Module 9 – Parasite control

The following module has been adapted from the Meat & Livestock Australia commissioned report *Options for the control of parasites in the Australian goat industry, 2007.*

What to do?

Parasite management is about risk management and reducing the risk of infestation is essential to any goat production operation. Factors to consider in managing internal parasites include:

- Grazing management
- Visual assessment of animals
- Animal selection
- Faecal egg count testing
- Responsible chemical use

How to do it?

This module describes various parasite problems that may be encountered in goat production and presents options available to goat producers to minimise the production risks associated with internal and external parasites.

Guidelines for controlling nematode parasites of goats in pasture–based systems

Worms, or parasitic nematodes of the gastrointestinal tract, of goats are a major constraint to efficient production in pasture–based systems worldwide.

The overuse of chemicals to control worms in the sheep and cattle sectors has led to significant resistance issues and anecdotal evidence suggests a similar situation in goats.

The sustainable control of worms involves a dramatic reduction in chemical use and increased diligence in monitoring for worm burdens, testing drenches for efficacy and incorporating browse and nutrition supplementation as a minimum standard for better worm control.

Less reliance on chemical use is important in preserving those drench actives still giving good control. Management of worms is as much about management of drench resistance as it is about the worms themselves. **Without a change in attitude towards drench usage, drenches currently effective are unlikely to be so in a year or two.**

The integration of non-chemical control strategies with infrequent drenching is therefore imperative in achieving the sustainable production of a residue–free product.

Key nematodes

The major nematode parasites of concern in goats are the barber's pole worm (*Haemonchus contortus*) and the small brown stomach worm (*Teladorsagia* [*Ostertagia*] *circumcincta*) that parasitise the abomasum. The scour worms (*Trichostrongylus spp.*) are resident in the small intestine and the nodule worm (*Oesophagostomum columbianum*) is found mainly in the large intestine.

Of lesser concern are the thread worms (*Strongyloides papillosus*) and the thin–necked intestinal worms (*Nematodirus*) that are also found in the small intestine. The large–mouthed bowel worm (*Chabertia ovina*) and the small bowel worm (*Oes. venulosum*) inhabit the large intestine. The small lungworm (*Muellerius capillaris*) is common in higher rainfall areas and the lungworm (*Dictyocaulus filaria*) is occasionally found in goats pastured in cooler climates.

Distribution of key nematodes

In summer rainfall zones, barber's pole worm and the nodule worm are the most important genera with scour worms, in particular *Trichostrongylus colubriformis* and the thin–necked intestinal worm of lesser importance. In the winter rainfall zone, the non-seasonal rainfall zone and the Mediterranean zone, the scour worms are of great importance with large-mouthed bowel worm of lesser importance. Cold–adapted barber's pole is also important in some non-seasonal and winter rainfall regions.

Worms are rarely a problem in pastoral areas due to the combination of low rainfall, the availability of browse and low stocking rates.

Detecting infections

Most of the clinical signs associated with worm infections are not highly specific but are generally related to intestinal disturbances such as scouring (winter scour worms), constipation (barber's pole worm) or hunched back with mucoid scours (nodule worm). These changes in digestion can lead to inappetance, poor growth, a rough coat, weight loss, emaciation due to reduced appetite, scouring and sometimes death.

Eyelid colour scoring for signs of anaemia.

Barber's pole worm however sucks blood and heavy infections can quickly lead to anaemia, submandibular oedema (bottle jaw) and sudden deaths. Anaemia is best detected through an unusually pale lower inner eyelid. On smaller properties in prone areas, individual animals can be examined for anaemia by checking the lower inner eyelids each week during warm moist conditions. See Glossary Eyelid Colour Scoring. Individual animals can be targeted and heavily infected goats treated.

Liver fluke and *Mycoplasma* ovis will also cause anaemia and in endemic zones their presence needs to be considered in the diagnosis of anaemia.

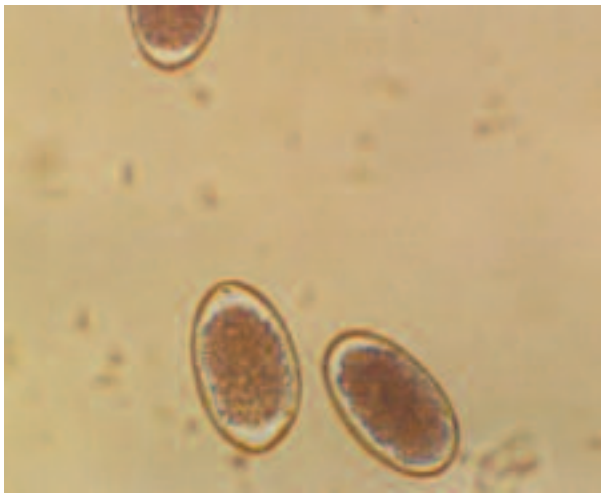
Where scour worms are of importance body condition scoring also on a weekly basis becomes important to detect rapid loss of condition. See Glossary Body Condition Scoring.

Laboratory testing

By the time the clinical symptoms above become evident, productivity losses would have already occurred. Laboratory worm egg count testing provides a method to monitor any rise of worm egg counts and allows clear decision making on the need to drench or not to drench. The latter saves money on treatment and helps prevent or delay worm resistance.

