Strategic Parasite Control - A Door Opens

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Take Home Message

- Eprinomectin (Ivomec Eprinex7), a new entry in the group of macrcyclic lactone broad spectrum parasiticides, allows strategic control of a wide range of parasites, at times when control is most beneficial, without concern over milk withdrawal.
- Absence of milk withdrawal also allows treatment of individual animals that develop parasitic infections regardless of their place in the lactation cycle.
- The parasites of most concern in western Canadian dairies appear to be lice and mange
- Good diagnosis should precede parasite control decisions
- Economics of parasite control vary, but the aesthetic factors may be very important in making treatment decisions.

Introduction

Controlling parasites is certainly not the highest priority on the list of items for herd management. However, strategic parasite control programs can provide benefits in terms of increased productivity, better health status and in that intangible area where the cattle just “look better”. Strategic programs can also prevent the build-up of parasite populations by reducing the contribution that susceptible animals make to the overall parasite burden of the herd.

The western Canadian climate limits the occurrence and build-up of many parasites that are of concern in other regions and countries. Nonetheless, there are parasites present which can be detrimental to production and which reduce the well being of all age classes of animal.

There is a selection of products that are highly effective against almost the entire range of parasites encountered by cattle in western Canada. However, until recently the available products have had long milk withdrawal times that have severely restricted their usage in dairy cattle. This concern has been eliminated by the availability of Ivomec Eprinex7 which has a broad spectrum of activity against both internal and external parasites, but which has **no milk withdrawal**. This product allows a completely different approach to the control of parasites and opens the door to planned parasite control programs that focus on the most biologically relevant treatment times and also allows effective spot treatments of parasitized cattle.

▪ Strategic Parasite Control

Effective parasite control requires an understanding of the interactions between several factors. Each region or climatic zone will have a distinctive parasite complex that is largely a reflection of the **climatic conditions** and the way in which the life cycle of the parasites is influenced by those conditions. The spread and build-up of the parasites within a herd is also largely regulated by the climatic conditions. Differences in climatic conditions between years will often produce sharp increases or decreases in the abundance of some parasites.

Also of importance to the build-up of parasite populations within a herd is the **age of the animals and their immune status**. Parasite populations are often well regulated by the development of immunity. Younger animals, without previous exposure to parasites, will tend to be more susceptible to parasitism primarily because they have not had previous exposure and have not developed an effective immune response. Resistance to parasites and the development of immunity are influenced by the hosts genetics. Thus, in most groups of animals there will be a small percentage that have little resistance to parasites. These animals will often act as the source of infection or contamination that constantly supports the parasite population in a herd. Herd based strategic treatment programs will keep these animals from continuing to spread their parasites throughout the herd.

The ability of cattle to develop effective immunity and resist parasitic infection is a function of their general **health status**. This factor is regulated as a function of overall herd management and includes elements of nutrition, shelter, bedding, cleanliness and overall husbandry. Of these **nutrition** is particularly important as it has a major influence on the ability of the animal to develop an effective immune response.

Although several features of dairy herd management can be combined as part of a parasite control program the predominant element is the effective use of a **parasite control product**. Selection of this critical component of the program and the timing of its use are vitally important to the success of the program. In the dairy industry, more so than in other sectors of the cattle industry, **timing of treatment** has largely been influenced by the issue of milk withdrawal times.

▪ Parasites in dairy cattle of western Canada

Internal parasites

Table 1 lists the species of round worms that are known to be present in western Canada, not including the western side of the Rocky Mountains. This list includes several species that are known to have a major impact on health and productivity. A brief discussion of the life cycle, seasonality and suggestions on the best timing of control products follows.

Table 1. Common round worm parasites of cattle in western Canada.

Round worm	Location in host	Comments
Cooperia	small intestine	common
Ostertagia	abomasum	common
Trichostrongylus	small intestine/ abomasum	occasional
Haemonchus	abomasum	occasional
Oesophagostomum	large intestine	rare
Nematodirus	small intestine	common / low numbers
Trichuris	cecum	common / low numbers
*Thelazia**	eyelids/eye	transmitted by face flies
*Stephanofilaria**	skin	transmitted by horn flies
Dictyocaulus	lungs	occasional

The parasites in Table 1 that are not marked with an asterisk have what are known as direct life cycles. The adult worms, in the infected animal, deposit eggs that are shed in the faecal matter. In the external environment, the eggs undergo development and young worms emerge. These young worms are not yet capable of becoming parasites, they must grow and mature before becoming infective to the cow. When that process is complete the young worms are then ‘eaten’ during the grazing activity of the cow. Once in the gut the young worms select the best site and begin the process of becoming adult worms. If the outside conditions are correct some of the young worms may not finish development when they reach the gut. These young worms undergo what is called ‘arrested development’. They cease development and remain hidden within the gut tissue. Given a suitable trigger the hidden worms will resume development toward maturity.

