DIAGNOSING GASTROINTESTINAL PARASITISM

FECAL EGG COUNTS (FEC)

FECs are a measure of the adult parasite population in the sheep or goat, but not a measure of total infection (i.e. L4 and immature adults). There is considerable animal-to-animal variation in FEC, so it is important to sample a random proportion of the group in order to get an accurate picture of the parasite load of that group.

WHO TO SAMPLE

Sheep or goats grazing pasture that are representative of the group should be sampled. Do not sample animals that have been held off feed for any reason, or that are off-feed due to illness. Ideally submit 10 samples representative of lambs/kids and 10 samples representative of ewes/does. It is important to sample youngstock separately from adults, as counts will be very different - even on the same pasture.

GETTING THE SAMPLES

The simplest way is to group the animals into a corner of the pasture (with clean ground), hold them for 15 minutes and then release them. Pick up 10 individual faecal samples that are fresh (warm), ideally not trampled, and place in individual plastic bags, e.g. sandwich bags. Immediately remove as much air as possible and place in a cooler with ice packs. Faecal samples can be collected from the rectum if you choose. Again, use a plastic bag or disposable glove. Apply a small amount of lubricant (e.g. methylcellulose or KY® Jelly) to the gloved finger and gently tease out the faecal pellets. This latter method allows results to be tied to an individual animal if required and not later pooled. For pooled results, animals must be randomly selected. See Appendix 1 for more detailed information on how to collect, label and store samples.

TRANSPORTATION AND STORAGE OF THE SAMPLES

It is very important that the samples be kept cool (< 5°C) but not frozen until they reach the laboratory. This is to prevent hatching of the eggs, which will lead to underestimation of the level of parasitism. Refrigerated samples should be analysed within 7 days of collection.

ANALYSIS OF THE SAMPLES

A trained person should examine the samples to prevent confusion with air bubbles, plant cellulose and pollen or other artefacts commonly found in feces. It is also important that the samples be evaluated using a quantitative technique. The modified McMaster technique is one such method that will allow the number of eggs per gram (epg) of feces to be reported. Qualitative counts (e.g. 1+, 2+, 3+) are not useful for differentiating between a moderate infection (e.g. 150 epg) or a severe infection (e.g. 1,500 epg) as both will be interpreted as 3+. See Appendix 2 for a description on how it is performed.

POOLED VERSUS INDIVIDUAL SAMPLES

There is considerable animal-to-animal variation in egg output, with 30% of animals responsible for ~ 70% of the egg output. Pooling of samples, so that only one test is done per group of animals is a valid way of analysing parasite load. However, samples should be pooled at the laboratory (not at the farm) to make sure that an equal weight of faeces is contributed by each animal (minimum 4 grams of feces each). For this reason, it is important to collect individual samples in individual bags when submitting. While results from individual samples will allow the veterinarian to identify and treat the most severely parasitized, it is much more expensive to run 10 individual samples rather than one pooled sample.

WHAT ARE SIGNIFICANT EGGS PER GRAM LEVELS?

The following cut-points are often used for individual or pooled samples:
• Low = <500 epg;
• Moderate =500 to 1,000 epg;
• Severe =>1,000 epg.

However, there are several factors that need to be appreciated when deciding what cut-point to use or what action to take:

### Species of GIN

*Haemonchus* is a very prolific egg producer and is associated with rapid changes in pasture infectivity. Moderate infections with *Haemonchus* may have FEC of > 1,500 epg – a level that would signal a severe parasite load with any other GIN species. If *Haemonchus* is the predominant GIN, the FEC can change very quickly, as can the level of disease in the lambs/kids. Furthermore, even within the 3-week prepatent period of the parasite, youngstock can become very anaemic - before egg levels change significantly.

Generally, we do not know which type of parasite is contributing to the GIN FEC but can use history of previous infections to help. A technique utilizing fluorescent peanut agglutination (PNA) lectin binding is used in some commercial laboratories to stain and identify the proportion of eggs that are of the *Haemonchus* type.

Larval culture and identification of GIN species can be done in specialized laboratories, although that service is not routinely provided in central Canadian diagnostic laboratories. The standard technique involves hatching and culturing the eggs to the L3 stage. Identification of the different species involves morphological differences including measuring tail length – a very laborious and possibly inaccurate procedure. A new technique being developed by the University of Calgary involves culturing the eggs only to L1 stage (much more easily done) and using a PCR method (detects parasite DNA) to differentiate species. Preliminary work at that University along with collaboration with the University of Guelph, has demonstrated that this method is very accurate.

