

Wormwise for Goats



wormwise
national worm management strategy

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Introduction

Internal parasites (worms) are a major animal health challenge and cost in New Zealand farming systems. Many enterprises rely on anthelmintic (drench) use, especially in young stock, to manage this challenge and maintain animal performance.

A complication to this approach has been the development of resistance to the various drench chemicals within worm populations. There are few New Zealand sheep and cattle farms that do not have resistance to one or more of the various classes of drench.

Most goat farmers are acutely aware of the impact of worms on their stock. Goats are more susceptible to parasitism than sheep or cattle when grazing pasture alone and, in general, do not develop the same degree of innate immunity to worms once they reach adulthood.

From industry feedback, and the limited published information available, it would seem that drench resistance on goat farms is widespread and severe. The fact that many goat dairy operations run a “cut and carry” system to feed their goats grass is testament to the difficulty of managing worms in a pasture-only goat grazing system.

There is little current science around managing worms – and especially drench resistance – in goats, but much can be extrapolated and adapted from recent work with sheep and cattle.

Since the early 2000s, New Zealand scientists have led the world in

improving understanding of the on-farm risk factors for drench resistance, and importantly, management practices to minimise its development and progression.

Dr Dave Leathwick and his team at AgResearch have defined a number of elements, which if integrated into a well-managed system, can significantly slow the onset and severity of drench resistance on sheep and cattle farms. Much of this advice can and should be adapted for goat farms.

New Zealand sheep and cattle farmers and their advisors are fortunate to have access to a comprehensive resource in the Wormwise initiative to help them understand and manage internal parasites in a sustainable manner.

Much of the material presented in the Wormwise manual, “A handbook of sustainable worm management livestock farmers”, and the previously-published Wormwise seasonal newsletters is of use and relevance to those farming goats. This material can be accessed via your local B+LNZ extension manager.

It is recognised that many people using Wormwise for Goats may not use the existing Wormwise resources. Therefore, Wormwise for Goats has been designed to capture the salient points from the existing Wormwise literature and build on them for goats.

Hopefully, you find this a practical resource that answers many of your questions around worm management in goats.

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This booklet includes general Wormwise information not specific to goats and is highlighted wherever you see this icon

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Disclaimer

The author has made every effort to ensure that the information and advice presented in this resource are accurate and up to date. However, the advice within is of a general nature only and is not intended to substitute for individual worm management recommendations from a veterinarian or other animal health advisor skilled in parasitology and farm systems management.

Any use of “Off Label” recommendations should be done in consultation with a Veterinarian and the maximum withholding period must be adhered to.

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Periodic updates to this resource may be published via the Wormwise website.

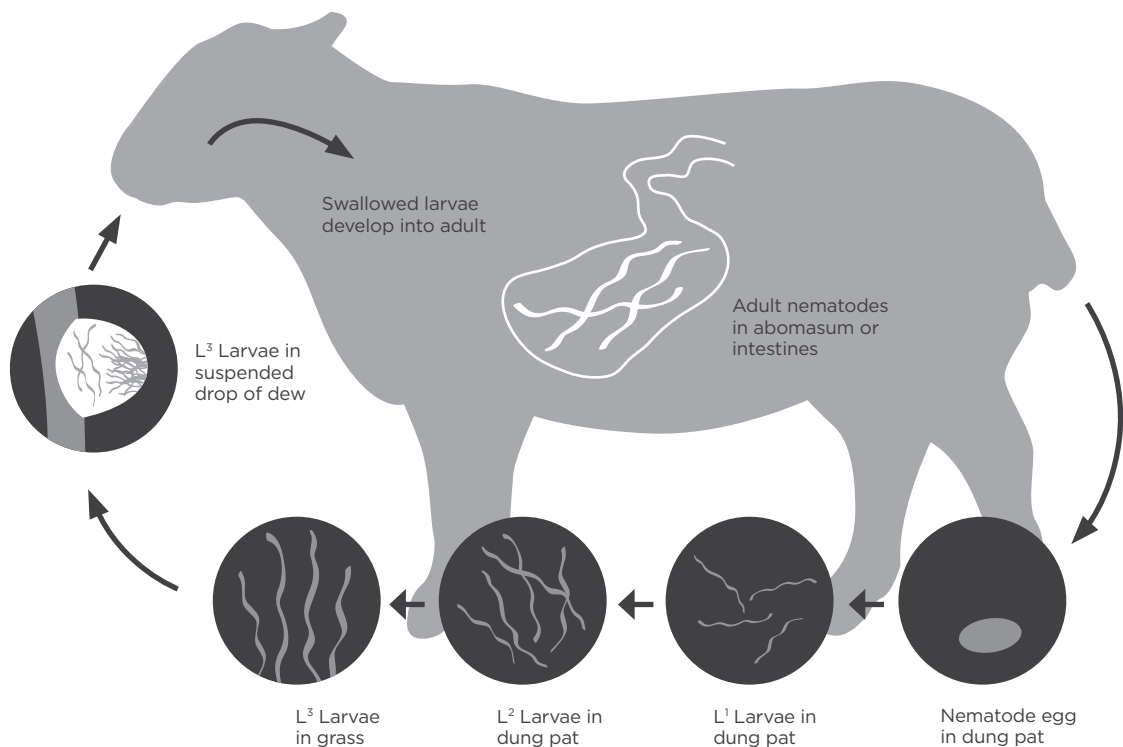
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CHAPTER 1:

What effects do worms have and how do they limit production?

