFAS Extension
UNIVERSITY of FLORIDA

NORTH FLORIDA
LIVESTOCK AGENTS GROUP

What is a weed?

Any plant growing where it is not wanted

Why should we control them?

- It is estimated that weeds cost ranchers statewide in excess of $180 million annually
- If not properly managed, weed densities can rapidly take over
- Infested areas can reduce stocking rates and cause health issues with animals

Weed Prevention

- Scout fields often
- Proper species identification is key
- Don’t let weeds reproduce
- Minimize spread of weeds to un-infested areas
- Maintain a healthy forage stand

Cultural Control

Management practices that increase crop competitiveness

- pH
- Fertility
- Water management

*Target pH of bahiagrass and bermudagrass is 5.5

Mechanical Control

- When properly timed, prevents weed seeds from spreading
- More effective on broadleaf and annual weeds

Biological Control

- Use of plants, herbivores, insects, nematodes, and phytopathogens to suppress weeds
- Suppress weed populations, but rarely provide complete control
- Rarely a fast-acting method of control

Chemical Control

- Properly identify weed species
- Know the forage tolerance to herbicides
- Use correct herbicide and application rate
- Preemergence application should be made before weeds germinate and emerge
- Apply postemergence herbicides early in the growing season (when weeds are small)
- Broadcast vs spot treatment

Why do livestock consume toxic plants?

- Contaminated hay
- Lack of adequate forage/feed
- When used to clear woodlands/wetlands
- Exposed to landscape plants

Creeping indigo

(*Indigofera spicata*)

- Common in heavy traffic/grazed areas
- Prostrate growth
- Stems grow 6 feet long
- Pink flowers bloom from base of leaves

Hairy indigo

(*Indigofera hirsuta*)

- Erect growing
- Reaches 4-7 ft tall

Coffee Senna

(*Senna occidentalis*)

Leaves: alternate, compound, 8-12 in, pointed ends

Stem: branching, without hairs

Flowers: yellow, multiple in cluster

Growth Habit: erect

Life Cycle: annual, perennial (South)

Poisonous Parts: ALL, especially pods and beans

Symptoms: diarrhea, tremors, dark brown urine

Scarlet milkweed (*Asclepias curassavica*)

* Other common milkweed species are also toxic

Leaves: opposite, 5 inches long, pointed ends

Stem: green, thick, contains milky sap

Flowers: orange and red in 2-4 in clusters

Growth Habit: erect

Life Cycle: perennial

Poisonous Parts: ALL

Symptoms: vomiting, stupor, weakness, spasms

Credits: Edward F. Gilman, UF/IFAS

Oleander

(*Nerium oleander*)

Leaves: simple narrow, pointed, thick, leathery, 3-10 in

Stem: clump forming

Flowers: white, pink, red, yellow, five or more petals in clusters

Growth Habit: erect

Life Cycle: perennial

Poisonous Parts: ALL

Symptoms: start 4hr after consumption, drooling, lethargy, weakness, death

Sicklepod

(*Senna obtusifolia)*

Leaves: alternate, pinnately compound, 4-6 leaflets, 8-12 in

Stem: branching, without hairs

Flowers: Yellow flowers on upper leaves

Growth Habit: erect

Life Cycle: annual

Poisonous Parts: ALL (especially pods/seeds)

Symptoms: diarrhea, tremors, dark brown urine

Showy crotalaria

(*Crotalaria spectabilis*)

Leaves: alternate, 3-6 in, wider at apex, narrow at base

Stem: branching, green to purple

Flowers: yellow, terminal racemes

Growth Habit: erect

Life Cycle: annual

Poisonous Parts: ALL, especially seeds

Symptoms: weight loss, lethargic, aimless walking

Photo credit: Doug Mayo

Lantana

(*Lantana camara*)

Leaves: opposite, rough, aromatic

Stem: square

Flowers: multicolored including pink, orange

Growth Habit: erect

Life Cycle: perennial

Poisonous Parts: ALL

Symptoms: vomiting, diarrhea, dilated pupils, labored respiration; the leaves may cause dermatitis

Bracken fern

(*Pteridium aquilium*)

Leaves: arise from rhizomes, 6.5 ft tall, hairy underneath

Flowers: none

Growth Habit: erect

Life Cycle: perennial

Poisonous Parts: ALL, especially rhizome

Symptoms: diarrhea, tremors, dark brown urine

Photo credit: UF/IFAS

Dogfennel

(*Eupatorium capillifolium*)

Photo credit: Missouri State

Spiderling

(*Boerhavia* spp)

Johnsongrass

(*Sorghum halepense*)

- prussic acid poisoning
- Occurs when the plant is stressed after frost (72hrs-10 days after event)

WE Love Plant ID

UF | IFAS Extension

Here is how to send quality pictures to us so we can help you!

Conclusion

- Develop a weed management plan that incorporates prevention methods
- Properly identify weed species before implementing a control method
- Utilize your county extension office for help with identification

EDIS Document:
Weed Management in Pastures and Rangeland
https://edis.ifas.ufl.edu/wg006

Questions?

Courtney Darling
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UF/IFAS Extension Suwannee County
gryderc@ufl.edu

GOAT AND SHEEP HEALTH MANAGEMENT

Jane Cant and Luara Ladner, UF/IFAS

AN OUNCE OF PREVENTION…

- Biosecurity
- Body Condition Scoring
- Foot Rot
- Parasite Control Program
- Vaccination Program
- Predator Management

FLOCK/HERD BIOSECURITY

BIOSECURITY

Start	Start with healthy stock
Buy	Buy from reputable breeders
Isolate	Isolate new animals for 30 days
Maintain	Maintain closed herd
Don't loan/board	Don't loan/board/mix your animals
Don't loan	Don't loan equipment (but sterilize if you do!)
Limit	Limit access to your animals
Control	Control rodents, flies, birds, and predators

BE PREPARED

- Thermometer
- Record book
- Syringes and needles
- Sharps container
- Tagger and tags
- Dewormers and guns
- Bandaging equipment

Photo Credit: Farmers Weekly

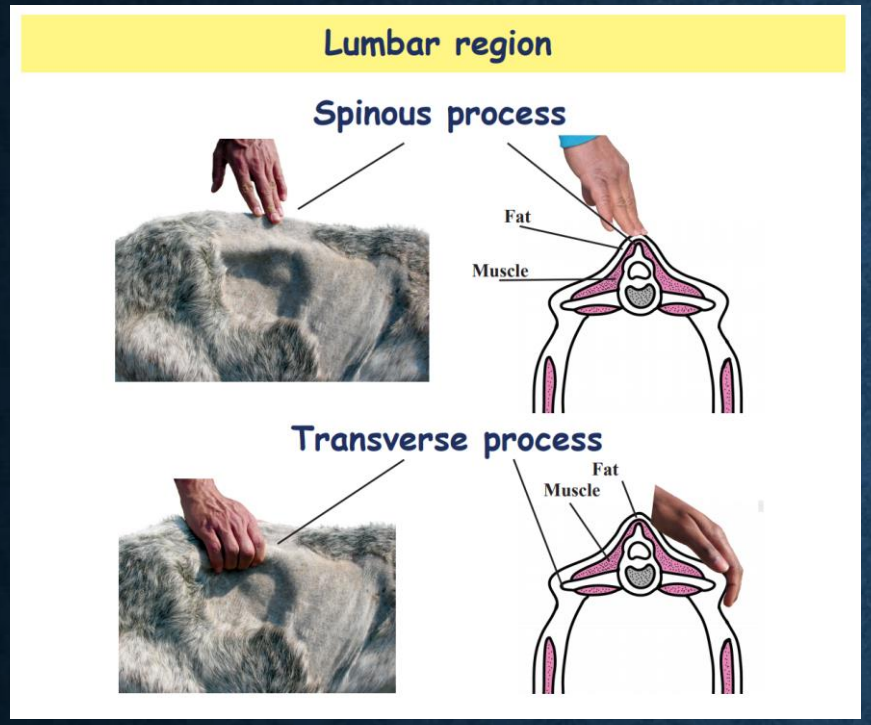
KNOW WHAT IS NORMAL

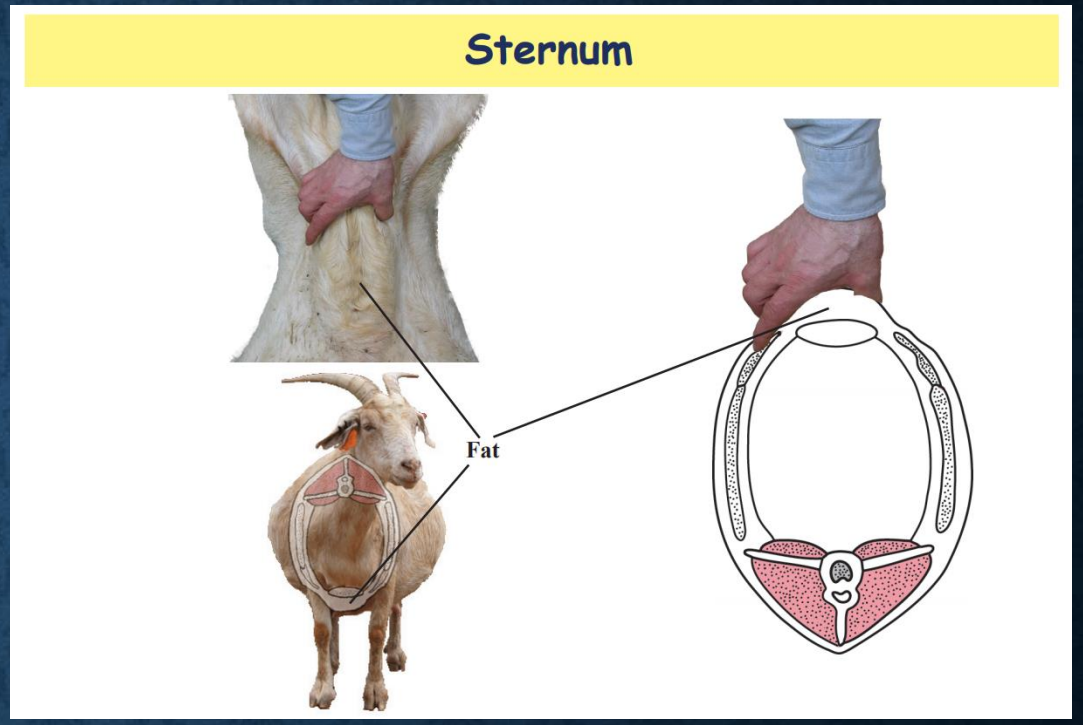
Indicator	Goats	Sheep
Rectal Temperature	101-103 F	101-103 F
Estrus Cycle	18-21 days	16-21 days
Gestation Length	145-155 days	145-155 days
Body Condition Scoring, FAMACHA, behavior, intake		

BEHAVIOR

- Eating?
- Drinking?
- With the herd/flock?
- Sound?

Photo Credit: Whitestone Boers

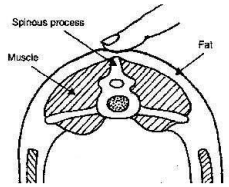


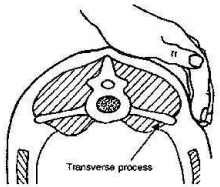


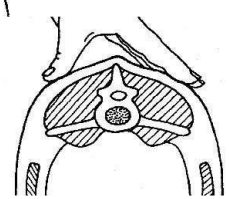
BODY CONDITION SCORING

Body condition scoring

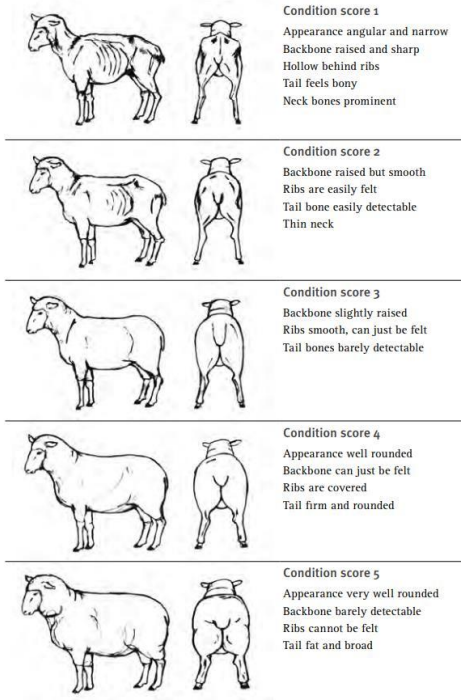
an estimate of fat and muscle







- It is a subjective score. The exact score is not as important as the relative scores and differences between scores.
- Both the vertical bone protrusion (spinous process) and horizontal protrusion (transverse process) of the loin are felt and used to access body condition scoring.



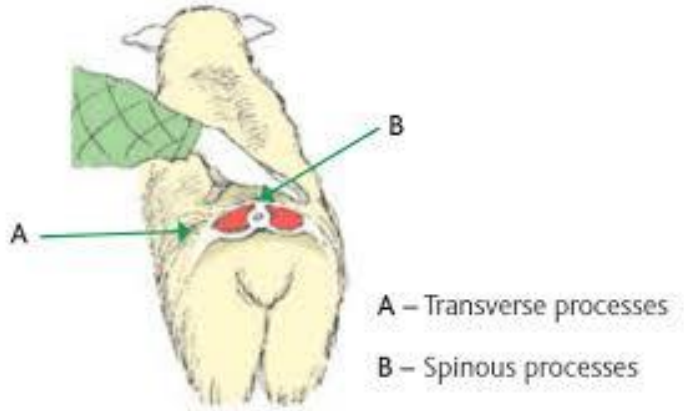
Condition score 1
Appearance angular and narrow
Backbone raised and sharp
Hollow behind ribs
Tail feels bony
Neck bones prominent

Condition score 2
Backbone raised but smooth
Ribs are easily felt
Tail bone easily detectable
Thin neck

Condition score 3
Backbone slightly raised
Ribs smooth, can just be felt
Tail bones barely detectable

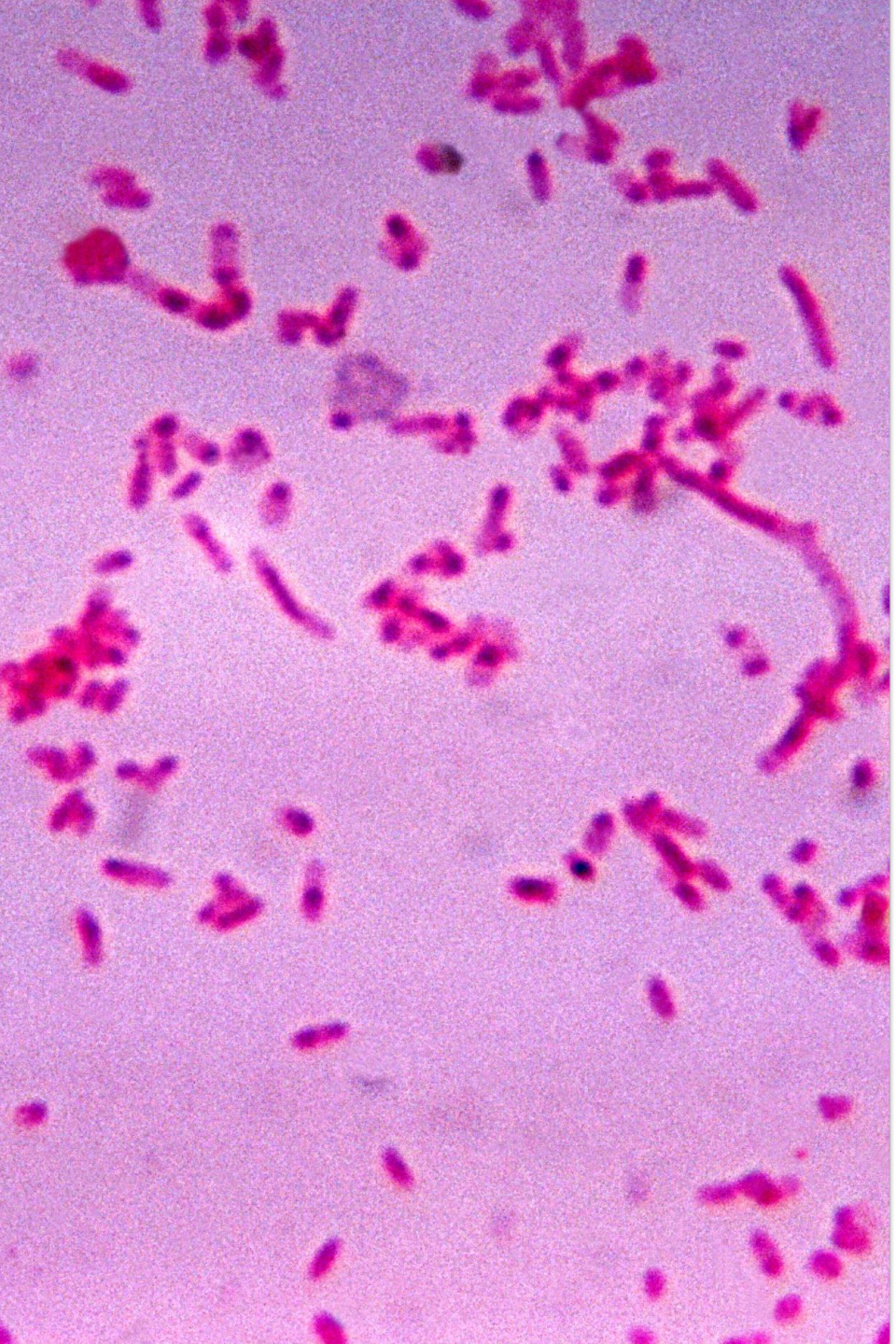
Condition score 4
Appearance well rounded
Backbone can just be felt
Ribs are covered
Tail firm and rounded

