UDDER HEALTH FOR DAIRY SHEEP AND GOATS

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GUIDES FOR UDDER HEALTH FOR DAIRY SHEEP / DAIRY GOATS

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Why did we write a guide?

- In Ontario, in last 15 years the dairy sheep and dairy goat industry started to attract many new entrants – still increasing
- Goat industry milk quality problems
- Sheep industry really, really new
- Little SR dairy information
  - Lots of research
  - But little translation and transfer of that research
- So we decided to write a guide...
What is the purpose of this guide?

- To achieve production of high quality milk
- Maintain the health of the animals that produce that milk, and in particular the health of the udder
- Assist support personnel as well as producers
- Need access to information that will facilitate this
- Guide integrates information from research and extension from around the world.
- Sheep version is available on-line
  - Link: http://www.uoguelph.ca/~pmenzies/index.html
- Goat version will be posted on IGA website this spring
Dairy sheep industry in Ontario

- Not regulated by legislation so attracts independent sorts – unknown # of producers
- Seasonal milking versus year round
- Removal of lambs at birth versus early weaning
Dairy Goat Industry in Ontario

- Regulated ~ 270 licensed shippers and growing
  - Herd sizes are increasing up to 1,500 does
- Two main processors – both from cow milk industry
- Very large demand for milk right now
- Usually kids are removed at birth
  - Reared artificially
  - High mortality rates
- Lactation length varies
Organization of the Guide

Section I: Normal lactation
Section II: Mastitis: What causes it and how it is detected
Section III: Milking management
Section IV: Proper maintenance and use of milking equipment
Section V: Milk quality
Section VI: Treatment and control of mastitis
Section VII: Monitoring udder health and goal setting
Section VIII: Dairy goat health management
Appendix I: Definitions of words or phrases
Appendix II: Self-assessment quizzes
Appendix III: References and additional reading
Section I: Normal Lactation

- We thought producers (& vets) should first know normal
Normal Lactation

- How is milk produced?

Anatomy of an Alveolus

- myoepithelium
- milk globules
- secretory epithelium

Apocrine Secretion

- milk globule
- milk particle
- cytoplasmic particle
Normal Lactation

- The physiology of milk production
  - Mammary gland development
  - Hormonal production of milk & milk let-down
  - Involution of the udder at dry-off
- Expected milk production

![Graph 1: Comparison of 1st and 2+ Lactation Curves - Saanen](#)

![Graph 2: Lactation Curves: Primiparous versus Multiparous Ewes](#)
Section II: Mastitis and detection

- Definition of mastitis
  - Inflammation of the mammary gland usually resulting in a change to the anatomy and/or physiology
Economic costs of mastitis

Benefit – Cost Ratio

Financial improvements in cost of disease from implementing control measures

Costs of disease + cost of measures implemented to control disease
Costs of Mastitis

- Lost milk production
- Lower levels of components and poorer cheese making quality
- Early culling & replacement costs
- Penalties or lost bonuses associated with poor quality milk
Costs of Mastitis

- Treatment costs
- Increased feed costs associated with feeding less productive animals
- Increased management costs – separating treated animals, or animals with contagious mastitis
- Reduced welfare
  - Pain and illness
  - Avoidable death
Costs of Mastitis

- Public Health Risk
- Consumption of infected raw milk / raw milk soft cheeses can cause significant human disease
  - *Staphylococcus aureus*
  - *E. coli O157:H7*
  - *Listeria monocytogenes*
  - *Salmonella spp*
  - *Pseudomonas spp*
  - *Coxiella burnetii*
  - *Campylobacter spp*
  - +many more
Costs of Mastitis

- Loss of income from rejection of milk due to poor quality
  - Bacterial / coliform counts
  - Somatic cell counts
  - Off flavours
  - Inhibitors (antibiotics)
Costs of an Udder Health Management Program

- Improvements in housing
  - Stocking density, ventilation, cleanliness
- Improvement in milking equipment & maintenance
- Improved hygiene, e.g. gloves, disinfectants, paper towels – this may slow milking process
- Therapies (e.g. dry cow mastitis ointment)
- Detection of mastitis (e.g. CMT, culture)
- Cull chronically infected animals
Signs of Mastitis

