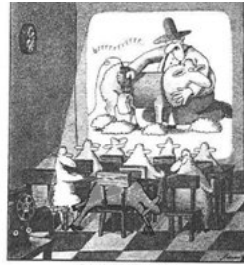


Overview of Today's Topics on Control of Disease in Sheep and Goats

Dr. Paula Menzies
October 27, 2007



Lots to Cover Today



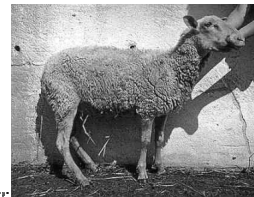
Sheep health classes

- Gastrointestinal parasites
 - Anthelmintic resistance
- Coccidiosis
- Pneumonia
- Pulpy kidney
- Abortion
- Maedi visna
- Johnes disease



What is Chronic Wasting Disease?

- Disease that causes weight loss / poor weight gains / low body condition score
 - With or without other signs of disease
- Whole group
 - Stage of production
 - Nutrition
 - Parasites (+ -)
- Individuals within the group
 - Competition
 - Chronic disease



BCS Goals by Stage of Production

Stage	Description	Length (days)	Nutritional Demand	BCS
Maintenance	Dry period	0 to 180	Low	2.5 - 3.0
Flushing & breeding	3 wks before & after breeding	42 to 84	High	3.0 - 3.5 ewes 4.0 - rams
Early gestation	Mostly placental growth	90 days	Moderate	2.5 - 3.0
Late gestation	Fetal & udder growth	42 days	High	3.0 - 3.5
Early lactation	Nursing or milking	35 - 90	Very high	2.0 - 2.5 @ weaning or peak milk



What are the common causes?

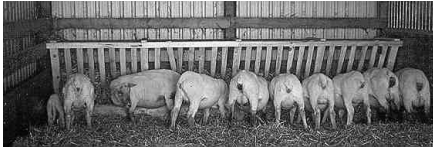
- Competition
- Dental Disease
- Internal Parasites
 - Usually gastrointestinal parasites
- Maedi Visna / Caprine Arthritis Encephalitis
- Johnes Disease
- Caseous Lymphadenitis
- Scrapie (with or without neurological signs)
- Contagious Ovine Footrot (with lameness)



Control of Gastrointestinal Parasites in Sheep and Goats

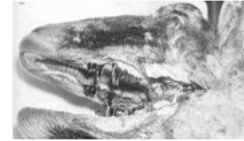
Competition

- Inadequate feeder space
- Mixing of sizes/ages
- Mixing of classes
- Species incompatibility
- Breed incompatibility



Dental Disease

- Broken mouth
 - Loss of incisors due to gingivitis or old age
- Periodontal disease
 - Gingivitis
 - Molar loss
 - Secondary bone infection



Control of Internal Parasites in Sheep and Goats

Dr. Paula Menzies

Presented to Manitoba Sheep and Goat Symposium
October 27, 2007



Sheep and Goats Get Lots of Parasites

- **External**
 - Lice
 - Mange
 - Keds
 - Fly larvae
- **Internal**
 - Protozoal (cryptosporidia, coccidia)
 - Tapeworms – intermediate and definitive host
 - Nematodes
 - Liver flukes



Coccidiosis

- **Eimeria fairly host specific**
 - *E. crandallis*, *E. ovina* & *E. ovinoidalis* most pathogenic to lambs
 - *E. arloingi* & *E. ninkohlyaki* most pathogenic to kids
- **Many other species less pathogenic**



Coccidiosis

- 4-6 wks of age up to yearlings
- **Acute**
 - Bloody diarrhea
 - Dehydration
 - Death
- **Chronic disease**
 - Pasty stool
 - Poor growth
- **Risk Factors**
 - Contaminated environment
 - Naïve animals
 - Other disease, e.g. pneumonia

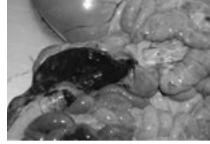


Sources of Infection

- Oocytes (eggs) in environment
- Chronically infected lambs and kids
- Periparturient egg rise (PPER) from does and ewes



Diagnosis



- Feces from affected animals
- Fecal egg count
 - > 5,000 eggs per gram of feces
 - Low levels always present and not significant
- Post mortem
 - Intestine affected



