Anthelmintic Resistance and Control of Internal Parasites in Small Ruminants

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AUESPP
Adj holistic - emphasizing the organic or functional relation between parts and the whole
Avoid or try to Minimize

- Opportunistic deworming
- Suppressive deworming – selection for resistance (Meningeal worm prevention)
- Endectocide rotation
- Sub-optimal nutrition
- Pasture contamination & overstocking
How Resistance Happens

Poor Management

Using cow doses for sheep & sheep doses for goats… !
(Conder, Adv Parasit, 1995)

Route of MOX might effect efficacy (90% PO vs 58% SC)
(Zarate, WAAVP, 2009)

Topical application on camelids not absorbed to therapeutic concentrations…..designed for cattle
Avoid or try to Minimize

- Opportunistic deworming
- Endectocide rotation
- Sub-optimal nutrition
- Pasture contamination & overstocking
- Suppressive deworming – selection for resistance (Meningeal worm prevention)

(Pugh, Hilton, & Mobini, Comp Cont Ed, 1998; Pugh & Navarre, Vet Clin North America, 2001)
Classes of Dewormers

Avermectins - ivermectin, doramectin, eprinomectin

Milbemycins - moxidectin

Benzimidazoles - albendazole, fenbendazole, oxfebendazole, oxibendazole

Cholinergic Agonists - levamisole, morantel, pyrantel

Amino-Acetonitrile Derivatives (AADs)
How Resistance Happens

Indiscriminate use of anthelmintics

Over use of anthelmintics

Lack of Biosecurity
  - animal movement to & from farms
  - poor quarantine practices
  - failure to effectively treat new farm additions

Poor Management
Anthelmintic Resistance

- Increased frequency of dewormer administration

- Continued and frequent use of a single class of dewormer

- Underdosing (poor wt estimation, improper administration, etc)
SUPPRESSIVE DEWORMING PROGRAMS SELECT FOR RESISTANCE

- Resistance alleles occur naturally, but selection (treatment) increases frequency

- Practices that select for resistance include:
  - Repeated and exclusive use of a single class of dewormer
  - Frequent treatments (<E.R.P.)
  - Anything that minimizes *refugia*
Dewormers
Drug Resistance

Refugia – The proportion of the population (*Haemonchus*) that is not selected by drug treatment

It provides a pool or reservoir of drug-susceptible genes and dilutes the prevalence of resistant genes, and maintains biodiversity within a species

Avoid or try to Minimize

• Opportunistic deworming
• Endectocide rotation
• Sub-optimal nutrition
• Pasture contamination & overstocking
• Suppressive deworming – selection for resistance (Meningeal worm prevention)

(Pugh, Hilton, & Mobini, Comp Cont Ed, 1998; Pugh & Navarre, Vet Clin North America, 2001)
Macrocyclic Lactones Resistance

**Sheep & Goats**

Craig & Miller, Vet Rec, 1990 - IVM (Tx)
Miller, Vet Parasitol, 1994 IVM (La)
Mortenson, JAVMA, 2003 goats – 94% - IVM, 5.5% - MOX
Howell, JAVMA, 2008 sheep/goats – 76% - IVM, 24% - MOX

**Camelids**

Gillespie, Vet Parasit, 2010 ( – 88% - IVM, - 22% - MOX)
Sarre, Vet Parasit, 2012 (Belgium, DOR – 68% - 41% efficacy)
Benzimidazoles

Benzimidazoles….albendazole, fenbendazole, oxfebendazole, oxibendazole

- Resistant worms suck more blood (larger?) lay more eggs

Albendazole – high dosing (20-50mg/kg) for multiple days, signs-bone marrow suppression, diarrhea, hair loss, death
- 3 cases at Auburn (Unpublished data)
- 12 cases at Tufts (Gruntman J Vet Int Med 23, 2009)

Fenbendazole – paste formulation is absorbed similarly in goats, sheep & lamas, but it’s rate of elimination is longer in lamas (Beier, Small Rumin Res, 2000)
Benzimidazoles Resistance – Sheep/Goats

