



The need for alternative methods to control nematode parasites of ruminant livestock in South Africa

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LA NÉCESSITÉ DE NOUVELLES MÉTHODES DE LUTTE CONTRE LES NÉMATODES PARASITES DES RUMINANTS EN AFRIQUE DU SUD

En Afrique du Sud, la production ovine et caprine est actuellement menacée par le problème, répandu et en augmentation rapide, de la résistance des nématodes parasites à tous les groupes d'anthelminthiques. L'industrie bovine ne semble pas encore concernée, mais cela parce que les informations nécessaires pour pouvoir juger en connaissance de cause font actuellement défaut. Il n'est pas possible non plus de prévoir si cette absence apparente de résistance chez les parasites des bovins, demeurera telle dans un avenir proche. Actuellement, la tendance consiste à financer de préférence des recherches sur des problèmes considérés comme d'importance majeure par les exploitants, notamment dans les communautés agricoles pauvres en ressources. Cela risque de compromettre sérieusement la recherche sur les helminthes, qui sont rarement détectés par les éleveurs. L'accent doit être mis sur un enseignement et une formation qui embrassent l'ensemble du système agricole, des exploitants à faible revenu jusqu'aux grands producteurs commerciaux, afin que l'importance des parasites internes soit reconnue. Il est urgent d'intervenir de manière décisive pour trouver une alternative aux anthelminthiques face au grave problème des nématodes parasites chez les petits ruminants en Afrique du Sud, surtout en considération de la résistance à ces produits qui est observée actuellement chez les moutons dans le pays.

NECESIDAD DE MÉTODOS ALTERNATIVOS PARA COMBATIR LOS NEMATODOS PARÁSITOS DE LOS RUMIANTES EN EL ÁFRICA AUSTRAL

La producción de ovinos y caprinos en el África austral se ve amenazada por el problema generalizado y en rápido aumento de la resistencia de los nematodos parásitos a todos los grupos de antihelmínticos. Parece que en la industria del ganado vacuno todavía no se ha planteado el mismo problema, debido a la falta de información para tener una opinión ponderada. Además, no es posible prever si la falta actual de resistencia en los parásitos de los vacunos seguirá siendo estática en un futuro próximo. Se tiende a preferir la financiación de la investigación sobre problemas señalados por los agricultores como muy importantes, sobre todo en las comunidades agrícolas con recursos limitados. Esto puede obstaculizar la investigación sobre los helmintos, que rara vez detectan los agricultores. Hay que insistir en la importancia de la educación y la capacitación en todo el espectro de la agricultura, desde los agricultores

con recursos limitados hasta los comerciales en gran escala, a fin de adquirir una perspectiva apropiada de la importancia de los parásitos internos. Es necesario adoptar medidas urgentes que no se limiten a la dependencia de los antihelmínticos, para abordar el importante problema de los nematodos parásitos de los pequeños rumiantes en Sudáfrica, especialmente si se considera la situación actual de la resistencia a los antihelmínticos de los nematodos de los rebaños de ovejas en el país.

INTRODUCTION

The production of sheep and goats in South Africa is being threatened by the widespread and rapidly increasing problem of resistance to all anthelmintic groups in nematode parasites. Although it is clear that the cattle industry is not yet faced with the same problem, there is no available information to make an informed judgement as to the status of resistance in cattle parasites; nor is it possible to predict whether the present state of affairs, with regard to the apparent lack of resistance in cattle parasites, will remain static in the foreseeable future.

The current tendency is to fund research investigations into problems that are identified by the farmers as being of major importance, particularly in resource-limited farming communities. This may seriously jeopardize research into helminths, which are seldom detected by farmers and are consequently perceived to be of less importance than conditions that are easier to see. It must be emphasized that education and training is important across the farming spectrum, from resource-limited to large-scale commercial farmers, in order to put the importance of internal parasites in perspective.

As an alternative to the reliance on anthelmintics, decisive action needs to be taken to tackle the major problem of nematode parasitism of small ruminants in South Africa. This is particularly urgent when one considers the current status of anthelmintic resistance of nematodes in sheep flocks in South Africa.