- Clinical
  - Severe clinical
  - Moderate clinical
  - Mild clinical
- Subclinical – most common
  - Measures of inflammation are elevated
  - Production losses
- Agalactia
  - Total loss of gland; blocked teat
Types of Mastitis Pathogens

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

- Environmental
  - Agent originates in the animal’s environment
  - Occasionally animal-to-animal transfer
Staphylococcus aureus

- Most important and common cause of clinical mastitis
- Most frequent cause of gangrenous mastitis
- Public health significance?
- Source: Other animals, skin, teat lesions, hands, nose

Contagious
Coagulase negative Staphylococcus (CNS)

- Large group of bacteria with variable pathogenicity, e.g.
  - *Staph. caprae* (goats)
  - *Staph. epidermidis*
  - *Staph. warneri*
  - *Staph. simulans*
  - + many more...

- Most common cause of sub-clinical mastitis

- Intramammary infection when
  - > 5 colony forming units / µl milk and
  - No more than 2 colony types

Contagious
Contagious

*Mannheimia haemolytica*

- Most often associated with nursing kids and lambs
- Strains identical to those isolated from nasopharynx of kids
- Teat damage needed for clinical infection
Caprine Arthritis Encephalitis virus

- Associated with production losses (~10%) and mildly increased SCC but not increased risk of bacterial IMI
Maedi Visna virus

- Contagious
- Ovine Progressive Pneumonia in USA
- 5 to 12% decrease in milk production
Contagious

**Mycoplasma**

- *Mycoplasma mycoides* subsp capri (USA)
  - Septicaemia, arthritis, pneumonia in kids
  - Survivors can be carriers
  - Mastitis: mild to severe

- *Mycoplasma agalactia*
  - Europe
Streptococcus uberis & dysgalactiae

- Appears to be more common than thought
- Associated with a dirty environment
- Can also behave as a contagious bacteria
- I believe this is a big problem in our industries but why?
Environmental streps and standard plate counts (SPC)

- Owner had fluctuating SPC over 4 months
  - Violable > 50,000 cfu/mL milk in Ontario
  - Six of eleven tests were violable with two TNTC
- Bulk tank culture 3+ *Strep dysgalactiae*
- CMT all goats by half
  - One goat / one half abnormal
    - SPC on that gland was TNTC
    - Culture positive *Strep dysgalactiae* 4+
- Removed goat from tank and SPC levels dropped to below 10,000 cfu/mL
Coliforms

- *E. coli*, *Klebsiella pneumonia*, *Salmonella* spp
- Occasional but less common than in dairy cattle
- Associated with dirty environment, some bedding materials
Pseudomonas aeruginosa

- Associated with dirty water, environment
- Severe mastitis
  - Very poor cure rate
- Does can be carriers – contagious
- May grow in biofilms on equipment
  - +ve bulk tank culture may be milk quality problem
- Cryptococcus
  - Rarely resolves
- Candida
  - Spontaneously resolves
- Associated with
  - Overuse of antibiotics
  - Poor sanitation
  - Infusion technique
Environmental: miscellaneous

- **Bacillus spp**
  - May be contaminant of milk culture
  - *B. cereus* can cause severe mastitis
  - *B. licheniformis* spores can “blow-up” cheeses
    - Probably from dirty teats

- **Listeria monocytogenes**
  - Public health hazard rather than mastitis

- **Prototheca** (non-chlorophyllic algae)
  - Important in dairy cows
  - Swampy environment
  - Small ruminants?
Risk Factors for Mastitis

- Nursing kids and lambs
  - Contagious ecthyma / soremouth
  - Teat biting
  - Carriers of important bacteria on skin and in throats
  - Uneven nursing
Risk Factors

- Milking management, e.g.
- Poorly maintained inflations
- Improper udder preparation
- Dirty hands
- Over-milking / high vacuum levels causing teat-end damage
Risk Factors – Udder & Teat Shape

Nine-Point Linear Scale for Udder Traits

Teat Placement

1 5 9

Depth of Separation of the Two Halves

1 5 9

Degree of Suspension of the Udder

1 7 9

Adapted from:
Does this effect milk-out?

- Machine stripping & teat damage?
How do we detect mastitis?

