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

CHAPTER OVERVIEW

After reading this chapter you will have an understanding of how worms impact animal production. There are worm management approaches aimed at maximising profitability.

- Larval challenge occurs whenever animals graze on pasture contaminated with infective L3 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.
- Production loss due to worms is of greatest importance in young stock.
- Physical signs represent the end stage of a complex and progressive disease process. Their appearance represents failure of your worm management strategies.
- Young stock are a fertile breeding ground for the multiplication of worm populations and can become a major source of pasture contamination.
- No drench can completely eliminate the effects of larval challenge.
- Successful worm management strategies should aim to minimise larval challenge at critical points in your farming operation.

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

As livestock farmers know, worms are one of the main threats to stock health and production and impact the viability of their farming operations. After reading this chapter you will have an understanding of the ways in which worms exert their effects on animal production and how this affects different stock classes throughout the year. You will also appreciate how this understanding can assist in your farm management profitability.

Two popular concepts of how worms affect livestock are they compete for nutrition with the animals they infect, and cause damage to the gut leading to inefficient feed utilisation and scouring.

Both of these are true, although for the most part even large numbers of worms do not “rob” animals of nutrition. The exceptions to this are the blood sucking parasites such as *Haemonchus* species (Barber’s Pole worm).

The impact of worms on animal production begins the minute animals are exposed to worm larvae on pasture. These effects may be viewed as a continuum from no exposure to worms, and therefore no impact, to the presence of heavy burdens of worms in animals leading to disease and even death.

The point at which these effects become visible either through stock weight loss, or body condition, or through physical symptoms such as scouring, is called clinical parasitism. Before this point is reached the unseen but important effects, from a productivity point of view, are called subclinical. In today’s modern livestock farming operations minimising these subclinical effects can mean the difference between profit and loss.

This diagram illustrates that long before clinical (visible) signs of worms infection occur, there can be significant production loss.

Subclinical effects

The process begins with animals picking up infective L3 worm larvae when grazing contaminated pasture. This is known as larval challenge. These larvae are foreign to the animal in a similar way to bacteria or viruses and have two major effects.

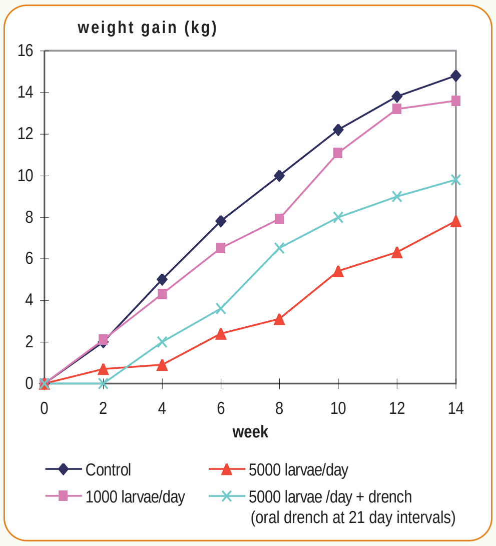
The first is appetite suppression and changed grazing behaviour. This occurs even at very low levels of larval challenge resulting in reduced food intake. The second effect is the generation of an immune response to the incoming larvae. The immune response requires energy and protein. Both of these needs are met at a cost to production whether it be for body weight gain or maintenance, wool growth or milk production.

There are numerous studies that demonstrate these effects. Two of these are summarised below: one in lambs and a series of trials in cattle.

As long as there are larvae in the pasture that animals are grazing these effects will be continuous. It is safe to say all grazing animals in New Zealand will be exposed to worms on pasture. The level of impact will depend on the amount of pasture contamination, but it is the constant nature of the exposure that results in accumulated productivity loss.

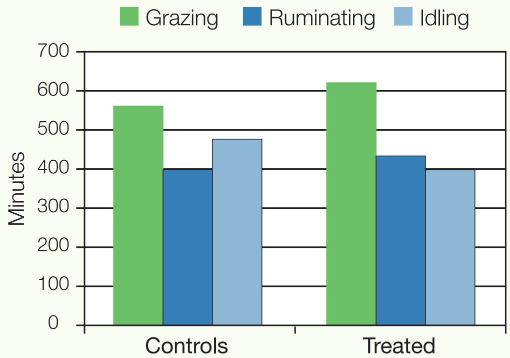
Effect of daily intake of *Ostertagia* larvae and anthelmintic on growth of young lambs *(adapted from Coop et al 1982)*

The graph shows the growth rates of previously worm free lambs dosed with different levels of infective L3 (larval challenge). The control animals received no larvae. The animals were housed and fed a dry ration. Growth rates and feed intake were monitored.



It can be seen that the challenge with L3 reduced growth rates occurs immediately. The effect was increased with increasing challenge.
The depression of feed intake of both drenched and undrenched groups receiving 5,000 larvae per day was the same. At slaughter the drenched group had no resident worms, from which we can deduce that establishing worms were removed at each drench. None of the animals in this trial showed clinical signs of parasitism.

This trial demonstrates the subclinical effects of larval challenge. Regular drenching to remove any established worms has minimal impact. In other words no drench on its own can eliminate the effects of worms.