The stages of these parasites that live outside the host are tiny and their survival depends on the presence of suitable environmental conditions. They are sensitive to heat and sunlight, they need moisture and they are sensitive to cold. As a result the climatic conditions will have a strong regulatory effect on population build-up.

The lung worms have a direct life cycle similar to that of the other nematodes described above. The important difference with these worms is that they are shed in the faecal matter as young worms, not eggs. In the outside environment they are faced with the same challenges as other young round worms.

Two other roundworm parasites of cattle are the eye worms and the skin worm known as *Stephanofilaria*. Both of these parasites are transmitted through the bite of blood feeding flies; the face fly and the horn fly respectively.

Seasonality

In most cases round worm populations survive through the winter in the host, there is limited survival of eggs or young worms in the environment. Infected animals seed the pastures each spring with new eggs. Egg output, which is usually low throughout the winter will increase sharply in the early spring. Thus, as the weather gets more favourable there are large numbers of infective stages available to new animals.

Research in western Canada has shown that roundworm populations build, both on the pastures and in cattle, from low levels in the early spring throughout the summer. The highest number of young worms are present on the pastures in late summer. Egg output by newly infected animals also reaches a maximum late in the fall and then declines as the animals develop immunity.

Application of a parasiticide in the fall, after the opportunity for reinfection no longer exists, will remove the roundworms that have been acquired during the summer. This allows the animals to go into winter without the added strain on their systems. This approach also reduces contamination of pastures the next spring.

External parasites

Table 2 lists the species of external parasites that are most common in western Canada. A discussion of the life cycle, transmission, seasonality and the optimal timing for application of an anti-parasitic product follows

Table 2. Common ectoparasites found on dairy cattle of western Canada.

Insect/mite	Location	Comments
Lice		
Bovicola bovis	skin	chewing louse / common
Linognathus vituli	skin	sucking louse / common
Solenopotes capilatus	skin	sucking louse / occasional
Haemaotpinus eurysternus	skin	sucking louse / occasional
Cattle grubs		
Hypoderma bovis	under skin	
Hypoderma lineatum	under skin	
Mites		
Chorioptes bovis	skin/tail-head	do not burrow in skin/scab forms becoming more common
Psoroptes communis	skin/withers/back/tail	do not burrow in skin/scab forms
Sarcoptes scabiei	skin	burrow in skin/heavy scab becoming rare

Sucking lice

These blood feeding insects spend their entire life cycle on the animal. Transmission is by contact between animals or by contamination from eggs on shed hair. Because lice are blood feeders they do not survive off the host for long periods.

Lice have a simple life cycle with three basic life stages: the eggs, nymphs and adults. The nymphs look very much like the adults, but are smaller and are not reproductively active. The life cycle takes about 21-40 days to complete (egg to egg). The length of the life cycle is influenced by the skin temperature which is influenced by ambient temperature. Cooler temperatures increase the length of the life cycle while higher temperatures shorten it. However, as temperatures increase above 32^{o}C the survival of the lice decreases. At temperatures above 41^{o}C lice die very quickly. Sunlight on the back of animals quickly raises skin temperatures into the lethal range.

Louse populations are very low in the summer months, but as the air temperatures drop and sunlight hours shorten the populations begin to rise. Peak populations usually occur in late January or early February and then begin a sharp decline toward spring (Figure 1).

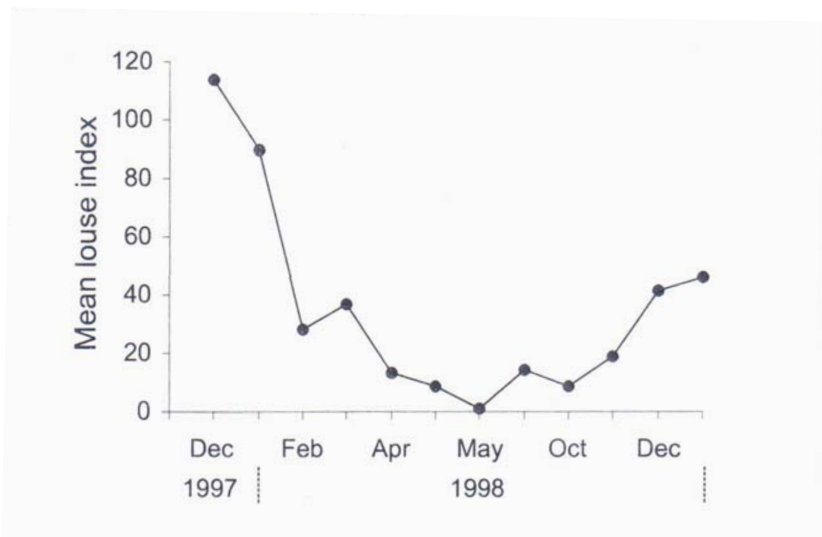

Figure 1. Mean louse index (determined by counting all lice on 8 specific sites on each animal) for a group of calves monitored for more than one year. Note the decline of louse burdens in the spring and summer followed by a rebuilding in the following fall and winter. The effect of immunity on louse burdens is seen from the relatively lower peak value in the second year.