- Examination of the doe/ewe, udder and milk
- Detecting evidence of inflammation –
  - E.g. Somatic cell counts
- Milk culture

### Somatic Cell Count (Cells/ML) Table

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<td>6,400,000</td>
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Detection of Abnormal Milk

- Visual inspection of the milk
  - Use strip cup
  - Colour, consistency, flakes
- Don’t use hand, boot, parlour floor
Detection of Somatic Cells

- **Apocrine secretion**
  - Include cell wall and nucleic fragments but not DNA
  - Similar in size to somatic cells – counted in SCC?
- **Number of particles**
  - Goats: ~150,000 / mL milk
  - Sheep: ~15,000 / mL milk
Sheep: Somatic Cells in Normal Milk

- Types are similar to cattle
  - Polymorphonuclear neutrophils 10 to 35%
  - Macrophages 45 to 85%
  - Lymphocytes 10 to 17%
- Don’t vary based on stage of lactation
- In mastitic animals, PMN’s increase in proportion
Goat: Somatic Cells in Normal Milk

- Primarily PMN’s
  - Different from cattle and sheep
  - 50% in early to mid-lactation
  - 70 to 80% in late lactation

- Levels greatly affected by stage of lactation
  - < 120 DIM ~ 200,000 cells / mL (LS=4)
  - By end of lactation ~ 1,000,000 cells / mL (LS > 6)

- Parity
  - First freshener versus multiparous
Linear Score of Uninfected Animals

Moroni et al, 2005 - goat

The diagram shows the somatic cell score over days in milk for uninfected and infected goats. The x-axis represents days in milk, and the y-axis represents somatic cell score. The lines indicate an increase in somatic cell score with time for both uninfected and infected goats. The uninfected goats maintain a lower somatic cell score compared to the infected goats, indicating better health conditions for the uninfected group.
Using SCC to Screen for IMI - Goats

- Tremendous variation in healthy udders
- Non-infected gland will have elevated SCC levels similar to infected gland in same animal
- Proposed cut-points for culture or further diagnostics (France):
  - < 90 DIM 556,000 cells / mL
  - Later lactation = 1,200,000 cells / mL
  - Detect both minor and major pathogens
SCC Variation Sheep

Detecting mastitis – CMT video

http://www.youtube.com/watch?v=5Mplg93MUz8&feature=youtu.be
Taking milk samples for culture

Interpretation of Culture Results
Why Culture Milk?

- Consider SCC a screening test and not a selection for treatment
  - Adjust cut-points to optimize sensitivity
- But expect high proportion of negative culture results
  - Moderate to poor specificity
- Determine which pathogen
  - Appropriate treatment
  - Appropriate control measures
Why Culture Milk?

- But not detecting infected animals expensive
- Contagious bacteria will spread
- More clinical and subclinical mastitis
- Delays action to correct problem appropriately
Milk Culture

- Freezing samples OK
  - Increase chance of isolating SA
- Significant results for CNS
  - > 5 colony forming units / µL milk
  - 1 or 2 colony types
- Microaerophilic culture to enhance chance of isolating *M. mycoides capri*
Monitoring with Milk Culture

- Bulk tank sample
  - Little work done yet on monitoring bulk tank and level of mastitis in goats and sheep
Section III: Milking Management
Milking: Clean Udder and Teats

- Clip udder and teats if hairy
- Clean with approved products only
- Single use towels or udder wipes
- Teat ends cleaned first
- Udder must be dried
Milking: Clean Udder and Teats
Milking: What if the udder & teats aren’t cleaned properly?
Milking: Cleanliness of Milker’s Hands

- Hand-milking, difficult to keep hands clean
  - Wash hands frequently?
  - Wear gloves to cover small cuts on hands
Strip foremilk

- Onto black surface, e.g. strip cup
- Detect mild clinical mastitis
- Wear gloves
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?
Milking: Pre-dipping

- Reduce environmental mastitis
  - Does the herd have an environmental problem?