Treatment & Control

- In an outbreak can treat with sulfonamides or amprolium orally
 - drawbacks
- Control
 - Deliver an anticoccidial drug starting before time of risk
 - Kids and Lambs – 2 weeks of age for 90 days
 - PPER – last trimester of pregnancy to weaning
 - Feeding management



Anticoccidial Drugs – Vet Script

DRUG	Active Ingredient	Dosage BW/day	Delivered to animal	Comments
Sulfas	Sulfadimidine / Sulfamethazine	25 - 140 mg/kg	In water; 4 days on 3 off & repeat	Higher dose for treatment only
Amprol	Amprolium	10-20 mg/kg	In water or feed; 5-21 days; at 50 mg/kg orally once as treatment	Resistance & PEM toxicity reported
Rumensin	Monensin	1.0 mg/kg	In feed 11-22 gm/tonne; for 8 to 12 wks	Narrow safety range for sheep
Bovatec	Lasalocid	1.0 mg/kg	In feed 36 gm/tonne for 8 to 12 wks ad lib feeding	Approved for sheep; Moderate toxicity
DecoX	Decoquinatate	0.5 - 1.0 mg/kg	6% premix in feed @ 1.5 kg/tonne for min of 75 days	Low toxicity; immunity poor if treated < 3 cycles



Tapeworms

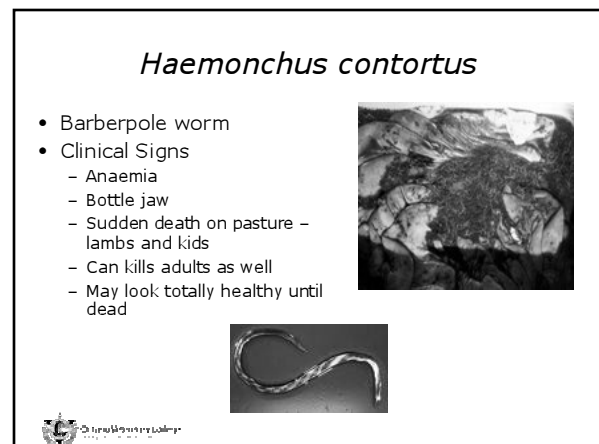
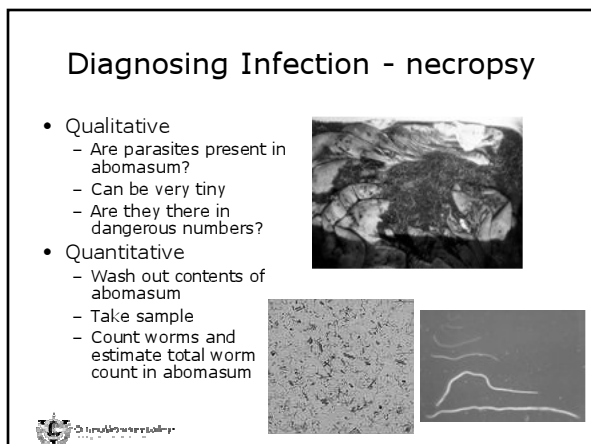
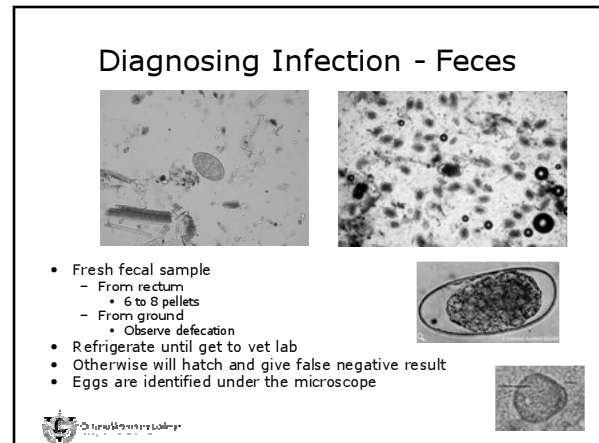
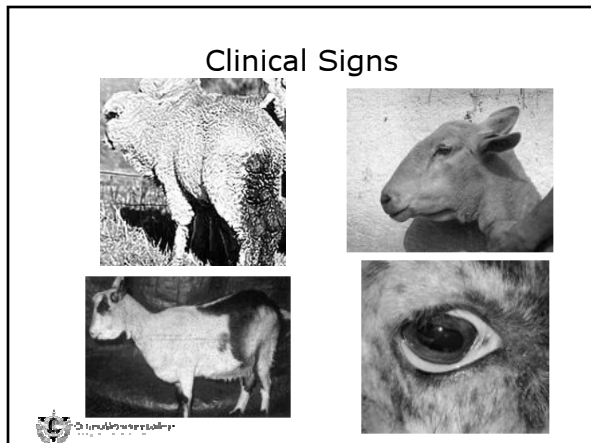
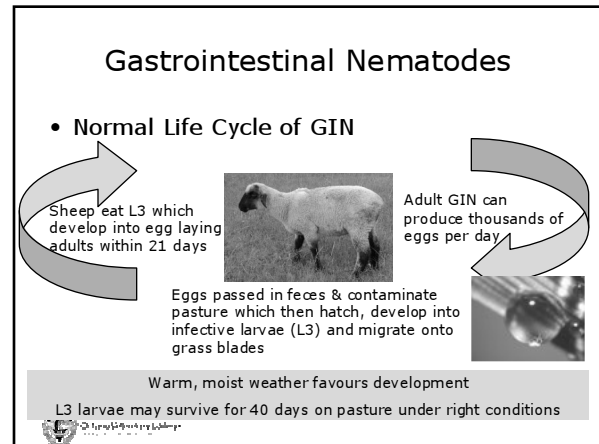
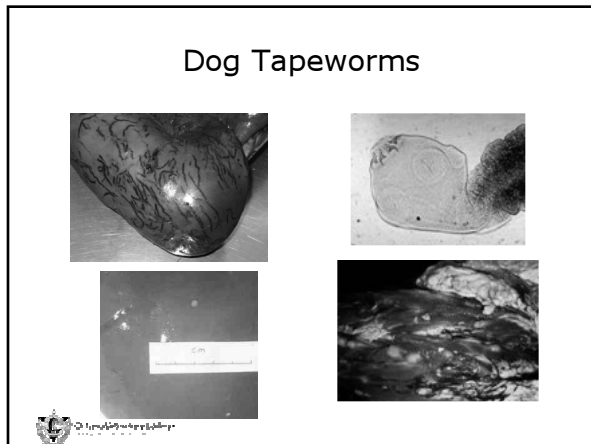
- Sheep & goats are adult host
- Intermediate host is free living oribatid mites found on pasture
- Any clinical effects?
 - Generally not
 - Heavy infestations may interfere with gut motility
 - Associated with pulpy kidney outbreaks?
 - Can be seen in feces
- Otherwise incidental finding