### Emergence of arrested larvae from infection from the previous season

In the winter months, sheep/goats that grazed the previous summer may have a significant hypobiotic (arrested) load of GINs that are sitting in / on the abomasal wall waiting for more favourable climate conditions before developing to adults. In the spring, the re-emergence of large numbers of these larvae can be associated with significant disease - often called “Type II” disease. The animals have diarrhea (*Teladorsagia*), bottle jaw and / or anaemia (*Haemonchus*) along with a negative FEC as the larvae have not yet reached the adult egg-producing stage. Understanding when this might happen in a flock or herd is critical to proper interpretation of FECs.

### Grazing heavily contaminated pastures

Naive animals that graze very heavily contaminated pastures may experience disease due to *Teladorsagia* and *Trichostrongylus* before the prepatent period is complete. Like Type II disease, these animals will have watery diarrhea and bottle jaw with some deaths - along with a very low FEC.

### Individual variability in FEC

It has been shown that approximately 30% of young-stock are responsible for 70% of the total egg production. This means that there is tremendous animal-to-animal variation in egg output - also called “over-dispersion” by researchers. If averages are used to determine how infected a group of animals is, there is a great risk of underestimating the level of
infection. An example: 3 faecal samples have a count of 1,000 epg and 6 faecal samples have a value of 50 epg, this gives an average value of 367 epg. In this example, if a cut-point of 500 epg is used, it might result in a decision not to treat when treatment should have been performed on the high-shedding animals. Factors that should also be taken into account include the clinical condition of the animals, as outlined below.

**CLINICAL CHANGES IN THE ANIMAL**

**DIARRHEA / DAG SCORES**

Faecal consistency (formed pellets, soft pellets, liquid diarrhea) may reflect parasite load, but some animals with parasite infections (e.g. acute haemonchosis) do not exhibit diarrhea. An animal with coccidiosis may have severe diarrhea but no GIN. Diet type also greatly influences faecal consistency, with lush grass causing diarrhea, so interpreting dag score must be done in light of the type of pasture being grazed. Dag is defined as faecal contamination of the wool or hair coat around the tail and hindquarters. Soft or diarrheic stools will cling to the wool/hair. A dag score will give an approximation of faecal consistency or prevalence of diarrhea in the group of sheep/goats. It should be noted that animals with diarrhea might actually have decreased FEC because the eggs are diluted, so low FEC in an animal with diarrhea, does not always mean that animal is not parasitized.

**POOR WEIGHT GAINS / WEIGHT LOSS**

Gastrointestinal parasitism is associated with poor growth rates. The poor growth is primarily due to decreased appetite from the parasite infection. Additional factors are the energy losses associated with the animal fighting the infection (i.e. immune response) and the losses of protein and blood that the parasites consume. Producers that weigh lambs/kids on pasture, can track growth rates and use this information (along with FEC) to determine if parasitism is clinically important. This may be one of the most sensitive indicators of significant levels of parasitism in individual sheep/goats. A weigh scale set-up so that it is easy to run lambs/kids through every few weeks during the highest risk periods, can allow for selective treatment of those animals not gaining as expected. At the same time, the level of anaemia can be assessed (FAMACHA® score, see below). However,
there are other causes of poor weight gains (e.g., poor pasture, coccidiosis, pneumonia) so that FEC should be done to confirm a parasitism problem.

Body condition score (BCS) is difficult to use as a reliable indicator of parasite burden, as so many other factors influence BCS. By the time an animal is thin (≤ 2.0), it is also experiencing severe clinical illness – too late for a screening test to be of good use. For these reasons BCS is not the best indicator to use to determine level of parasitism. However, an animal in poor BCS may be more susceptible to parasites particularly if debilitated from another disease such as Johne’s disease (paratuberculosis).

**ANAEMIA (HAEMONCHUS)**

A major clinical feature of haemonchosis is anaemia. In central Canada, from late July on in warm and wet summers, haemonchosis can be the most important type of parasitism on some farms. Lambs and kids can be monitored during this period for evidence of anaemia. This can be done by taking a blood sample and measuring the proportion of red blood cells (packed cell volume or haematocrit). But assessing the level of anaemia can also be done by assessing the colour of the conjunctival mucous membrane. This is the tissue inside the eyelids. The colour is normally pink but it can be pale pink to white in significant *Haemonchus* infections.