Anthelmintic resistance in South Africa

In common with a number of other major sheep-producing countries in the world, South Africa has a looming crisis with regard to anthelmintic resistance, particularly in gastrointestinal nematodes of sheep and goats. All the important nematode parasites are involved, but it is especially a problem with the highly pathogenic haematophagous parasite of the abomasum, *Haemonchus contortus*. Surveys have indicated that more than 90 percent of worm strains in the major sheep-producing regions of South Africa show varying degrees of anthelmintic resistance (van Wyk, Malan and Bath, 1997). On 65 percent of the farms surveyed, parasites showed resistance to drugs from three of the four groups of anthelmintics available on the market in South Africa. Even on communal grazing areas in Northern Province, where little anthelmintic resistance was expected, it was detected in four of the five flocks included in a study conducted in 1993 (J.S. van der Merwe, personal communication).

This serious situation of escalating resistance has also been experienced elsewhere. A series of anthelmintic resistance surveys has recently been conducted in four countries in southern Latin America, namely Argentina (Eddi *et al.*, 1996), Brazil (Echevarria *et al.*, 1996), Paraguay (Maciel *et al.*, 1996) and Uruguay (Nari *et al.*, 1996). All reported high levels of resistance to the benzimidazole and levamisole/morantel groups of anthelmintics and that the combination product was failing and, most important, all reported some measure of resistance to the macrocyclic group of anthelmintics as well. This resistance exceeded 50 percent of sheep farms surveyed in Paraguay which was considered by the

authors to be the worst situation with regard to resistance worldwide. We believe that the situation is equally bad in South Africa.

Investigations showed resistance to drugs from five anthelmintic groups on a sheep farm (van Wyk, Malan and Randles, 1997) and the surveys mentioned above indicated that this is probably not an isolated case. A representative survey of 26 farms in the Ermelo district, the highest wool-producing area in South Africa, showed that, on 8 percent of farms, *H. contortus* was less than 40 percent susceptible to drugs from all four groups currently available in South Africa (M.O. Stenson, personal communication).

New anthelmintics: future salvation or forlorn hope?

The international problem of anthelmintic resistance is compounded by the fact that, while chemotherapy continues to be the cornerstone of parasite control (Soll, 1997), there seems little hope that any novel, chemically unrelated anthelmintics will be forthcoming for at least the next decade. Discovering and developing new chemical entities is an arduous, costly and time-consuming process. It has been reported that, out of approximately 7 500 compounds shown to have anthelmintic activity, only three are submitted for registration and only one is eventually approved for commercial sale (Soll, 1997). Pharmaceutical companies are under continuous commercial pressure to focus on markets that offer the best returns. The sheep (and goat) anthelmintic market is relatively small in global terms. Although the total veterinary parasiticide sales constitute approximately 25 percent of the global veterinary pharmaceutical sales, sheep products represent only 7 percent of this figure. Future developments are likely to be driven by the requirements of the major markets, and for the veterinary parasiticides this is associated with cattle and companion animals, especially dogs (Soll, 1997).

Setting research priorities

Persons responsible for setting research priorities, as well as funding agencies and managers of research institutions, should take note that anthelmintic resistance is not easily perceptible to the farmer. This highlights one of the main problems in the field of helminthology - the need to educate farmers as to the importance of worm parasites, particularly in sheep and goat farming. While good commercial farmers generally recognize that worm infections need to be controlled to safeguard the health and production of their animals, even they find it difficult to appreciate their major importance compared with the more visible problems such as external parasites, enterotoxaemia, pasteurellosis, bluetongue and heartwater. Only through continuous education and demonstration will it be possible to achieve, and maintain, a balance in the order of importance of problems and thus set the priorities for research and investigation.

In the case of the resource-limited farmers, the problem outlined above is even greater. With few exceptions, these farmers have no contact with advisory personnel who are knowledgeable about the implications of worm infection and the importance of anthelmintic resistance. The ubiquitous nature of worm infections magnifies this problem. The modern tendency to class research priorities in resource-limited farming communities largely according to surveys of what farmers want would obviously discriminate against funding for essential helminth research and extension.