Tapeworms of Dogs

- Intermediate host of dog tapeworms
- Infected dog or coyote sheds tapeworm eggs on pasture or feed
- Eggs eaten by sheep
- Migrate
 - *Cysticercus tenuicollis* – to liver mostly
 - *Cysticercus ovis* – muscle of diaphragm, heart and skeletal muscle
- No effect on sheep but at slaughter...
- If dead sheep fed to dogs or scavenged
 - Cycle is complete →





Haemonchus

- How does it kill?
 - 1 worm sucks 0.05 ml blood / day
 - 1000 worms suck 50 ml blood / day
 - A 50 lb lamb has only 1750 ml of blood
 - 1000 worms will drain ½ its blood supply in ~ 2 weeks
- Environmental survival
 - 7 days to 5 weeks to reach infective stage
 - Moisture, warmth, light
 - L3 survive for weeks on pasture
 - Eggs and L3 killed by hard frost and cold but
 - One adult worm can produce 10,000 eggs per day

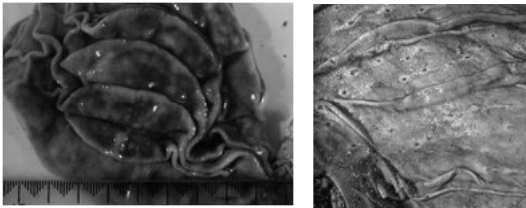


Ostertagia

- *Teladorsagia circumcincta*
 - Brown stomach worm - small
- **Clinical Picture**
 - Lives in abomasum and sucks proteinaceous fluid
 - Prefers cooler weather (September?)
 - Bottle jaw
 - Diarrhea - watery
 - Thin and poor doing
 - Abomasum can be permanently harmed



Ostertagia - abomasum



Others

- **Trichostrongyle** – black scour worm
 - Clinically like ostertagia
- **Nematodirus**
 - Only in youngstock
 - Doesn't need pasture to develop
- **Many others but these are the "Biggies"**



How Are Parasites Controlled?