Drudge, AJVR 1964 (Ky)
Shelton, JAS 1968 (Tx)
Anderson, AJVR 1973 (Australia)
Miller, AJVR 1980 (La)
Herd, JAVMA 1984 (Ohio)
Uhlinger, J Vet Int Med 1988 (NC)
Craig, Vet Rec, 1990 (Tx)
McKenna, NZ Vet J 1990 (NZ)
Uhlinger, JAVMA 1992 (NC)
Mortenson, JAVMA 2003 – Goats 93% (Ga/SC)
Howell, JAVMA 2008 – Sheep/Goats 98% (Southeast USA)
Benzimidazoles Resistance – Camelids

Zarate WAAVP, 2009
Gillespie, Vet Parasit, 2010 – 100% resistance
Classes of Dewormers

Cholinergic Agonists….levamisole, morantel, pyrantel

Levamisole (Imidothiazole)
- effective against active feeding worms
- resistance by Haemonchus is sex linked

Morantel (Thiofuran)
- approved for use in lactating dairy goats

*H contortus* – Morentel tarturate not consistently effective when fed to levamisole susceptible camelids

(Williamson ICRS, 2012)
Levamisole / Morantel- Sheep & Goats

Hembry, AJVR, 1986
Craig, Vet Clin NA, 1986
Miller, Vet Parasitol, 1987
Miller & Craig, TAES Res Rept, 1988
Mortenson, JAVMA, 2003 - goats LEV - 24%
Howell, JAVMA, 2008 – sheep/goats LEV – 54%
Camelid nematode GI parasites

Zarate WAAVP, 2009 - still sensitive to LEV
Williamson ICRS, 2012 – 22 % - LEV

Strongid C fed to llamas daily (2x horse dose) for 1 yr had no significant EPG difference than controls after 2 mo (Pugh, Bagburn, Hendrix, Proceed Camelid Res Conf 1998)
Multi-family Resistance

Craig, Pro West Vet Conf, 1998 (BZD, LEV + - Tx)
Craig, Small Rumin Res, 1996 (all but MOX – Tx)
Zajac, Vet Parasitol, 2000 (all but MOX - Va)
Mortensen, JAVMA, 2003 (all + MOX in 1/15 – south east)
Kaplan, AAVP Proceed, 2005 (all- 1 farm - Arkansas)

Howell, JAVMA, 2008 (48% of all farms had resistance to all but MOX… 17% were resistant to all – 8 SE states)
Camelid trichostrongyloide-type nematode parasites (GIN)

*Haemonchus contortus*

- 97% (28 farms) multi drug resistance
- 13% (4 farms) resistant to all classes of dewormers

*T. colubriformis*

(Williamson ICRS, 2012)
Haemonchus contortus

• Tremendous fecundity – 5000 – 6000/eggs/female/day
  (T Craig – personal communication, 2006)
• Host develop poor immune response
  - animals <3-6 mo old
  - high prolactin concentrations
  - low protein diet
  - poor genetics
• Hypobiotic in small ruminants
Monitoring Parasite Resistance

• Fecal Egg Count Reduction Test
  – Want 90% decline in egg count 10 days -FECRT
• Fecal egg counts can also
  – determine when to deworm again – verify ERP
• Prevent resistance with minimal use of anthelmintics and surveillance of ERP
Parasite Control Programs

- Need Sustainable programs
- Dilute anthelmintic resistant worms by selective deworming
- 20% of animals harbor 70-80% of the parasites….ID and CULL (FAMACHA, EPG, BCS, etc)
- Salvage deworm and CULL
- Pasture rotation programs => clean pastures
Deworming Programs

Targeted Deworming

- Treat only those that need deworming, contribute the most to pasture contamination
- Periparturient animals
- Peak Lactation animals
- Decrease resistance
Targeted Deworming

BCS, FEC, Milk Production, ?
(van Wyk Vet Parasit 2006)

FAMACHA
(Kaplan Proceed AVMA Ann Conf 2003; Burke Vet Parasit 2007;
Kaplan Vet Parasit 2004)
Strategies - Disease Control

• Does an ID & record system exist to allow monitoring of disease?

• What is the current herd status?
  – Is this disease being monitored?
  – What other diseases should be considered?

• Do the goats commingle with other species?

• Is the herd “closed” and to what degree?
Deworming Programs

- Deworm when the potential for parasites is increasing....