Life cycle of a typical roundworm



When animals eat pasture, they also consume the larvae of internal parasites that live in droplets or water films on the grass. These larvae have developed from worm eggs deposited in the dung of infected animals.

It is natural to think of the egg-laying adult worms in the animal's gut as the culprits that cause the signs we see when animals have worms (i.e. scouring, weight loss etc).

However, the majority of the production loss seen with worms is in fact the result of on-going *larval challenge* - that is, the daily intake of large numbers of worm larvae. While treatment with a worm drench (anthelmintic) removes the adult worms, immature worms and larvae in the gut today, it cannot prevent the on-going ingestion of larvae from the pasture which is responsible for such a large amount of the production loss seen with worms.

The "industry standard" monthly drench for lambs/calves/kids is a means to cut in on the build-up of worms in these vulnerable young stock at intervals regular enough to prevent severe disease or deaths. But this regular drenching does not eliminate daily larval challenge, which puts a ceiling on growth performance. For example, in the sheep industry, the growth of undrenched lambs on "low contamination" forage crops or newly-sown grass will frequently be double or triple that of regularly-drenched lambs grazing worm-contaminated permanent pasture. This is partly a nutritional effect, but also in large part due to the removal of worm larval challenge.



Larval challenge in goats

Goats have a different feeding behaviour to sheep and cattle and will choose a much greater proportion of their diet from weeds, shrubs and trees, if allowed. It is thought that, because of this preference, goats have not developed as high a level of immunity or tolerance to worms as sheep and cattle. Most of the worm larvae live in the bottom 2cm of the pasture and goats will tend to graze much higher than this (more like 10cm up the sward), if given the choice.

In systems where goats are required to eat most of their diet as permanent pasture, where they are the dominant stock class, and especially where they are forced to graze close to the ground, they will tend to require a lot of drenching. Managing goats in this way is not sustainable in the long term.

Where it is possible to run goats under systems of low larval challenge, they will be healthier and require minimal drenching.



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Ill-thrift and production loss from worms

- Production loss due to worm challenge is of greatest importance in young stock.
- Worm populations can build up most quickly in young stock, and they can be the major source of pasture contamination.
- Physical signs of worms are the end stage of a complex and progressive disease process. They signal a failure of your worm management strategies.



Losses caused by worms in goats

Goats under about one year of age (and probably up to 18 months of age for more worm-susceptible types) are the most susceptible to worm challenge. They pass out the most worm eggs in their dung and are the greatest source of pasture contamination.

New Zealand work (and the experiences of competent goat farmers) has shown that adult goats do develop some degree of innate immunity to worms, though on average this immunity is weaker and more susceptible to breakdown when animals are under stress.

Some individuals develop an immunity as strong as an adult sheep (and almost never require drenching), whereas others only maintain a weak level of immunity and require regular drenching. This variation means there is great potential to breed goats for improved tolerance to worms. Some breeders have made considerable progress in this area, although the small size of the New Zealand goat industry does make this challenging (due to low numbers of animals to select from).

On average, the level of worm immunity of adult goats is similar to that of a two-tooth ewe: if they are well fed and under minimal stress they are able to resist or tolerate parasite challenge without the need for drenching. Does may lose some immunity around kidding and contribute to pasture contamination at this time. Stressful events such as shearing can also compromise immunity to worms.

Anecdotally, New Zealand feral goats and their crosses appear to have a better tolerance to worms than the breeds which have evolved in arid climates where there is lower worm challenge (e.g. Angora, Boer). Whether this is a true tolerance or a more highly developed habit of browsing and only grazing the top of pasture has not been proven.

Presumably because of a less active immune response, some goats will accumulate large burdens of worms with minimal outward signs until the infection is very severe. They then appear to “crash” and can be difficult to turn around. Contrast this with lambs or calves which will frequently develop a scour or look “off” at a much earlier stage of infection. This phenomenon can make it confusing for producers to decide when or whether individual goats may need treatment for worms.



Larval challenge

- Larval challenge occurs whenever animals graze on pasture contaminated with infective L3 worm larvae. Infection causes appetite suppression and changed grazing behaviour as well as demanding an immune response, which is a cost to production.
- All animals grazing pasture in New Zealand will be exposed to larval challenge.
- No drench can completely eliminate larval challenge.
- Successful worm management strategies should aim to minimise larval challenge at critical points in your farming operation.

Angora goats may develop a syndrome called “water belly” where large amounts of fluid accumulate under the skin of the brisket and belly, and even down the legs (so-called “cankles”). This appears to be related to worm larval challenge and is often associated with other stressors, such as shearing and cold weather. Affected goats are not anaemic (low in red blood cells, as would be the case with Barbers Pole worm challenge) and blood protein levels are frequently normal. A postulated cause of adrenal gland dysfunction (due to severe or chronic stress) and related retention of fluid has not been conclusively proven in New Zealand. Affected animals appear to improve with drenching and good feed. Individual producers have been able to select against this syndrome and eradicate it from their flocks.