Condition score 5
Appearance very well rounded
Backbone barely detectable
Ribs cannot be felt
Tail fat and broad



BODY CONDITION SCORING

HOOF CARE



FOOT ROT

- Anaerobic gram (-) bacteria
  - *Bacteroides nodosus* (BN)
  - *Fusobacterium necrophorum* (FN)
- FN is a normal inhabitant of the ruminant digestive tract
  - Interacts with *Corynebacterium pyogenes* in wet weather
  - Scald- infection of skin between the toes
  - Lowers immune system and allows BN to cause foot rot
- BN can only live in the hoof of infected animals OR soil (10-14 days)

FOOT ROT

- BN is spread by contaminated sheep
  - Manure on ground, trucks, bedding, etc.
- Wet environment between 40F and 70F
- Carrier will continue to re-infect the flock/herd

FOOT ROT

1. Area between toes is moist and red
2. Separation of hoof
3. Foul odor
4. Lameness
5. But it may be something else!

PREVENTING AND TREATING FOOT ROT

- Foot Trimming
  - Reduces cracks and crevices
  - Provides oxygen
  - Clean equipment between every animal
  - 1-2 times per year
- Footbaths/Footsoakes
  - Treatment: 1-2 times per week
  - Preventative: after trimming
  - Zinc Sulfate- 10% solution, surfactant can increase penetration, 30-60 minutes, do not allow animal to drink
  - Copper Sulfate- 10%solution, dissolve in warm water, VERY corrosive and toxic

PREVENTING AND TREATING FOOT ROT

Dry Chemicals

- Dry zinc sulfate in an area where sheep walk will decrease spread
- Lime, disinfectants, or drying agents around feed and water areas reduce moisture

Oral Therapy

- Antibiotics (consult with a veterinarian)
- Zinc sulfate at 0.5g/day for 21 days
- Zinc sufficient diet

Injectable Antibiotics (consult with veterinarian

- Penicillin/Streptomycin combinations
- Procaine Penicillin G
- Tetracycline

PREVENTING AND TREATING FOOT ROT

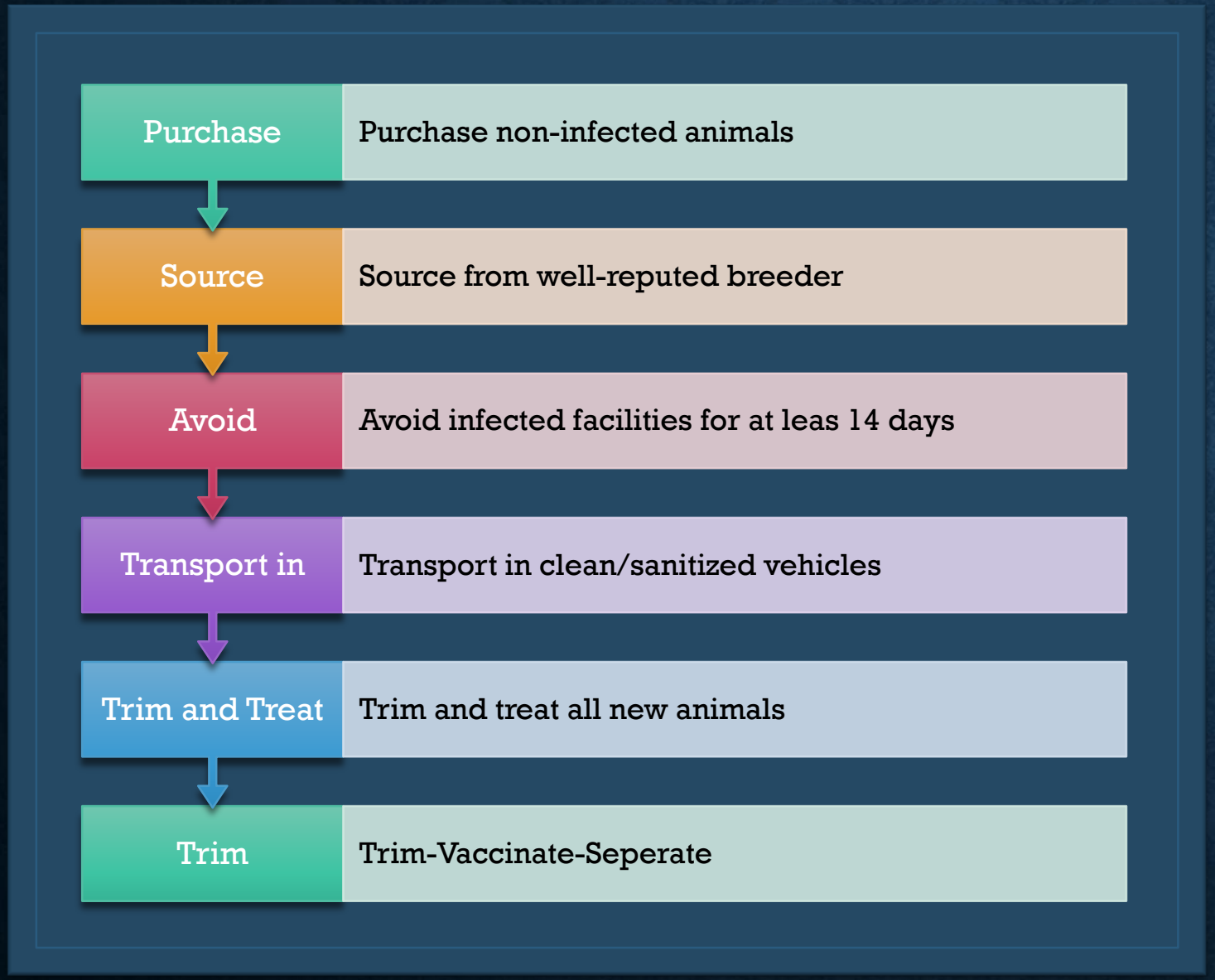
Topical Medications

- Zinc Sulfate- 0.25lbs/1qt warm water
- Copper Sulfate- 0.25lbs/1 qt warm vinegar
- Copper Sulfate- 2 parts CuSO4 in 1 part pine tar
- Ocytetracycline Solution- 1 25.69g package to ½ cup water, then add alcohol to bring solution to 2 qts

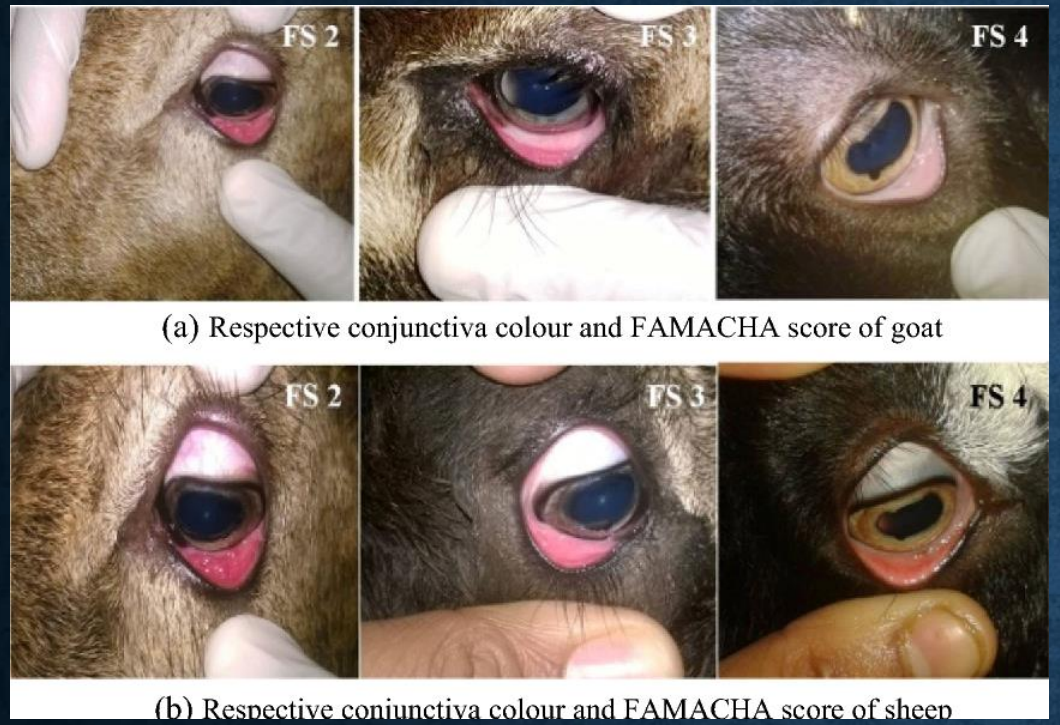
Vaccination

- BN vaccines approved in US
- Most report 60-80% effectiveness
- Preventative and Treatment
- 2 SQ injections in neck 4-6 weeks apart, followed by annual booster prior to wet season
- Abscesses at injection site are common but should not be treated

PREVENTING FOOT ROT

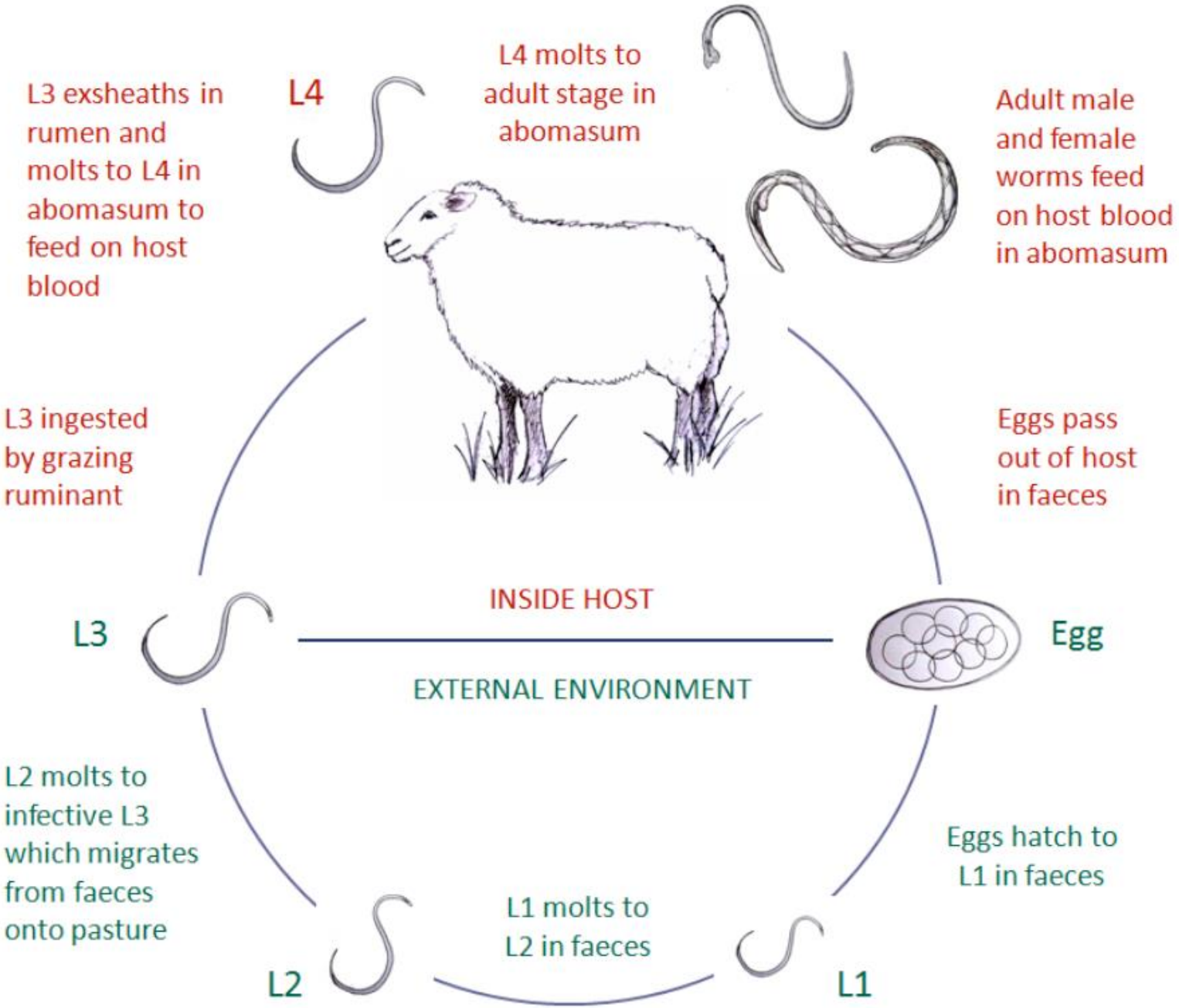


INTERNAL PARASITES



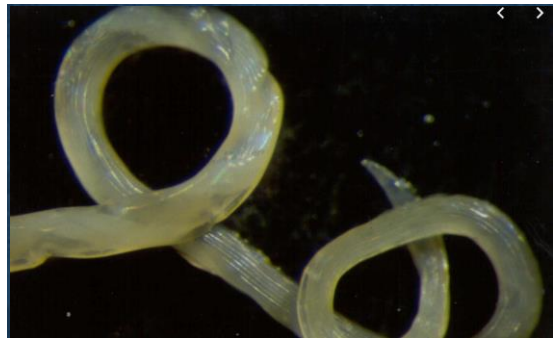
FAMACHA SCORING

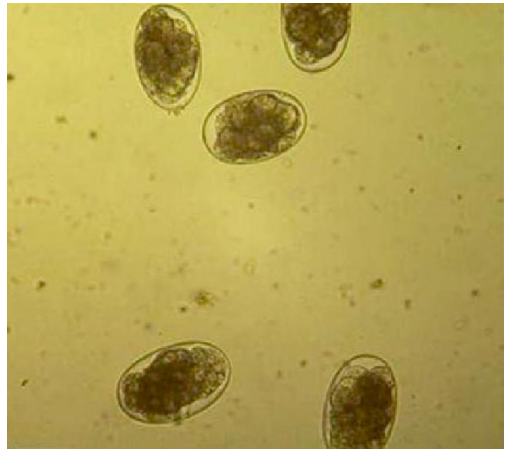
- Barber Pole Worm Only
- Deworm 4&5 always
- Don't deworm 1&2 (unless other symptoms)
- Deworm 3 if >10% of the flock/herd is a 4 or 5
- Check every 2 weeks if <10% are 4 or 5
- Check every week if >10% are 4 or 5



GASTROINTESTINAL PARASITES- *HAEMONCHUS CONTORTUS*

- Barber Pole Worm
- 21 day lifecycle
- L3 is ingested
- Travels to abomasum
  - Hypobiosis
  - Molt into L4 then to adult
- 14 days to lay eggs (5,000/day)
- "Periparturient rise"
- 90 day summer pasture survival
- 180 day winter pasture survival
- Prefer 70-80 F and rain
- Consume 1/10th of total blood/day





RECOGNIZING HAEMONCHUS CONTORTUS

- Anemia
- Edema
- Diarrhea not common
- Fecal egg counts

WHO IS THE MOST SUSCEPTIBLE?