- EPG (>1000 EPG in spring and >2000 in fall in the southern and >500 EPG in northern USA)
  T Craig, 2006

- 10-14 d post rain

- When moving to new pastures
Deworming Programs

- Save a life
- Does not select for resistance
- Low level parasitism is tolerable
- Healthy appearing Camelids with optimal BCS are less likely to be severely parasitised (Williamson, ICRS, 2012)

- Dr Francois (Fafa) Malan’s Chart
- 1- deep red (non anemic)
- 2 - red – pink (non anemic)
- 3 - pink (mild anemia)
- 4 - white – pink (anemic)
- 5 – white (severely anemic)
“Mother worm can’t even differentiate (HOTC complex) eggs”

Tom Craig DVM PhD Hero Scholar
Parasitologist of the Highest Order

Haemonchus eggs distinguishable with a Peanut Agglutination
(Hillrichs WAAVP 2009 pg 81)
Parasite Control Helpers FERT

Periodically check effectiveness of dewormers
(Deworm/fecal EPG => fecal EPG 10-14 d later….. <90% drop in EPG= resistance)

*Haemonchus contortus*
Classes of Dewormers

Avermectins... ivermectin, doramectin, eprinomectin

Milbemycins... moxidectin

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Cholinergic Agonists... levamisole, morantel, pyrantel

Amino-Acetonitrile Derivatives (AADs)
Increase efficacy –
Fast overnight
Dry Feed
Cydectin Pour-On: Sheep/Goats

Cydectin Pour-On...PO...1cc/22# BW => 1cc/50# BW ???

(Pugh, Hilton, & Mobini, Comp Cont Ed, 1998; Pugh & Navarre, Vet Clin North America, 2001)

MANY OTHERS........still

NOT APPROVED FOR USE
Classes of Dewormers

Benzimidazoles….albendazole, fenbendazole, oxfendazole, oxibendazole

- Resistant worms suck more blood (larger?) lay more eggs
- Fasting increases contact time…and increases efficacy

also – divide dosage over several days, dry feed
Classes of Dewormers

Cholinergic Agonists....levamisole, morantel, pyrantel

Levamisole (Imidothiazoles)
– effective against active feeding worms
- resistance by Haemonchus is sex linked
- Be careful on HOT days
- dose at 1.5 x cow dosage (?)

Levamisole – 5-8 mg/kg, PO; or 6 mg/kg SC
Pyrantel pamoate – 8.5 mg/kg, PO
Dosage Recommendations

Goats – 2x sheep dosage of Benzimidazoles and ML’s
- 1 => 1.5x sheep dosage of cholinergic drugs

Small Ruminants can be given combinations of dewormers at the same time,

Benzimidazoles can be given every 12 hours for several doses to increase the effectiveness.
Deworming Programs

- Treat only those that need deworming, contribute the most to pasture contamination
- Periparturient animals
- Peak Lactation animals
- Decrease resistance
Coccidia

Counts

- 5000 epg feces => significant (> 100,000 in severe outbreaks)
- Ocysts found in normal animals
Coccidia

- **Kids!**
  - 3 weeks to 5 months of age
  - Most important cause of diarrhea
- **Immunity**
  - Develops “resistance” over time

- **Prevalence**
  - 38-100% of all infected goats
  - Infection with multiple species
Clinical Signs

• Sudden death

• appetite, listlessness, weakness & abdominal pain

• Diarrhea
  – Watery yellowish-green to brown ± frank blood
  – Stained hind quarters

• Dehydration

• Secondary bacterial infections

• Stunted growth, ill thrift

• Weight loss
Diagnosis of coccidia not \textbf{(NOT)} based on detection of oocysts in feces… but ???
(Chigerwe, J Vet Diag, 2007; Ballweber, Vet Clin NA, 2009)

Majority of GIT damage occurs pre shedding (E Mac…..) (Cebra, JAVMA, 2007)

Diagnosis of clinical cases ..... based on ???
- Previous farm history
- Clinical signs
- History of recent stress
Tapeworms & seen in normal asymptomatic animals
(Williamson UF Alpaca Symp 2010)

Tapeworms – no problem in sheep
(Elliott New Zealand Vet J 1986 +)

Tapeworms associated with C. perfringens ???
(Craig Personal communication 2010)
Monezia sp – Tx FBZ (<~50mg/kg q5d PO)
praziquantel (50mg/kg PO)
albendazole (10mg/kg PO)
Resistance to parasites

Heritability of resistance to some nematode parasites in sheep might be as high as 0.3 to 0.4 (pretty high !!!!) for sheep.....

