ECOLOGICAL AND STRATEGIC ENDOPARASITE CONTROLLING IN RUMINANTS IN TROPICAL SOUTH AMERICA

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Hygiene of the forage area and the application of substances against parasites

The principle of managemental control of parasites is to prevent pasture contamination, thereby preventing the parasite from completing its life-cycle in the host. The easiest way to implement this strategy in ruminants is to prevent them having contact with contaminated pasture or feed. Fernandez, 1994, suggests that the control of the grass contamination and the care of calves is the most important target of a strategic programme. The grass rotation every 3 days with a 33 days' break was reported by Delgado (1999) as optimal for the control of *Dictyocaulus viviparus* in cattle under tropical and subtropical conditions. Ruminants grazing pasture are likely to encounter many infective parasite larvae which they will inadvertently ingest during grazing. All of the following factors will increase the daily infective dose that a grazing ruminant ingests:

- High stocking density
- Heavily grazed pasture
- Use of the same pasture by multiple ruminants
- Presence of ruminants with high faecal egg counts
- Presence of young ruminants (which tend to be more heavily infected)
- Warm, damp weather.

One of the best methods of a parasitic control program is to reduce the number of parasites that the ruminants are exposed to in the first place. One way to accomplish this is to manage the pasture in a way that will reduce its parasite load. There are several ways to do this:

- Take a hay crop or plow and reseed. This type of pasture can be incorporated into a dose and move program in which ruminants are grazed on one pasture in the early grazing season and then dewormed and moved to another

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ruminant pasture which was used for a first cutting of hay. Another move before the end of the grazing season will probably provide the best parasite control.

- Graze a contaminated pasture with another species. There is only one worm species that can infect cattle, sheep, goat, pigs and ruminants and for practical purposes it is not very important. When another animal species eats the goat parasite larvae they will be killed. This does not apply to sheep, which find goat worms equally delectable.
- Pasture Rest. Unfortunately, it takes a long time for the worm eggs and larvae to die off if the pasture is just left empty. A year or at least an entire grazing season is required. This is usually impractical and it also means that the kind of rotational grazing at short intervals used to maximize pasture production usually does not have much impact on parasites.

Utilization of resistant hosts as a chance to control parasites

The utilization of resistant hosts in order to control the parasite sickness has something to do with the selection of resistant breeds or individuals resistant within the herd. Breeds from *Bos indicus* are less susceptible than *Bos taurus* to acquire parasites. Because a genetical variation exists, it permits the incorporation of new characteristics in the programmes for genetical selection. The first condition in order to incorporate a new genetical characteristic for a genetical selection is the control as an answer to this selection.

Of the novel approaches to parasite control, breeding sheep for resistance seems to be the most promising application that can be used to complement the strategic use of dewormers and improved pasture management. Resistance refers to the sheep´s ability to suppress the establishment and/or development of parasites. From an economic point of view, resistance allows sheep to maintain existing levels of production even if they are infected. Australian researchers have termed this ability to maintain levels of production as „resistance“.

There is substantial evidence that supports variation among breeds in resistance to internal parasites, particularly to *Haemonchus contortus*, *Ostertagia circumcincta* and *Trichostrongylus* spp. For example, the Florida Native is much more resistant to *Haemonchus contortus* than the European breeds Rambouillet and Merino as well as the Suffolk breed. In a more recent trial conducted at Alabama A&M University, Ruvana and Stephens (1997) observed that the egg per gram (EPG) of faeces was approximately eight times lower in Florida Native ewes than in Suffolk ewes under natural conditions of infection. The resistance values of Florida Native and Suffolk in this trial suggest that parasitic resistance may be improved through systematic crossbreeding of these two breeds, and other breeds may be able to be crossbred or backcrossed to the Florida Native to improve their resistance.

AS the Florida Native breed is relatively unimproved in terms of production of wool or meat, it may be readlily accepted or utilized by producers if available. However, Albers et al. (1987) concluded that breeding for resistance to *Haemonchus contortus* may have positive effects on the production capacity of Merinos. Currently large international surpluses of wool and meat as well as dwindling sheep market prices require reduction in production costs. Breeders who choose to reduce costs by breeding sheep with resistance to internal parasites are more likely to see cost savings than those who choose to increase the genetic potential for more wool or meet. There is substantial evidence that supports the fact that some breeds are naturally more resistant to internal parasites in sheep than others.

There is evidence that selection for resistance to internal parasites in sheep is feasible. Producers could reduce costs by breeding sheep such as the Florida Native or Florida Native crosses that are resistant to internal parasites.

Biological control

The biological control of parasites is continuously under research. The utilization of some fungi species like *D. flagrans* causes the destruction of parasite larvae with the following mechanisms: catching the parasite larvae through adhesive nets or points and constriction rings. This fungi can also penetrate the spores, the cuticle and the digestive tube of the larvae. With ticks, infection is not possible by biological control because they do not have any natural enemies. In the case of flies there are wasps that belong to the family Pteromaligae like *Spalangia cameruni*, *Spalangia endius* and *Muscidifurax raptor*, which can be produced in laboratories and liberated in fly-infested regions (Rodriguez, 1992).

The use of micro-organisms to reduce pasture infectivity as a possibility to control resistant nematodes is being investigated at EMBRAPA Dairy Cattle Research Center. The first studies with Brazilian isolates were aimed at the identification of nematophagous fungi, which colonize cowpats and sheep faeces, and the speed by which colonization occurs. For this purpose, the faeces of these animals were spread on *Brachiaria decumbens* pastures in the Mata Region of Minas Gerais State (Branchin, 1996).