Genetic resistance

Older animals have more resistance

More likely with sheep

Lactating animals are highly susceptible

Young animals most susceptible

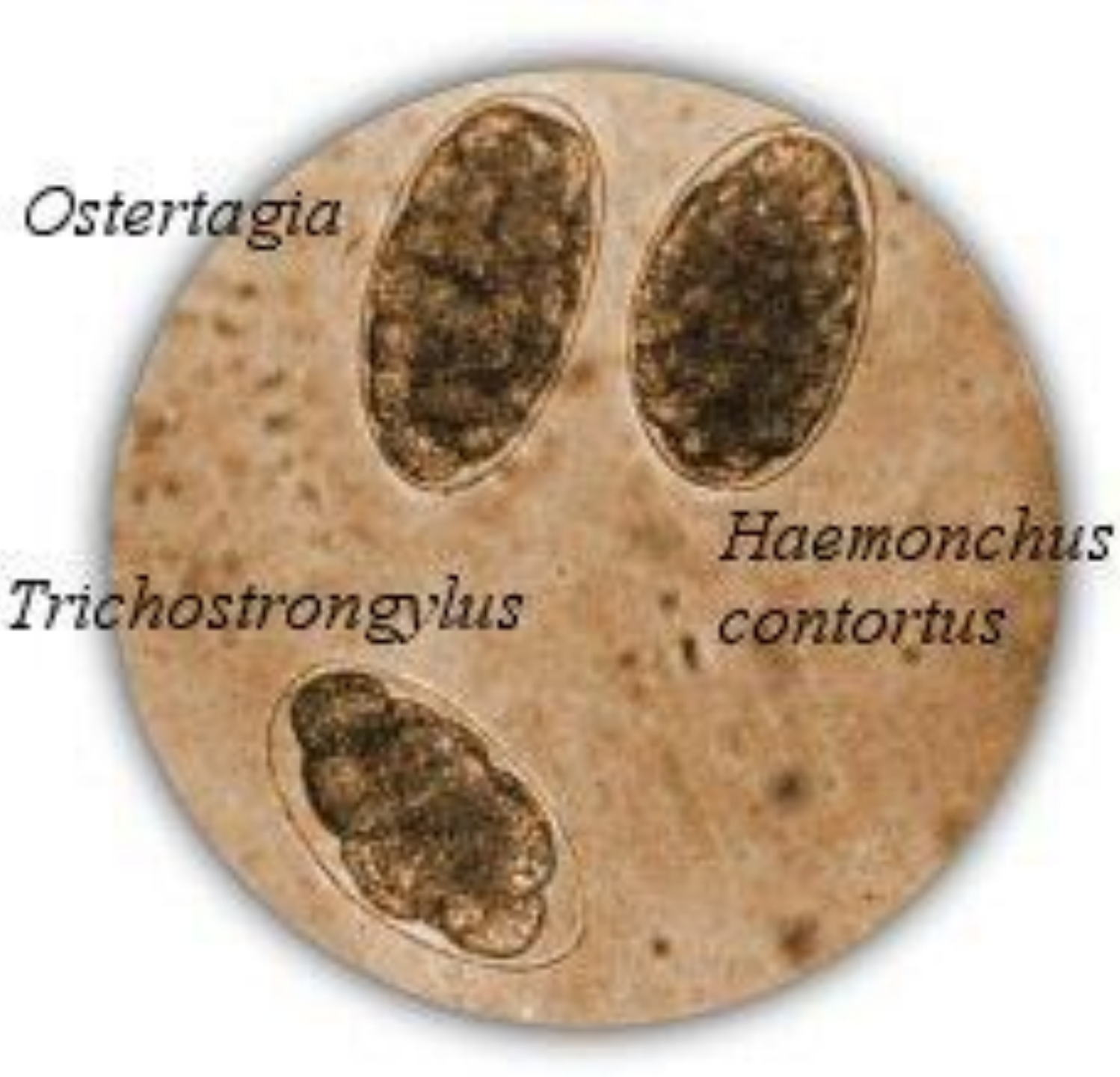
no exposure and periparturient rise
Develop some immunity at 6-8 weeks

Goats are always more susceptible

Little natural resilience or resistance

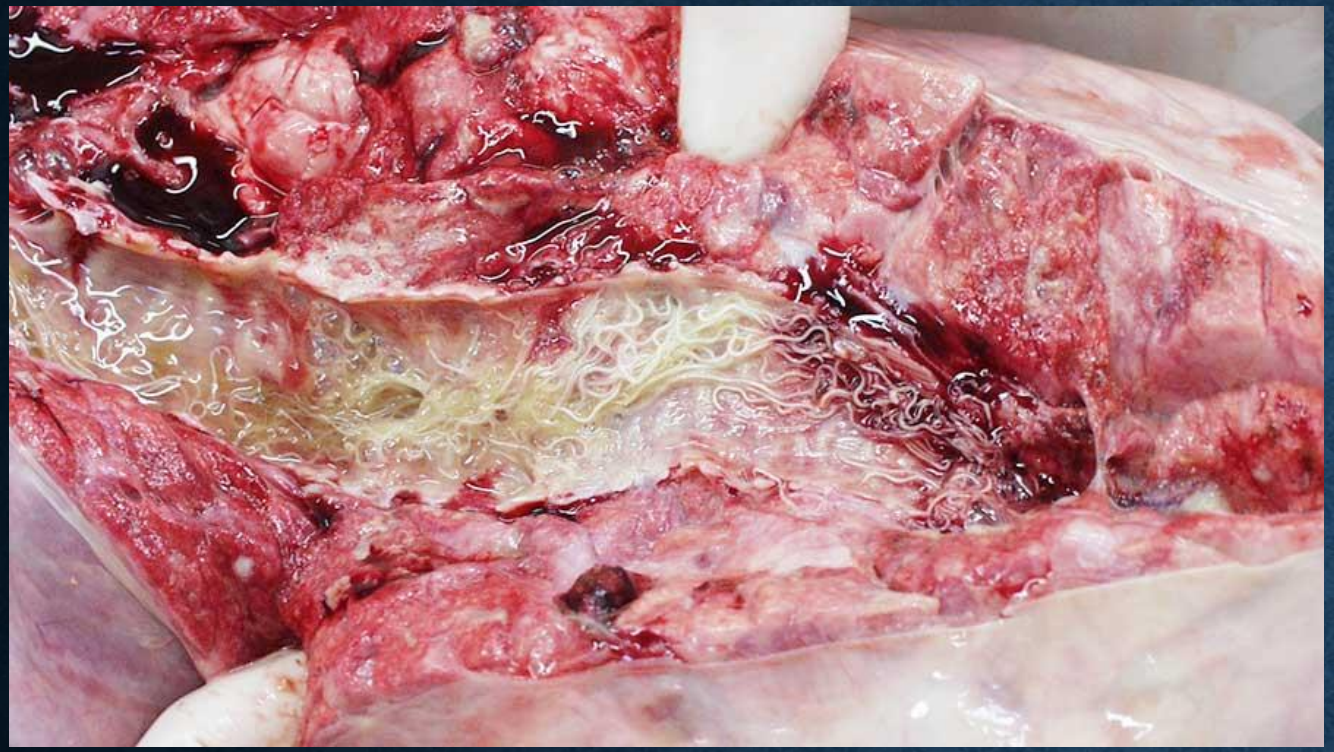
Ewes/Does in late gestation and early transition more susceptible

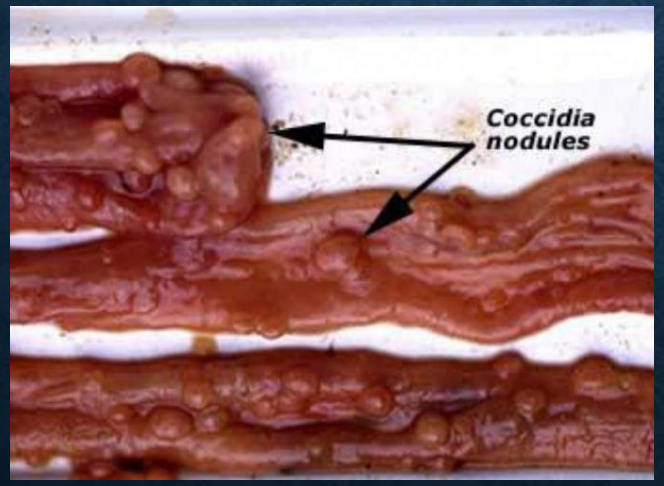
Hormones and photoperiod



USING FECAL EGG COUNTS

- Determine contamination level on pasture
- Herds can be resistant with high counts or susceptible with low counts
- Identify individuals
- Develop a culling program





OTHER INTERNAL PARASITES

- Coccidia
  - Linings of intestines
  - Destroy intestinal folds and papilla
  - Diarrhea, weight loss, 'failure to thrive'
- Liver Flukes
  - Burrow through liver
  - Waste accumulates in blood
  - Edema, depression, stupor
- Lungworms
  - Irritate bronchioles
  - Coughing and fast breathing
  - Eggs found in fecal sample

INTERNAL PARASITE CONTROL

1. Anthelmintics
2. Animal Management
3. Pasture Management

PASTURE MANAGEMENT

- Infective larvae survive on pasture
- Sheep graze close to ground, do not avoid fecal matter
- Goal is to provide ‘rest’, the larvae die before they are ingested
- ‘Safe Pasture’
  - Tilled (or planting annuals)
  - Burned
  - Grazed by other species
  - Rested for 90 days (summer) or 180 days (winter)
  - Cover crop or hay removal

ANTHELMINTICS (DEWORMERS)

- Not many options in small ruminants
- Parasite resistance is a problem
- Keep animals in current pasture/dry lot after treatment before rotating (12-24 hrs)
- Ewes and Does- treat before breeding, two weeks before lambing/kidding, and 1 week after lambing
- Rotate classes
- **Always, Always, Always work with your veterinarian**

CLASSES OF ANTHELMINITICS

Imidothiaozoles

- Only approved in sheep
- Extra-label if used in goats
- Great for Haemonchus
- Less resistance issues
- Levamisole

Avermectins

- Only approved in sheep
- Extra-label if used in goats
- Sheep get drench, goats get higher dose
- Good Haemonchus control
- Ivermectin and moxidectin

Benzimidazoles

- 'White drenches'
- Safe
- Poor control of Haemonchus
- Albendazole, fenbendazole, mebendazole, oxfendazole, and oxibendazole

EXTRA LABEL USE

Not labeled for use in certain species

Greater issue with goats

Must work with a veterinarian

- Prescriptions
- Doses
- Withdrawal times

ANIMAL MANAGEMENT

Only treat animals that need treating

Source from good genetics and reputable buyers

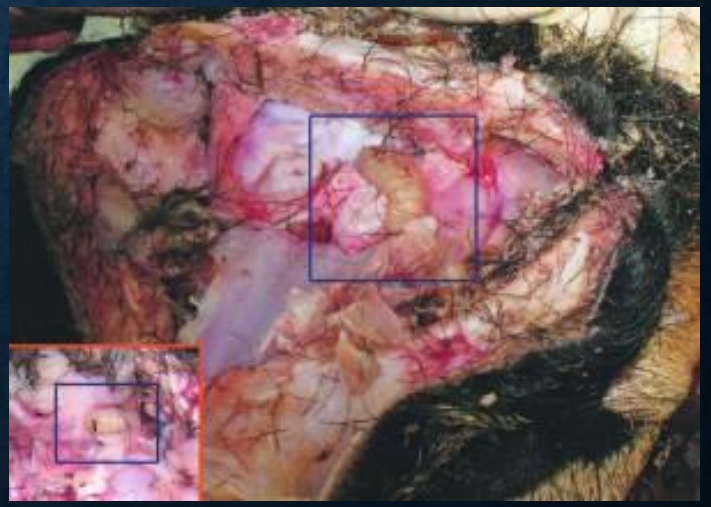
Maintain immune system

- Water
- Low stress
- BCS
- Vaccination program

CULL!!!!!

20% of the herd/flock carries 70-80% of the parasite burden

ECTOPARASITES



ECTOPARASITES SEASONALITY, SIGNS, AND SYMPTOMS

Table 1: Summary of control recommendations for certain external parasites found on goats.

Pest	*Season*	*Herd management*	*Sanitation Practice*	*Insecticide Practice*
Lice	Late fall through late spring.	Isonlate new animals away from the herd for at least two weeks.	None	Apply approved product and reapply after ten days.
Nose Bot Fly	Adults: spring and summer. Bots: fall through spring.	Look for unthrifty animals with blood flecks within the nasal discharge.	None	Consult with your veterinarian for proper application of product.
Keds	Fall and winter.	Isolate new animals away from the herd until a thorough examination of the animals can be conducted.	None	Apply approved products with at least 50 psi and only treat five to ten animals at a time.
Mites	Late fall through spring.	Isolate new animals away from the herd for at least two weeks.	None	Apply approved product and reapply afer ten days.
Fleas	Spring and Summer	Isolate new animals away from the herd for at least two weeks and monitor herd dogs.	None	Apply approved product and only treat five to ten animals at a time; apply spont-on products to the herd dogs.
Ticks	Spring and summer, but occasionally certain ticks will be presendt during the winter	Isolate new animals away from the herd until a thorough examination of the animals can be conducted; monitor herds in wooded areas with tall grass more frequently.	Keep vegetation cut short around barn areas.	Apply approved products and only treat five to ten animals at a time.
Flies	Spring through fall.	Monitor animals for fly activity expecially mid-morning during the late spring ans summer months.	Clean out bedding regularly, keep weeds cut down, drain standing water, and maintain a manure management program.	Apply approed products and only treat five to ten animals at a time. Do not treat animals if significant moisutre is present (i.e. heavy dew). Apply approved premise sprays to barn walls, fencing, and other fly resting places.

ECTOPARASITE TREATMENTS

Anthelmintic	Administration	Dosage	Parasites controlled	Withdrawal[a]
Ivermectin	Injectable	1 mL/112 lb	Nasal bots, ticks, fleas, lice, roundworms, lung worms, and liver flukes	14 days
	Oral (drench)	3 mL/26 lb		11 days
Moxidectin (Cydectin)	Oral (drench)	1 mL/11 lb	Nasal bots, ticks, fleas, lice, roundworms, lung worms, and liver flukes	14 days
Doramectin (Dectomax)	Injectable	1 mL/11 lb	Nasal bots, mites, ticks, fleas, lice, roundworms, lung worms, hook worms, bankruptworms, and wire worms	35 days

[a]Withdrawal is the minimum number of days required by law between administration and time of slaughter.

VACCINATION PROGRAM

WHY VACCINATE?