- Proper method National Mastitis Council
  - Only approved pre-dip products
  - Apply after cleaning
  - Manufacturer’s guidelines for contact time
  - Dry teats and teat ends with single service paper towel

- Avoid iodine residues
  - Human health hazard
Milking: Pre-dipping
Milking: Attaching and Removing Cups

- Break the vacuum before removing
- Automatic take-offs for goats
Milking: Set-up of 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%
Milking: Setting up Machines

- 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 - IDF

Typical milk flow curves for goats and sheep with long milking times (> 120 sec)

From IDF Bulletin 370 / 2002

Typical milk flow curves for goats & sheep with short milking time (< 120 sec)

From IDF bulletin 370 2002
Milking: Milk-out Time

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

- Machine stripping is common – why?
- Poor udder conformation?
- Poor stimulation?
- Teat damage is the result
Milking: Post-Dipping

- Spray versus dip
- Total coverage of teat
- Non-return
- Approved products only
Milking: Post-Dip
Milking: Post-Dip Spray
Management After Milking

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

Healthy First Fresheners ➔ Mature Healthy Ewes ➔ Ewes with Mastitis, e.g. *Staph aureus*
Section IV: Proper maintenance and use of milking equipment

- Milking parlour – entering and leaving
  - Pre-milking pen – getting the animals into the parlour
  - Head-gates, enter and leave system
Milking Parlour

- Feeding grain in the parlour
  - Pro
    - Encourages animals to enter the parlour
    - Keeps them occupied
  - Con
    - Cant control intakes – may be not enough or too much grain
    - Good for rumen health?
      - Enterotoxaemia in goats?
Components of milking systems

Milking Equipment for Parlour Milking
- Vacuum and milk lines may be high or low
- Vacuum regulator
- Interceptor / trap
- Sanitary trap
- Milk pump
- Milk is pumped through a filter to bulk tank
- Receiver jar with probe
- Vacuum gauge
- Air line for pulsators
- Air line for milking vacuum
- Milk line
- Pulsator
- Shut-off valve
- Milk meter or Recorder jar
- No claw system
- Milk lines – blue
- Vacuum lines – black

Milking Equipment for Bucket Milking
- Vacuum pump and motor
- Bucket
- Long milk tube (blue)
- Long pulsator vacuum tube (black)
- Air pipeline
- Vacuum regulator
- Vacuum tap
- Vacuum gauge
- Vacuum line
- Pulsator
- Claw
Pipeline versus bucket
Versus Hand-Milking
How to clean milking equipment

**Four Steps**

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

**Four Factors**

- Physical Action
- Time
- Chemical Strength
- Temperature
Explanation of the cleaning process

- What is the necessary temperature of the water
  - At the different stages of cleaning
  - At beginning and end of each cycle
  - What is necessary to achieve this?

- Discard first rinse

- Hot chlorinated alkaline detergent wash
  - Necessary pH to clean properly
  - Alkali breaks down milk fat
  - Effect of water quality and hardness
Cleaning Process

- Need slugs of cleaning solution to scrub lines and equipment
  - Volume, speed and number of slugs
- Acid rinse
  - Necessary pH
  - Role to reduce detergent residues and prevent mineral deposits
- How to clean the bulk tank
- How to clean milk pails and buckets
Troubleshooting Cleaning

- Problems to detect and possible solutions
Design parlour so can be kept clean
Set-up of equipment

Milking Phase
- Teat
- Milk flow
- Teatcup Shell
- Liner / Inflation
  - Open
  - Closed
- Pulsation Chamber
  - Under Vacuum
  - Under Atmospheric Pressure
- Vacuum on
  - Air flows out
  - 50% of phase
- Vacuum off
  - Air flows in
  - 50% of phase

Massage Phase

Stratified flow through the milkline.
No risk of flooding

Flooding of the milkline caused by slugging of milk. Worse when line enters low. Risk of backflow of milk to ewe and drop in vacuum.
Maintain Milking Equipment

- Follow manufacturer’s recommendations for maintenance and cleaning
Keep the environment clean

- Dust free
- Control flies
- Keep wash sink clean
Section V: Milk Quality

- Regulations may vary by region + processor may have higher standards
Bacterial Counts

- Standard Plate Count
  - < 50,000 cfu/mL of milk
  - Aerobic, live bacteria only
  - Laborious hand counting

- Bactoscan - Goats
  - < 321,000 individual bacterial cells (IBC) ml/milk
  - Live and dead, aerobic and anaerobic
  - Also prototheca and yeasts
  - Automated