- Important to understand infection in the animal and
- Life cycle on the pasture

- Strategic parasite control requires understanding the normal epidemiology of the parasite



What is Hypobiosis?

- **During the winter, the parasites in the animal**
 - Produce fewer eggs
 - Go into arrested development
 - Wait for the correct conditions to contaminate environment, i.e. spring and birth of new victims

- **Checking the manure for eggs during the winter may give a false negative reading**



Control of Gastrointestinal Parasites in Sheep and Goats

Sources of Pasture Contamination with Eggs

- *** Summer pasture build-up from infected lambs and kids
 - This is the most important source
- Overwintered eggs & L3
 - Except for haemonchus which overwinters poorly
 - Deep snow cover improves survival of other GIN
- Periparturient spring rise of egg production
 - Pregnant ewes and does
- Manure contamination of feed and grazing
 - from manure piles & manure spreading on pasture
- The eggs and larvae on pasture termed "Refugia"



Periparturient Egg Rise

- PPER
 - ~2 weeks prior to lambing / kidding & 6-8 wks after
 - Relaxation of immunity allows arrested nematodes to increase egg production
 - Major source of spring pasture contamination for GIN
 - Reduced by high level nutrition in late gestation
- Self cure
 - Occasional occurs in adult sheep but not a substitute for control
 - Not common in goats



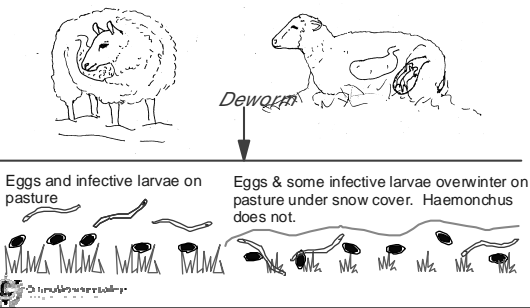
STANDARD PROTOCOL FOR PARASITE CONTROL

Autumn:

Deworm at housing with drug that kills adults & larvae

Winter:

Sheep overwinter with few larvae and adults.



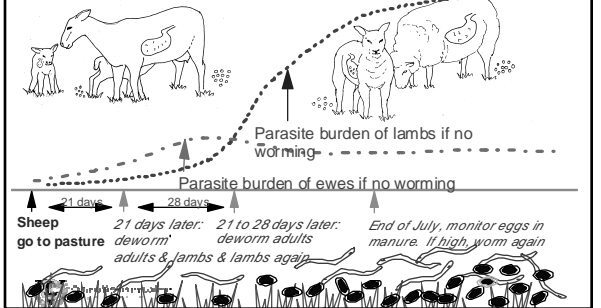
PPER can be prevented by worming pre-lambing

Spring:

On pasture, sheep eat infective L3. From infection to egg laying takes 21 days

Summer:

Worming prevents pasture contamination. Naive lambs produce most eggs so must be dewormed!



What Dewormers Can Be Used

- Licensed for sheep:
 - Ivermectin for sheep – drench and injectable
- Licensed for goats:
 - Nothing
- Rest of use is extra label drug use
 - Prescription by a licensed veterinarian.
- Must withhold milk in lactating animals where milk is used for human consumption



Dewormers in the Arsenal?

- Benzimidazoles (white drenches)
 - Fenbendazole (Safeguard) cattle drench
 - Albendazole (Valbazen) cattle drench
- Levamisole
 - Not readily available anymore
- Avermectins
 - Ivermectin (Many trade names) sheep drench and injectable
 - Eprinomectin (Eprinex) cattle pour-on
 - Moxidectin (Dectomax) cattle injectable



Control of Gastrointestinal Parasites in Sheep and Goats

What happens when we de-worm?