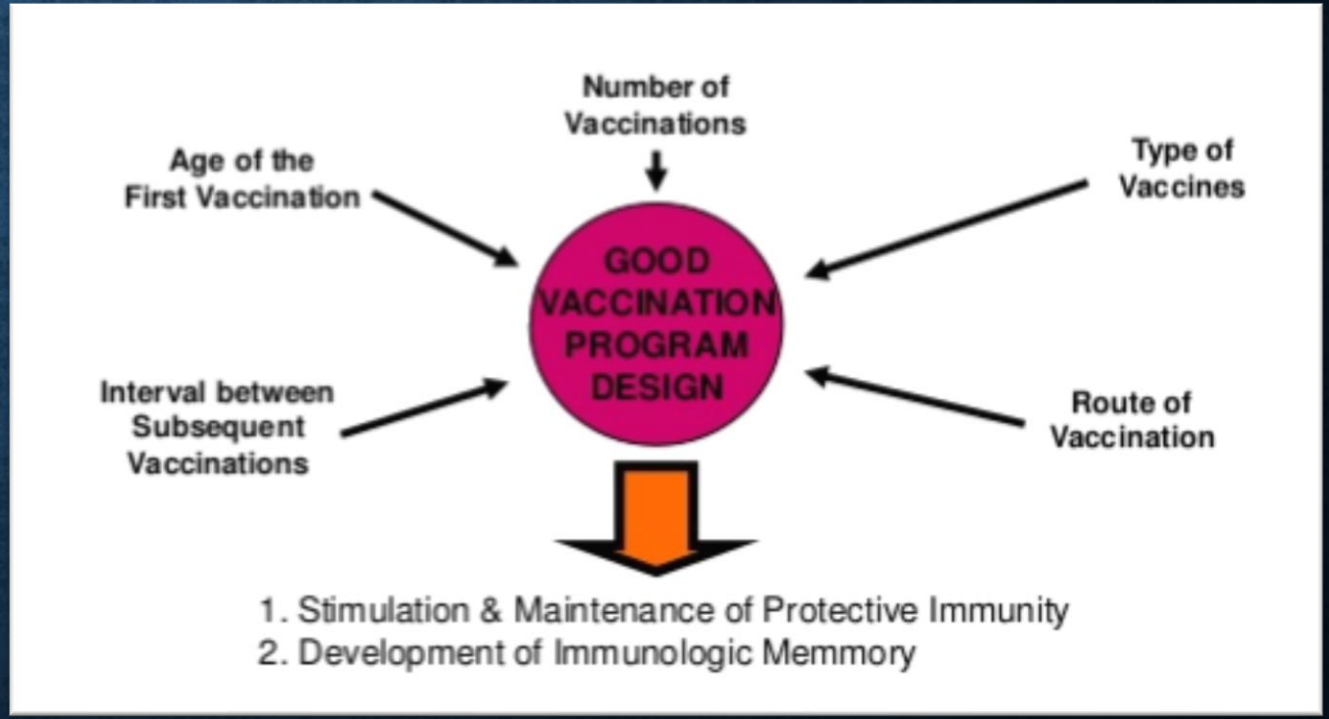
- Integral part of a flock health management program
- Guaranty animal health and profitability
  - Provide cheap insurance against diseases

IMMUNIZATION

- Passive immunity
  - Transferred from mother to baby
  - Transferring antibodies from an animal that is already immune
- Active immunity
  - Cause an immune response by exposing the body to a weakened (alive) or inactivated (dead) pathogen or antigen

ELEMENTS OF A VACCINATION PROGRAM

- Number of vaccination
- Type of vaccination (dead or alive)
- Age of the first vaccine and mother immunity
- Interval between vaccines
- Rout of vaccination (injection, intranasal, ocular, oral, topical)



FOOT AND MOUTH DISEASE

- Highly contagious viral disease
- FMD is not a public health or food safety threat
- United States eradicated the disease here in 1929
- The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) makes efforts that include preventing FMD from reentering the country
- Traceability

- AFTOVAXPUR – Aluminum hydroxide trivalent vaccine – March and September

ENTEROTOXEMIA

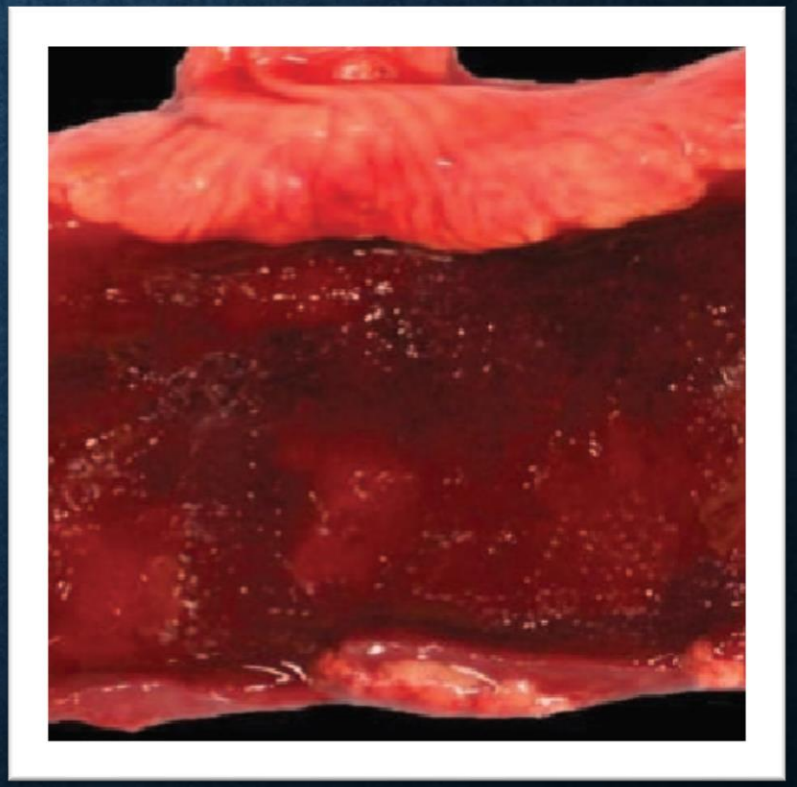
- Universally recommended vaccine for sheep and goats is CDT

- CDT toxoid provides three-way protection against enterotoxemia caused by
  - Clostridium perfringins types C and D
  - Tetanus (lockjaw) caused by Clostridium tetani

- **3-way vaccine** called **CDT**
- **8-way vaccine** called **Covexin®-8**

ENTEROTOXEMIA TYPE C

- Hemorrhagic enteritis or "bloody scours"
- mostly affects lambs and kids during their first few weeks of life
  - Bloody infection of the small intestine
- Often related
  - Indigestion
  - Change in feed
  - Sudden increase in milk supply



ENTEROTOXEMIA TYPE D

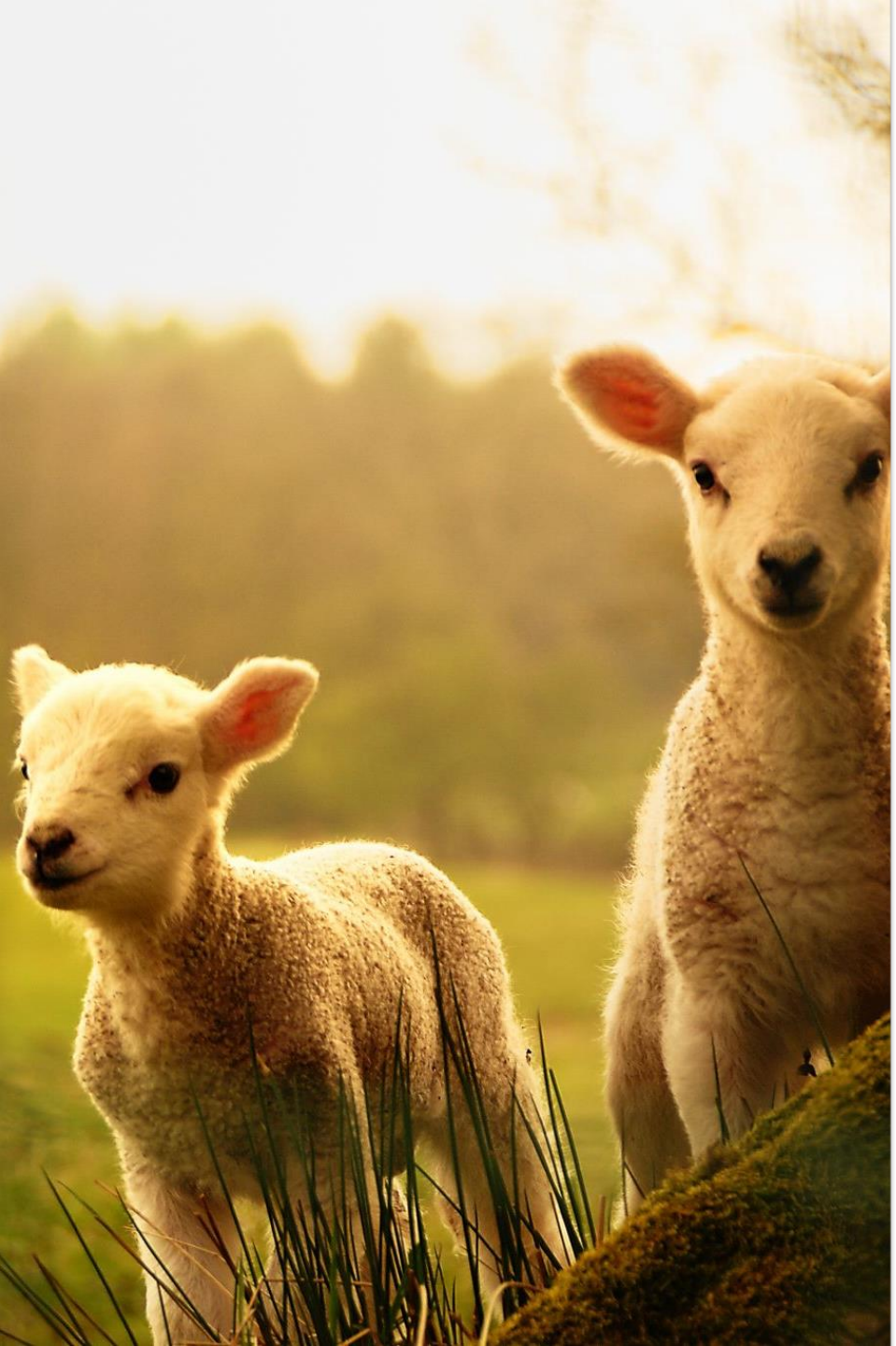
- "pulpy kidney disease" - *Clostridium perfringens* type D
- Affects lambs and kids over one month of age
- Observed in animals that are consuming high concentrate diets
- Bacterium, that normally inhabits the animal's intestines, begins to multiply and produce a toxin that poisons the animal

PASSIVE IMMUNITY TO LAMBS AND KIDS

- Ewes and does should be vaccinated 2 to 4 weeks prior to parturition
- First time birth females should be vaccinated twice in late pregnancy (4 weeks apart)
- Lambs and kids protection for two months
  - if offspring have ingested adequate colostrum
- Lambs/kids - CDT vaccination at 6 to 8 weeks old
  - booster 2 to 4 weeks
- Anti-toxins can provide immediate short-term
  - non vaccinated dams or in the event of disease outbreak or vaccine failure
- Vaccinate for tetanus
  - docking, castrating, and disbudding

CASEOUS LYMPHADENITIS

- CLA affects primarily the lymphatic system
- Results in the formation of abscesses in the lymph nodes
- Highly contagious
  - Becomes in a chronic wasting disease, when in internal organs
- CLA vaccine is combined with CD-T
- CLA vaccine should only be used in flocks which DO NOT already show signs of CLA infection.



ABORTION

- Individual and combined vaccines for several of the agents that cause abortion in sheep
  - Enzootic (EAE,Chlamydia spp.) and vibriosis (Campylobacter fetus)
- Administered prior to breeding
- No vaccine (available in the U.S.) for toxoplasmosis
- Disease-causing organism is carried by domestic cats
  - Control the farm's cat population

RABIES

- Risk to sheep and goats is usually minimal
- Vaccination may be considered if the flock is located in a rabies-infected area
  - access to wooded areas or areas frequented by raccoons, skunks, foxes
- Large animal rabies vaccine is approved for use in sheep
- No rabies vaccine is currently licensed for goats
- Only healthy livestock should be vaccinated, consult a veterinarian regarding rabies vaccination

SUGGESTED GOAT & SHEEP VACCINATION SCHEDULE

SMALL RUMINANT VACCINE PROGRAMS

Kevin D Pelzer DVM MPVM, Diplomate of ACVPM
Virginia/Maryland Regional College of Veterinary Medicine

Small Ruminant Vaccine Programs

Prepartum vaccines

1) Does and ewes should be vaccinated 3 to 4 weeks prior to the time of parturition in order to provide colostral immunity to the neonates.

a) Clostridium perfringens type C and D
- Vaccine will cross protect against Cl. perfringens type B
- Vaccine prevents hemorrhagic enteritis and overeating disease

b) Clostridium tetani
- protects neonates from tetanus
- Especially important if horses have been/are on the premise
- Neonates at risk because of tail docking, castration, and dehorning

Note: the Cl. perfringens C and D and tetanus come in a combination vaccine

c) Parainfluenza 3
- protects against parainfluenza 3, a viral disease that predisposes neonate to pneumonia
- The product contains both PI3 and Infectious Bovine Rhinotracheitis Virus
- The product is given intranasally, 1/2 of the cattle dose – 1 ml in one nostril
- reduces the shedding of PI3 by dams and provides good colostral immunity to neonates

Optional vaccine

1. Clostridial 8 way vaccine
- I don't recommend because of the reaction that this vaccine causes, eg. abscesses, fever, malaise. This may cause the dam to go off feed and develop pregnancy toxemia.
- Vaccine contains Cl. chauvei, septicum, novyi, hemolyticum, perfringens C and D, and tetani
- except for perfringens C and D, and tetanus the other agents rarely cause problems in sheep and goats. One may encounter Cl. novyi, Black's Disease or Necrotic Hepatitis, if animals are infected with flukes.
- Vaccine should be given in the axillary space because of tissue reaction.

Preweaning vaccines

1. Lambs and kids need protection against Cl. perfringens C and D because of feed changes and introduction to concentrates
2. Lambs and kids need a series of 2 injections given approximately 2 to 4 weeks apart.
3. Lambs and kids receive the first vaccine 2 weeks prior to weaning and the second vaccine, booster, at the time of weaning or shortly afterwards.
4. The combination Cl. perfringens C and D and tetani vaccine is used.

Prebreeding vaccines

1. Vaccine is used to protect dams from aborting so need to administer 30 days prior to introduction of the males.
   a) Campylobacter fetus subsp. intestinalis and jejuni vaccine (Vibrio vaccine)
      - Ewe lambs and doelings need a booster 3 weeks after the first injection and then again 60 –90 days later for a total of 3 vaccinations. Timing of vaccine varies with vaccine manufacturer.
   b) Chlamydophilia abortus vaccine
      - Ewe lambs and doelings vaccinate 60 days and 30 days prior to introduction of males.
      - Vaccine has variable results and periodically goes off the market.
   c) Clostridium 8 way for the ewe lambs and doelings 60 and 30 days prior to breeding **if** this vaccine is used.
      - Booster ewes and does 30 days prior to breeding

Rams and Bucks

– CD and T yearly booster

– Foot Rot vaccine at the time adminstered to adult females

Other vaccines used in small ruminants

1. Foot Rot vaccine
   a) Can be used as a preventive as well as part of the treatment protocol.
   b) Should be given prior to the time of year in which foot rot prevalence is the highest. This is usually during wet times of the year – Eg. late winter/spring.
   c) Use the foot rot vaccine for sheep (FootVax)– contains strains against *Dicheliobacter nodosus* (Bacteroides nodosus)
   d) Vaccine administration
      - Initially vaccinate and then repeat in 6 to 8 weeks
      - Does cause a high rate of abscessation
   e) Currently off the market
2. Contagious ecthyma or Orf vaccine
   a) Do not use unless orf is on the property
      - is highly recommended for show animals as they often acquire the infection at shows
   b) Vaccinate replacement animals around 8 months of age, immunity lasts approximately 3 years so may need to revaccinate older animals
   c) Is a live vaccine that is infectious to humans, wear gloves
   d) Vaccine administration
      - must disrupt the skin surface
      - scarify the skin in the axillary space
      - paint vaccine on with a cotton swab
   e) Some recommend vaccinating neonates at 2 –3 days of age in the axillary space if a real problem in neonates
3. K 99 E. coli vaccine
   a) Vaccinate with the same schedule as CD and T prelambing
   b) Use if problem with E. coli scours
4. Rabies
   a) Expensive but may be indicated in areas endemic for rabies or in high value animals
   b) There is a 3 year vaccine

https://www.valleyvet.com/library/sheep_vaccine.html?catargetid=12029525000046625 6&CAPCID=330539468130&CATCI=dsa-295317350131&CAAGID=27298063575&CADevice=m&gclid=EAIaIQobChMIv_jf9sjg5AIVF4eGCh3FUg7sEAAYASAAEgJmxPD_BwE

PREDATOR MANAGEMENT

PREVENTING PREDATORS

- Manage predator populations
- Scout
  - Hair, scat, dens, paths
- Kidding/lambing sheds
- Penning animals at night
- Guard animals
- Electric Fencing

IDENTIFY THE PREDATOR

Coyotes- Attack throat and collapse the trachea

Bobcat- Bite at base of skull or side of head, death caused by crushing spine or skull

Foxes- Multiple bites on the back, usually only prey on lambs and kids

Feral hogs- Consume the entire carcass of lamb/kid, look for sign of hogs

Domestic and Feral Dogs- Multiple bites on hind quarters, flaps of skin pulled away from carcass

Panthers- Either crushed trachea or top of neck/skull, will cover carcasses

Black Bear- Mauling, bites along spine at withers, multiple bites at upper neck, most move, cover/bury the carcass

CONTROL

- Lethal methods
  - Snares, live traps, shooting
  - Poison is NOT LEGAL in Florida
- Non-Lethal methods
  - Guardian animals