Finally, all grazing livestock require exposure to a low level of on-going worm challenge to maintain their immunity, so attempting to completely eliminate worms from a production system could be counterproductive, unless instigating a complete “zero grazing” policy. A better compromise is to feed goats on pasture really well and accept that there will be some worm challenge that requires management.



CHAPTER 2:

Worm biology

A basic understanding of worm biology will help you understand some of the reasons behind the principles of worm management suggested in “Wormwise for goats”.



General Wormwise information on worm biology

- Grazing livestock in New Zealand get infected by a variety of different worm types. Worm eggs pass out in the animal's dung onto pasture, and animals get infected when they swallow infective (L3) larvae that have developed in the dung and then moved out onto the pasture sward.
- It takes around 21-28 days from when an animal eats a worm larva to when worm eggs appear in the dung.
- The whole life cycle may be completed in four weeks and, in special cases, even less.
- Numbers of larvae on pasture are affected by the weather. Warm moist conditions speed up larval development, resulting in greater numbers of eggs developing into infective larvae.
- Spring climatic conditions coincide with high numbers of young susceptible stock (lambs, calves, kids) being present on many farms, so worm numbers on pasture start to build in spring.
- Prolonged periods of hot dry weather kill off a large percentage (but not all) of worm eggs and larvae on pasture, as they require moisture to survive. In dry summers, the initial spring peak of larvae may drop; in moist summers, it will increase, which can result in pastures with very high larval challenge by autumn.
- This cycle slows down in cold weather. When air temperatures are less than 10°C, most eggs on pasture will die, however, the L3 larvae of many species are relatively hardy and may last as long as eight months in cooler conditions.
- That said, the longer pasture is spelled (left without grazing animals), the fewer infective larvae it will have. The length of time this takes will vary depending on climatic factors
- The numbers of eggs and larvae present on pasture are much higher than the number of worms inside animals. Therefore, effective worm management requires more than simply killing worms in the animal. It should minimise exposure of animals to worms at crucial times.
- Most larvae are found in the first 2cm of pasture height and 1cm of soil depth.
- Intensive grazing exposes animals to a higher level of worm larval intake compared to animals lightly grazing the same pasture.
- For more detail on worm biology and further information on specific worm species, see Chapter 2 of The Wormwise manual, “A handbook of sustainable worm management for livestock farmers”, available from B+LNZ.



Worm biology for goats

Levels of worm larvae on goat-grazed pasture follow a similar pattern to that described above.

Does will generally lose some immunity to worms over kidding and early lactation. Their worm egg output at this time can add to the challenge faced by the young kids. Though, in general, the majority of this challenge is likely to come from worms already present on pasture, unless a "clean" area has been prepared for kidding.

Given that worm larvae can survive up to eight months in cool moist conditions, it is obvious why pasture spelling can be an impractical tool for reducing worm challenge; a spell of a few weeks is not enough and in some cases worm challenge can be the same or even higher when goats return to a paddock after a few weeks, depending on climatic conditions and worm infestation level of the goats at the previous grazing.

The experience of intensive dairy goat farmers that it can take several years for a grazing property to become essentially "worm free" once converted to a cut and carry system illustrates that some worm larvae probably survive even longer than the quoted eight months on pasture.

However, swapping grazing areas with other livestock can still be an effective way of reducing worm challenge to goats, if done well:

- Goats share the same worm species as sheep. Therefore, sheep are a less useful species to integrate with goats from a worm management perspective, though there may be other management reasons for doing so on some farms.
- Goats and cattle harbour different worm species, with one exception (*Trichostrongylus axei*, which seems to be of little practical significance). Cattle can, therefore, be an effective species to alternate with goats in a grazing system.
- It takes several months of grazing by, say, cattle to significantly reduce the level of goat worms on a pasture. Systems where grazing swaps work effectively typically use spells of six-plus months.



- That said, even where it is not possible to use such long spells before swapping back to goats, there will be a dilution effect of running a significant proportion of cattle or deer in a rotation with goats. These alternate species can have a "vacuum cleaner" effect on goat worms, if following goats in the grazing rotation. Adult animals are more likely to be effective in this role than weaners.

While prolonged hot dry spells kill off large numbers of worm larvae on pasture, it is common to see outbreaks of parasitism in intensively farmed goats after a drought breaks. Some larvae in the bottom of the sward survive – as do those in the soil layer – and these become active again with the rain, climbing up the short green grass blades to be consumed in large numbers by goats hungry for a pick of green grass.

Goats respond well to being offered long pasture (they actively eat seed head and flowers) scrub, trees (such as willows and tree lucerne) and other browse species. Being able to consume up to 60% of their diet as browse removes much of the larval challenge they would encounter if grazing pasture only. If made to consume beyond about

60% of the diet as scrub weeds, goats will tend to lose weight. This percentage can be lower on some types of scrub. (See www.kikonui.com/assets/pdf/weeds.pdf for a more complete guide to managing goats on scrub/weed species.)

Many New Zealand references state that goats do best if not forced to graze below about 2500kgDM/ha (about 11cm high winter-grown pasture and 7cm high summer-grown pasture). At this level of grazing, they will gain optimum nutrition from the grass they eat, selectively eat weed species that take their fancy (this can vary through the year) and be consuming very few worm larvae.