So..... Selection for resistance can help...a bunch
Novel Worm Control Strategies in Development

The buck / ram account for ~50% of flock genetics.
- Perform multiple FEC in spring-summer, cull highest count males
- FAMACHA, cull highest scores
Parasite Control Helpers

Quarantine & deworm (with 2 different classes of dewormers) ALL flock additions for 30+ days

Kaplan’s Quarantine Plan – Fast new additions 24hrs, then deworm sequentially –same day-moxidectin, levamisole, albendazole. Wait 14 d, fecal float and allow animal to enter flock if negative.
Parasite Control Helpers

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Parasite Control Helpers

Periodically check effectiveness of dewormers
(Deworm/fecal EPG => fecal EPG 10-14 d later..... <90% drop in EPG=resistance)
Parasite Control Helpers

• Dose based on largest animal of group
• Insure adequate intake
• Fast animals 24 hrs pre-deworming, and hold animals in a paddock (feed) for up to 72 hrs post deworming…then move to safe pasture
Parasite Control Helpers

- Dose 2 classes of drugs…together
  (T CRAIG…. Personal communication; ACVIM Proceed, 2005)
- Give a drug @ therapeutic dosage for 3-5 d
  (Fleming + J Vet Int Med 2006)
- Move to NEW ground
Other environmental factors

- **Moisture** favors Strongyle development and persistence.
- most infective larvae will be near the root of the grass.
- **Overgrazing**
  - Increases exposure

(DC Taylor, personal communication, 2013)
Pasture Management

Parasites – more animals => more feces
(more parasite eggs => larvae => more parasites)
Need grass to complete life cycle (kinda)
Management Practices

- Reduce Stocking Rate
- Rotation grazing (long rest – 70 d ?))
- Graze forage >4” above ground…ONLY
- Graze tannin-rich crops (sericea lezpedeza, chicory, birds foot trefoil, )
- Graze/Browse sorgham, sudan, eastern gama, etc
- Alternate grazing with (cows etc) row crops, hay
- Strategic, Tactical, Targeted
- Cull repeat Offenders
Pasture Management Rotation

- Rotate to pastures used for small grain, hay horses, cows.....etc...NO small ruminants for a while

- Soil test and fertilize accordingly (burn, etc)

- Graze when grass is 6-8” tall ...stop grazing when grass is 3-4” from the ground

- Legumes (protein, organic content of soil, good bacteria, increase water retention, improved digestibility of forages)
Decreasing Exposure

- removing feces from pasture
  - not-practical in most settings (except arid areas)
  - cannot get it all

(DC Taylor, personal communication, 2013)
Mineral Nutrition and Parasites

- Ca (legumes)
- P (winter forages)
- S (if browsing & feeding NPN)
Mineral Needs

- Phosphorus and Trace Minerals
  - 6 to 12 % P
  - All trace minerals

- Consumption is very important
  - 1 to 2 ounces/day of total mineral supplement
Novel Worm Control Strategies in Development

• Condensed tannin containing forage
  – *S. lespedeza*, Quebracho extract, Sanfoin hay
    (Min JAS 2003; Shaik South Africa JAS 2004)

• Nematophagous (nematode-trapping) fungi
  – *Duddingtonia flagrans*
    (Terrill Vet Parasit 2004; Larsen JAS 2006)

• Copper-wire bolus
Novel Worm Control Strategies in Development

Copper-wire bolus (COWP)
- copper oxide
- OK for Haemonchus ~ 60% effective ????

Copper oxide wires in kids

- **Dose**
  - 0.5 gram

- **Frequency**
  - repeated as soon as 6 weeks not to exceed 4 treatments in a worm season

- **extra label/compounding**

- potential for toxicity – know dietary intake and forage analyses including Mb, S, and Cu

Cu sulfate - ~60% effective ????
poorly effective for Haemonchus
Cu oxide less toxic than Cu sulfate

(Cu toxicity- Scharko ACVIM 2006; Van Saun – numerous, Junge
Organic

Noun

1. A substance, especially a fertilizer or pesticide, of animal or vegetable origin.

2. Chemistry An organic compound.

3. Carbon-based chemistry

\[2 \text{ Cu} + \text{ O}_2 \rightarrow 2 \text{ CuO}\]
If You Are Sick:

2000 B.C. – Here, eat this root.

1000 A.D. – That root is heathen. Here, say this prayer.

1850 A.D. – That prayer is superstition. Here, drink this potion.

1940 A.D. – That potion is snake oil. Here, swallow this pill.

1985 A.D. – That pill is ineffective. Here, take this antibiotic.

2000 A.D. – That antibiotic is artificial. Here, eat this root.

• How do we know which treatments are useful?
• Evidence Based Medicine?
Herbal’s

- Herbal anthelmintic remedies were administered in the traditional way by healers. Efficacy was determined using percent fecal egg count reduction (percent FECR) test.