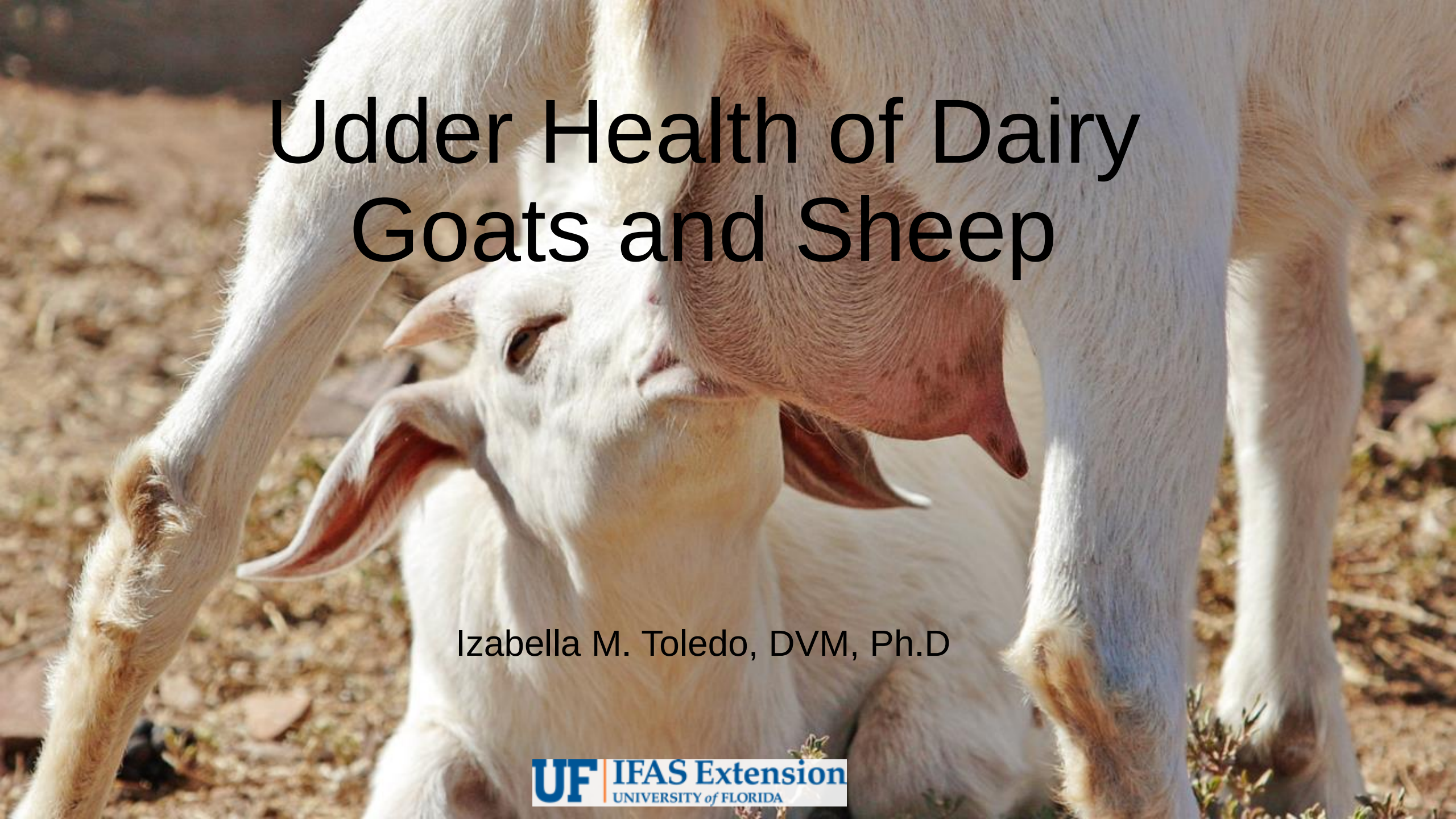
REFERENCES

- https://www.lsuagcenter.com/NR/rdonlyres/6FFBE529-FA0A-434E-8C7D-0DDA896FCCB1/69837/PredationinSmallRuminantsMay2010.pdf
- https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9622/$FILE/bcs-sheep.pdf
- https://www.cattlemen.bc.ca/docs/investigation___evaluation_of_predator_kill_attacks.pdf
- http://www.luresext.edu/sites/default/files/BCS_factsheet.pdf
- https://www.pubs.ext.vt.edu/410/410-028/410-028.html

REFERENCES

- https://www.extension.purdue.edu/extmedia/as/as-573-w.pdf
- https://www.pubs.ext.vt.edu/410/410-365/410-365.html
- https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/412/412-501/412-501_pdf.pdf
- https://www.pubs.ext.vt.edu/410/410-853/410-853.html
- http://extension.missouri.edu/johnson/documents/Goat%20Nutrition%205-10-2012.pdf
- http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-5175/EPP-7019web.pdf
- https://aces.nmsu.edu/pubs/_b/B112/welcome.html


THANK YOU



Udder Health of Dairy Goats and Sheep

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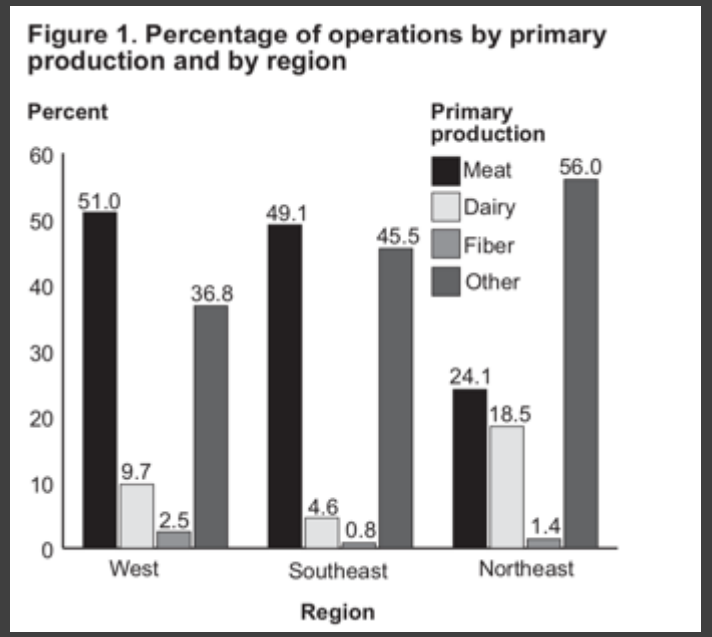
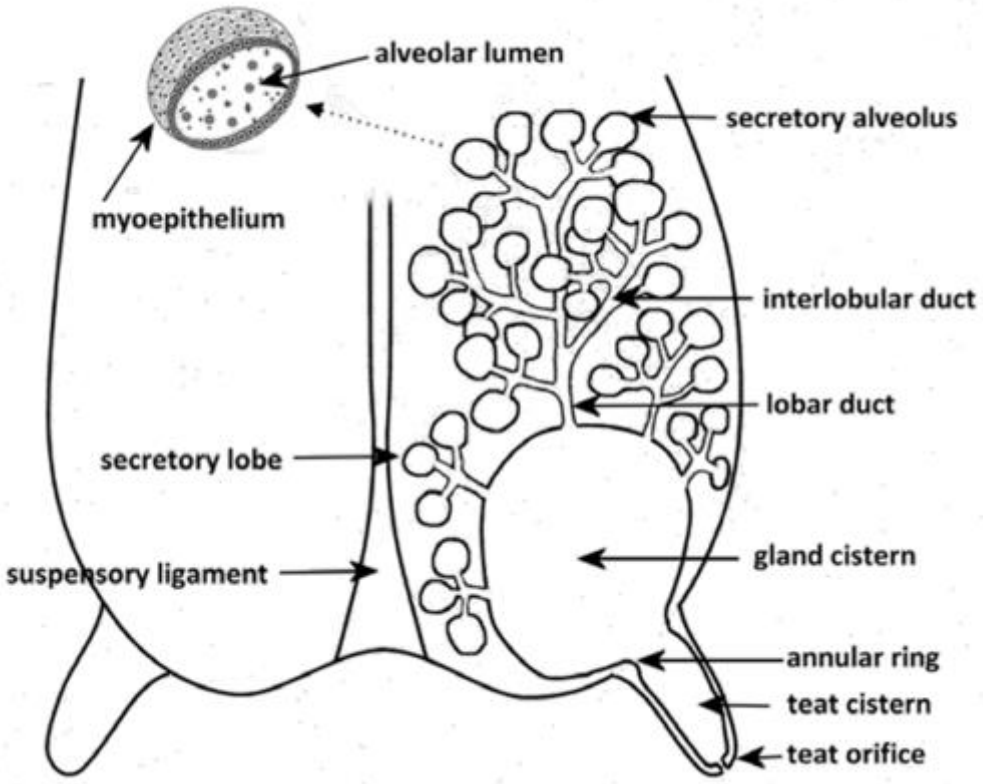
UF IFAS Extension
UNIVERSITY of FLORIDA

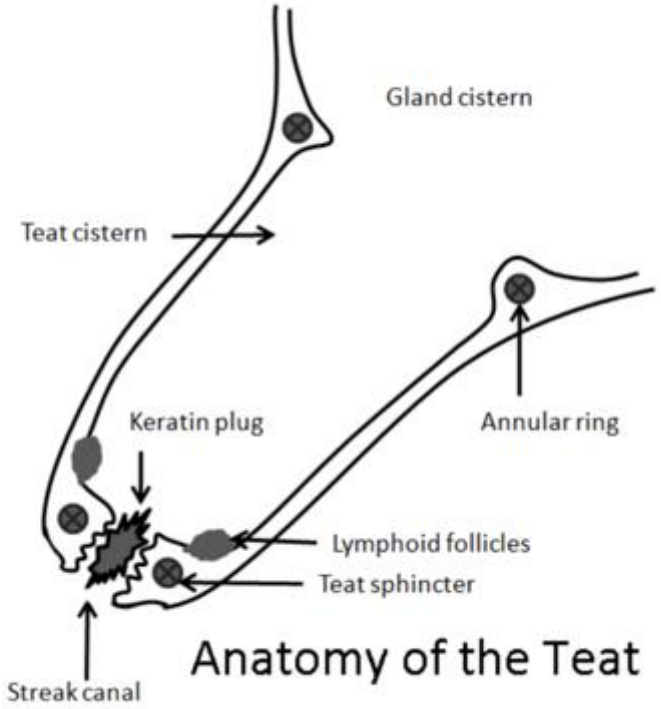
Why is it Important?

- High quality milk
- Maintain animals' health

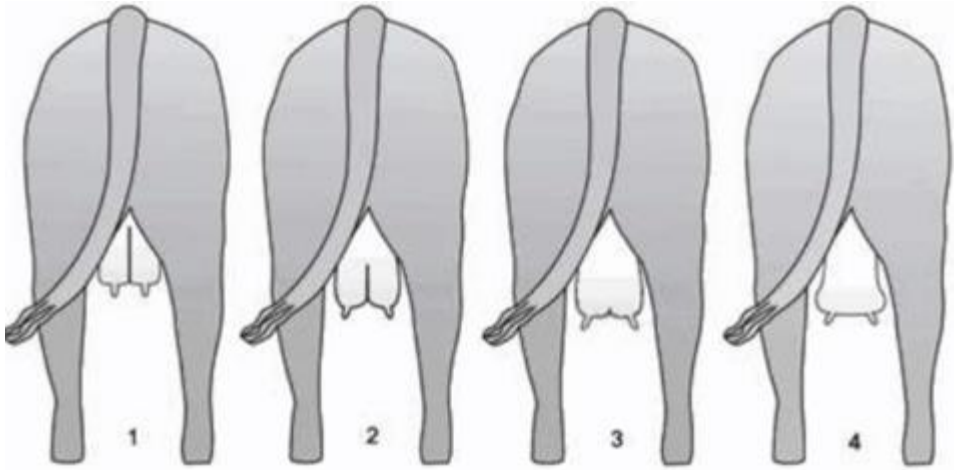


Anatomy


alveolar lumen
secretory alveolus
myoepithelium
interlobular duct
lobar duct
secretory lobe
gland cistern
suspensory ligament
annular ring
teat cistern
teat orifice


Gland cistern
Teat cistern
Keratin plug
Annular ring
Lymphoid follicles
Teat sphincter
Streak canal
Anatomy of the Teat

Udder Conformation



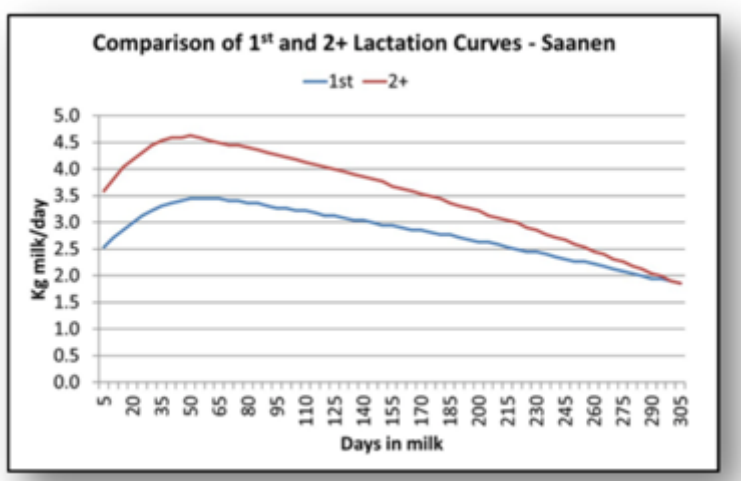
Drawing 1: Prominent medium suspensory ligament which holds the udder tight to the body cavity. Teats suspend perpendicular to the ground.

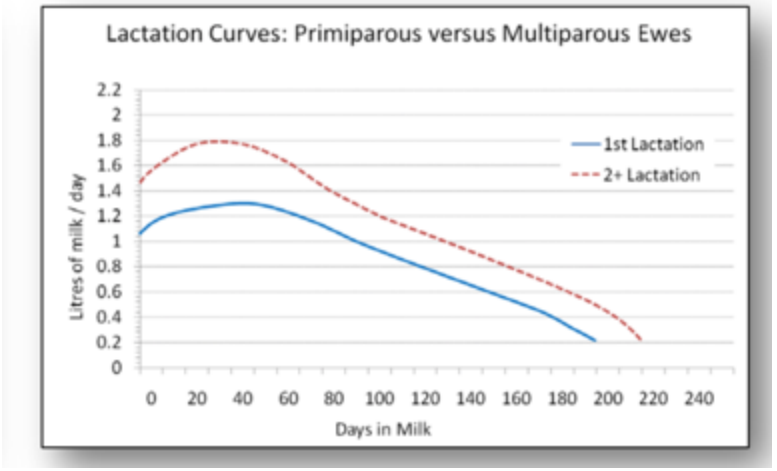
Drawing 2: Intermediate prominent suspensory ligament. Udder suspended further from body cavity. Udders suspended about level with the hock and almost perpendicular to the ground.

Drawing 3: Very week median suspensory ligament. Udder and teats suspended below the hock. When the udder and teats are engorged with milk, teats splay outward.

Drawing 4: Median suspensory ligament absent, udder and teats suspended below hocks. Udder balloons and teats splay outward.

Drawing 1: Udder suspension - Very Tight, very pronounced median suspensory ligament. Udder suspension score = 9.
Drawing 2: Udder suspension - Tight atachment, pronounced median suspensory ligament. Udder suspension score = 7.
Drawing 3: Udder suspension - Intermediate attachment. Udder suspension score = 5.
Drawing 4: Udder suspension - Loose attachment, weak median suspensory ligament. Udder suspension score = 3.
Drawing 5: Udder suspension - Very loose and pendulous attachment, very weak median suspensory ligament. Udder suspension score = 1.