Laboratory testing can offer goat owners a number of tests to monitor the progress of infections over time and to determine worm populations and if drenching is required. Most properties in the rainfall zones of >380 mm per year carry some resistant worms and the type and severity of the resistance can only be determined with the assistance of laboratory testing.

Worm egg count and larval culture: It is standard practice within the ruminant industries to base decisions to drench on the results of a worm egg count for the numbers present and a larval culture to identify the types of worms present. The worm egg count can only determine the size of the adult worm burden and not the immature burden.



Nematode eggs.

This is of particular concern during spike infections with barber's pole when warm temperatures and rainfall followed by a few overcast days will initiate mass hatching of eggs in dung and increased survival of infective larvae on pasture. In this scenario, worm egg counts are often low but deaths due to the immature burdens can occur in susceptible goats often within 2 weeks. A new faecal occult blood field test using cheap indicator strips which detect free blood in faeces offers precise usefulness in this situation.

Worm egg counts taken from weaners and pregnant and lactating does 3-6 weeks after rain, and repeated at 2 to 6–weekly intervals, depending on location and weather conditions, will monitor the rise in infection levels until the season becomes dry and continues dry again.

Drench resistance testing: A faecal worm egg count resistance test (FECRT) is the standard to determine drench usefulness in killing worms. This is an on–property trial involving 15 goats per treatment group and an undrenched control group. Many goat owners consider the FECRT as unmanageable and prefer to use the drench–screen option. However this will not define resistance to a range of anthelmintics.

Drench-screening involves selecting out and identifying 20 young wormy goats of an even line. Dung samples for a worm test are taken at–drenching and from the same 20 goats, 10-14 days after drenching to look for a reduction in worm eggs. Test goats are best restricted to a house paddock for 14 days of the trial. A drench efficacy of at least 80% is useful if combined with browsing strategies and careful monitoring of worm burdens. Checking drenches for a change in the resistance pattern is recommended every 2 years.

Most drenches are now less than 80% effective increasing the need for non chemical worm control techniques.

Your local state government or private veterinary laboratory will assist with trial design and procedures for the FECRT and the drench–screen and will also provide interpretation of worm egg counts specific to your location.

Controlling infections

The nematode cycle of constant infection and reinfection can be broken by preventing new infections and by treating existing infections.

Preventing new infections

Reducing the size of new infections can be accomplished by reducing the intake of infective larvae from the pasture and strengthening the host's ability to prevent establishment of these ingested larvae.

Reducing the intake of infective larvae: Goats are browsing animals and should have at least 30-50% of their food supplied as browse for optimal nutrition and good worm control. Grazing lower than 10cm above the ground exposes goats to larval parasites that congregate there because of the greater moisture levels at the soil–grass interface. Separation of the feed from larval contamination can be achieved through the provision of browse. Browse does not necessarily mean trees. Browse plants, such as lucerne and other leguminous crops in pasture–based systems, will supply extra nutrition when pasture quality is poor, provide food free of larval contamination and contribute a moderate antiparasitic effect due to their contained condensed tannins.

Browse is provided here as saltbush.

Larvae climbing the walls of a jar having hatched in droppings. This demonstrates how larvae climb pasture; the longer the pasture the better!

Browse does not necessarily mean trees; lucerne and other leguminous crops properly managed in pasture based systems can provide valuable browse.

Cattle grazed with goats will contribute strongly to better worm control and improvements in pasture quality. Goat and cattle interchanges are based on host specificity. Goats share the same nematodes with sheep but only one with cattle. Adult cattle are resistant to nematode infection and any larvae eaten while grazing will not develop to adults. Attention must be paid to stocking rates however cattle can be grazed with goats or in rotation with them.

Strengthening the overall immunity to worms: Malnourished goats are particularly susceptible to nematode infection. Extra nutrition in the form of protein, energy and minerals may be required during critical times. This typically occurs at weaning in kids and in does for about 2 weeks before and up to 8 weeks after kidding.

Malnourished goats are particularly susceptible to nematode infection.

There is growing evidence from other goat–rearing countries around the world that goats have a higher requirement for copper than sheep. Many goat owners supply copper as part of a general mineral mix.

During a moderate worm infestation, many goats appear unaffected while others seem to be severely affected. Identifying those goats less able to carry worm burdens without productivity losses and culling them will increase the overall immunity of the herd to worms. These susceptible cull goats can be managed more intensively in another paddock or sold. In the interim they should be restricted from breeding programs. This process will have to be repeated for each herd.

Identifying those goats less able to carry worm burdens without productivity losses and culling them will increase the overall immunity of the herd to worms.

Many producers are actively undertaking breeding programs to produce a better quality animal. Increased immunity to worms should also be incorporated into the index for those enterprises in the higher rainfall zones. There is evidence based on worm egg counts that selection for increased resistance to worms is possible.

Barber's pole worms have a huge biotic potential. Each female worm can lay up to 10,000 eggs every day. In barber's pole endemic districts during ideal 'worm weather' pasture contamination can become excessive in a short period of time. Goats selected for increased resistance to this worm can contribute to the control of their own parasite burden and reduce the need for drenching.

"At the end of the day it comes down to three critical elements; classing on body condition and taking the tail out of the mob, providing browse as much as is possible and maintaining pasture length and supplying adequate nutrition to allow the goats immune system to fight internal parasites naturally." David Booth, Cootamundra, NSW

Drenching nematode infections in goats

The need to treat existing burdens can be determined by worm egg counts and larval cultures. Strongly resilient goats are however well able to carry worm burdens without productivity losses and this attribute needs to be considered in the interpretation of worm egg counts.