- Efficacy for Myrsine afriacana, Albizia antihelmintica and Hilderbrantia sepalosa against Monezia sp was 100%.

- The efficacy for albendazole was 63% (?)  

(Ganthuma, J Ethnopharmacol 91:7, 2004)
Herbals

- Herbal anthelmintic remedies were showed no benefit, when following manufacturer recommendations.
- Treated group were more anemic (Ar)

(Burke, Vet Parasit, 2009)
**Novel Worm Control Strategies in Development**

- 600mg/kg bw of Orange oil emulsion reduced FEC by **97.4%** @ 14 d post tx in sheep (Squires, Vet Parasit 2010)

- Albizia anthelmintica bark fed to lambs (0.9 mg) reduced FEC by **78%** (Grade, Vet Parasit 2008)

- Lippia sioides essential oil (283 mg/kg) reduced FEC by **56.9%** by 14 d post Tx vs ivermectin 39.3 against Haemonchus (Camurca-Vasconcelos, Vet Parasit 2008)

- Ethanolic extracts of Iris hookeriana rhizome (2g/kg bw) reduced FEC by **45.62%** by 10 d post Tx (Tariq, J Helminthol 2008)
Novel Worm Control Strategies in Development

- Feeding Azadirachta indica (neem) leaves did not affect FEC vs controls (Chandrawathani, Trop Biomed 2006)

- Azadirachta indica seed (3mg/kg) @ 15d post Tx reduced FEC by up to 40.2% vs levamisole (99.2%) (Igbal, Vet Parasit 2010)
**Novel Worm Control Strategies in Development**

- Mucuna pruriens a tropical legume reduced FEC 7-18% vs levamisole (87%) in goats (Huisden, J Ethnopharmacol 2010)

- Cocos nucifera fruit extracts had no activity against GIT in sheep (Oliveria, Vet Parasit 2009)
Holistic Parasite Control

Onions

Garlic

Diatomaceous earths
Holistic Parasite Control

Onions
Garlic
Diatomaceous earths
Mix with Moxidectin
General Health Care

Heifers gained an average of 20.2, 16, 4, and 20.4 kg for control, DE, and CT, respectively, during the six-weeks study.

(Alternative Anthelmintics for Organic Dairy Cattle; Project Leader: Dr. Jean Bertrand, Professor, Animal and Veterinary Science)
Mean fecal egg counts (FEC) ± SE for heifers on control, diatomaceous earth and condensed tannin (CT) treatments. -------x------DE

(Alternative Anthelmintics for Organic Dairy Cattle; Project Leader: Dr. Jean Bertrand, Professor, Animal and Veterinary Science)
Novel Worm Control Strategies in Development

• Dilution of resistance
  – Re-introduction of susceptible strains of parasites

• Vaccines

• Protein Supplementation before kidding/lambing
  – 250 gm cottonseed meal per day
    (Kyriazakis, 1996; Coop, 1999)
Nutrition & Parasites

Feeding to meet nutritional requirements for optimal growth/production are more prone to have better resistance and resilience (Wallace Res Vet Sci, 1996; Coop Vet Parisit, 1997)

Providing supplemental protein improves resistance & resilience, particularly with protected protein (Kyriazakis, 1996; Coop, 1999; Houdijk, 2009)

- Protein Supplementation before kidding/lambing
  - 250 gm cottonseed meal per day (Kyriazakis, 1996; Coop, 1999)

……..However SBM is effective (Torres-Acosta, 2004)
Nutrition & Parasites

Feeding forages with condensed tanins may help prevent parasitic disease (Min, 2003; Niezen, 1995; Min & Hart, 2003; Athanasidou, 2001; Shaik, Vet Parasitol, 2006 etc)
Protein / Energy / Vitamins

