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Sustainable worm control practices in South America☆

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ABSTRACT

A high prevalence of nematodes, especially *Haemonchus contortus* and *Trichostrongylus colubriformis*, that exhibit multiple anthelmintics resistance has been reported in sheep in several South American countries. For this reason, the development of strategies that are less dependent on anthelmintic treatments is imperative for the prophylaxis of gastrointestinal nematode infections in small ruminants. Integrated grazing using cattle and sheep can be used for pasture decontamination with considerable reduction of *H. contortus* and *T. colubriformis* infective larvae after cattle grazing. Several breeds of sheep exhibit genetically related resistance against nematode infections, as is the case of "crioulo", "native" or naturalised breeds of sheep. These breeds descend from livestock introduced by Portuguese and Spanish settlers and have been submitted to a long process of natural selection in various environmental conditions. In the South, the Crioula Lanada breed is more resistant to *H. contortus* than are Corriedale sheep. In tropical areas, where the minimum temperatures are usually higher than 20 °C, hair sheep flourish, especially the Santa Ines breed, which also display a higher level of resistance to nematode infections compared with certain breeds of European origin. However, Santa Ines sheep have inferior carcass quality compared with other commercial breeds. Recent studies showed that the crossbreeding of Santa Ines ewes with sires of breeds with high potential for growth and meat production, results in crossbred animals with high productivity and a satisfactory degree of resistance against nematode infections. Several studies have indicated that improvement in nutrition has a beneficial effect on the development of resistance in lambs that were naturally or artificially infected with nematodes. Therefore, supplementary feeding and breeding strategies to improve resistance to nematodes are feasible options in the effort to reduce dependence on anthelmintic drugs to control worm infections in sheep.

1. Introduction

Among the people involved in the sheep industry, there is a consensus that gastrointestinal nematode infections are the primary obstacle for the development of sheep husbandry in South America. In Brazil, *Haemonchus contortus* is the major parasite followed by *Trichostrongylus colubriformis*. Clinical cases of haemonchosis, particularly in young animals and periparturient ewes, may occur year round in most part of the country (reviewed by Amarante, 2009). In the extreme south of the country, in Rio Grande do Sul state, *Trichostrongylus* spp. and *Ostertagia* (=*Teladorsagia*) *circumcincta* assume dominance during winter and spring due to lower temperatures, causing widespread clinical disease and productivity losses, while *H. contortus* is the major problem during the summer months (Echevarria et al., 1996).

In Uruguay, *H. contortus* is also the most important parasite in all seasons, except for winter, when *T. colubriformis* in particular and, to a lesser extent, *Trichostrongylus*

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axei, *Ostertagia circumcincta* and *Cooperia* spp. assume importance (Nari et al., 1996). Similarly, in Argentina, *H. contortus* is the primary nematode pathogen in the north-east provinces, where *T. colubriformis*, *T. axei*, *O. circumcinta* are also prevalent. Major problems of clinical parasitism accompanied by significant mortality due to *H. contortus* are regularly encountered in summer and autumn, with other parasites assuming dominance in winter and spring (Eddi et al., 1996). In Argentina's western Pampas, the sheep flock acquires massive worm burdens during the warmer months of the year, from summer to mid-autumn. The major parasite is *H. contortus* and to a lesser degree *T. colubriformis* and *Nematodirus spathiger* (Suarez and Busetti, 1995). One exception appears to be the sheep production in Patagonia, Argentina, where due to low temperatures, an arid environment and low animal density per hectare, the losses caused by gastrointestinal nematode infections appear to be minimal, apart from the few mountain valleys and highly restricted areas along water courses that are subjected to periodic flooding (Eddi et al., 1996).

2. Sheep production

Sheep production in Argentina, Uruguay and South Brazil (Rio Grande do Sul State) has witnessed a sharp decline in the number of animals. Part of this decline can be attributed to the reduction in wool prices during the 1990s. For this reason and because of the strong demand for lamb meat, a considerable number of farmers have shifted their focus to sheep meat production.