From a management perspective, grazing with another species – or some other form of pasture control – will be required to maintain an acceptable sward. Allowing pastures to remain at 2500kgDM/ha or above will result in a low quality pasture with excessive dead matter in the base, dominated by thatch forming species, such as Yorkshire Fog and Browntop.

Cattle grazing from 2500kgDM/ha down to residuals of 1500kgDM/ha will fit this requirement. This is also the optimum grazing range for high cattle performance.



CHAPTER 3:

Principles for worm management

This section looks at how stock policies and farm management can be used to reduce the impact of worms and the need for drenching.

Worm management principles for goats

Pasture management

Systems where goats are the only – or dominant – stock class and are managed under an intensive grazing regime with low pasture residuals (i.e. “sheep-length” pasture) will be very prone to worm issues and will not be sustainable, due to a heavy reliance on already-failing drench chemicals.

Goat-dominant, intensive systems require skilled and careful management of feed and an individualised approach to drench use to remain viable. (See next chapter.)

A system that “lets goats be goats” is best. There are many examples of how this can work in practice, from small flocks of goats used for weed control on intensive farms, through to big goat mobs that largely graze scrub and unimproved areas on run blocks. But, in all cases, goats are able to graze at high residuals and consume weeds and browse to appetite. In these systems, they consume very few worm larvae and the need for drench inputs is minimal.

Owners of goats on lifestyle blocks should be prepared to feed their goats supplements for periods of the year when pasture gets short (hay, nuts/grains, cut fodder trees, vegetable scraps, etc) to maintain good body condition and minimise the need for drenching. On many lifestyle blocks, this period can cover as much as nine months of the year, depending

on stocking rate. As a rough guide, a medium-sized adult goat needs to consume around one large rubbish sack full of green grass/leaves (1kgDM) every day just to maintain itself. This amount will be greater for the larger breeds and increases by two-to-three times for pregnancy, feeding a kid, shearing times and in cold weather.

Well-fed adults goats will develop a level of immunity to worms, but this can vary substantially between individuals and will tend to breakdown when goats are underfed. Well-fed goats maintain their immunity better.

Hay and silage aftermath – especially if closed up for three months or longer – will generally have a much lower level of worm larval contamination than grazed pasture.

Spelling pasture for three months or longer will reduce the level of worm eggs and larvae. On smaller lifestyle blocks, there is a good case for goats to be held off pasture and fed in yards or barns for periods of the year – to allow grass to regrow to an acceptable pre-grazing length and reduce worm larval challenge. Get good nutritional advice before attempting such a change, however. Careful management of drench inputs in such a system would be required to maintain adequate refugia. (See the following chapter for further information on this concept.)

Fodder crops and newly-sown pasture will have very low levels of worm eggs and larvae, but be aware of the permanent pasture remnants at the edges of these.

General Wormwise information worm management principles

The purpose of any worm management plan is to maintain or enhance profitability by:

- Minimising contamination of pasture by infective worm larvae.
- Minimising uptake of infective larvae by susceptible stock.
- Monitoring the success of the worm management strategies.

Many tools are available to minimise contamination and larval uptake. The mix will vary from farm to farm and could include:

- Manipulation of pasture and stock management plans to reduce exposure of animals to worms at key times.
- Ensuring animals are well fed and have adequate mineral status.
- Minimising stress and attending to disease prevention.
- Breeding resistant/resilient animals.
- Appropriate drenching strategies, including knowing the effectiveness of the drenches being used.

Monitoring the success of worm management strategies:

- A key factor in implementing any strategy is knowing what is happening with worms on your farm. Currently-available tools are: faecal egg counts (FECs), faecal larval cultures (to determine which worm species are present), plus monitoring production measures such as weight gain.
- The faecal egg count reduction test is currently the definitive way to test the effectiveness of the various drench chemical classes on your farm.



Goat stock management

Maintain a low goat stocking rate. The lower the percentage of stock on the farm that are goats, the easier worm management becomes.

Graze kids ahead of older stock (kids get the first pick of a fresh paddock). Adult goats follow kids. Clean up behind goats with another species (cattle, deer).

If possible try to avoid grazing kids in autumn on paddocks where does will kid the following spring. (Much of the worm challenge to does at kidding is overwintered contamination from the previous autumn.)

Goat drenching

Hopefully, by the time you reach this chapter, you have a better understanding of how worms in goats can be managed without the need for massive amounts of drench. If you skipped straight to this chapter, *shut this page and go back to chapter one!*

The following chapter (Drenches and drench resistance) details specific information regarding the various classes of drench chemical and their application to goats. This chapter deals with the overall approach to drench use in goat systems.

Overall

As detailed above, where goats are well fed year-round, where adult breeding animals are maintained in good health and “round” body condition, where they are allowed to graze high up the pasture sward and given access to browse, scrub, and weeds, the need to do a lot of drenching drops away.

Young kids will normally need a number of treatments for worms to help them stay healthy, while their innate immunity develops (12-18 months of age). Regular drenching of adults should be unnecessary. However, there may be times in some years when all or most of the adults need treatment, and other times where individual adults may require a drench on an as-needs basis. These situations are detailed below. Finally, keeping your property safe from worse drench resistance than you already have, via quarantine drenching, is discussed.