- Excessive tannin intake => depression of food intake
  binding dietary proteins and digestive enzymes
  injury to parts of the GI tract (Zafar, 2002)

Thus... balance must be drawn to maximize the positive effects on GI parasite control, while minimizing some of the deleterious effects
Dietary Management

Supplemental soybean meal and energy can improve resilience. Dietary supplementation appears is more effective when targeted. (NRC, 2007)

Ex- additional of protein during early pregnancy => immunity to parasites at parturition (sheep ?) (Kindane, Vet Parasit, 2009; Valderrabano, Vet Parasit, 2006; Kahn, Vet Parasit, 2003)
Feeding Ruminant Animals

- Feed related costs account for >60% of total expenditures for herds/flocks herds

- Four-Step Supplementation
  1) Energy
  2) Protein – maintain 7-8% CP for entire diet when not lactating
  3) Vitamin – supplement / inject
  4) Minerals – free choice salt w/ 8-12% Ca & P, and TM (S Wikse)
Goats

- VERY selective grazers
- Utilize browse
- Add one for each existing cow without competing for forage
- About 5-7 per animal unit
Limitations

- If forage availability is not limiting then can generally meet all needs
  - Selective
    - Specific plants
    - Specific plant parts
- Browse is also important
  - Browse vs grass (2:1)?
- Under these conditions only minerals would be needed
Body Condition Score (BCS)

BCS 3.5

Spinous processes not visible
Shoulder & sternum not palpable
Limited Forage

- Needs for energy and/or protein

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<th>Prod Status</th>
<th>TDN</th>
<th>CP</th>
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<td>55</td>
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<td>Lact</td>
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Protein Supplementation

- Soybean meal and cottonseed meal
  - Both work extremely well for goats
  - Compare cost
Supplementation Methods

- Submissive goats underfed and dominant goats overfed
  - Provide as much feeder space as is practical
  - With some feeds can feed twice as much every other day
  - Best is limit grazing of high-quality forage
Feeding the Doe

BCS of 2.5-3 (1-5) and gaining wt

Flushing – good response moderate condition
- poor response good to fat does
- begin 2 wks prebreeding=>for 2-3 wks
Feeding & Reproduction

- And they were as fed horses in the morning, everyone neighed after his neighbor’s wife.

  Jeremiah 5:8
Energy Supplementation

- **Corn**
  - Can be fed whole-shelled
  - Always begin with gradual amounts

- **Soyhulls**
  - Widely available in Southeast
  - Equal to corn as a supplement
  - Less problems with acidosis
Supplementation Methods

- Submissive goats underfed and dominant goats overfed
  - Provide as much feeder space as is practical
  - With some feeds can feed twice as much every other day
  - Best is limit grazing of high-quality forage
Feeding the Doe: Late Gestation

Trimester 1 & 2 => maintenance

Trimester 3 => increase CP & E

BCS >3 => potential for dystocia and pregnancy toxicity
Feeding the Doe: Lactation

More nutrients needed for more milk produced
(30% more milk for twins vs singleton)

Doe weighs ~10% of cow... but needs >12-14% more nutrients
Lactating doe can consume ~ 4-5 % of BW... or more
Peak lactation => expect wt loss
Feeding the Doe: Lactation

Can feed a diet up ~ 4-5% fat (2-3% oil seed – 1-2 % speciality fats)

WCS – 90% TDN & 21-23% CP..... <20% of diet

Feed a diet of 12-14% CP and 55-60% TDN
Weaning Kids

Wean as early as 3-4 wks

- weigh 20-25 #, eating 0.5# grain/d (16-18% CP)
- feed Bunks ‘T’ to fence line
- good quality forage
- feed dam hay only

Need a post weaning death loss of < 4%
The Cyclicity of the Doe

cycling

transitional

anestrous
The Cycling Doe and Prostaglandins

Prostaglandins:
- dinoprost
- cloprostenol

ESTRUS
24-72hrs
Biosecurity

- Separate pregnant female by age & gestation stage
  - quarantine & monitor 30 d PP
  - late gestational immunosepression => potential for nasal shedding or fecal shedding

- Immediate isolation of sick or abortion cases
Fetal Wastage - Prevention

- Biosecurity – Isolate additions for 30d
  - Avoid cow, hog, cat, rat, deer, dog(?) exposure
  - Maintain separate production units
  - Maintain healthy animals – CP/Minerals, BCS, clean water, feed above ground, etc