Every time a goat owner picks up a drench gun they should consider the 4'R's;

- **worm RESISTANCE to drenches,**
- **the number of parasites in REFUGIA,**
- **the use of REGISTERED drenches and**
- **chemical RESIDUES in product.**

When a chemical treatment is administered a few resistant worms are left in the goat because drenches are not 100% effective in all goats at all times. Their progeny then replace susceptible worms on pasture. In other words, a drench becomes less effective

every time it is used, albeit very slowly initially. This rate of decline in efficacy is largely influenced by the numbers of free–living parasite stages on the pasture ie in refugia. In dry weather when few larvae are on pasture, heavy selection for drench resistance takes place. Following on from this, utilise browse paddocks in dry weather rather than drenching.

A drench becomes less effective every time it is used.

There are 3 main areas of drench use on property. Most drenching occurs during the breeding cycle and while growing goats to market–ready stage over a 1–2 year period. Other drenching takes place as a quarantine drench of goats coming onto a property and in the 6-week period prior to sale.

1. Drenching goats during the production cycle

Only those goats identified as carrying damaging worm burdens should be drenched. On smaller properties, individual goats can be examined and removed for treatment. On larger properties, drenching on a herd basis is the most practical solution.

Certain BZs, Oralject® (morantel citrate) and Caprimec® (abamectin) drench actives are registered for goats and Neguvon® (trichlorfon for *H. contortus* control) has a minor use permit. See *Module 9 – Parasite control Toolkit 9 page 5*. Use of unregistered products will require an off-label recommendation from your veterinary practitioner. It is imperative that accurate records of administered chemical treatments and their Withholding Periods and Export Slaughter Intervals are kept. Increasingly goat owners are being asked to nominate any chemical treatments used in raising their goats if they are to be sold for human consumption.

Many goat owners yard goats at night for protection against wild dogs. This night paddock is often the source of infection for goats and, like other paddocks, needs to be incorporated into a rotation system with attention given to cleaning when vacated. Feed and water troughs should be raised above the floor to prevent contamination with dung pellets. Leaky water troughs should be fixed as moist conditions provide microhabitats for worm larvae.

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Goats released from night paddocks can be held in gravel yards until the light intensity from the sun is strong enough to force worm larvae to retreat down the grass blade to the soil-grass interface. Larvae also move closer to the ground as dews evaporate.

2. Quarantine drenching incoming goats

The quarantine drench is important to exclude resistant worms carried by goats introduced from other properties. Since the type of resistance in imported goats is most likely not known, drenching with more than one active is standard practice. Registered drenches should be used but not mixed together prior to dosing.

If drench resistance is not well controlled by registered drenches, your veterinary practitioner may be able to give a recommendation for an unregistered drench. Take care with WHP and ESI. Keep accurate records.

Goats can be held in a quarantine paddock until a worm test 10 days later is negative and then moved onto a wormy paddock containing browse. Once that paddock is vacated, it should be grazed by adult cattle or cropped to ensure imported resistant larvae do not establish on your property.

3. Drenching six weeks prior to sale of goats

If goats are at risk of becoming infected within this period and drenching is deemed necessary, care should be taken with respect to the WHP and ESI. Only registered products should be used to avoid residues in meat product. Read labels on drench containers and keep accurate records.

If drenches are inefficient due to drench resistance or because the larval challenge from the pasture is high, stock rotations through browse paddocks become particularly important.

Caprimec® is the first product registered for goats that has a goat-specific WHP and ESI. When the BZ and Oralject® drenches were registered for goats the WHP and the ESI were inferred from sheep but only for some BZ drenches. See *Module 9 – Parasite control Toolkit 9 page 5*.

Managing drench resistance

Drench resistance develops from 2 main sources – it can be developed on–farm through ineffective drenching and through frequent use of drenches at suboptimal dose rates particularly in dry weather or by being imported onto property with purchased or agisted goats.

Strategies to counteract drench resistance include:

- Use feed withdrawal at drenching

  Withdrawing feed 24 hours before and 12 hours after drenching will extend the useful activity of the BZ and abamectin drenches, with concomitant increases in efficacy against resistant strains of worms. Do not withdraw feed if using the Neguvon drench. Ensure access to water at all times.

- Use grazing strategies to stabilise drench resistance

  Stock should be treated with registered drenches and left on a low-worm long pasture or a browse paddock. As reinfection may occur very quickly a move to the low-worm long pasture or browse paddock a few days prior to drenching is advocated. The time interval in the new paddock before treatment can be varied in relation to the estimated levels of infection carried by the animals at the time of the move.

- Follow with paddock rotations

  Paddock rotation of goats either at short interval for barber's pole or at longer intervals for black scour worm has been successful on many properties.