ALTERNATIVE APPROACHES TO NEMATODE PARASITE

CONTROL OF LIVESTOCK

The FAMACHA system: clinical identification of developing anaemia

The FAMACHA system is focused on the management of *H. contortus* infections in sheep and goats. It was developed following the results of a trial (Malan and van Wyk, 1992) in which routine drenching was stopped for 125 days in 388 sheep that were exposed to heavy infections of *H. contortus*. Only those sheep found to have pale mucous membranes, and where subsequent determinations showed a haematocrit of 15 percent or below, were drenched to prevent death. It was found that 69 percent of the flock required no anthelmintic treatment. A further 21 percent required only a single treatment and only 1 percent of the animals required four salvage anthelmintic treatments. This trial is in dramatic contrast to the monthly treatment normally practised on the same farm. This work not only clearly demonstrated that a great saving in anthelmintic use can be achieved, but also that animals could be identified for culling. Such an approach also dramatically reduces the selection for anthelmintic-resistant parasite populations as nearly three-quarters of the flock remained untreated, with the result that their worm populations were not exposed to drug selection.

Following the success of this pilot investigation, the FAMACHA system is now in the process of extensive field evaluation under a range of sheep farming conditions in South Africa. Further refinements have been and are likely to be made with time. One important feature of the system is that it is equally applicable to all levels of the farming community. The visual appraisal of anaemia is linked to an identification chart and it has been found that very limited training is required for farmers to master the procedure. The FAMACHA system can be used to control *H. contortus* throughout its endemic region and we commend the programme to other countries that face a crisis in worm control of sheep and goats owing to anthelmintic resistance.

However, it is important that farmers are made clearly aware that the FAMACHA system is only applicable to *H. contortus* infections and must be used in conjunction with other sound helminth control measures. Other nematode parasites need to be closely monitored, particularly *Oesophogostomum columbianum*, to ensure that the greatly reduced drenching does not lead to their re-emergence after decades of suppressive anthelmintic treatment in South Africa.

Reversion in resistance by the introduction of susceptible worms

The state of resistance in South Africa, and in some South American countries, is apparently at such a high level, generally involving several different anthelmintic groups, that reversion to susceptibility following total drug withdrawal for a prolonged period is both unlikely and impractical. Reversion, by the dilution of resistant parasite populations with the phased introduction of susceptible strains, offers an alternative. Studies in South Africa (van Wyk and van Schalkwyk, 1990) obtained reversion by dilution. This was achieved by thoroughly deworming sheep infected with a resistant strain of *H. contortus* at a time when pastures were expected to have very low levels of infectivity. This was followed by artificially infecting sheep with infective larvae from a susceptible strain. The sheep were closely monitored to ensure that these introduced infections did not lead to

clinical disease. If this occurred, anthelmintic treatment would, of course, have been warranted but, during the time that the susceptible worms remained *in situ*, contamination and thus dilution of pasture populations of *H. contortus* would have occurred.

We believe that this technique of diluting resistant with susceptible worms has particular relevance in the relatively new grazing system (referred to as the 50/50 system) now being promoted in South Africa (Kirkman and Moore, 1995). In this system, all the animals on a given farm are concentrated on half the pasture, while the other half is rested, with these treatments being rotated annually. In this way practically worm-free pastures are available annually and it should be possible to obtain very high levels of dilution of resistant worms, on the condition that special precautions are taken to prevent exposure to resistant larvae surviving in places of common access on the farm, e.g. surroundings of handling pens, "passageways" for herding sheep between paddocks, etc.

Alternating sheep and cattle

Despite sheep and cattle being susceptible to both *H. contortus* and *H. placei*, preliminary results of investigations at various localities in South Africa have indicated that it may be advantageous for the farmer to alternate the two species of livestock on pasture, particularly in helping to control *H. contortus* of sheep and goats.

Nematode-destroying fungi

While no previous investigations in this field appear to have been done in South Africa, we have observed that larval cultures from certain regions of South Africa were infected to such an extent with unidentified fungi that *H. contortus* larvae were destroyed within one week following harvesting. The extent of the fungal infection was such that, in a number of cases, we were unable to isolate intact larvae from these cultures. We intend to isolate and investigate strains of fungi affecting nematode larvae in routine faecal cultures in the laboratory.

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