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BioWorma® –Frequently Asked Questions

There is a new tool for worm control in goats and one that acts on a completely new part of the worm lifecycle. Previously we only have had drenches that only act on the worms inside the goat and it is estimated that in warm, wet weather, these are only 10% of the worms on any farm, with 90% being the eggs and larvae on the pasture. BioWorma® was registered by the Australian Pesticides & Veterinary Medicines Authority in April 2018 and was launched in Australia and New Zealand in mid-July and other countries will have it available as soon as their registrations are finalized. It is now registered in the USA.

BioWorma® is a concentrated mix of the spores of the fungus *Duddingtonia flagrans* IAH 1297 that go straight through the goat's gut. These spores can't germinate in the anaerobic conditions of the goat's gut. After being passed through the gut, these fungal spores germinate and grow in the manure at the same time as the worm larvae hatch from the eggs. The fungus builds lassos or nets that trap these worm larvae and the fungal hyphae then penetrate the worm larvae's cuticle and then consumes them.

How is BioWorma® sold?

BioWorma® is provided in two forms:

- Fungal spores for use by feed-mills as a manufacturing product and for sale by veterinarians.
- A combination product with Livamol with BioWorma® that can be purchased by any animal owner over the counter or on-line. Livamol is a protein, energy, polyunsaturated oils, vitamin and mineral supplement that has been used for decades for show animals. Some produce merchants stock it.

How much do I need to feed and how often?

Both products are required to be fed daily for best results and so suits those goat owners that feed a grain mix to their goats every day. The amounts of BioWorma® to be fed depends on the animals' weights and a 25 kg goatling or miniature goat gets 1.5 grams, a 50 kg dairy doe gets 3 grams and a 100kg buck would get 6 grams a day. The dose for the Livamol with BioWorma® product is 1 gram per kg bodyweight so the same goats would get 50 grams and 100 grams. Pure BioWorma® works out as less expensive and is the only product sold by Goat Veterinary Consultancies – goatvetoz, goatvetoz@gmail.com.

I don't have any small scales so how much do I feed?

A guide is as follows:

- Small goat or kid of 25 kg – half a level teaspoon (1.5 grams)
- A 50kg goat – one level teaspoon (3 grams)
- A 100kg goat – 2 level teaspoons (6 grams)

Was there research done on Australian goats?

A research trial done with goats at Dayboro, Queensland in autumn showed that while worm larvae counts on the pasture in the control group given a placebo rose to 27,000 then dropped to 18,000 after 8 weeks, the larvae on pasture of goats fed BioWorma® stayed at zero for the full 8 weeks. This was an outstanding result and better than the good results from trials in other livestock. So BioWorma can be used to make

worm free paddocks for vulnerable age groups of goats i.e. weaners.
See <https://www.youtube.com/watch?v=HWD1TbnA1U4&t=58s>

Is BioWorma® a silver bullet?

No. This product must be used as part of an integrated worm plan. However it is a very exciting new development as it acts on a new part of the worm life cycle and will kill worm larvae that are resistant to any drench. Remember in SE Queensland most worms will be on the pasture and any drench that is 98% effective (assuming no resistance) will kill only 98% of 10% or 9.8% of the total worms (at any stage of their lifecycle) on your farm. Continuous use of BioWorma® should kill 70% of 90% of worms or 63% of the total worms on your farm. My clients get a worm plan that shows how all available tools should be used including BioWorma®. Contact me if I haven't already provided one and a cost will be quoted.

If one of my goats eats all the feed I put out for my small herd, will they get an overdose?

No – as the BioWorma® just goes straight through the goats gut the goat won't be affected. However the manure of the other goats will then allow larvae to escape and contaminate the pastures. BioWorma® suits small herds where goats are fed on a daily basis and every goat gets its fair share. Cost is also an important factor so it is more economic to ensure it is used correctly.

Will it kill the worms inside the goat's gut?

No. This is why it is important to do a worm egg count on the faeces of goats before you start. The barber's pole worms already in the 4th stomach will not be killed and will continue to suck blood but they will eventually die of old age in around 50-70 days. There may also be some final stage larvae in hibernation in the gut wall if there are already a lot of adult worms already in the gut and this is more likely in winter. If the worm egg count is high then you must drench, even if feeding BioWorma®.

What is the With-Holding Period?

As these spores just go straight through the gut and are not absorbed by the goat, there is a **NIL** with-holding period for meat and milk. The fungal spores do not hatch inside the goat and pass out into the faeces where they start to grow.

Will BioWorma® kill the larvae already on the grass?

No unfortunately- only the larvae in the manure as the fungus doesn't get out of the manure. This means your goats will still be getting new worms until all the existing worm larvae die off. In summer this can be as short as 2 months if daily maximums are above 35 C for barber's pole worms but can be 6 months in winter when larvae are less active and hence do not use up their internal food stores. There are graphs available matching maximum daily temperatures with larval life (<https://wormboss.com.au/tests-tools/preparing-low-worm-risk-paddocks/>).

Can it be sprayed on the pasture or will spreading the goats manure help?

BioWorma® is designed for the animal is the delivery vehicle for the fungus into the faecal pat. If it was used as a foliar spray the cost would prohibitive, it would not work as the fungus needs to be in direct contact with the parasitic larvae and it would largely be wasted. Spreading the goat manure onto pastures to spread the fungus won't work either. BioWorma® relies on massive fungal spore doses so lots of fungus within the faeces to kill the vulnerable first stage worm larvae. The fungus is already in your soil as it occurs all around the world but in such low numbers it does very little.

How soon will my pastures be safe now I am feeding BioWorma®?