The colonization of cattle and sheep faeces by nematophhagous fungi in these studies was fast and diversified. From the 390 cowpats deposited during the whole period, 293 fungi were isolated. A total of 123 fungi were isolated from the 120 sheep deposition. Twenty-eight species of nematode-destroying fungi were identified from the osolates: 22 predators and six endoparasitic. Among the predators were a predominance of those fungi, which produce adhesive nets. These were able to colonize faeces in both the dry and wet seasons. *Arthrobotrys oligospora* predominated in the bovine faeces while *A. oligospora* and *Monacrosporium eudermatum* predominated amongst the sheep isolates. *Myzocytium* sp. and *Harposporium anguillulae* were the species that were predominate among the endoparasitic fungi (Padilha, 1999).

A single oral dose of an aqueous suspension containing 11,350,000 chlamydospores of a Mexican isolate of *Duddingtonia flagrans* (FTHO-8) given to sheep, resulted in a maximum reduction of 88% (range 86.7-90.4%) of the population of *Haemonchus contortus* infective larvae in the faeces. The effect of this treatment continued for 4–5 days after suspension administration. The possible use ot this treatment as a method of control of ovine haemonchosis is discussed (Mendoza et al., 1998).

Integration of biological control into parasite control programmes to reduce pasture infectivity in South America, where most ruminants are raised on permanent pasture under extensive conditions, should be applied in the seasons of the year where transmission is greatest. Formulations, which could deliver standard doses to animals everyday, if needed, should be developed.

The use of fungi or any other biological agents, which act on the free-living stages of trichostrongylid species on pastures, will change the concept of worm control. Today farmers apply anthelmintic to reduce the worm population in the gut and as a consequence decrease the number of eggs passed in faeces, resulting in a reduction in the number of infective larvae in the herbage. In future, farmers will use a formulation to be fed to animals, which will act directly on the development of the free living stage in the faeces. Extension officers and farmers will need to be made aware of this new concept which will require continuing training courses and worm control campaigns.

Chemical control

Worming drugs

The use of drugs to suppress faecal egg output has been the mainstay of parasite control for many years. The rationale behind the use of worming drugs was to kill the egg-laying adult parasites and thereby minimise pasture contamination. Worming drugs can be used in a number of different ways:

1. Interval dosing

This strategy involves the administration of a specific drug at regular time intervals during the high-risk, summer grazing period. Some ruminant owners continue to dose their animals at the same frequency during the lower-risk winter period or when stabled for most of the day. This is expensive and often unnecessary. Furthermore, many ruminant owners use worming drugs at inappropriate intervals, e.g. monthly use of ivermectin which is unjustified scientifically. The over-use of worming drugs increases the speed at which parasites will develop resistance to the drugs.

2. Strategic dosing

The use of worming drugs at specific times of the year to disrupt the seasonal cycle of transmission has been widely and effectively employed in farm animal practice. The seasonality of ruminant parasites suggests that strategic dosing at turn-out, in the middle of the grazing season and again in the autumn is a rational approach to parasite control. Problems can arise with such a system in years with abnormal weather patterns leading to early or late peak pasture larval burdens. Such a system is susceptible to breakdown if heavily parasitised ruminants are added to the population. Also, the fact that ruminants do not develop a significant degree of protective immunity, and the fact that they graze in mixed age groups, make this method more difficult to institute.

3.Targeted strategic dosing

This is a modification of the strategic dosing system. Strategic dosing is employed to suppress pasture contamination at critical times of the year, but all ruminants have faecal egg counts performed prior to dosing. Treatment is then targeted at animals with significant (>200 eggs/gram) adult parasite burdens. Diagnostic limitations mean that mucosal larval parasites cannot be detected by faecal egg counts so such a regimen must include larvicidal dosing of ruminants. Most wormers currently available lack efficacy against mucosal larvae in a state of arrested development. Therefore, it is important that these stages are not allowed to build up in large numbers in the colon wall of young, susceptible ruminants. Anti-tapeworm treatments can be targeted by identification of significantly infected animals using the tapeworm antibody ELISA.

Resistance to worming drugs

Worms can develop resistance to worming drugs in just the same way that bacteria can develop resistance to antibiotics. Resistance occurs across chemical groups of worming drugs, if the worms are resistant to one drug in that group, they will have cross-resistance to all chemically similar drugs. This is a worrying situation because it may mean that in the future some or all of the worming drugs presently available will be ineffective. At present, there is widespread resistance to benzimidazole drugs in the UK but not to pyrantel or ivermectin/moxidectin. The onset of resistance to these drugs must be delayed by using them responsibly and sparingly. Diagnostic tests can help.

Worming drugs are not all the same

Just as different antibiotics are active against different bacteria, so worming drugs each have their own spectrum of activity. To control all the major parasites of ruminants, different drugs must be used. Each type of wormer also has its own recommended dosing interval. This is because the period of suppression of the passage of worm eggs is different for each drug.

Livery yards with many ruminant owners

Many ruminants are kept in livery yards where individual owners are responsible for worm control in their ruminants. Under conditions of shared grazing, owners must realise that if their ruminant is shedding lots of worm eggs, other ruminants in the paddock are likely to become infected. The paddocks available for grazing are often smaller than is ideal for the number of ruminants. This leads to close-cropped grass and ruminants grazing close to piles of dung. Most livery yards also have a high turnover rate of ruminants. New ruminants, with unknown worming histories, are a particular threat. They might bring worms into a previously "clean" population of ruminants; they might bring resistant strains of worm into the population. Diagnostic tests can help assess the parasite status of new ruminants so they can be treated appropriately.

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