Lactation

- Physiology of milk production
  - Mammary gland development
  - Hormonal production of milk and milk let-down
  - Involution of the udder at dry-off
- Expected milk production
  - Milk ”comes in” about 24-72 hours after birth
  - Peak production occurs within 4-6 weeks of parturition

Milk Volume/Composition

- Sheep
  - 7.6% fat
  - 6.2% protein
- Goats
  - Average 4% fat, but can be as high as 4.9% in some breeds
  - Average about 3% protein
  - Smaller fat globules

Immediate Postpartum Period

- Udder is over full
- Edema
- Colostrum

Mastitis

- Inflammation of the mammary gland usually resulting in changes to the anatomy and/or physiology

- Udder is abnormal
  - Swollen
  - Hot, red
  - “Hard” or lumpy
  - Painful to touch

Mastitis

- Milk is abnormal
  - Blood tinged or yellow
  - Texture may be thick, “lumpy” or watery
  - May have foul odor
  - Lamb/Kid refuses to nurse
- Animal may be visibly ill
  - Fever
  - Depression
  - Off feed

Signs of Mastitis

- Clinical
  - Mild: milk abnormal with flakes, clots and watery. Udder may be swollen, hot or sensitive
  - Severe: hot, hard, painful and sensitive udder; fever (105-107°F), depression, weakness, loss of appetite
- Subclinical
  - Inflammation measures
  - Production losses
  - May be chronic

Mastitis

- Costs:
  - Poor milk quality
    - Decreases in milk production
    - Decreases in milk components
  - Increases in early culling and replacement costs
  - Treatment costs
  - Increased management costs
  - Decreased welfare

Types of Mastitis Pathogens

- Contagious
  - Animal to animal transmission
  - Fomite: animal-fomite-animal

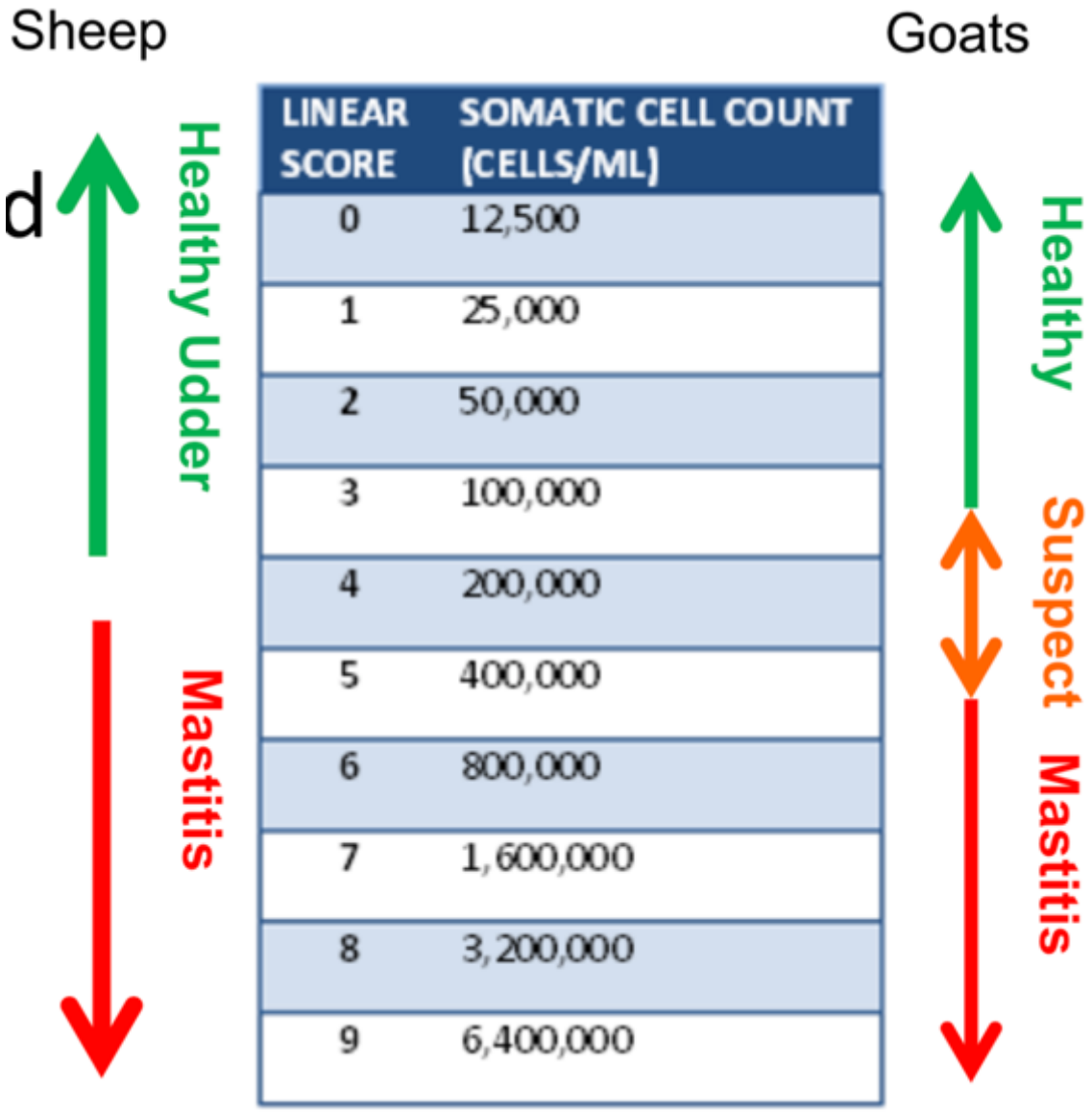
- Environmental
  - Agents originates in the animal’s environment
  - Occasionally animal-to animal transfer

Risk Factors for Mastitis

- Nursing kids and lambs
- Udder and teat shape
- Milking management
  - improper udder preparation
  - dirty hands
  - over-milking/high vaccum levels causing teat-end damage

How to Detect Mastitis?

- Examination of udder and milk
- Somatic cell counts
  - Goats: variable values in healthy udders
- Milk Culture



LINEAR SCORE	SOMATIC CELL COUNT (CELLS/ML)
0	12,500
1	25,000
2	50,000
3	100,000
4	200,000
5	400,000
6	800,000
7	1,600,000
8	3,200,000
9	6,400,000

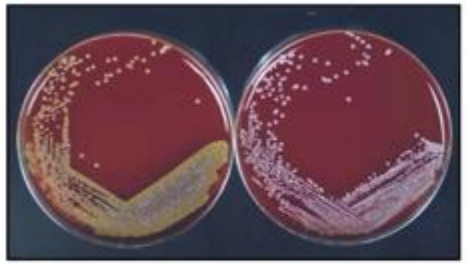
Abnormal Milk

- Visual inspection of milk
  - Use strip cup
  - Color, consistency, flakes

California Mastitis Test

https://www.youtube.com/watch?v=5Mplg93MUz8&feature=youtu.be

Milk Samples for Culture

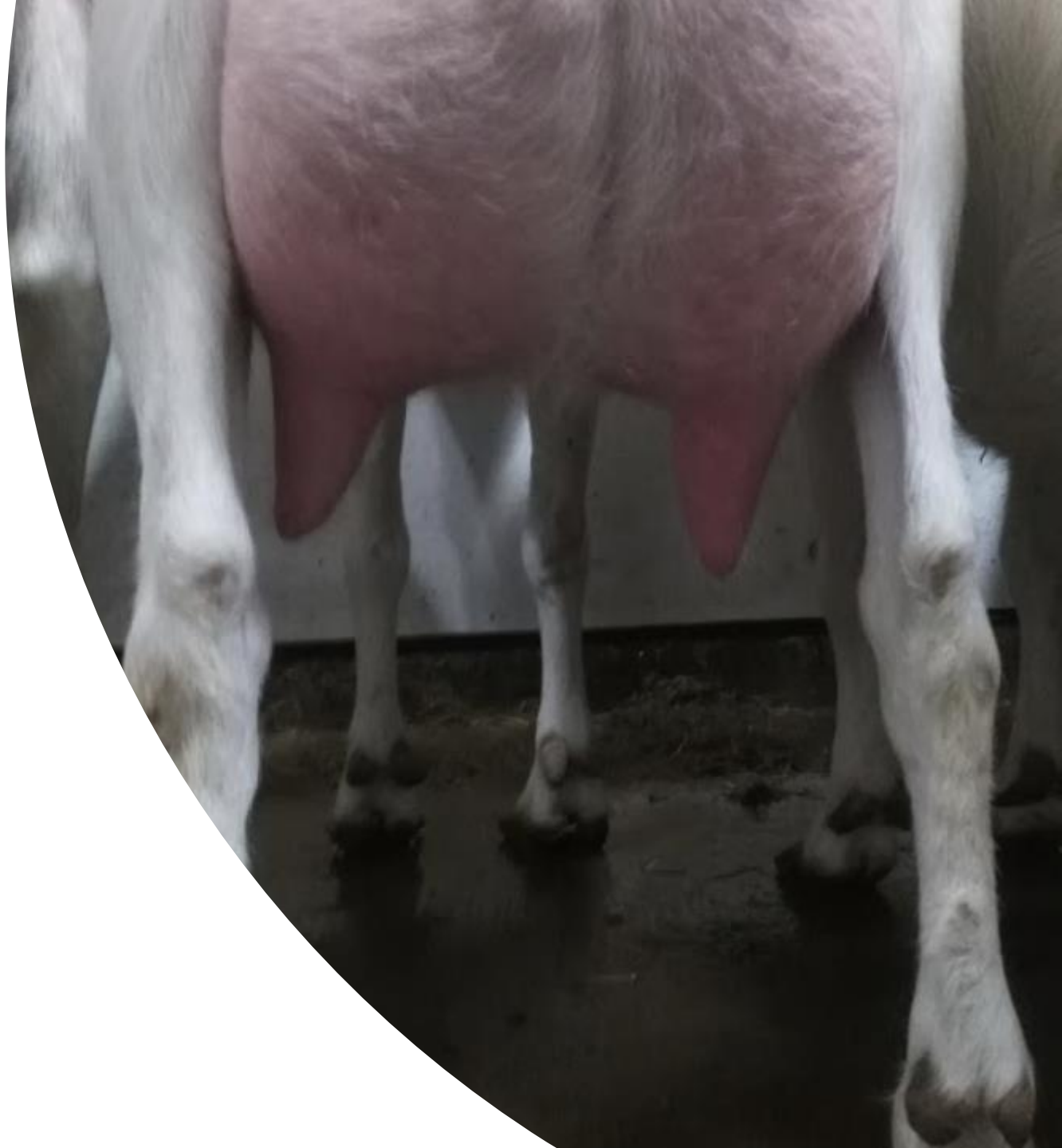


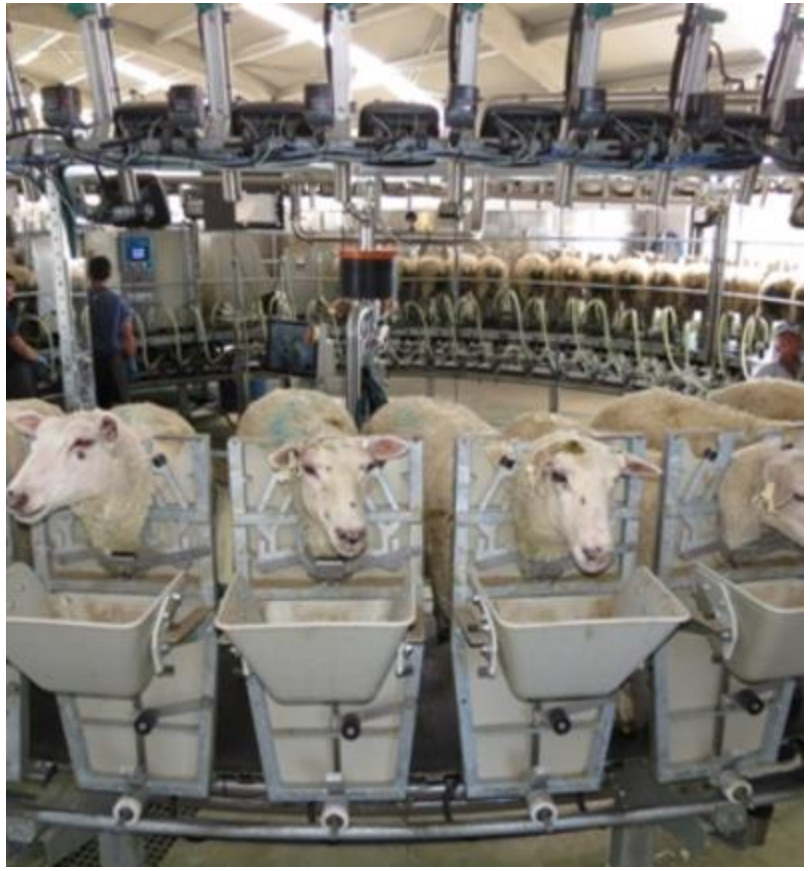
Interpretation of Culture Results

PREVENTION OF MASTITIS

Udder Health Management Program

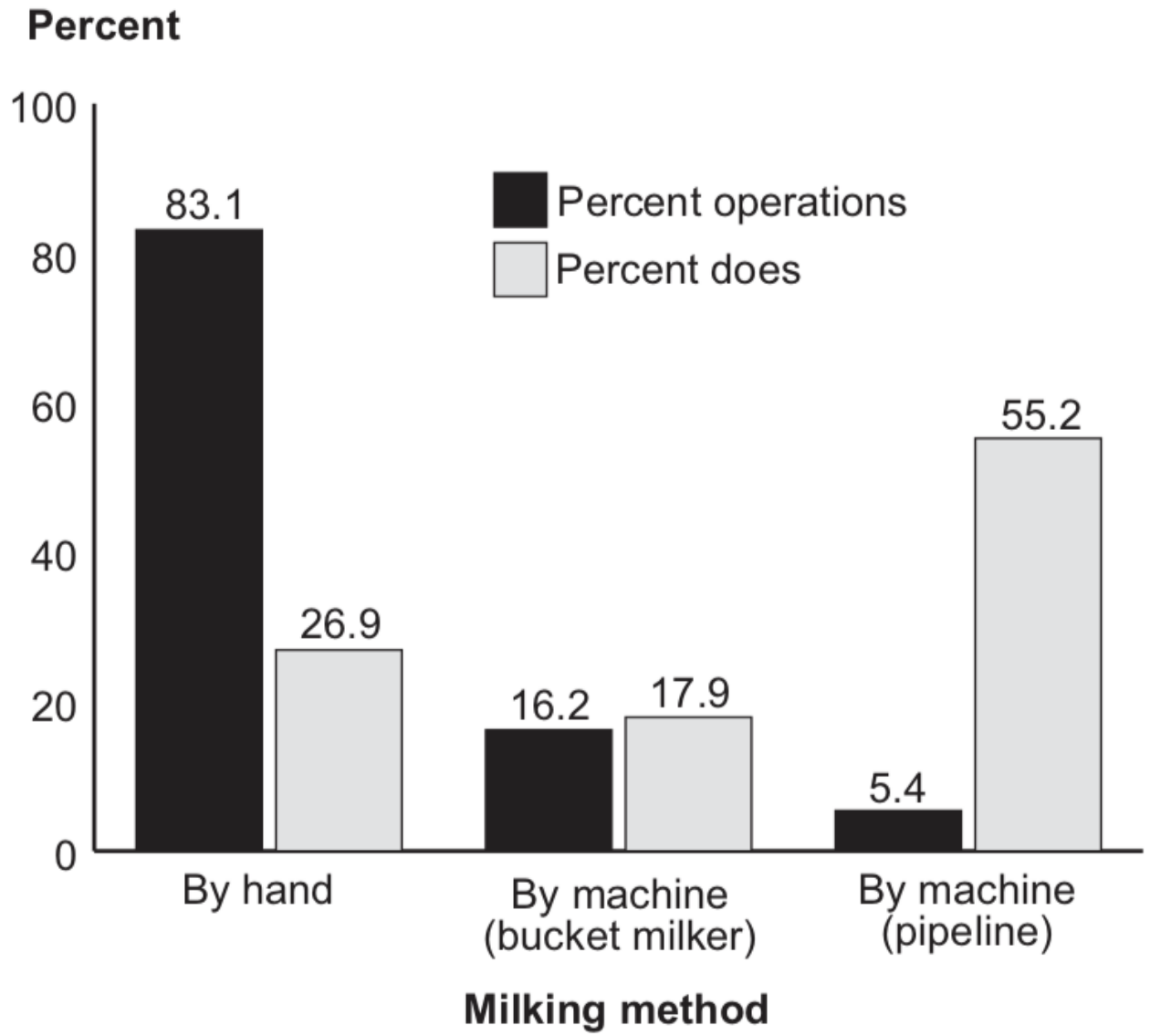
- Improvements in housing
- Improvement in milking equipment and maintenance
- Improved hygiene
- Therapies
- Detection of mastitis
- Cull chronically infected animals





MILKING PROCEDURES

Figure 2. For operations with 10 or more goats that milked any does, percentage of operations (and percentage of does milked on these operations) by milking method