Preventive drenching of kids

In their first couple of months of life, kids should not require worm treatment due to the high proportion of their diet that is milk. Beyond peak lactation, and as kids start to graze more pasture, they will begin to accumulate a worm burden. How quickly this burden grows – and its effect on the kids themselves – is dependent on a number of factors, including pasture length, availability of browse or supplements, goat stocking rate, paddock history and type of goats.

Preventive drenching involves treating kids for worms at intervals regular enough to prevent clinical disease, and to prevent the large build-up of larvae on pasture that will occur if kids are left with an uncontrolled and increasing worm burden.

The “standard” preventive drench programme for lambs on permanent pasture is four to five monthly drenches from weaning, which covers the summer/autumn period.

How this is adapted to a goat system depends on the individual farm, but in general the more intensive the system and the greater the proportion of goats, the greater will be the need for a similar preventive programme in kids. In these systems, it is imperative that a highly-effective combination drench is being used and that some worms are left in refugia. (See the next chapter for more detail.)

Drenches should not be given at intervals of less than 28 days.

Many farmers with a small number of goats (or with goats that are able to browse extensively) find that a drench of kids at weaning and one or two more on an as-needs basis is all that is required. The Kikonui breed has been developed with a policy of only retaining kids who are able to manage with one weaning drench and no further treatments. While such an approach could be disastrous in an intensively grazed Angora flock, it illustrates the progress that can be made.

Drenching adult goats

As mentioned in previous chapters, and as noted by many goat farmers, there is wide variation between individual adult animals in their ability to handle worm challenge. Some need regular drenching, while others seem similar to highly immune adult sheep and almost never require treatment.

Worm management in adult goats must attempt to exploit this phenomenon, to avoid regular whole-flock drenching of adults and maintain a population of worms in refugia.

In general, adult goats tend to need higher drench inputs than adult sheep. But more attempt should be made to only drench those adults who need it (e.g. drenching the tail end, drenching the worst half of the flock, leaving the fattest adults undrenched, only drenching the young adults).

A highly effective combination drench should be used in most situations.





Quarantine drenching for goats

Quarantine drenching is always mentioned in discussions on reducing the development of drench resistance.

However, in practice, it is usually poorly done (if at all). Poor product choice and inadequate attention to the management of imported animals after treatment often combine, with the result that resistant worms still survive the process and contaminate the farm.

Five keys to successful quarantine treatment:

1. Find out what you can about the resistance status of the property of origin. Don't be scared to ask for this information. This is not done enough and, even if formal drench testing has not been undertaken, owners can know a surprising amount about how the various drenches appear to be performing. Enlist the help of a vet or other advisor competent in parasitology to help you ask the right questions. If the vendor refuses to adequately answer, be suspicious.
2. Get help from someone with an in-depth understanding of worm management and drench resistance to help with product choice (see below) and subsequent management.
3. Treat goats with a product or products that have the best chance of killing any resistant worms (see below). To maximise the chance of a

complete kill, consider split dosing (a follow up dose of the same treatment 24 hours after the first).

4. Hold goats off your pastures (with water and possibly supplement available) until at least 24 hours after treatment. Forty-eight hours would be better still, to ensure that any drench resistant worm eggs already on their way out of the animal have a chance to pass out into the yards, woolshed floor, etc, where they cannot develop further. Not all drench chemicals kill eggs already present in the faeces, so treatment alone does not guarantee animals will not pass eggs within the two-to-three-day window after treatment (though most eggs will probably have been passed within 24-48 hours). The gold standard is to hold goats off pasture, on supplementary feed, until a "zero" faecal egg count is returned at seven days post treatment.
5. After the quarantine treatment, graze new goats on an area likely to be well contaminated with the farm's existing goat worms. In the unlikely event that any worms have survived your quarantine treatment, these will be 'diluted out' by breeding with the large mixed population of worms already present. In contrast, if your new goats graze an area that has low or no worm contamination, such as new pasture or a cattle block, the only worms that will be breeding on that area are those which have survived your quarantine drench.

Product choice

The ideal quarantine drench is a combination of unrelated drench actives that are each highly effective in their own right. When such a combination is used, the chances of any worm surviving the treatment are infinitesimally small.

In reality – for goats in New Zealand – here are few, if any, drench actives that we can have confidence are highly effective on their own. The best we can do is opt for those most likely not to fail, which therefore probably includes one or both of the new actives (Zolvix and Startect).

Given the speed with which resistance appears to have developed to Zolvix on several goat properties where it has been used regularly, it is probably unwise to recommend this product on its own as a quarantine drench for goats you are buying in.

Depending on the individual circumstances and likely level or risk posed by the imported goats, there are several product choices to consider. At present, the options for quarantine drenching of goats could be:

- Startect (Derquantel plus abamectin). Use of this product alone could be hazardous, if there is a reasonable risk of abamectin-resistant *Ostertagia* being present in the imported goats. The Derquantel component is inherently weaker against this species.
- Startect plus Zolvix. (NOT mixed together, but drenched separately). In many cases, this should fit the requirement of a combination of highly effective actives.
- A triple combination plus one, or even both, of the new actives (Zolvix or Startect). There are several goat properties with diagnosed resistance to triple-combination drenches, but the addition of one or both of the new actives makes it less likely that resistant worms will survive. Note that, on at least one of the properties with Zolvix resistance, triple drenches were already failing. So Zolvix plus a triple could be inadequate for goats from such a property.
- In chapter 4, we emphasise the need for goats to receive a higher dose of drench than the standard sheep dose and that repeat dosing of goats can be beneficial. This also applies to quarantine drenching.