- Coliform & E coli counts?
Goat Milk Quality - Case

- 2001 Ontario provincial auditor noted milk quality of goats was often in violation

Mean microbiological results for goat’s milk, September 2002

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<td>SCC /mL</td>
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- 21% of producers in violation
- 11% of producers > 100,000 cfu
- Jan 2003: monthly surveys showed 23% to 36% in violation
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Ontario Dairy Goat Milk Quality

- Jul-15 to Jul-16 median values (n = 250 farms)
- Bactoscan (ibc/mL milk) 92,000
  - Limit is 321,000 ibc/mL
- Fat 3.79%
- Protein 3.39%
- Freezing point -0.546 C
- SCC 1.238 X 10^6 cells/mL milk
- But still have lots of work to do

% Producer Compliance with Bactoscan

Troubleshooting high bacterial counts

- Udder cleaning and preparation
  - Wet udders
  - Dirty teats
- How are one-sided does/ewes milked?
- Teat cups falling off
Dirty & Worn-Out Equipment
Troubleshooting high bacteria

- **Handmilking**
  - Hand cleanliness
  - Wear gloves
  - Wash hands frequently

- **Buckets**
  - Protect from flies and falling debris
  - Clean properly between milkings
Troubleshooting high bacteria

- Cleaning equipment properly
  - Water quality
  - Water temperature at end of cycle
  - Proper use of detergents and acids
  - Flush through
Insect Control
Troubleshooting high bacteria

- **Bulk tank**
  - Cool down quickly to 4°C within 2 hrs
  - Alarm system in place
  - Proper agitation
  - Volume of tank and volume of milk
  - May see freezing and poor mixing with low volumes
Troubleshooting high SPC

- Freezing milk quickly and maintaining temperature
Troubleshooting high bacteria

- Milk pick-up frequency
  - Optimally not less than every 2 days
  - Longer times – even good producers will get caught!
Troubleshooting high bacteria

- Mastitis as a cause?
- Eliminate the obvious causes first
- Identify environmental mastitis
  - Treat or cull
Troubleshooting freezing point

- Ontario regulatory is $> -0.534^\circ C$ in violation
- Malfunction of cleaning system
- Freezing of milk in bulk tank
- Washing buckets or pail and not drying before milking
Troubleshooting inhibitors

- Reasons for a positive inhibitor test
  - Milk from treated doe enters bulk tank before end of withdrawal period
    - E.g. poor records, poor communication, animal not identified, separate unit not used, dry doe in lactating pen
  - Prolonged drug withdrawal time because antibiotics used improperly
    - Used at too high dose, too frequently etc
    - Purchased treated doe without records
    - Dry does kid early
    - Topical antibiotic used with no withdrawal
Troubleshooting off-flavours

- Milk handling, old milk
- Dirty, poorly ventilated barn
- Ruminal acidosis
- Corn silage
- Close proximity to bucks
- Low vitamin E in diet – oxidized flavour
- Some weeds on pasture
Section VI: Treatment and Control of Mastitis
Avoiding Drug Residues in Milk

- All drug use in lactating dairy sheep and goats is extra-label
- Must consider all classes of drugs
  - Antimicrobials
  - Hormones
  - Anti-inflammatory
d- Anthelmintics
- Follow FARAD / CgFARAD recommendations
Detecting residues

- No level of antibiotics in the milk is OK
  - On-farm test kits for detecting antibiotics as sensitive as the official laboratory tests
  - False positives if detection limit lower than official tests or?
  - False negatives may cost big time
- If in doubt, throw it out.
How to avoid residues. Excellent...

- Individual animal identification
- ID of treated animals
- Record keeping & communication
- Protocols for milking management of treated animals
- Storage and management of livestock medicines
- All drug use with valid VCPR
  - Written instructions
  - Withdrawal for meat and milk
Sheep & Goat On-Farm Food Safety Programs