Milking Management: Milkers

- Wash hands frequently?
- WEAR GLOVES

Milking Management: Clean Udder and Teats

- Clip udder and teats if hairy
- Single use towels or udder wipes
- Teat ends cleaned first
- Udder must be dried

Milking: Pre- Dipping

- Reduce environmental mastitis
- Apply after cleaning
- Manufacturer’s guidelines for contact time
- Dry teats and teat ends with single service paper towel
- Avoid iodine residues

Strip Foremilk

- Onto strip cup
- Detect mild clinical mastitis

Attaching and Removing Cups

- Break the vacuum before removing

Machine Stripping

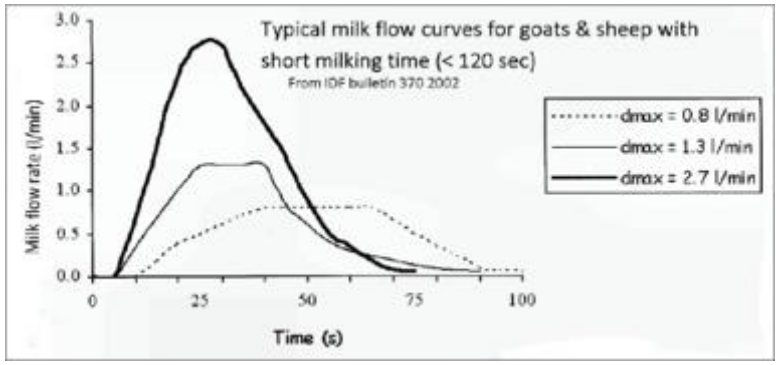
- Machine stripping is common
- Teat damage is the result

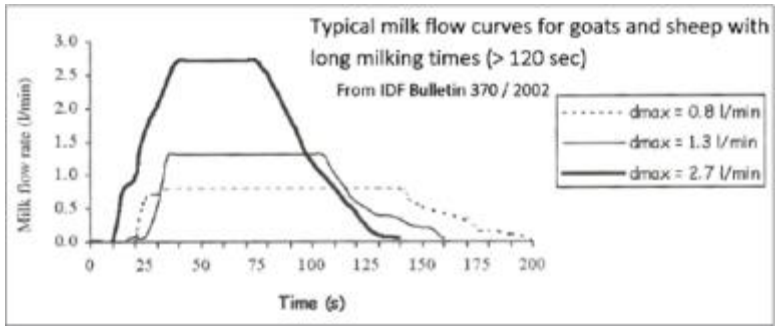
Set-Up Machines

- **Sheep**
- Pulsation rate of 90 to 180 cycles / minute
- Pulsation ratio of 50 to 60%

- **Goat**
  Pulsation rate of 60 to 90 cycles / minute
- Pulsation ratio of 50 to 60%

- **Vacuum – sheep and goats**
  At claw: 39-39 kPa (10 – 11.5 “ Hg)
- Low line: 38-42 kPa (10.5 “ Hg)
- High line: 39 kPa (11.5 “ Hg)





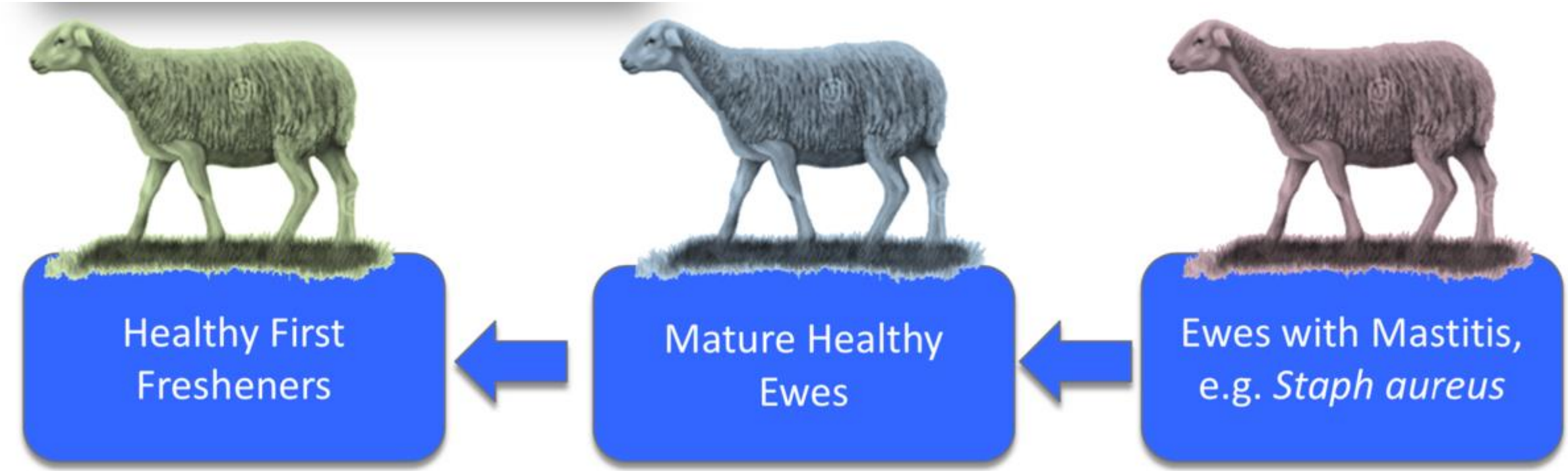
Milk-Out Time

- 1 to 2 minutes depending on stage of lactation and volume produced
- Peak milk at 25 to 35 seconds
- Implications for number of machines per milker
- Prep-time versus milk-out time

Post-Dipping

- Total coverage of teat

Milking Order



Proper Maintenance and Use of Milking Equipment

- Milking parlor – entering and leaving
- Pre-milking pen – getting the animals into the parlor
- Feeding grain in the parlor
- Pros:

  Encourages animals to enter the parlor

  Keeps them occupied
- Cons:

  Can’t control intakes – may be not enough or too much grain

Milking:
Clean Teat Cups

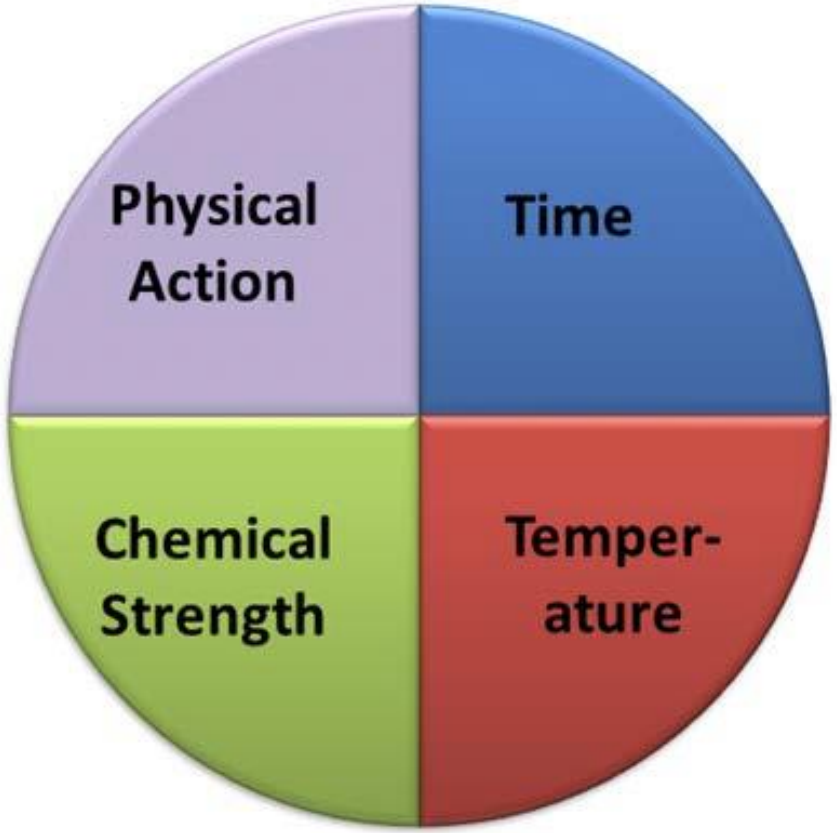
- Most small ruminant dairies don’t have back- flush systems
- Should teat cups be rinsed in a disinfectant between animals to control contagious mastitis

Follow Manufacturer's Recommendations for Maintenance and Cleaning of Milking Equipment

Four Steps

1. Pre-Rinse
2. Hot Wash
3. Acid-Rinse
4. Sanitize

Four Factors



Parlor Design

Management After Milking

- Teat sphincter open
- Encourage standing after milking
- Water supply: keep area around dry
- Feed available
- Bedding clean and dry

Dry Period

- Recommended: at least a 60-day dry period to allow their mammary systems enough time to prepare for the next lactation

- No dry period= lower milk production in next lactation cycle

Summary

- Udder health is important for milk quality and overall health of the animal!
- Detection and prevention of mastitis
- Milking procedures
- Maintenance of milking equipment
- Dry period of 60 days


Thank you
izatol@ufl.edu

How To Do The Modified McMaster Fecal Egg Counting Procedure

The most common and efficient way to obtain fecal egg counts for sheep, goats, young cattle and horses is to use the Modified McMaster Test. This is a flotation test that separates parasite eggs from debris based on density; the eggs float to the surface of the counting chamber. This test uses a special microscope slide with a grid, which makes counting easier (Figure 1).

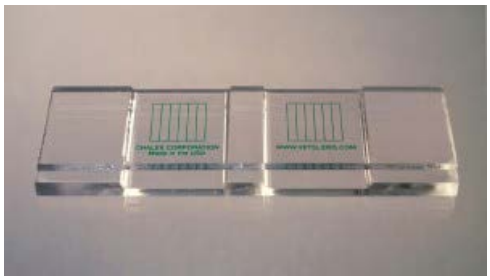


Figure 1. McMaster microscope slide.
www.vetslides.com

Manure and flotation fluid is measured and mixed and only a small portion of the total mixture is counted. A calculation is performed to determine the number of eggs/gram in the manure. This technique can be used to count strongylid (also called strongyle or trichostrongyle) eggs, including those of the barber pole worm (*H. contortus*).

This information sheet will describe the supplies needed and the procedure for the Modified McMaster Test for fecal egg counting as it relates to small ruminant parasite management. View our demonstration video on fecal egg counting for more information on how to do this procedure. View our information sheet, *Why Do Sheep and Goat Fecal Egg Counts* for more information on using and interpreting fecal egg counts. These resources can be accessed from our website, ***http://web.uri.edu/sheepngoat*.**

Reference: Zajac, A.Z., Conboy, G.A., 2012, Veterinary Clinical Parasitology 8th Edition, 8-11.

Fecal Egg Counting Supply List:

- Scale to weigh fecal sample. Scale must weigh in 0.1 gram increments; a digital kitchen scale could be used.
- Two paper or plastic cups, at least 5 ounces
- Fecal flotation solution (can be Fecasol®, a commercially available solution, sugar solution, or a saturated solution of pickling salt (NaCl) or Epsom salts (MgSO4) - see procedure notes on how to make this solution.)
- Dispenser bottle, measuring cup or large syringe for measuring flotation solution
- Tongue depressor / craft stick or spoon for mixing
- Straining technique – this can be a tea strainer; unfolded gauze 4” X 4” pads or squares; or cheese cloth cut into squares (6” squares preferred)
- 2-chamber McMaster slides. See procedure notes for more information including suppliers.
- 1 ml syringe, or eye dropper, or transfer pipette for filling slide
- Compound microscope with internal light source, moveable stage and 4X and 10X objective lenses. A binocular microscope is more comfortable than a monocular scope, but not essential.
- Timer

Fecal Collection Supply List:

- Exam gloves (powder free is best)
- Labels (1” x 3”) to identify sample
- Permanent marker
- KY Jelly / lubricant
- Container with cooler/ice packs
- Refrigerator

Collecting a fecal sample:

1. Put on a clean glove. Apply a nickel size amount of water or water-based lubricant to index and middle fingers.

2. Insert index and middle fingers into the rectum of the animal, one finger at a time. No need to go very deep. Spread fingers to allow air into the rectum. The air duplicates fullness in the rectum and a wave of muscular movement will often move feces out into your hand.

3. Remove ~4 grams of fecal matter. A good sized adult pellet is about 1 gram.

4. Peel the glove off your hand keeping the fecal sample encased within it.

5. Squeeze as much air as possible out of the glove. Twist the wrist portion of the glove and fasten with a label (farm and animal ID) making sure the label sticks to itself, as it won't stick to the glove. You can also twist and tie off the glove and label the glove itself with an indelible marker.

Store the sample in the refrigerator until it can be analyzed (the sooner the better, but samples can be stored in the refrigerator for a week). If you are collecting many samples at one time, have a cooler with ice on hand to keep the samples cool until you can get them into a refrigerator.

Don't use this collection method to sample very young animals. If you can't insert your fingers don't force them. Another option is to collect a sample **immediately** after it has been naturally deposited by the animal. Rectal fecal sample collection is most successful when the animals have been resting for a while, so if you need to pen them up to do the collection, let them rest there for a couple of hours before collecting the samples if possible.

View the fecal egg counting video for a demonstration. The video can be accessed from our website, ***http://web.uri.edu/sheepngoat*.**

Performing fecal egg count test:

1. Label two cups with animal ID as well as farm ID (if needed).

2. Tare one labeled cup on scale.

3. If manure is pelleted, crush the pellets in the glove and knead the manure in glove to mix. Cut off fingertip of glove containing feces to access fecal pellets, making sure to leave label intact.

Step 3. Kneading manure in glove to mix fecal sample.

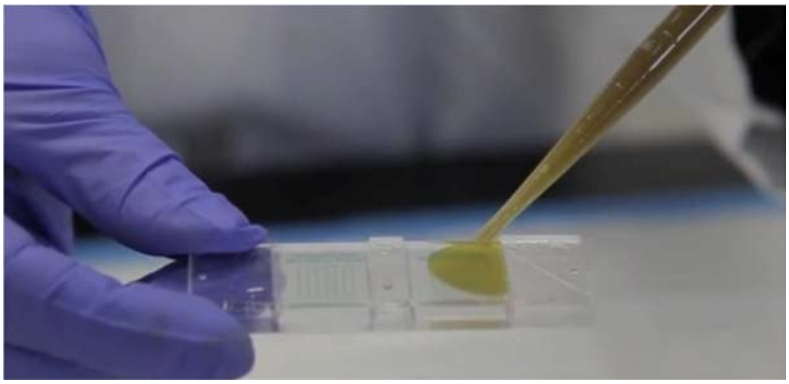
4. Measure two grams of fecal pellets into cup on scale.

5. Dispense 28 ml flotation solution into the cup, mix and let soak for approximately 5 minutes. *See following notes on flotation solution for how to make up your own saturated salt solution.

6. Once you are confident in the procedure you can weigh out multiple samples, add flotation solution and mix until 6-10 samples are set up.

7. Return to the first sample and mix again. Place tea or fabric strainer on top of the second cup (don't stretch fabric tight across the cup). Pour the mixture of feces and flotation solution through, pressing fluid through with the tongue depressor.

8. **Immediately**, fill both chambers of the McMaster slide using a transfer pipette, eye dropper, or syringe. If large bubbles are present, empty the slide and refill. Even if a large bubble is not actually under the grid, the slide should be refilled. Fill the entire chamber, not just the area under the grid.

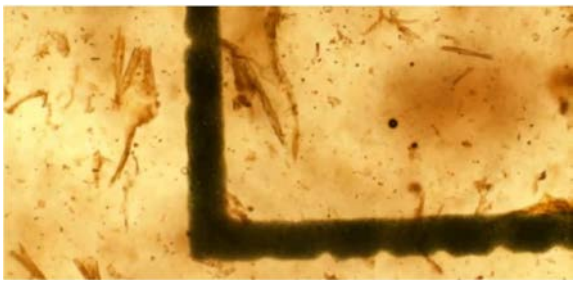


Step 8. Filling the first chamber of the McMaster slide using a transfer pipette.

9. Set slide aside for at least 5 minutes to allow parasite eggs to float to the surface. Read slides within about an hour of filling the slide. If slides are left too long, fluid evaporates and salt crystals form.