- Vaccinate – Chlamydia, Campylobacter, etc in endemic areas 4 & 2 mo pre partum (?)
Pregnant Female Care: Final Trimester

Avoid Transport

Vaccinate – 4-6 wks PP

Move to Cria-tion site 14-21d pre-birth

Birthing site - Pasture
  - Stall -14x14
  - Straw bedding
    (stripped and cleaned between animals)
Feeding the Doe: Late Gestation

Trimester 1 & 2 => maintenance

Trimester 3 => increase CP & E

BCS >3 => potential for dystocia and pregnancy toxicity
PARTURITION

The second stage

-delivery of the fetus, 1 to 2 hrs., usually in lateral (older does may remain standing)

-the amnion protrudes from the vulva, followed by the forefeet & head (NOTE: A Doe that fails to continue progressing should be examined)

-posterior presentation is normal if both legs are extended and delivery occurs rapidly

-With multiple kids the Doe may or may not rest between deliveries or the deliveries may occur in quick succession
PARTURITION

The Second Stage

If the Doe strains without producing any kid more than 30 min, intervention is indicated.
PARTURITON

The Third Stage

- delivery of the placenta (6 hrs) and involution of the uterus.

- If no signs of septicemia or toxemia, placenta delivery should cause no concern until 12 to 18 hrs.

- Uterine involution should be complete by day 28

- Lochia (a nonodorous, reddish-brown discharge) is normal for up to 3 weeks
Parturition

The 3-30 rule

Doe should be examined 30 minutes after contractions begin or after the breaking of the chorioallantoic membrane.

If the female is normal and parturition is progressing normally, the clinician should wait at least 30 minutes before beginning any treatments or manipulations.

Females should be examined 30 minutes after delivery to determine whether another fetus is still in the uterus or birth canal.
Parturition

The 3-30 rule ..........

Dystocia may be complicated with:

- fatigue

- signs of pain and panting

- Uterine Inertia & Hypocalcemia (both primary or secondary to respiratory alkalosis) => poor uterine contractility
Dystocia

Most common cause: fetal postural abnormalities

- incomplete cervical dilation,
- simultaneous presentation of kids
- cervicovaginal prolapse
- uterine inertia
- fetal-maternal size disproportion (singleton, overly finished does)
Goat Dystocia

- Patience
- Clean (Ivory soap)
- Lube (already hydrated => KY Jelly)
- Light traction (very friable uterus)
- Gentleness
- Small hands
Observations

Late onset of estrus and cyclicity
Low kidding rates
 Interruption or ‘Gaps’ in kidding
Pregnancy toxemia
Abortion
Stillbirths
Neonatal mortality
RFM
Goat Herd Health Programs

• Individual Animal Identification
  – neck tags, tattoos, ear tags, RFID

• Management Group Identification
  – temporary / permanent grouping

• Record System
  – herd management,
  – regulatory
Goat Identification Methods

Registration tattoos

Premises ID tattoos

Ear tags

Electronic ID
• National Scrapie Eradication Program (mandatory)

• Scrapie Flock Certification Program (voluntary)
Prioritize Disease Prevention/Control

What Diseases are most prevalent?

What Disease Kill Quickly on this farm?
(Mycoplasma, Staph/Pseudomonas mastitis, Clostridium, GIT)

What kills slowly or cause early culling?
(CLA, CAEV, Johnes, Footrot)

What results in decreased production, growth?
(Coccidia, sub clinical mastitis, Pneumonia, GIT)

Are Zoonotic diseases present?
(Brucella, Clamydia, Q fever, Toxoplasmosis)
Contageous Foot Rot
“Don’t get stuck on stupid”

Lt Gen R Honore, USA
Then he will say to those on his left hand, “Go away from me, with your curse upon you, to the eternal fire prepared for the devil and his angels”

Mathew 25:33
Sheep Goats and the Holy Bible
Fate of Good and Holy Sheep

He will place the sheep on his right hand and the goats on his left.

Mathew 25:33

People (sheep) on the right will go to heaven...

Mathew 25:34 - 40
Internet ............
Organic

Adj  or·gan·ic  (ôr-g n  k)

❖ 1. Of, relating to, or derived from living organisms: *organic matter*.

❖ 2. Of, relating to, or affecting a bodily organ: *an organic disease*.