  In the tropics and subtropical zones, infective larvae of barber's pole are present on pasture about 4 days after egg deposition and fall to barely detectable levels within 4–6 weeks. A grazing system utilising 10 paddocks, each one grazed for 3.5 days and then spelled for 31.5 days, reduced egg counts of goats to less than half those of similar goats set–stocked on an adjacent area. The rotation cycle was 35 days. For black scour worm, longer rotation intervals to compensate for the longer survival times on paddock, perhaps up to 60 days, are recommended but need to be tailored for the location. **Consult with your veterinary advisor.**

Hints for effective drenching

- Know the capacity of registered drenches to kill worms on your property by conducting a drench–screen – check with your local veterinary laboratory for details.
- Use drenches at the correct dose rate.
- Check the accuracy of the drenching gun. Set the gun at the required dose rate (eg. 2ml), make five squirts into a medicine glass and the level should be five times the dose rate eg. 10ml. If not, adjust the gun until it is delivering an accurate dose.
- Dose to the heaviest in the group. If bodyweights vary throughout the herd separate goats in weight groups and dose to the heaviest in each group.
- Administer drugs effectively. Make sure that the dose is given at the back of the mouth as a firm squirt. If the dose is placed at the front of the mouth it will be directed to the abomasum and not to the rumen.
- Always drench in a race. Goats should be standing properly in the race so that the dose can be swallowed quickly and the tube to the gun doesn't suck in air from the pack. This occurs when the operator's head is down and the pack is inverted. Don't miss any animals.
- Check contraindications. Check labels for advice. Most products are very safe.

Guidelines for controlling lice and other external parasites on goats

The most common external parasites of goats are lice, a number of species of mites and, in some areas, ticks. Biting flies can cause problems from time to time, sheep nose bots may also infest goats and occasionally animals can become fly struck.

Lice

Four species of lice, divided into chewing and sucking species, infest goats in Australia. The chewing lice, *Bovicola caprae* and *Bovicola limbatus*, feed mainly on skin scurf, superficial skin cells and bacteria. *B. caprae* will infest all breeds of goats whereas *B limbatus*, the Angora goat chewing louse, is restricted mainly to Angora and crossbred goats. Chewing lice irritate goats, causing them to itch and rub against trees, fences and other structures. This is particularly damaging in fibre goats where lice can decrease the amount of mohair and cashmere produced and significantly reduce the quality and market value of the fibre. Infestations with chewing lice can also affect skin quality.

The sucking species (*Linognathus stenopsis*) and African blue louse (*Linognathus africanus*) feed by penetrating capillaries with finely adapted mouthparts and sucking blood. The common goat sucking louse *L. stenopsis* is found on most goat species and often occurs in mixed infestations with chewing lice. The African blue louse was first identified in Australia in 1988 and is probably not widespread.

Sucking lice can reduce weight gains and cause anaemia when present in high numbers. The formation of scabby bleeding areas, stunting of weaned goats and occasionally death in heavily infested kids has been reported however heavy infestations generally only develop when goats are in ill health or under stress.

Detecting infestations

The most common indication of lice is the observation of goats rubbing, scratching or biting themselves. Many other things can however cause goats to itch so it is important to actually see lice to diagnose an infestation.

Lice can be found on most parts of the body, although largest numbers are generally found in areas with long fibre.

Chewing lice and sucking lice look quite different. Chewing lice have a broad brown head and a pale brown body with dark bands. The young lice (nymphs) are smaller with a cream coloured body and a brown head, but no bands. Sucking lice tend to be larger than chewing lice with a narrow head and much wider dark brown body. They sometimes appear almost bluish in colour because of blood ingested during feeding.

Controlling lice

There are two main elements of good lice control in goats – preventing new infestations and effective treatment when infestations occur.

Preventing new infestations

In Australia goat lice appear to be specific to goats and do not generally breed on other animals or birds. Most new infestations result from contact with other infested goats, although often a supposed new infestation will have come from failure to completely eradicate lice at a previous treatment.

Goats carrying lice come from three main sources;

- newly purchased animals,
- strays or feral goats and
- goats that were missed at last treatment.

Infestations beginning from contact with other infested goats at shows or field days have also been reported. Developing strategies to minimise the chance of new infestations from these sources will do much to reduce the need for treatment and prevent losses from lice.

Although goat lice have been collected from sheep overseas, studies in Australia showed that chewing lice did not transfer from goats to sheep held in close contact for 8 weeks and that although sucking lice transferred from goats to lambs run with them, they did not persist on the lambs beyond 12 days. Therefore it is unlikely that other animals will be a source of new infestations. However, other animals paddocked in close contact with goats could carry goat lice for short periods and should be either removed from the goat herd when lice treatments are applied or treated at the same time.

In intensively managed or housed goats there is also the chance of reinfestation from contaminated facilities if animals are treated with a non residual treatment and returned to areas where lice or lice eggs have been dislodged. Although the likelihood of infestation from contaminated facilities is very low, a period of 2 weeks exclusion for chewing lice and 3 weeks for sucking lice will remove any risk.

Treatment for lice

Sometimes goats carry only low numbers of lice that cause little problem. This is particularly so with short haired breeds. In addition, lice numbers tend to increase during autumn and winter but then fall away in summer. As needless treatment increases selection for resistance and can leave residues in product, it is important to consider whether the lice are causing any distress to goats or are likely to cause economic loss before deciding to treat. If you cannot detect an infestation treatment is not warranted

Animals with long hair in winter and under stress from disease or poor nutrition tend to develop the heaviest infestations.

Methods of pesticide application available for goats include backline application, spraying and dusts. Products currently registered for treating lice in goats are shown in *Module 9 – Parasite control Toolkit 9 page 6*.

Backline application

One product, Clout-S, which contains the synthetic pyrethroid deltamethrin, is registered for control of lice in goats. In contrast to sheep, it is not necessary to shear goats before the application of Clout-S, however better effect is likely with Angora goats if they are shorn before treatment.