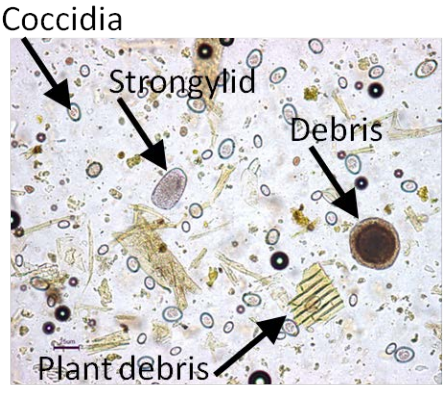
10. Place McMaster slide onto the microscope stage.

11. Bring the grid lines on the McMaster slide into focus using the low power (4X) objective and the coarse adjust knob. Turn to the 10X objective and refocus grid lines using the fine adjust knob. You can also focus on the air bubbles.



Step 11. Bringing the grid lines on the McMaster slide into focus.

12. Count all eggs inside of the grid areas using the 10X objective (include eggs on the grid line if greater than ½ of egg inside grid) in both chambers.



13. Always start at the same point on the McMaster slide (for example, top left or bottom right). That way, you won't lose track of whether you have counted only one or both chambers.

14. Count only strongylid eggs (oval shaped, ~80-90 microns long). Quantify *Nematodirus* eggs separately as they can be clearly distinguished. Other parasites present should be recorded and may be counted if desired, but numbers are often difficult to interpret. *See the parasite egg identification section of this fact sheet for photos (pages 7 and 8).

15. Count both chambers. Total egg count:
    (chamber 1 + chamber 2) * 50 = eggs per gram (EPG)

This multiplication factor of 50 is specific to the ratio of feces (2 grams) to flotation solution (28 ml) described in this procedure. Each egg observed represents 50 eggs/gram therefore, this procedure will not detect fewer than 50 eggs/gram, which is equivalent to seeing one strongylid egg on the McMaster slide.

Be consistent:
Many laboratories perform this test and you may see slight variations in the procedure described. **The important thing is to always perform the test the same way each time—consistency is critical in order to monitor your animals over time or test the efficacy of drug treatment.**

Additional notes on procedure:

Flotation solution:
The following commercial solutions are commonly used by labs and can be obtained through your veterinarian:

Fecasol® - Vetoquinol, **www.vetoquinolusa.com**; Phone: 800-267-5707
Feca Med - Vedco Inc., Saint Joseph, MO, **www.vedco.com**; Phone: 816-238-8840

You can make up your own saturated salt solution using regular salt (sodium chloride) or Epsom salts (Magnesium Sulfate). A sugar solution is also available, but it is very viscous and sticky and results in difficult clean-up.

The approximate amounts of salt and water needed are provided on page 6. Add more salt as needed to fully saturate the solution. Add and mix the salt to lukewarm tap water until some of the salt no longer dissolves (the solution is saturated). Let it sit overnight. The amount of salt it takes to saturate the solution is affected by temperature, so the final test is to be sure you always see some un-dissolved salt at the bottom of your container. Pickling salt works better than table salt for making this solution because table salt contains anti-caking agent that doesn't dissolve and may mislead you into thinking that the mixture is saturated.

Sodium chloride (pickling salt):
Approximately 180 grams per 500 mls of water.
¾ of a cup of salt to 1 pint (16 ounces) of water – this would do about 16 fecal samples

Magnesium sulfate (Epsom salts):
Approximately 125 grams per 500 mls of water.
½ cup of salt to 1 pint (16 ounces) of water – this would do about 16 fecal samples

McMaster Slide:
The following are two U.S. Suppliers of this slide:

Chalex Corporation, 5004-228th Ave SE, Issaquah, WA, 98029.
Phone: 425-391-1169; **www.vetslides.com**

FEC Source, P.O. Box 601, Banks, OR 97106
Phone: 844-838-7543; **www.fecsource.com**

Video available: view our video which provides step-by-step instructions and commentary on how to perform the Modified McMaster fecal egg counting procedure. This includes instruction on using a microscope and information on parasite egg identification. The video can be accessed from our website, ***http://web.uri.edu/sheepngoat*** and can also be viewed directly from the URI YouTube channel page **(UniversityOfRI):** ***https://www.youtube.com/watch?v=ZZQymZKe_hs*****.**

Parasite Egg Identification: The following two pages show the microscopic appearance of stronylid eggs, as well as other types of parasites, air bubbles and other material (such as plant material) commonly contained in sheep and goat fecal samples. These are also covered in detail on the video.

Parasite Egg Identification: Common Parasites in Small Ruminant Fecal Samples

Figure 1. Strongylid egg

Figure 2. Larvated strongylid egg. These may be seen in old fecal samples

Figure 3. *Nematodirus* egg

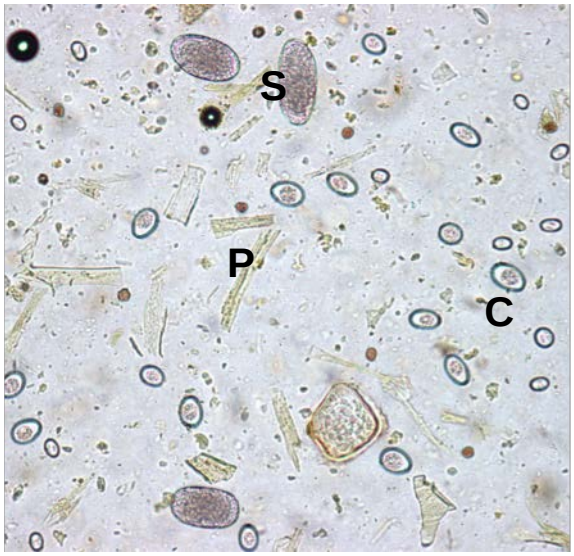


Figure 4. Strongylid egg (S), coccidia oocysts (C) and plant debris (P). Note size differences between eggs and oocysts.

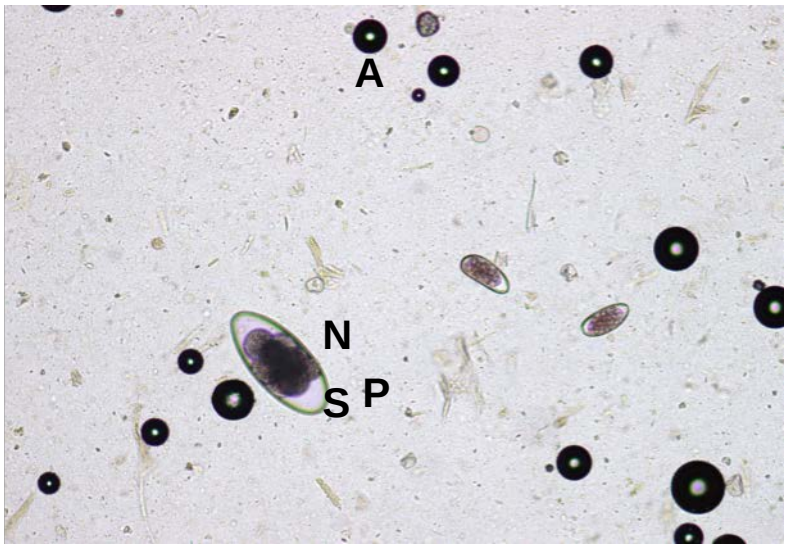


Figure 5. *Nematodirus* (N) and strongylid (S) eggs. Note size difference between eggs. Also note the presence of air bubbles (A).

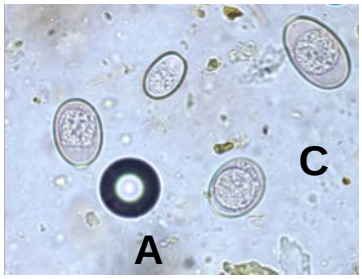


Figure 6. Coccidia oocysts (C) and air bubble (A). Small ruminants are infected with several different species of coccidia that vary in size.

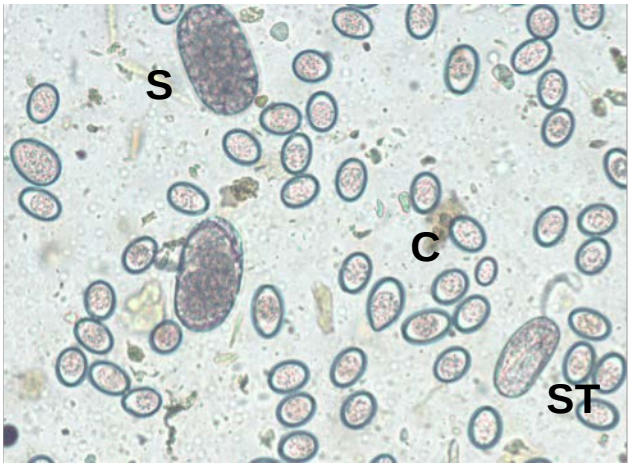


Figure 7. Strongylid (S) eggs and *Strongyloides* (ST) egg and coccidia (C) oocysts. Note size difference between eggs. *Strongyloides* eggs are larvated in fresh feces, strongylid eggs are not.

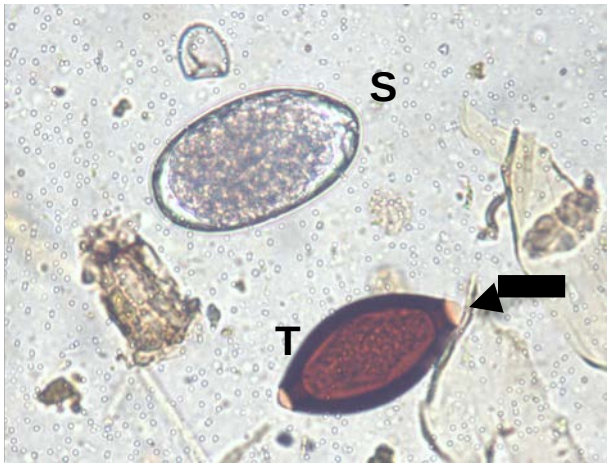


Figure 8. Strongylid (S) and *Trichuris* (T) eggs. Note similarity in size. *Trichuris* eggs have two distinctive polar plugs (arrow).

Figure 9. *Aoncotheca* egg. This egg looks like *Trichuris*, has polar plugs (arrow) like *Trichuris* but is about one- third smaller and is an uncommon finding.

Figure 10. *Moniezia* (tapeworm) egg. These eggs contain a small round embryo (E) with hooks (arrow). The embryo is difficult to see at 10X power. Eggs may appear square or triangular. The presence of the embryo distinguishes the egg from some confusing plant debris (see Figure 4).

Figure 11. Strongylid (S) and *Moniezia* (M) eggs. Note similarity in size.

Photos: Anne Zajac, DVM, Ph.D. Parasitologist, Virginia-Maryland Regional College of Veterinary Medicine / Virginia Tech

For more information including our information sheet, *Why Do Sheep and Goat Fecal Egg Counts* and our demonstration video on fecal egg counting, visit our website at ***http://web.uri.edu/sheepngoat.*** The video can also be viewed directly from the URI YouTube channel page **(UniversityOfRI):** ***https://www.youtube.com/watch?v=ZZQymZKe_hs*.**

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The Modified McMaster Fecal Egg Counting Procedure:

Necessary Equipment and Estimated Costs 2019*

Paulette Tomlinson, Agriculture & Natural Resources Agent – Columbia County

- ☐ McMaster slide – 4 for $64 or $19 each (Amazon)
- ☐ Graduated cylinder - $9 or a large syringe - $0.20 – 2.00 any farm store
- ☐ Vinyl, latex or latex free gloves - $8 for 100
- ☐ Scale (min. 0.1 gram increments) - $ 15.00
- ☐ Plastic cups (min. 5 ounces) - $2 for 56 - 9 ounce cups
- ☐ Strainer – less than $2 – Hitchcock's Grocery
- ☐ Pipettes - $7 for 100
- ☐ Tongue depressor - $6 for 200 ice cream sticks
- ☐ Fecal floatation solution (commercially available or "make your own") Commercial - $25 -1gal or make your own - $5
- ☐ Labels (sample identification) – masking tape could work - $5
- ☐ Permanent marker - $2

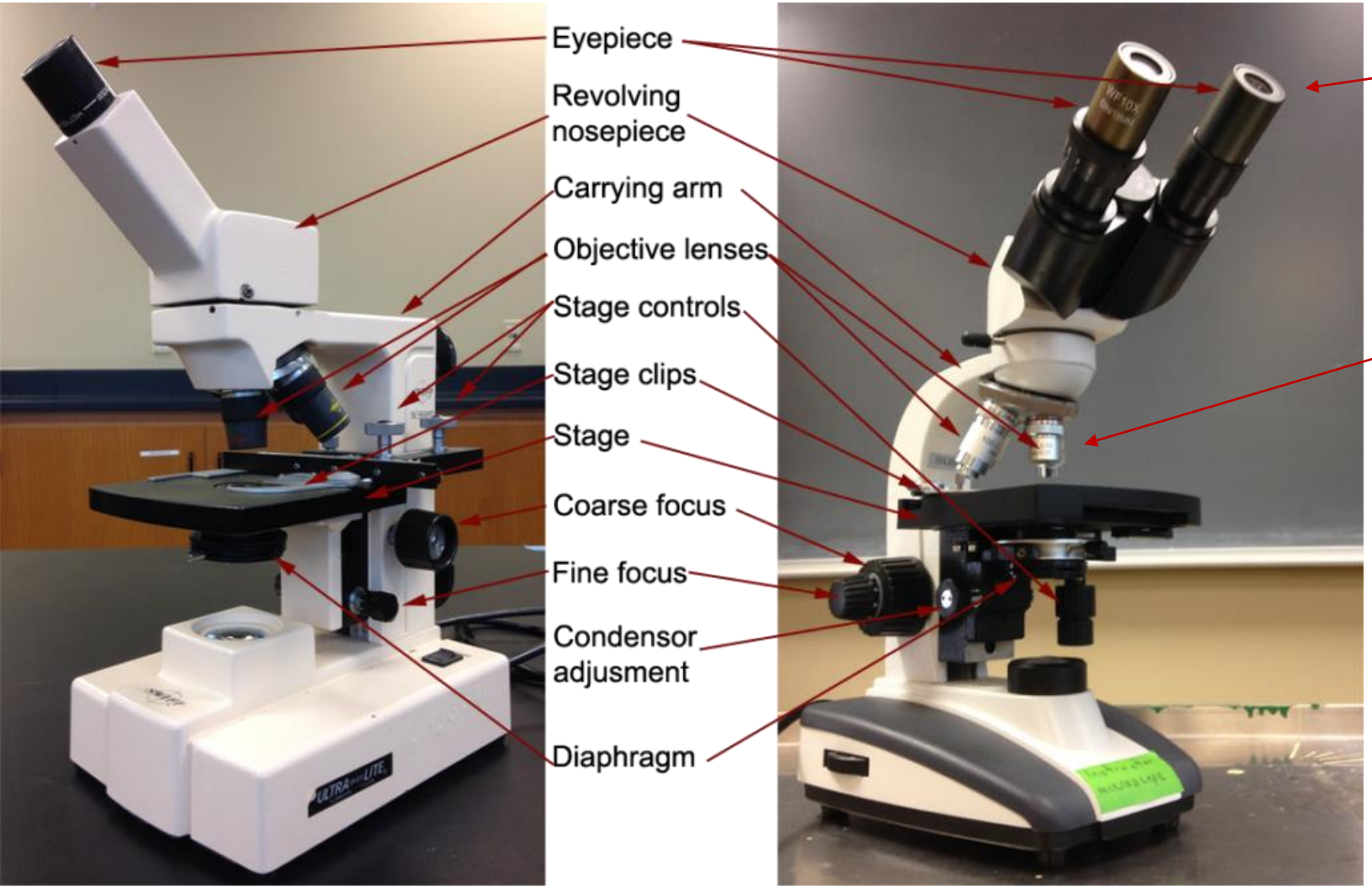
- ☐ KY Jelly / lubricant (this could create more difficulty reading the slide) - $5 - $25

- ☐ Cooler & ice packs - $10 / refrigerator

- ☐ Microscope – see Kevin Korus' microscope handout "Compound Microscope" for specifications and potential costs. Don't forget you can search online for the best deal!

*NOTE: This equipment list was partially compiled using the SARE publication *How To Do the Modified McMaster Fecal Egg Counting Procedure* (LNE10-300). It is not an exhaustive list nor meant to recommend one product over another. For educational purposes only.

Compound Microscope



Eyepiece
- **10x**

Common Objective Magnifications
- **4x, 10x, 20x, 40x, 100x**

Cost
~$200 - $10,000+