Resistance or immunity to lice increases with the age of the animals. This is evident in Figure 1 where the peak in louse populations in January of the second year is much lower than in the first. Nutrition of the host animal also affects the louse populations. Cattle under nutritional stress tend to have higher louse numbers and the louse population will persist longer see Nelson 1984). Often the louse burden in a group of cattle is concentrated on a relatively small proportion of the herd, with the remainder of the herd having few if any lice.

Chewing lice

These insects feed on dead skin, hair and debris on the surface. The actions of their chewing mouthparts may abrade the outer skin layers and may result in an immune response. Chewing lice can live away from the host for periods of several days, but that survival can be affected by both high and low temperatures. The life cycle and seasonality of the chewing lice is very similar to that of the sucking lice.

Mange

Three types of mange mites are present in western Canada. Only one species, *Sarcoptes scabiei* actually has stages that burrow under the skin. Female mites burrow beneath the skin feeding and depositing eggs. Young mites emerge from the eggs and continue the burrowing. Spread of the infestation requires contact between animals and exchange of mites from one to the other. Damage to the skin and irritation from the secretions of the mites leads to an intense inflammation with accompanying hair loss and lesions. Sarcoptic mange tends to be most prevalent during the late winter. The appearance of the deep crusty lesions with accompanying hair loss seem to be associated with the stress of winter. This species can have serious impacts on animals, but is not very common at present.

What is often called ‘tail-head mange’ is usually caused by the mite *Chorioptes bovis*. This mite feeds by making numerous punctures in the skin that induce inflammation and leakage of fluids that combine to produce the characteristic crusty lesion. Once thought of as being mostly a winter conditon this problem seems to be occurring more frequently and at almost anytime of year. While the lesions rarely get out of control the problem certainly affects the aesthetics of the animals. Also, the intense itching that will accompany the inflammation causes some difficulties with heat detection as the animals will scratch a great deal which will often lead to inaccurate heat detection.

Cattle grubs

Despite the results reported in the Canadian Beef Quality Audit (van Donkersgoed *et al.* 1997) that cattle grubs have almost disappeared the use of a blood test on calves directly on ranches at several locations across western Canada indicate that this parasite is a lurking problem (Colwell, unpublished data) . Most ranches will have at least some calves that test positive for cattle grubs. Some ranches have high percentages of calves testing positive (e.g. >85%). These observations indicate that this highly damaging parasite is still present and if control efforts relax it has the very real potential to become a major concern.

Economics of parasite control

In western Canada there are very few instances where parasite burdens become heavy enough for there to be visible signs of disease. In the case of roundworms the climate is tough enough that populations only rarely reach obvious clinically significant levels. Ecto-parasites, although not as strongly influenced by climatic conditions, very rarely reach population levels that produce a visible disease condition. In the absence of visible disease the question then becomes one of measuring the impact of sub-clinical parasitism on the health and productivity of the dairy animal.

It has been difficult for researchers to demonstrate that control of roundworms will consistently produce milk yield increases. This is particularly so when the numbers of worms are as low as have been recorded in western Canada (Kennedy et al 1984). In the absence of clear indications of economic benefit there are few clear recommendations that can be made. It is important to remember, however, that more than one type of parasite is usually present and that interactions occur between them which may be significant.

The importance of parasite control to the growing and maturing replacement heifer is more clear. Control of internal and external parasites during the pasture season allows the heifer to reach that critical weight, and hence puberty, significantly earlier (Caldwell *et al.* 1998).

Treatment decisions

The first element in making the decision whether to embark on a strategic parasite control program is to determine the parasite burdens, in general, within the herd, i.e. **diagnosis**. Knowing what the parasites are and roughly how abundant they are can then lead to a decision regarding whether treatment is warranted and what anti-parasitic should be used.