Methods of worm monitoring for goat farms

Faecal egg count (FEC)

This is an indirect measure of how many adult worms are present in the stock being tested. Approximately 10 fresh faecal samples from a mob are required.

FECs can be done at your vet clinic, by various other commercial operators, and you can even buy a microscope and learn to do them yourself (however, they are fairly time consuming). The main uses for faecal egg counts are to estimate how wormy animals are (whether or not they need drenching) and to check whether a drench has been effective.

“Wormwise for goats” cannot give hard and fast rules about what constitutes “high” or “low” faecal egg counts. But, in general, for individual animals, a count of less than 300 eggs per gram would be considered “low”, 300-900 “moderate”, and egg counts in the thousands ‘high’. Individual animal health advisors may choose cut-off points that vary somewhat from these.

Generally, the higher into the thousands egg counts go, the more likely the worm burden is to be dominated by more pathogenic species, such as *Haemonchus* (Barbers Pole Worm) or *Trichostrongylus* (Black Scour Worm).

As a quick test of how well a drench treatment has worked, a FEC can be performed seven-to-10 days after the drench has been given. Ideally, all animals sampled will have a FEC of zero, indicating that the drench has been fully effective. This process for testing the effectiveness of drenches is called a drench check.

Larval cultures

Faecal samples that have been used for faecal egg count can be pooled together for a larval culture. A larval culture gives a guide as to which worm species are present in stock. In this test, the worm eggs in faeces are allowed to hatch and develop through to larvae, which can then be examined under a microscope and identified to their species group. The process takes 10-14 days, so is too slow for use in practical on-farm decision making (i.e. Answering a questions such as “have stock got Barbers Pole worm?”). But note that larval cultures are an essential part of the faecal egg count reduction test (FECRT). In future, a polymerase chain reaction (PCR) test (that detects worm DNA in faeces) will hopefully replace the larval culture, as a much faster way to determine what worm species are infecting stock.

Faecal egg count reduction test

This is the test used to evaluate the various drench chemical classes for effectiveness. It measures the ability of each chemical to reduce the faecal egg count of treated goats. Larval cultures are used, both before and after drenching, to ascertain which worm species are involved in any resistance that is detected.

Get help from a vet or advisor competent in parasitology to help you plan and carry out this test. A lot of time and money can be wasted, if it is not done properly.

Breeding goats for worm resistance or tolerance

There are several ways that breeders can achieve this:

- Simply selecting replacements from goats that get by with less drenching than the average of the mob.
- Culling those that need frequent drenching.
- Selecting goats that have a lower FEC than the average. It is more reliable to select on the basis of two FECs, rather than one. (Note that FEC in goats has been shown to be quite poorly heritable and the first two approaches may be more useful than using FECs.)
- The relatively new CARLA saliva test, which measures antibodies to worm larvae, is showing some promise in goats and is currently being evaluated on commercial goat farms. (See www.carlasalivatetest.co.nz)



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Drenches and drench resistance

The development of drench resistance is a particular problem on goat farms. The causes of this are both biological and farm management-related. It is imperative that goat farmers complete some level of drench testing on their properties, so informed decisions about drench use can be made.

Drench resistance in goats

Drench resistance in goats is driven by several factors:

- The greater susceptibility that most goats have to worms. This has meant that, where they are farmed intensively, they have received much greater drench inputs than would sheep under a similar system.
- The standard sheep dose rate for most drench chemicals would appear to be only partially effective in goats. Goats metabolise drugs faster than sheep or cattle, thus the in-contact time with worms is shortened and many drugs reach a lower peak level in the blood in goats than in sheep, when given at the same dose rate.
- A high percentage of adult goats retain the “oesophageal groove reflex”. This reflex is present in kids and diverts milk straight into the abomasum (the true stomach), whereas swallowed grass or other fodder goes first into the rumen to be fermented. Drench needs to end up in the rumen to be absorbed properly. However, in a high proportion of adult goats, it goes straight into the abomasum and is thus not fully absorbed.

It is therefore easy to understand why a greater frequency of drench use, at a suboptimal dose, has led to speedy development of drench resistance on many goat farms. In a number of the early reports of drench resistance on

goat farms (in the 80s and 90s), the problem appeared to have developed within a four-to-five-year period. In the newly-reported cases of resistance to Zolvix, the problem may have developed in less than three years of use.

The most recent comprehensive work on drench resistance on New Zealand goat farms was reported by Juriah Kamaludeen in 2010, as part of a Master’s thesis undertaken at Massey University. In a drench efficacy study of 17 goat farms nationwide, 11 farms had *Trichostrongylus colubriformis* worms that were resistant to all three of white, clear and ivermectin drenches individually (until recently, this represented the three main broad-spectrum drench families). On three of the 14 farms, there was a similar pattern of resistance to all three drench families in *Ostertagia circumcincta*.