- **Perfect world:**
 - Kill 99% of parasites
 - Some residual activity to slow down re-infection
 - But...
- **Not so perfect world:**
 - Now animal only has genetically resistant parasites in gut which still shed eggs
 - Will not lose resistance over time
- **What happens on pasture under intensive deworming programs?**



Why do De-wormers Fail?

- **Didn't give a sufficient dose of the product**
 - Animal didn't get enough dewormer to effectively kill the parasites
- **Parasites are resistant to dewormer**
 - Anthelmintic resistance = AR



How do we know that the de-wormer has failed?

- Still seeing clinical disease 2 to 3 weeks after de-worming
- 2 weeks after de-worming, large numbers of eggs in feces
 - < 10 days may get temporary suppression of egg production
 - > 21 days may see eggs from new infection



Drench Response Test

- Take fecals from representative proportion of animals
 - 10 from adults
 - 10 from youngstock
- De-worm at same time
- Take fecals again 14 days later
- If poor decline – possible resistance



Drench response test - treated with 3 cc injectable ivermectin on March 7th, 2007
treated with 10 ml of Safeguard on - April 1, 2007

ewe	Mar-21	Mar-22	Apr-1
717	4110	5500	2320
130	2000	40	20
1434	1460	6300	5700
86%	700	630	240
84%	360	0	200
41%	360	780	5700
81%	300	240	1940
P49	260	20	20
18%	200	600	1220
38%	220	480	20
22%	200	80	100
2557	180	40	160
30%		60	
68%	40		
31%	20		
57%	0		
42%	0		
46%	0		
105L	0		
HP 0			
average	585	1237	662

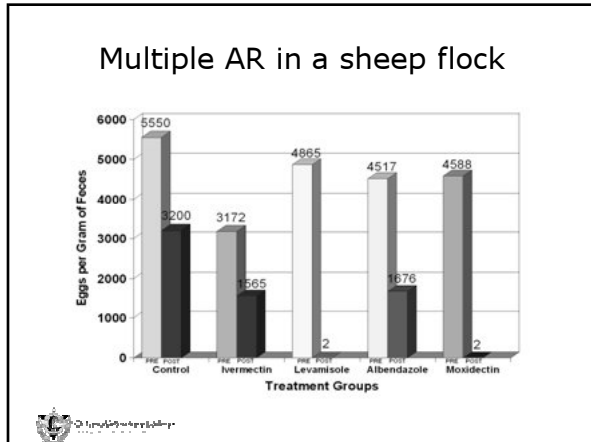
sheep	Mar-21	Mar-22	Apr-1
355	120		
185	10		
1727	140		
1732	20		
1731	20		
255	20		
345	120		
555	40		
155-ewe	0		
1724	0		
1735	20		
1719	80		
1740	0		
1720	0		
1728	80		
average	49.333333		



Fecal Egg Count Reduction Test

- Randomly assign youngstock to treatment groups (1 per de-wormer class) + a control group (no treatment)
- As with drench response test but must do quantitative counts (eggs per gram of feces) rather than qualitative (e.g. 1+, 2+)
- Compare reduction to the control group





- ### How can we control parasites and avoid AR?
- **Smart Drenching**
 1. Find out if AR is in your flock
 2. Make sure that animals receive correct dose
 3. Withhold feed prior to treating
 4. Treat only those animals that need it or only when needed
 5. Pasture management to reduce refugia of eggs and larvae

- ### Receiving the Correct Dose
- **Route of Administration**
 - Don't use cattle pour-on products as a pour-on
 - May not be absorbed well leading to under dosing
 - Don't use injectable products
 - Too long residual activity leading to survive of partially resistant GIN
 - **Repeat dose rather than "overdose"**
 - More is not always better – too long residual activity leading to selection for genetic resistance
 - Treat twice 12 hours apart only for benzimidazoles

- ### Receiving the Correct Dose
- Dosages for sheep are the same as for cattle
 - **Goats must be dosed at:**
 - 1.5 X cattle dose for levamisole
 - 2 X cattle dose for other drugs

- ### Receiving the Correct Dose
- **Estimate the weight accurately**
 - Weigh individuals and dose to heavier weights
 - **Calibrate drench gun so delivering the amount needed**
 - **Administer with a proper drench gun to back of throat**
-

- ### Withholding Feed
- **Prior to treatment**
 - **This may slow transit time of the drug so it works better**
 - **12 to 24 hours for benzimidazoles, ivermectin and moxidectin**

Should we...?