## Record 2: Animal Health Product Treatment

**Dairy producers please use Record 3: Animal Health Product Treatment for Dairy Operations**

<table>
<thead>
<tr>
<th>Treatment Date (d/m/y)</th>
<th>Animal or Pen Identification</th>
<th>Condition Treated</th>
<th>Product Name</th>
<th>Prescription (P) or Non-prescription (NP)</th>
<th>Dose</th>
<th>Estimated Animal Weight/Number of Animals Treated</th>
<th>Route (See abbreviation codes below)</th>
<th>Withdrawal Date (Date safe to ship to slaughter or auction)</th>
<th>Treated by (Initials)</th>
</tr>
</thead>
<tbody>
<tr>
<td>05/02/03</td>
<td>Pen #2</td>
<td>Pneumonia</td>
<td>Drag A</td>
<td>NP</td>
<td>700</td>
<td>170 lbs (8 does)</td>
<td>IV</td>
<td>19/05/03 (d/m/y)</td>
<td>JD</td>
</tr>
</tbody>
</table>

**MUST DO**

*Abbreviations:
- **IV** – In the vein
- **IM** – Intramuscular
- **TM** – Topical treatment (mucosal)
- **OR** – Oral
- **SL** – Sublingual
- **ID** – In the dermis
- **ED** – In the ear

In an animal during an injection, record the animal’s identification number, location of the needle and date it occurred in the comments section.

Date: ____________________________
Audit Date: ________________________

Each record before signing.

CANADIAN NATIONAL GOAT FEDERATION - Goat On-Farm Food Safety Program
Administration of Drugs

- Handling of animal health products
- Route of administration
- How to administer an intramammary treatment
- What to do if treated milk accidentally into tank
Dry Period Management

- Dry period treatment
  - When should it be done
  - Efficacy
- Selective treatment versus blanket treatment
- Assuring low risk of antimicrobial residues
Dry Period Treatment

- What is in the literature supports routine treatment
  - Cure existing
  - Prevent some new infections
- Must be done immediately at dry-off
  - Important if batch drying because of seasonal milking
- Length of dry period important
  - If kid < 60 days, withhold from tank 7 days
Dry Period Treatment - Sheep

- Systemic treatment may work well and avoids risk of imm infusion and poor technique
  - Meat ewes from 9 sheep flocks
  - Treated with tilmicosin or control (blinded treatment)
  - Lambs raised by treated ewes 0.52 kg heavier at 50 days (weaning) than raised by control ewes
  - At following weaning, treated ewes had 43% lower prevalence of palpably abnormal udders.

- Croft et al, Cdn Vet J. 2000
Eradicating / Controlling Mastitis Pathogens

- **CAE / Maedi Visna**
  - Can be done through serological testing and biosecurity of replacements

- **Mycoplasma capri**
  - Serial culturing of milk and culling and biosecurity of replacements

- **Environmental mastitis**
  - Control environmental cleanliness, access to dirty wet conditions, stocking density
Controlling *Staph aureus*

- Only curable in the early stages of infection
  - Becomes chronic and difficult to cure
- Important to identify early and make sure that doe is not a risk to others in the herd
  - Clinical *Staph aureus* mastitis is only the tip of the iceberg.
  - Culture and cull
When should a doe/ewe be culled for mastitis?

- Incurable infections, particularly contagious bacteria
- Abscessed udders, draining bacteria
- Reduced milk production
- One-sided animal?
**Section VII: Monitoring and Goal Setting**

**SMART GOALS**

- **SPECIFIC**: Whether the goal is big or small, it is important that each is outlined very specifically to ensure that each task is being conducted properly.

- **MEASURABLE**: Putting specific measurement units (e.g. # of clinical cases of mastitis per year; average SCC or linear score) on each goal can benefit producers when actually implementing each goal strategy.

- **ACHIEVABLE**: Although some goals can be more challenging, it is important to ensure that each goal that is pursued can be achievable within the constraints of available resources – both financial and labour.

- **REALISTIC**: Goals are generally well intentioned, however it is important to assess whether they are realistic to complete, or that they will have the beneficial impact on the flocks that is anticipated.