As part of this work, it was also reported that a strain of *T. colubriformis* from goats had been identified that was resistant to the three main drench families when used in combination (i.e. a triple combination drench – Matrix sheep drench).

It is likely that resistance to multiple chemicals is widespread and severe on New Zealand goat farms.

Only five of the 17 (29.4%) farms in this survey had done any sort of drench efficacy testing. This ratio is probably much better than the actual level of awareness nationally. Of 30 goat

producers who responded or were interviewed as part of a survey for “Wormwise for goats”, eight (26.7%) had done a faecal egg count reduction test or drench checks. In both cases, the farmers involved were probably more likely to have an interest or concern about worm management, so may have been more likely to have completed drench testing than the average.

Dr Ian Scott and co-workers from Massey University have recently reported two cases of goat farms in the Manawatu that have independently developed resistance to the new active Monepantel (Zolvix) within three years of starting to use it.

The manufacturers of Zolvix have emphasised that the product is not and will not be registered for goats. However, it has been demonstrated that 1.5 times the standard sheep dose of Zolvix is required to properly kill fully-susceptible (i.e. non Zolvix-resistant) worms. It has also been demonstrated that twice the standard sheep dose rate is safe and effective in goats.

To date, there are no reports of resistance to Startect (Zoetis) in goat worms. It is similarly not registered for goats. Anecdotally, researchers and farmers who have treated goats with Startect report that twice the sheep dose appears to be safe in goats. Efficacy of Startect at this dose on New Zealand farms (most of which will have drench resistance) has not been reported.

Given the situation outlined above, it is imperative that goat producers who rely heavily on drench reassess their farming systems and look for ways to farm their goats with lower worm challenge, better nutrition and reduced dependence on drench chemicals.

“Wormwise for goats” can provide recipes for doing this, but hopefully it provides some ideas and direction for thought and discussion into how this may be achieved on an individual farm.





General Wormwise information on drench resistance

- Drench resistance is present when previously susceptible worm populations in the animal survive a correctly applied, standard dose of drench chemical. The resistant worms do not die, but carry on to breed. Over time, the resistant worms make up an ever-increasing proportion of the population, as susceptible worms continue to be killed each time the particular drench chemical is administered – whereas the resistant ones carry on breeding.
- Drench resistance to all drench families is increasing.
- The risk of drench resistance development can be evaluated and steps can be taken to minimise it.
- Risk factors for drench resistance include:
 - Use of long-acting drench products prior to lambing (kidding) – high risk.
 - Whole-flock drenching of adults at other times of the year – variable risk, but the more frequently this is done, the less worms there will be in refugia.
 - Drenching stock onto pasture with low worm contamination (low refugia; few worms to dilute out any resistant worms surviving the drench).
 - Buying in resistant worms in imported stock.
 - Using single-active drenches.
 - Continued use of ineffective product.
- “Refugia” is an important tool in reducing the development of drench resistance: Leaving some worms on the farm not exposed to drench chemicals.
- Leaving undrenched animals to create a refugia population will ensure there are still non-resistant worms around to dilute out the drench-resistant ones and slow the growth of the drench-resistant population.
- The aim is for the drench-susceptible larvae to significantly outnumber the resistant larvae on pasture. Thus, when worms breed in the animal, the gene frequency for resistance will be diluted.
- See pages 35-37 of the Wormwise manual, “A handbook of sustainable worm management for livestock farmers” for ideas on how refugia can be created on a farm.
- Balancing the need to reduce the risk of drench resistance and yet manage worms so that production and animal welfare do not suffer involves compromise.
- Drenching should be just one part of an overall management plan.





Please note: the following information is based on current practise and does not necessarily conform to the current Principles of Worm Management by using "Off Label" products.

Drenches and goats

Product choice

The best decisions on product choice are made once you actually know the resistance status of your farm. Get a FECRT done. If you only have small numbers of goats, not all chemicals may be able to be tested at once, but they can be tested in sequence.

There are only a small number of drench products actually registered for use in goats and they represent single action drench products from the older classes of chemical to which there are likely to be high levels of resistance on most goat farms.

Therefore from a sustainability and efficacy point of view, the registered products – in most cases – will be a poor choice for treating goats.

There are even fewer choices for treating adult does producing milk for human consumption.

The default withholding period for products used "off label" (i.e. products not registered for goats) is 91 days for meat and 35 days for milk.

It is recommended that users seek advice from a veterinarian prior to using products off label, to ensure that the risk of drug residues is appropriately managed and that use will not cause unnecessary pain or suffering of the animals under treatment.

However, there should be no debate that, in most cases (except dairy goats), the appropriate product will be one that is not registered for goats. So producers and advisors need to accept that products will need to be used off-label and come up with practical solutions for managing the withholding period.

For most drenching applications, the product of choice is likely to be a combination of as many unrelated (and preferably highly-effective) actives as possible. Given that there are already worms on goat farms that are resistant to commercially-available triple combinations, this may not be as easy as it sounds.

In these cases, switching to one of the newer actives (especially Zolvix, which is not a combination) is likely to result in the rapid development of resistance

to these as well, *unless major changes are made to the system.* (For example, improved grazing management, overall nutrition, integration of cattle, change in proportion of goats to other stock, provision of browse, periods of zero grazing, use of refugia.)