To gain good effect from backline treatment there are a few key rules that should be followed.

- Set dose rate for the heaviest goat in the group, according to label instructions.
- Use the correct application gun and ensure that it is delivering the required dose. This can be done with a small measuring cylinder or perhaps a medicine glass.
- The application strip should be along the middle of the back all of the way from the top of the head to the tail
- Avoid operator contact. If other management procedures are being conducted, apply lousicide last

Spraying

To obtain good lice control from spraying goats, it is important to ensure that the hair is thoroughly wet to the skin and that good coverage of the whole body is achieved. A coarse spray is most effective at wetting goats and reduces the likelihood of inhalation.

Dusts

Sprinkle lightly over the whole body and work into the skin. As rotenone and sulphur are the active ingredients in the only registered dusts for goats and have little residual effect, repeat treatments will be required to achieve eradication.

Dipping

No lice control chemicals are registered in Australia for application to goats by dipping.

Key rules for effective and safe use of louse control products.

- Apply treatments thoroughly and strictly according to label instructions. To eradicate lice, all lice on each animal must come into contact with the lousicide applied. Lice can occur on most parts of the body.
- All animals on the property must be treated at a similar time. Even animals without lice clearly visible should be treated. If this is not done, once the protective effect of treatment has worn off, undetected lice on the untreated goats can spread back to the treated animals. If different groups of goats are treated at different times this can set up a cycle of reinfestation. Remember that bucks and kids can be a source of lice and should also be treated.
- Remember louse eggs. Most lousicides do not kill eggs. Eggs can take up to 10 days to hatch and the hatching nymphs can start a new infestation. It is important to establish if the treatment you are using provides residual effect for this period and, if not, to apply a second treatment approximately 2 weeks after the first.

- If possible, avoid treating goats in damp weather or where rain is expected within 24 hours.
- Consult the restrictions for use and withholding periods. The meat withholding periods for products registered for application to goats are given in Table 1. Most products should not be used on lactating animals or where milk or milk products may be used for human consumption. Remember that it is illegal to use a product not registered for this use.
- Wear appropriate protective clothing and follow safety directions and indications for avoiding environmental impacts as stated on the label. Lousicides are toxic products and some products have been withdrawn from use on other species because of concerns about operator safety.
- Consult your veterinarian if control attempts are unsuccessful.

Ticks

A number of species of ticks are found on goats although they are seldom a major problem. The main species in Australia include;

- the paralysis tick *Ixodes holocyclus* (also commonly called the scrub tick or dog tick),
- the 'Australian' cattle tick (*Rhipicephalus* [*Boophilus*] *microplus*) and
- the New Zealand cattle tick (*Haemaphysalis longicornis*).

The brown dog tick *Rhipicephalus sanguineus* and various other species of native ticks are also occasionally recovered from goats. *I. holocyclus* is the main species of concern as it may cause posterior paralysis in young goats however affected goats usually recover.

I. holocyclus paralysis toxin anti-serum is however available under prescription as Purified Anti-tick Serum (Summerland Serums Pty Ltd, Astonville NSW) and is registered for treating *I. holocyclus* induced paralysis in goats.

Products registered for controlling ticks are shown in *Module 9 – Parasite control Toolkit 9 page 6*. These include mixtures of cypermethrin and chlorfenvinphos and formulations of amitraz. The latter are only registered in NSW although a permit currently also exists for their use, under supervision of QDPI&F, in Queensland. When treating for ticks, it is especially important to ensure that all parts of the animal, including the belly, inside legs and ears, are wet.

Mites

A number of mite species are known to infest goats but seldom cause significant problems. The main species are;

- the ear mites *Psoroptes cuniculi* and *Raillietia caprae*,
- the follicle mite *Demodex caprae* and
- the mange mite *Chorioptes bovis*.

In most cases mite infestations cause little obvious effect but sometimes, in young or old, diseased or stressed animals, lesions can spread and become more debilitating.

Ear twitching, scratching of the ears and head shaking are common signs of ear mites and sometimes, with close inspection, the mites, which are about 1mm long, can be seen in the ear canal. Breeds with hanging ears (such as Anglo Nubian) appear more susceptible to ear mites than goats with erect ears.

Chorioptic mange mites are found most commonly on the coronet, udder, scrotum and limbs of goats and may cause crusts or 'scabs' of yellowish exudate that can range in thickness from a few millimetres to several centimetres in thickness.

Demodex mites are highly specialised mites that live in the follicles and sebaceous glands and sometimes form papules or nodules on the head, neck, shoulders and flanks of goats.

No products are registered for treating mites in goats and, where lesions have become extensive or infestations are thought to be causing distress to goats, veterinary advice should be sought.

Biting flies and fleas

Stable flies, bush flies, mosquitoes, biting midges, March flies, sand flies, black flies and buffalo flies can all attack goats and may cause problems with goats if the numbers become too high. High numbers of biting flies can produce large sores on the legs, face, ears, udder and scrotum of goats and can cause reductions in weight gains. Bush flies (*Musca vetustissima*) can annoy goats by feeding around the eyes and are known to transmit eye diseases such as pink eye in other species.

Fleas can also infest housed goats but are unlikely to be a problem in paddock run animals.

Barricade S and Blockade S are registered for control of buffalo fly in goats (*Module 9 – Parasite control Toolkit 9 page 6*).