- **TIMELY**: Giving a timeline to each goal is essential to ensure that each practice is completed in a timely fashion. E.g. one year may be a suitable time-line to achieve many goals.
Example of a “Smart” Goal

- **Goal:** To reduce over-milking of does and prevalence of teat-end damage
  - **S** = remove milking units when milk flow ceases
  - **M** = measure over-milking and teat-end lesions
    - < 10% of units on longer than 20 sec when milk flow ceases
    - Prevalence of teat end damage < 1 in 20 teats
  - **A** = Fewer milking units per milker / automatic take-off units
  - **R** = Requires knowing current level
    - Measure milking time; Score teat ends once/month
  - **T** = set reasonable time-frames for change
    - Reduce prevalence of teat end lesions to < 5% in 2 months
Record Keeping

- Record
  - Somatic cell count / CMT information
    - Individual and bulk tank
  - Number of clinical cases of mastitis
  - Does / ewes culled or died from mastitis
  - Culture results

- Analyze
Record culture results

Table VII.1. Form to record culture results and treatments of individual does

<table>
<thead>
<tr>
<th>DATE</th>
<th>DOE LD.</th>
<th>GLAND (L / R)</th>
<th>SIGNS OF MASTITIS²</th>
<th>TREATMENT HISTORY</th>
<th>SCC / CMT RESULTS</th>
<th>CULTURE RESULT³</th>
<th>TREATMENT PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DATE</td>
<td>PRODUCT USED</td>
<td># OF TIMES</td>
<td>BACTERIAL TYPE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

² Record if doe was ill (e.g. fever), the gland was abnormal (e.g. swollen, hot), the milk was abnormal (colour, consistency), or if mastitis was sub-clinical.
³ Results as provided from the diagnostic laboratory. Usually bacteria isolated are identified, the amount of growth (e.g. # colonies or 1+, 2+, etc.) and if requested, which antibiotics appear to kill the bacteria.
Analyze data and set goals

Table VII.2. Assessment of udder health in dairy goats

<table>
<thead>
<tr>
<th>DATE OF ASSESSMENT</th>
<th>MILKING SYSTEM</th>
<th>FARM NAME</th>
<th>HERD VETERINARIAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average # does milked in previous 12 months</td>
<td>Avg. # days post-kidding does put into milk-line</td>
<td>Avg. length of lactation (milked)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEASUREMENT OF PERFORMANCE</th>
<th>PREVIOUS LEVEL</th>
<th>GOAL FOR HERD</th>
<th>CURRENT LEVEL</th>
<th>ACTION NEEDED?</th>
<th>ADDITIONAL ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSESSMENT OF CLINICAL MASTITIS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual incidence of clinical mastitis (%)</td>
<td>&lt; 5%</td>
<td>YES</td>
<td>NO</td>
<td>• Investigate stage of lactation, season, parity of animals with clinical mastitis.</td>
<td></td>
</tr>
<tr>
<td>Calculate: (# does with 1 or more cases of clinical mastitis in last 12 months / average # does milked in last 12 months) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual incidence of repeat cases of clinical mastitis (%)</td>
<td>&lt; 1.5 x above</td>
<td>YES</td>
<td>NO</td>
<td>• Culture cases to determine organism.</td>
<td></td>
</tr>
<tr>
<td>Calculate: (Total # cases of clinical mastitis in last 12 months / average # does milked in last 12 months) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence of does with a blind gland (%)</td>
<td>&lt; 5%</td>
<td>YES</td>
<td>NO</td>
<td>• Investigate reasons for failure to manage clinical cases (e.g. treatment protocols).</td>
<td></td>
</tr>
<tr>
<td>Calculate: (Total # of glands that did not produce milk in the last 12 months / total # of does milked in last 12 months) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| ASSESSMENT OF SUB-CLINICAL MASTITIS | | | | | |
| Proportion of does with SCC level > 800,000 [linear score 6] each test (%) | < 20% | YES | NO | • Investigate stage of lactation, season, parity etc. of animals with subclinical mastitis. |
| Calculate: (# does with SCC > 800,000 at last milk test / does tested) x 100 |
| Incidence of new infections during lactation (%) | < 5% | YES | NO | • Investigate stage of lactation, season, parity etc. of animals with subclinical mastitis. |
| Calculate: (# does with SCC > 800,000 at last milk test and ≤ 800,000 at previous milk test / does ≥ 800,000 at previous milk test) x 100 |
Analyze data and set goals