Adapted from Forbes et al. Vet. Parasitol. 2004

Recent work has looked at the effects of grazing behaviour in both young and adult cattle using sensors attached to the animals' jaws. Animals were either treated with long-acting drenches or allowed to become naturally infected by grazing contaminated pasture. The trials showed exposure to worms reduced productive grazing behaviour. Consequently there were reductions in weight gain in young cattle and in milk production in adult dairy cows. The graph shows the differences in behaviour between two groups of adult cows in one of these trials.

Cows exposed to worms spent less time grazing and ruminating and more time in non-productive behaviour (idling). Cows were either allowed to become exposed to natural infection (controls) or treated with a long-acting anthelmintic both to remove resident worms and negate the effects of larval challenge. The observations were made over a 28 day period. Milk production, weight and body condition were all reduced in the non-treated (infected) group.

None of the animals in either of these trials showed clinical signs at any stage. The trials demonstrate the subclinical effects of worm exposure and their impact on productivity. It appears that the suppression in appetite is involved in the immune response to challenge. Other trials involving animals whose immune system has been artificially suppressed have found no or minimal effects in terms of productivity when these animals are challenged with worm larvae.

Clinical effects

The clinical effects of worms on animals, are really a progression from the subclinical effects, as worms become established in the body. The distinction between clinical and subclinical is an arbitrary one and may depend on how hard you are looking. Generally speaking at the clinical stage there are visible signs in the animal. The major physical signs are weight loss, scouring and dehydration. Whilst worms cause varying amounts of direct damage to host tissues by their activities of feeding on the gut lining or sucking blood, most effects leading to clinical disease are due to the host reaction to the presence of the worms. The inflammation resulting from physical damage can lead to secondary bacterial infection and ulcers. Worm larvae invade glands in the gut lining and, whilst some adult worms burrow into the lining, many simply reside in the surface mucous layer. The host's defensive inflammatory response causes changes in the structure and physiology of the gut leading to disturbances in normal gut function. The gut lining may thicken or nodules may form. Abnormal acid or hormone production may occur and the gut becomes "leaky". The end result may be loss of fluid and protein. Feed conversion efficiency suffers resulting in weight loss, and diarrhoea (scouring) may occur. If these changes are sufficiently severe, death results. In the case of *Haemonchus,* death can also result from blood loss.

At this point the physical symptoms of worm infection are apparent, such as weight loss and diarrhoea which represent the end stage of a complex and progressive disease process. It could be said that the appearance of these signs represents failure of your worm management strategies.

Age effects and immunity

Young animals first encounter worms when they start grazing and at this point they have no specific immunity to them. This means it is easy for worms to establish themselves and become “residents”, and reproduce relatively freely. The result is that young stock are a fertile breeding ground for the multiplication of worm populations and can become a major source of pasture contamination.

Because young animals are utilizing large amounts of energy and protein to grow, they are highly susceptible to the effects of parasites. Production loss due to worms is therefore of greatest importance in young stock. Both cattle and sheep generally develop full immunity to worms by 18 to 20 months of age. It is often mentioned that continual exposure to worms is important for the development of good immunity. On New Zealand farms it is extremely likely there will be sufficient worm numbers on pasture for animals to develop immunity.

A successful worm management programme should aim at minimising exposure of young stock to worms. The immune system is energy and protein hungry and depressed by the physiological response to stress, so good nutrition and minimising stress are important management considerations.

Healthy adult animals generally cope much better with worm challenge as their immunity is fully developed and they are not growing. However the comments above regarding nutrition and stress still apply. Remembering the demand for an immune response is responsible for subclinical production loss, there are times when the impact of worms on the productivity of older animals will be important. Around lambing and calving times animals are under stress and there can be a decrease in immunity. This can lead to higher burdens of worms and higher faecal egg outputs as the immune relaxation allows them to reproduce more freely.

Ewes and cows in lactation have high energy and protein demand, so the effects of worm challenge will have a higher impact on productivity. Your worm management strategy should aim to minimise exposure of these animals to a worm challenge.

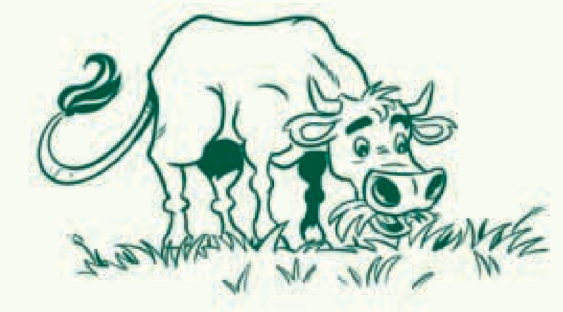
Rams and bulls at mating time are another example of when attention to these principles is important.

This chapter should have convinced you the subclinical effects of worms can have a major impact on profitability. It has attempted to show you how, by giving some thought to when each stock class is likely to suffer productivity losses from worm challenge, these losses can be minimised. Successful worm management strategies should aim to minimise exposure at these critical points in your farming operation. The rest of this book is aimed at providing the knowledge required to develop these strategies and put them into action.

Remember the whole area of worm management is extremely complex, far from fully understood and unexpected things will happen. Forming a partnership with your animal health adviser will greatly increase your chances of success.

Take away messages

1. **If you are seeing clinical signs, your worm management is not working and you may be losing money.**
2. **By minimising worm exposure at critical times, production may be increased.**



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