It depends on the weather. BioWorma® only kills the larvae in the goats manure, not the larvae on the pasture. In winter, the larvae on the pasture can last up to 6 months and two months in summer. There are graphs that collate the daily maximum temperature and the % of larvae on the pasture with days. See <http://www.wormboss.com.au/sheep-goats/tests-tools/management-tools/preparing-low-wormrisk-paddocks.php>. So keep monitoring worm egg counts in your goats' faeces until the required time has elapsed for your climate.

How long do I have to feed it before my pastures are clean?

Based on the answer and link above, you need to feed BioWorma® for 2 months in summer and 6 months in winter. However BioWorma® doesn't kill 100% of worm larvae, as no medicine work 100%, so some may have hatched. Also any new goats added to a pasture will have some worms and these can quickly contaminate the pasture again if they are not being fed BioWorma®.

I have bad frosts in winter. Do I have to feed BioWorma® in the middle of winter?

Once larvae no longer hatch out from the eggs in the manure there is no point in feeding BioWorma®. So next question is what temperature do worm larvae need to hatch. The answers are different for each worm species but they need 4-10 days of the following:

- For Brown stomach worm (*Teladorsagia [Ostertagia] circumcincta*)
Temperature: daily maximum >8°C
Moisture in this time: >10–15 mm rainfall
- Black scour worm (*Trichostrongylus spp*)
Temperature: daily maximum >15°C for *T. colubriformis* or >12°C for *T. vitrinus*
Moisture in this time: >10–15 mm rainfall
- Barber's pole worm (*Haemonchus contortus*)
Temperature: daily maximum >18°C
Moisture in this time: >10–15 mm rainfall

So look at your last couple of worm egg count and larvae culture results and see what types of worms you have and then check the conditions you need and if not meeting these conditions - stop feeding BioWorma® and start again when the weather warms up.

Remember frosts and even snow, does not kill larvae on pastures.

It is very dry right now – do I still need to feed it?

It depends. If you are in a district where the rainfall patterns are very reliable and you are sure to have 4 days' notice then you can stop feeding BioWorma® in the dry. This may be the case in the dry tropics that only get monsoonal rains or Mediterranean climate parts of Australia. There is a risk however that you may get an isolated storm that then will hatch many larvae from faeces without BioWorma®. Even one shower is enough to allow eggs to hatch for the next 4 days and these hatched larvae can last for variable periods inside the manure. It takes approximately 48 hours for any food to pass through the gut into the manure so feeding the day after the rain will mean 2 days of manure will allow the worm eggs to hatch. While barbers pole worms may only last a short while, other species can last weeks protected inside the manure until such time as a second shower breaks up the pile and they then escape.

Won't the BioWorma® eventually seed my whole property and so I won't need to feed it anymore?

No unfortunately. BioWorma® contains massive numbers of specific fungal spores per gram and these are needed for it to work. The germinated fungus stays mainly inside the manure. Small numbers occur naturally in the soil.

I can't afford to Feed BioWorma® all the time so when is it best to be fed?

Some suggestions would be:

- To recently purchased goats in quarantine after drenching as soon as they enter the property or ideally before they were loaded with drenches from different families. Keep feeding BioWorma® until faecal samples show nil eggs per gram or until 70 days (maximum life of a Barber's pole worm). Feeding BioWorma® will ensure any worms that have survived the quarantine drench protocol and hence are resistant, don't produce viable larvae to contaminate the rest of your herd.
- A peak worms times i.e. before and during the months when you had had bad worm problems in the past
- The groups of animals that are most susceptible to worm problems i.e. recently weaned kids
- Feeding to does in late pregnancy and early lactation to prevent the peri-parturient egg rise from massively contaminating your pastures and reinfesting does and their kids.
- When new goats are introduced they need to be quarantined for at least 30 days while blood tests for disease, examinations for lice, footrot, cheesy gland and quarantine worm drenching are done. Drench resistance is a growing problem and often drench resistant worms are introduced with newly purchased goats, sheep or alpacas. Feeding BioWorma® while in quarantine would be an excellent idea as the animals are generally confined in smaller yards and handfed. Ideally BioWorma® would be fed for 70 days, or the maximum life of a barber's pole worm.

Will BioWorma® kill earthworms or dung beetles?

No – this was examined during the registration process and earthworms and dung beetles were not affected. This fungus occurs naturally all over the world.

What worms won't BioWorma® control?

BioWorma® controls all the major strongyle worms e.g. barber's pole, scour worms, *Ostertagia* etc. However it will not control liver-fluke, tapeworm (both of which have complex lifecycles involving snails) nor coccidia (which have oocysts not eggs, nor larvae). See the label for the full list of worms whose larvae are destroyed.

How do I store the BioWorma®

The storage instructions for BioWorma® are "Keep container tightly closed in a moisture free environment." This means if you are feeding in treats you must make them up fresh just before feeding them. You can't make up a week's supply and keep them in the fridge. Instead keep the BioWorma® in the original pack with the edges closed in a watertight container in a cool place in summer (but not a fridge). Be warned that mice and rats love BioWorma so store in a rat proof container.

How do I feed the BioWorma?

Most just add the small amounts needed to their grain ration. However if you have wethers and don't feed grain, then can add to moistened slices of carrot, pumpkin, zucchini or apples or to a folded quarter of slice of bread with some peanut paste on top. Goats that don't like Livamol will eat pure BioWorma.

Where do I get more information?

A lot of information is available already on these websites: <https://www.BioWorma.com> and www.duddingtonia.com. The manufacturers of BioWorma® are publishing their results in scientific journals so they are available for peer review. They list them on their website see <https://www.duddingtonia.com/article/articles-list-overview>. There have been many studies on this and similar fungi since the 1990s and a search of journal databases using *Duddingtonia flagrans* will find many more references.