Flystrike

Goats can occasionally also become flystruck in wounds, particularly fighting wounds in bucks, and where goats become fouled with urine or faeces although this is seldom a significant problem. There are a number of products containing diazinon and synergised pyrethrins registered for treating fly strikes in goats (*Module 9 – Parasite control Toolkit 9 page 6*).

Nose Bots

Nose bot flies deposits small larvae, about 1mm long, in the nostrils of the goat. The larvae then move into the nasal passages and frontal sinuses where they complete their development. When sneezed out by the goat they may be up to 2cm in length.

The flies are most active in the warmer months and may disturb sheep or goats in their efforts to deposit their larvae. This can interfere with grazing and animals under attack are often seen bunched together with their heads pushed into the flanks of other animals or close to the ground. Nose bots often cause mucus discharge from the nostrils of goats and can cause frequent sneezing.

There is only limited information available on extent of infestation of goats in Australia and in most cases they cause little economic impact. Treatment is rarely necessary and, as there are no products registered for use in goats, should only be carried out only under veterinary instructions.

Toolkit 9 – Parasite control

Case studies

Tool 9.1

Finding further information

Options for the control of parasites in the Australian goat industry, MLA, 2007 (FULL REFERENCE REQUIRED).

Module 6 – Husbandry Toolkit 6 page 3 Common health problems

Module 7 - Nutrition

Websites

www.wormboss.com.au

http://www2.dpi.qld.gov.au/sheep/4720.html

Tool 9.2

Glossary of terms

Body Condition Scoring

Body condition scoring is a field based method of scoring the tissue over the lumbar vertebrae of goats. The winter scour worms such as Trichostrongylus spp. and Teladorsagia sp. cause reduced appetite, scouring and rapid weight loss that is easily detected by this method. Scour worms do not cause anaemia.

Export Slaughter Interval

An Export Slaughter Interval (ESI) is the time that should elapse between administration of a veterinary chemical to animals and their slaughter for export. ESIs manage differences between Maximum Residue Limits allowed for chemicals in Australia and its trading partners. ESI advice is particularly important for quality assurance schemes, and especially for producers filling out the National Vendor Declaration (NVD) forms as part of the whole-of-chain management of exported product. ESIs have been agreed to by the industry and the registrant of the veterinary chemical.

Eyelid Colour Scoring

Eyelid Colour Scoring is a field based method of scoring the colour of the conjunctiva (the lower inner eyelid) of individual goats against a simple colour chart to grade the degree of anaemia. Anaemia is associated with blood sucking nematodes such as Haemonchus contortus (barber's pole worm) but also has other causes. This method is used to detect affected sheep and goats for treatment and culling. Red is healthy, pink is moderate level anaemia and a trigger to drench while white is very anaemic.

Off-label use

An off-label use of a chemical product is use of the product in a way that is not covered by an instruction on the label approved by APVMA for the product registered in Australia.

Refugia

Refugia is the name given to that proportion of a given parasite population that escapes exposure to an anthelmintic and allows the survival of anthelmintic-susceptible parasites. This part of the parasite population is usually the free living stages on pasture but can also be worms in untreated animals or even inhibited larvae within the host.

There are 2 sub-populations that constitute the parasite population at any one time. One sub-population is in the host as developing and mature adult worms and the other subpopulation is on pasture as eggs, larvae and free living infective larvae. During hot dry summers, the numbers of free living stages on pasture (refugia) may be very low with most of the parasite population in the host. The reverse is true of wet summers, especially for barber's pole worm with most of the parasite population as larvae on pasture.

Drenching when very few worms are in refugia (the timing of this will vary with the type of climate, whether Mediterranean, winter rainfall or summer rainfall) will heavily select for drench resistance. The progeny of survivors of the drench will have little competition from the few larvae on pasture. When numbers in refugia are high, the progeny of the survivors of the drench will often be swamped by the high numbers of larvae on pasture and selection for resistance will take longer to occur.

Registered chemical

Before agricultural and veterinary chemical products can be sold, supplied, distributed or used in Australia, they should be registered by the APVMA. The registration process is governed by Commonwealth legislation and each chemical product undergoes rigorous scientific assessment before its registration can be approved. The APVMA allocates a unique registration number which is printed on the bottom of the product label.

Unregistered chemical

An unregistered chemical active constituent or chemical product is one that has not been assessed and registered in Australia by APVMA.

Withholding period

The withholding period (WHP) is the minimum period which must elapse between last administration or application of a veterinary chemical product, including treated feed, and the slaughter, collection, harvesting or use of the animal commodity for human consumption. WHPs are mandatory for domestic slaughter and on the label of every registered product.

Tool 9.3

Commercially available anthelmintics registered for nematode control in goats

Parasite	Active group	Constituent	Brand name	Manufacture	WHP meat (days)	ESI (days)
Nematodes, large lungworm, tapeworm and liver fluke (aid in the control of adult fluke)	BZ	albendazole* (19g/L)	Alben	Virbac	10	10 (inferred)
	BZ	albendazole* (19g/L)	Albendazole (Sheep, Lamb & Goat)	WSD	10	Not set
	BZ	albendazole* (19mg/mL)	Valbazen Sheep Lamb & Goat Drench	Coopers	10	Not set
Nematodes, large lungworm and tapeworm	BZ	fenbendazole‡ (25g/L)	Fenbendazole	4Farmers	14	Not set
	BZ	fenbendazol‡ (25g/L)	Fenbendazole	WSD	14	Not set
	BZ	fenbendazole‡ (25g/L)	Panacur 25	Virbac	14	Not set
	BZ	oxfendazole* (45.3g/L)	Oxfen LV	Virbac	10	14 (inferred)
Nematodes	Morantel citrate	morantel citrate* (30mg/mL)	Oralject Goat & Sheep Wormer	Virbac	7	Not set
Nematodes, large lungworm	Macrocyclic Lactone	abamectin" (0.8mg/mL)	Caprimec	Virbac	14	28
Baber's pole only	Organophospha	trichlorfon§ 800mg/kg	Neguvon	APVMA permit PER9864	7	Not set