In these extreme cases, it could be advisable to use both new actives (essentially a three-way combination – including abamectin, to which there may still be some sensitivity in the worm population), but *not without major changes to the system.* Otherwise you will end up with worms that nothing can kill.

Haemonchus (Barbers Pole Worm) is a special case. This parasite sucks blood from the abomasal wall and, in times of high challenge, has the potential to kill both young and adult goats. This typically occurs in late summer, especially in the first rains at the end of a dry spell, but in warmer parts of the country may occur throughout the year.

Drenches containing moxidectin and some forms of closantel have persistent activity that prevents reinfestation with *Haemonchus* for up to six weeks. Dosing goats (especially kids and yearlings) with one of these products may be necessary in times of high *Haemonchus* challenge. If moxidectin is used, it is good practice for the next drench to be with a highly effective combination, as levels of moxidectin tail off over time, giving a period where there are sub-therapeutic doses of drug in the animal – a risk for allowing partially-resistant worms to establish and breed.

Oral drenches are absorbed much better than pour-ons or injections. Do not use these products in goats. If lice control is required, use a specific lice product rather than a cattle pour on.

Dose rates

As mentioned above, goat-appropriate dose rates have not been established for most drench products.

Professor Bill Pomroy and co-workers at Massey University are currently undertaking a project to determine the

dose rate for goats of ivermectin and moxidectin that will approximate the blood levels of drug attained in sheep at the sheep dose rate.

For monepantel (Zolvix™), it has been determined that 1.5 times the sheep dose rate is effective at killing susceptible strains of the common intestinal parasites, and that twice the sheep dose is also safe and effective. Based on current understanding of the mechanism of resistance to Monepantel, increasing the dose rate of Monepantel is not likely to make it more effective against resistant strains of worm.

There is no published information on the efficacy of Startect™ in goats, and it is not intended to be registered for this species.

Currently, many veterinarians and animal health advisors recommend dosing adult goats at anything from 1.5-3 times the sheep dose rate of various drenches.

Goats are quite sensitive to levamisole toxicity. This can occur at three times the sheep dose rate. Signs range from twitching, salivating and incoordination, to sudden death within minutes of drenching. Therefore, it is probably wise not to go as high as three the sheep dose with products containing levamisole.

Kids are more sensitive than adults to toxicity. Some advisors suggest dosing young kids at the sheep dose rate, if using combinations. Another approach is not to use combinations containing levamisole until kids are four-to-six month old (depending on size and breed).

Repeat dosing (a second dose given 12-24 hours after the first) will improve the efficacy of most drenches given to goats and will do so more effectively than increasing the dose rate. This technique works best if goats are able to be yarded, with water available, between doses. This is not likely to be feasible in heavily pregnant or lactating does, or in young kids.

Accurately determining the weight of the goats to be treated is really important to prevent both under (resistance risk) and over dosing (toxicity).





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General Wormwise information on drenches

Scales are a great investment. With small numbers of goats, you can drench to individual liveweight. Otherwise drench to the heaviest animal in the mob. Draft into lines of similar size if there is a lot of variation.

Ensure that your drench gun is delivering the correct dose by calibrating it to a measuring cup/cylinder. They vary in which section on the internal plunger corresponds to the measurement marks on the barrel (i.e. is it the front or the base of the rubber seal? Check your own gun before you begin drenching.)

Some farmers observe that goats are good at spitting drench out (a further risk for underdosing) and that is easier to drench them properly by holding them in a sitting position (as for foot trimming or shearing), as opposed to drenching them in a race.

If possible, use a low volume drench (1ml/10kg or more) on adult goats, to try to get around their oesophageal groove reflex. This will increase the likelihood of the drench actually going into the rumen, rather than the abomasum.

Make sure the drench gun goes right over the back of the tongue. That way, it will be swallowed better and is less likely to trigger the oesophageal groove reflex. You should not see drench on the sides of the lips if you are doing it properly.

- Drenches mostly don't act directly in the gut: they are absorbed into the bloodstream first and then act on the worms as they pass through the gut, which is now perfused with blood carrying the drench chemical.
- "Long-acting" drenches (such as moxidectin and some of the injections and pour-ons) stay in the body for longer and thus come into contact with worms for longer. Long-acting products are frequently high-risk for accelerating drench resistance.
- Until recently, there were three "action groups" of broad spectrum worm drench that kill a wide range of internal parasites:
 - Benzimidazoles (BZs or "white" drenches)
 - Levamisole and Morantel ("clear" drenches)
 - Macrocyclic lactones (MLs, "mectins", "endectocides")
- In addition, there are a number of narrow spectrum drenches that kill/control only one or two types of parasite. For instance, Closantel (prolonged activity against Barber's Pole Worm), Praziquantel (Tapeworm) and Triclabendazole (Liver Fluke).
- In recent years, there have been two new broad-spectrum actives released:
 - Monepantel (Zolvix™)
 - Derquantel (combined with abamectin, in Startect™).
- There are also a number of "natural" or homeopathic remedies used for worm control. The efficacy of these has not been proven.
- Combination drench products have been shown, via comprehensive research, to delay the onset and development of drench resistance, especially when used in a management system with appropriate refugia.
- The more highly effective unrelated actives there are in a combination, the better it's resistance-delaying properties.





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