- Use 2 de-wormers at the same time?
 - Only if AR has been proven and only on the advice of a veterinarian
- Rotate de-wormers?
 - Don't rotate quickly, e.g. more frequently than once / year



How Do We Know When De-Worming is Needed?

- Know normal risk periods for disease
 - E.g. mid-July during warm and wet summer
 - E.g. before lambing / kidding PPER
- See clinical disease
 - Bottle jaw
 - Diarrhea
 - Anaemia - FAMACHA
- Egg counts in feces from routine sampling at known risk periods



What is FAMACHA?

- Scoring system for assessing anaemia
 - Due to infection with haemonchus
- Developed in S. Africa
 - Vets are trained to use and train producers
 - Lots of labour required
- Check flock every 2 to 3 weeks
 - Only deworm those that are anaemic
- Useful if haemonchus is your biggest problem
 - Not useful for other parasite infections
- Monitoring egg counts in feces might be better in Canada



Why not treat whole flock?

- Not every animal is equally parasitized
 - Genetics
 - Immunity
- If treat everybody, only resistant parasites are left to produce eggs
 - Eventually only resistant parasite eggs in the pastures
- If treat only heavily infected animals
 - Are treating the "BIG SHEDDERS"
 - Rest of animals still shedding non-resistant parasite eggs but not large numbers
- Refugia on pasture is mixed population
 - Greatly slows down development of resistance



What About Fecal Egg Counts?

- More accurate estimate of total worm burden but..
- Indicates status of group not individual
- For our climate best to check parasite burden
 - Mid to late July depending on temperature and moisture and previous parasite burden information
- How
 - 10% of group or 10 animals
 - Individual samples
 - From each group, e.g. young stock and adults



Environmental Management Reducing the Level of Refugia on Pasture

- Pasture rotation is good but...
- Weather determines survival of eggs & L3
- Summer – when are pastures safe
 - Cool and wet – up to 6 months
 - Hot and dry – 3 months
- Winter – when are pastures safe
 - Cold and open – likely only a few weeks
 - Snow covered – still not safe after the entire winter
 - Except haemonchus we think



Environmental Management

- Rotate weaned lambs and kids ahead of adults
 - Adults can tolerate heavy loads better than youngstock
- Rotate pastures quickly and graze intensively
 - Not for parasite control but for forage management
 - 30 days between grazing optimal for plant growth
 - Avoid overgrazing as this encourages grazing near fecal pellets or too close to ground
- Expose the larvae and eggs to UV light
 - Clip / groom pastures to break up heavy thatch
- Avoid the high risk time of day for larval migration
 - Don't graze until after dew is off grass



Environmental Management

- Manage PPER
 - De-worm periparturient ewes and does before grazing
 - Supplement with protein
 - Avoid those pastures for young-stock
- Allow goats browsing opportunities
 - Shrubby pasture
 - Reduces exposure to parasites
- Plow, till and reseed heavily contaminated pastures – don't use for hay
- Rotate pasture with cattle or horses
 - Different parasite species



Biosecurity

- Even if control on an individual farm is perfect
- Easy to purchase resistant nematodes
- Devise a treatment protocol with vet to aggressively treat additions while in isolation
 - Keep inside so don't contaminate pastures
 - Recheck with fecals 14 days after treatment



What About Alternative Methods?

- Should be science-based
- Should do no harm
- Pasture plants containing condensed tannins
 - Reduce intakes & growth but maybe some reduction in egg shedding
- Copper oxide wire particles
 - Only in copper deficient areas
 - Very risky to sheep if not deficient



Alternative Methods?

- Nematophagus fungi
 - Feed fungal spores (*Duddingtonia flagrans*)
 - Fungi grow in feces on pasture
 - Trap and infect newly hatched larvae
 - Must be fed daily for 60 days or given in bolus
- Genetic resistance
 - Some breeds more resistant
 - Select resistant sheep within a breed
 - Ram selection based on fecal egg count?