Diagnosis of round worm infections (those that live in the gut or lungs) requires collection of fresh faecal samples that can be examined for the presence of eggs or young worms. It is important to recognize that eggs in the faecal sample are not a good indicator of the relative number of parasites present. Egg output varies with season; e.g. egg outputs will be higher in the spring and just around calving than they will be in the winter, but the number of worms may not be any different. Thus detection of eggs in faeces should be only considered as indicators of the presence of round worms.

Diagnostic techniques for ecto-parasites will vary. Direct examination of cattle, by parting the hair and examining the skin at several sites on the body, is necessary for accurate detection of lice. Lice have preferences for particular sites on the body and these should be focused on during the examination (Figure 2)

Diagnosis of mange, although the lesions tend to be characteristic, requires actual scraping of the skin to recover mites that can be positively identified. Scrapings should be deep enough to draw blood since sarcoptic mange mites will be deep within the skin. Scrapping should also be focused at the edge of the lesions where live stages tend to be abundant.

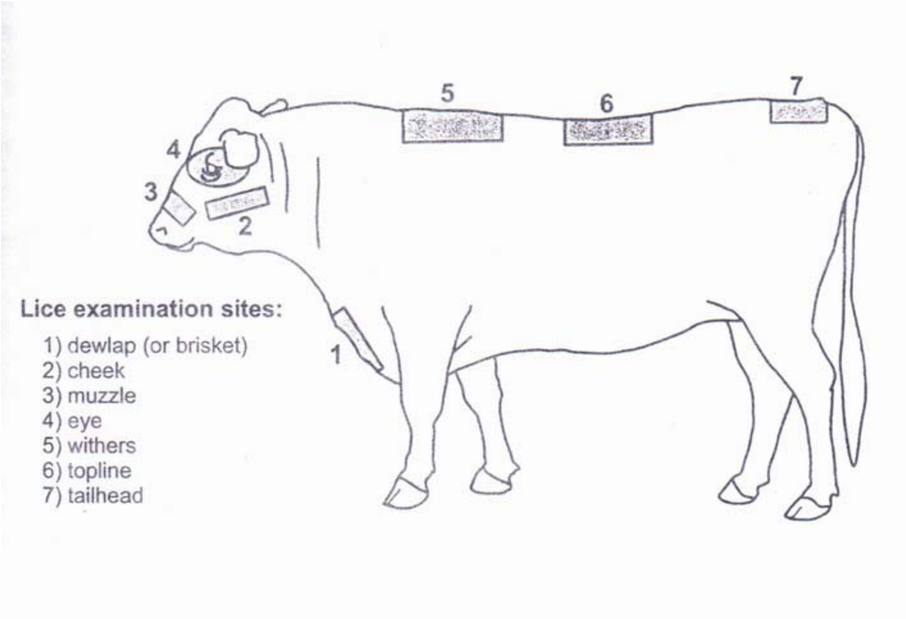

Figure 2. Preferred louse sites that are useful when examining cattle for the presence of either sucking or chewing lice.

Another important element in making parasite control decisions is found in the aesthetics. Regardless of the impact of the parasites on the health and productivity of cattle parasite control becomes important if the animals ‘look bad’. The object of the control program in improving the appearance of the cattle is no less important to the producer than a program aimed at improving performance. There may not be much economic reality associated with this, but the perception is an important factor in the decision making process.

With a firm idea of the parasites present the next step is to develop a management plan that will work on each age class and status of animal. The critical element in this step is selection of a parasiticide.

Current trends in the **management** of lactating cows, dry cows and replacement heifers affects treatment decisions. Dry lots reduce the exposure to infective stages of most roundworms. The reduced exposure is the result of conditions in the dry lots that are not optimal for survival of the young round worms. Ectoparasites, which are spread by contact or contamination still remain a concern in the dry lots. This can be a particular problem when new animals are introduced to the herd.

Choosing a parasiticide has become, in my estimation, a great deal simpler with the availability of a product that has no milk withdrawal. Optimal control of many of the parasites encountered in western Canada relies on fall treatments. Optimal control can be achieved, in keeping with the constraints of the parasite biology and pattern of abundance, either as part of a strategic approach or in spot treatments to deal with individual problems.

Ivomec Eprinex7 belongs to a group of compounds, generally referred to as the macrocyclic lactones. These compounds have excellent efficacy against a wide range of parasites while having a wide margin of safety for the host animals. These compounds attack an element of the nervous system that is common to a variety of parasites. Those parasites without this particular feature (e.g. flatworms and tapeworms) are not susceptible to the macrocyclic lactone compounds.

Ivomec Eprinex7 is a new member of this group of compounds. It is unique in that it was specifically designed to retain the efficacy against the range of parasites of its parent, ivermectin. The design process also focused on the development of partitioning within the host body that would allow effective control of the parasites while preventing the appearance of residues in muscle and milk.

▪ References

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