The FAMACHA® system makes use of this. A card with different colours of pink (from very pink to white) is compared to the conjunctivae of the lower eyelid of the animal and the level of anaemia is estimated. It was developed in South Africa in regions where the primary type of GIN is *Haemonchus*, and is used successfully in many parts of the world where this parasite is common. It allows the producer to monitor individual animals and to only treat those that appear anaemic. Its drawback is that if other parasites are important, then it will fail to detect those infections so faecal egg counts must always be done as well. There are other parasites that can cause anaemia, coccidia and liver flukes being two. It is also very labour intensive and requires good handling facilities that allow easy restraint of the head.

*Every sheep/goat should be scored at least every 3 weeks and every 2 weeks when *Haemonchus* is a problem in the flock.* Colour should be assessed ideally in the daylight. If this is not possible, barn light or a non-LED flashlight is suitable. LED flashlights have been shown to wash-out colour leading to the conclusion that the animal is more anaemic than it is in reality.

**FAMACHA® scoring and interpretation**

Animals that score 1 and 2 (pink) are considered healthy and do not require treatment. Animals that score 4 and 5 are considered severely anaemic and should be treated immediately with an effective dewormer. Animals that score 3 should be watched carefully and dewormed if there are > 10% of the group scoring 4 or 5.

The scoring is subjective, however and mistakes do occur. It is possible that animals are scored 4 or 5 and are not anaemic and don’t require treatment. This error has little consequence for the animal, as its health is not at risk if it is treated when it isn’t necessary. But animals may be scored 1, 2 or 3 that are actually severely anaemic. Not being treated when they should be is considered a fatal error; i.e. the animal may die because of misclassification. The system is designed to minimize fatal errors, but proper use of the FAMACHA card and interpretation of findings requires training before using. The FAMACHA® system should only be used under the guidance of a veterinarian and as an adjunct to routine FEC. If you believe that the FAMACHA® system would be useful on your property, contact your veterinarian for training on how best to

---

**Body condition score**

1

2

3

4

5

**FAMACHA card; courtesy of G. Bath, University of Pretoria, South Africa**
use it. On-line training is also available at the University of Rhode Island Northeast Small Ruminant Parasite Control website: https://web.uri.edu/sheepngoat/famacha/

**HYPOPROTEINEMIA (BOTTLE JAW)**

Almost all the GIN parasites feed on protein, also called albumin, which circulates in the blood and lymphatic system. Bottle jaw in Canada is most commonly associated with *Haemonchus* infections. In severe infections, the protein levels can drop very low and the fluid, which normally stays in the blood and lymphatic vessels, leaks out and gathers under the skin and in the gastrointestinal lining. When fluid accumulates under the jaw, this is termed “bottle jaw”. Edema in the gastrointestinal lining causes diarrhea and poor absorption of nutrients. By the time this is clinically apparent, parasitism is very advanced and the animal is in danger of dying.

**POSTMORTEM EXAMINATION AND WORM COUNTS**

If animals are dying and internal parasites are suspected of being the cause, it is very important to confirm this diagnosis with a total (adult) worm count from the gastrointestinal tract. Do not assume every dead lamb or kid found at pasture died due to worms - demonstrate this with a postmortem.

A veterinarian can perform a field postmortem and attempt to identify abomasal and intestinal nematodes. *Haemonchus* are large and easy to see. *Teladorsagia* and *Trichostrongylus* are small and should be counted in the laboratory using a microscope. The abomasal contents are removed and volume measured; a known volume is then removed and the worms counted. For example, if there are 20 worms counted in 1/10th of the volume of the fluid in the abomasum, then the abomasum contained 200 worms. A system recommended for interpreting burdens, in the manual for the Sustainable Control of Parasites in Sheep (SCOPS, 4th edition) from the UK, is as follows:

- 2 points = Parasitism is likely affecting productivity
- 3 points = Parasitism is likely causing clinical signs and even death

**Effects are additive**

- *Teladorsagia* spp: 3000 worms = 1 point
- *Trichostrongylus* spp: 4000 worms = 1 point
- *Haemonchus contortus*: 500 worms = 1 point
- *Nematodirus* spp: 4000 worms = 1 point
- Immature worms: 4000 worms = 1 point

**Next section is “Anthelmintic Drugs for Sheep and Goats”**