<table>
<thead>
<tr>
<th>MEASUREMENT OF PERFORMANCE</th>
<th>PREVIOUS LEVEL</th>
<th>GOAL FOR HERD</th>
<th>CURRENT LEVEL</th>
<th>ACTION NEEDED?</th>
<th>ADDITIONAL ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence of chronic infections (%)</td>
<td></td>
<td>&lt; 5%</td>
<td></td>
<td>□ YES □ NO</td>
<td>Determine period of onset of chronic mastitis cases with respect to stage of lactation, parity, season</td>
</tr>
<tr>
<td>Calculate: (# does with SCC &gt; 800,000 at 3 or more tests this lactation / total # lactations assessed) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Culture to determine pathogen type</td>
</tr>
<tr>
<td>Prevalence of infections at first test post-kidding (%)</td>
<td></td>
<td>&lt; 10%</td>
<td></td>
<td>□ YES □ NO</td>
<td>Investigate status of CAE infection in the herd</td>
</tr>
<tr>
<td>Calculate: (# does with SCC &gt; 400,000 at first test post-kidding / total # first tests) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Determine parity of affected animals</td>
</tr>
<tr>
<td>ANIMAL LOSS DUE TO MASTITIS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Investigate whether due to damage from nursing kids prior to placing in milk line</td>
</tr>
<tr>
<td>Turnover rate due to mastitis (%)</td>
<td></td>
<td>&lt; 5%</td>
<td></td>
<td>□ YES □ NO</td>
<td>Review dry-period mastitis treatment protocols and hygiene at treatment</td>
</tr>
<tr>
<td>Calculate: (# does culled and died due to mastitis / average # milked in last 12 months) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Investigate dry-off management</td>
</tr>
<tr>
<td>Incidence of does dying of mastitis annually (%)</td>
<td></td>
<td>&lt; 0.5%</td>
<td></td>
<td>□ YES □ NO</td>
<td>Review environment of dry does</td>
</tr>
<tr>
<td>Calculate: (# does dying of mastitis / avg. # milked in last 12 months) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of does culled due to mastitis (%)</td>
<td></td>
<td>&lt; 5%</td>
<td></td>
<td>□ YES □ NO</td>
<td>Review treatment protocols, including methods of detection of does with clinical mastitis</td>
</tr>
<tr>
<td>Calculate: (# does culled due to mastitis / avg. # milked in last 12 months) x 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Investigate causative agents causing death (e.g. Staphylococcus aureus)</td>
</tr>
<tr>
<td>Proportion of does culled that were culled due to mastitis (%)</td>
<td></td>
<td>&lt; 20%</td>
<td></td>
<td>□ YES □ NO</td>
<td>Review culling policies as well as areas above</td>
</tr>
<tr>
<td>Calculate: (# does culled due to mastitis / total # does culled in last 12 months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 A case of clinical mastitis is one in which there is a change to the udder and / or milk of one or more glands as detected by visual inspection.
Measure of Performance

- E.g. Annual incidence of clinical mastitis
  - Goal = < 5%
  - Where is the herd?
  - Action: investigate cases, culture, review milking management & milking equipment

- E.g. proportion of ewes with SCC level > 400,000 each test
  - Goal < 20%
  - Where is the flock?
  - Action: investigate cases, review milking hygiene, management of ewes with contagious mastitis
Section VIII: Health management

- Dairy sheep still in Section I
- Basic health management that influences the health of the doe/ewe and ability to produce milk
- E.g. Vaccination programs, control of chronic wasting diseases, control of abortion, management of the periparturient period, birthing management
Health Management of the Dairy Doe

- Body condition scoring and goals
- Nutrition and nutritional diseases
Health Management of the Dairy Doe

- Environmental management
  - Housing recommendations
- Feeding management
  - Water quality recommendations
- Reproductive, gestational, kidding management
So what now?

- We have the information out there but what is the uptake?
- Lots of producers doing no udder prep
- Significant proportion having issues with bacterial counts
- Don’t know level of mastitis
Next Steps

- Benchmarking study of udder health beyond milk quality
- Workshops to engage producers and veterinarians in best practices
  - Lots of new producers
  - Lots of blind-leading-the-blind
  - Lots of bad practices being perpetrated
- Industry is growing rapidly and we need to improve things now.
Acknowledgments

- Thanks to our funding partners as well as
- Dairy sheep and goat producers, veterinarians and extension personnel who gave generously of their time reviewing these guides
Plug for the International Goat Association

http://www.iga-goatworld.com
Questions?