* Not to be used in goats producing milk for human consumption or processing.
† Kids fed this milk should not be slaughtered for human consumption within seven days.
‡ Fenbendazole is registered for use in lactating does whose milk is to be used for human consumption. Milk withholding period is 24 hours.
§ Not to be milked for at least 28 days after treatment.
‖ Caprimec is registered as of August 2007. The withholding period for milk is four days.

Tool 9.3

Commercially available anthelmintics registered for nematode control in goats

Parasite	Active group	Constituent	Brand name	Manufacture	WHP meat (days)	ESI (days)
Liver fluke (immature and adults)	BZ	triclabendazole*† (100g/L)	Exifluke Oral Flukicide	Bomac	21	Not set
	BZ	triclabendazole*† (100g/L)	Fasinex 100 Oral	Novartis	21	Not set
	BZ	triclabendazole*† (100g/L)	LV Triclabendazole Flukicide	WSD	21	Not set
	BZ	triclabendazole*† (50g/L)	Flukguard S	Norbrook	21	Not set
	BZ	triclabendazole*† (50g/L)	Tricla 50	Youngs	21	Not set
		triclabendazole*† (50g/L)+Se as sod.selenate (0.5g/L)	Flukare S With Selenium	Virbac	21	63 (inferred)

* Not to be used in goats producing milk for human consumption or processing.
† Kids fed this milk should not be slaughtered for human consumption within seven days.
‡ Fenbendazole is registered for use in lactating does whose milk is to be used for human consumption. Milk withholding period is 24 hours.
§ Not to be milked for at least 28 days after treatment.
‖ Caprimec is registered as of August 2007. The withholding period for milk is four days.

Tool 9.4

Insecticides and acaracides registered for ectoparasite control in goats

Parasite	Active group	Constituent	Brand name	Application	Manufacturer	WHP meat (days)
Lice	SP	Deltamethrin	**Clout-S***	Backline	Coopers	3
	OP	Diazinon	**Nucidol 200EC**	Spray	Novartis	14
	OP	Diazinon	**Di-Jet†**	Spray	Coopers	14
	OP	Diazinon	**WSD Diazinon‡**	Spray	WSD	14
	Botanical/ inorganic	Rotenone & sulphur	**Inca Pestene Insect Powder§**	Dust	INCA	1
Ticks	OP/SP	Cypermethrin & chlorfenvinphos	**Blockade S***	Dip	Coopers	8
	OP/SP	Cypermethrin & chlorfenvinphos	**Barricade S***	Dip	Fort Dodge	Not set
	Formamidine	Amitraz	**Tacktic EC‖**	Spray	Intervet	Nil
	Formamidine	Amitraz	**Tacktic WP‖#**	Dip/spray	Intervet	Nil
	Formamidine	Amitraz	**Amitik#**	Dip/spray	Coopers	Nil
	Formamidine	Amitraz	**Amitik EC#**	Spray	Coopers	Nil
Mites			**Nil**			
Nasal bot			**Nil**			
Flystrike	OP/others	Diazinon & pyrethrins & PBO	**WSD Flystrike* Powder**	Dust	WSD	14
	OP/others	Diazinon & pyrethrins & PBO	**WSD Mulesing* powder**	Dust	WSD	14
	OP/others	Diazinon & pyrethrins & PBO	**Flystrike powder**	Dust	Coopers	14

* Do not use on female goats which are producing or may in the future produce milk or milk products for human consumption.
† Milk taken from goats within 48 hours following treatment must not be used for human consumption or processing.
‡ Milk collected from does with 48 hours following treatment must not be used for human consumption or processing. This milk should not be fed to kids.
§ Do not use on lactating does where milk or milk products may be used for human consumption.
‖ NSW only; however, a permit currently exists for use in Qld but only under the supervision of DPI&F.
Milk WHP nil.

Tool 9.4

Insecticides and acaracides registered for ectoparasite control in goats

Parasite	Active group	Constituent	Brand name	Application	Manufacturer	WHP meat (days)
Buffalo flies	OP/SP	Cypermethrin & chlorfenvinphos	**Barricade S***	Dip	Fort Dodge	8
		Cypermethrin & chlorfenvinphos	**Blockade***	Dip	Coopers	8
Fleas	OP/SP		**Nil**			

* Do not use on female goats which are producing or may in the future produce milk or milk products for human consumption.
† Milk taken from goats within 48 hours following treatment must not be used for human consumption or processing.
‡ Milk collected from does with 48 hours following treatment must not be used for human consumption or processing. This milk should not be fed to kids.
§ Do not use on lactating does where milk or milk products may be used for human consumption.
‖ NSW only; however, a permit currently exists for use in Qld but only under the supervision of DPI&F.
Milk WHP nil.

Case study

THE ORGANIC OPTION

NAME:	David and Mary Booth
TRADING NAME:	Buronga Organics
PROPERTY NAME:	Buronga
PROPERTY LOCATION:	Cootamundra, New South Wales
PROPERTY SIZE:	1,600ha
NUMBER OF GOATS:	800 breeding does
RAINFALL:	600mm (winter dominant)
MAIN GOAT ENTERPRISE:	Domestic meat production
TARGET MARKET:	Chevon. Direct to butchers, specialty markets including organics, farmers markets, and restaurants
SECOND GOAT ENTERPRISE:	Value-adding – leather and goatmeat jerky
TARGET MARKET:	Farmers markets and direct to consumer
OTHER FARM ENTERPRISES:	Organic meat sheep based on Dorper and White Dorper, organic beef based on Angus and Welsh Black and organic spelt cropping

David and Mary Booth operate an organically certified mixed grazing and cropping enterprise in southern NSW. Organic certification necessitates a chemical free production environment and reinforces the importance of preventative management to minimise the impact of parasites on production.

The Booths consider three key factors in managing the risk posed by internal parasites;

- bulk of pasture and dry matter,
- nutrition and
- body condition.

Throughout the year, goats are, wherever possible, strategically grazed to be allowed access to browse. This is particularly important during winter when the worm risk is highest and the threat posed by cold wet weather is greatest. Special paddocks with ample browse and good shelter are used during this period to maintain the goats in optimal nutritional condition so they can sustain a natural immune response to worm infestation.

During other times of the year the goats are allowed to graze more open pasture however pasture length is maintained by managing animal numbers. Destocking occurs when feed is scarce.

Goats are strategically grazed in a rotation with sheep and cattle to minimise the risk of cross contamination between sheep and goats. Cattle play an important role in cleaning up potentially infective larvae on pastures and are grazed with goats and between sheep and goats in a rotation. Whenever possible the Booths avoid grazing goats in close proximity to sheep when pastures are short as this has been identified as a key cause of infection.

The Booths believe that a manageable worm burden is normal to goats and it is only when this impacts animal health and production that worms become a problem. The provision of adequate nutrition to support the goat's natural immune response to worms is important. Supplementary feeding and strategic destocking to meet feed supply are used to maintain nutrition. Attention to nutrition is considered particularly important in the lead up to and during periods of peak demand, such as lactation, and pastures are monitored regularly at such times.

Throughout the production cycle, the Booths identify animals that appear to be more susceptible to internal parasites and cull these as a matter of principle. These animals may be in poorer condition than the herd average, have a rough coat or just generally lack bloom. Such animals are sold into the export meat market. This is important in building the overall resistance of the herd to worms and the sustainability of the goat enterprise in the long term.

Veterinary advice is sort whenever intervention is required and faecal egg count tests have been used in the past to identify potential problems. When a problem has been identified this has been dealt with according to veterinary advice and the requirements of international organic certification.

David commented that; "At the end of the day it comes down to those three critical elements; classing on body condition and taking the tail out of the mob, providing browse as much as is possible and maintaining pasture length and supplying adequate nutrition to allow the goats immune system to fight internal parasites naturally."

Case study

DRENCH RARELY AND ROTATE

NAME:	Max and Sandra Strong
TRADING NAME:	GM and SJ Strong
PROPERTY NAME:	Mountain View
PROPERTY LOCATION:	Gunnedah, NSW
PROPERTY SIZE:	420ha
NUMBER OF GOATS:	100 stud Boer goats 120 cross bred
RAINFALL:	600mm
MAIN GOAT ENTERPRISE:	Live export stud breeder
TARGET MARKET:	Malaysia breeder market
SECOND GOAT ENTERPRISE:	Domestic meat
TARGET MARKET:	Capretto, Sydney
OTHER FARM ENTERPRISES:	Dorper stud Meat sheep production Cattle, Angus x Wagyu breeding operation

Max and Sandra run a mixed grazing operation in the Gunnedah region of NSW. The goat operation involves a Boer goat stud breeding enterprise targeting the live export market as well as a domestic meat market focussed cross breeding operation.

The Strongs endeavour to minimise the impact both internal and external parasites have on their operation through preventative management strategies such as grazing management, moderate stocking and the provision of adequate nutrition including mineral licks. The cross breeding enterprise rarely requires intervention as the goats are grazed in low densities and rotated through clean paddocks where browse is often on offer.

Historically all animals brought in are drenched with a registered drench or according to veterinary advice on arrival and kept isolated for a three week period before being introduced to the herd.

Due to higher densities and the need for more intensive management, internal parasite problems are occasionally encountered in the stud enterprise. Problems are identified through visual assessment and treated on a needs basis. Livestock are not treated unless symptoms such as scouring or a loss of body condition are detected. Max Strong indicated that this usually only occurs prior to kidding in the does. Drenching is rarely required more that once a year and drenches are rotated over consecutive years to minimise the development of resistance.

Lice rarely present a problem however on the one occasion that they did, Clout-S was used. A poor initial result necessitated veterinary consultation. In this instance it was found that two applications at a ten day interval, dosing to the heaviest animal, achieved total erradication.*

The Strongs are currently implementing a fencing program to allow the goats to be strategically grazed with cattle to better manage the internal parasite risk. This combined with a faecal egg count testing program and visual assessment will further reduce the need for chemicals.

* This is not intended as a recommendation. A vet should be consulted as required.