The sheep industry has not shown signs of recovery after the sharp decline of the 1990s (Fig. 1), despite the relatively high value of lamb meat. There are two major reasons for this problem: (1) sheep production must compete with other, more profitable livestock and agricultural enterprises, such as soybean, maize and sugar cane plantations, which occupy large tracts of land; and (2) sheep productivity has been low due to the lack of appropriate management of grazing areas and due to sanitary problems, especially gastrointestinal nematode infections.

In contrast, other animal products, such as beef cattle and poultry, have been experiencing a significant increase in production in the last decades. For instance, in Brazil,

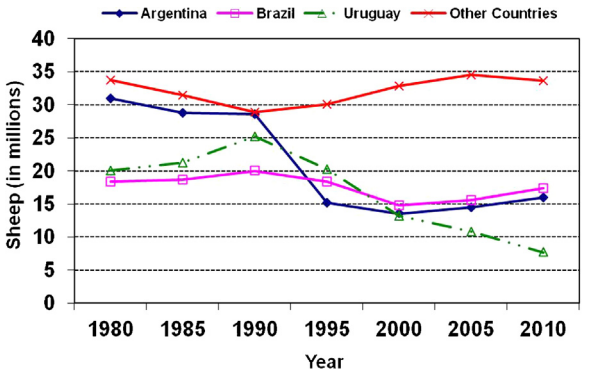

Fig. 1. Sheep population in South America from 1980 to 2010. Stocks of animals are given in heads.
Source: FAOSTAT (2013).

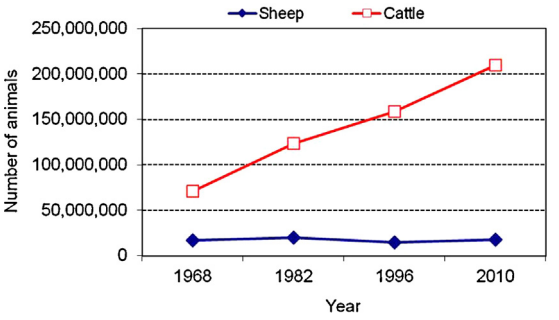

Fig. 2. Sheep and cattle population in Brazil from 1968 to 2010.
Source: FAOSTAT (2013).

the cattle population was 118,971,000 head in 1980 and reached 209,541,000 head in 2010 (Fig. 2). There is no doubt that nematode infections also affect cattle production (Borges et al., 2013). However, parasitic gastroenteritis is usually not noticed by the farmer, who is still likely to use avermectins (Delgado et al., 2009), despite recent studies that show an almost complete lack of efficacy of these compounds against cattle nematodes (Soutello et al., 2007; Souza et al., 2008; Almeida et al., 2013). Because cattle are usually more able to cope with the infection, farmers have the incorrect belief that the control measures are satisfactory. In contrast, haemonchosis in sheep can be devastating and is easily recognised by the farmer because the typical clinical signs, including severe anaemia and bottle jaw.

Farmers rely almost entirely on anthelmintics to control parasites in their flocks, and as the consequence of the frequent treatments, there has been the widespread appearance of resistance in nematode populations. The first large survey of anthelmintic resistance was carried out in the 1990s in four countries of South America and presented a pessimistic scenario (Table 1). In Uruguay, almost 50% of sheep farmers treated their lambs with more than seven drenches per year, and over 40% of farmers gave their ewes the same number of treatments (Nari et al., 1996). In Rio Grande do Sul, Brazil, traditional anthelmintic treatments were empirical and ranged from 6 to 12 treatments. Despite this intensive dosing regimen, the growth rate of young sheep was still highly compromised by parasitism (Echevarria et al., 1996).

Therefore, the prophylaxis of gastrointestinal nematode infections based exclusively on anthelmintic treatments has been proven unsustainable. Echevarria et al. (1996) stated that "a crisis situation was occurring and immediate, drastic action would need to be implemented, otherwise the sheep industry in the region would face a lack of any effective anthelmintic with the inevitable consequences of major restructuring or abandonment". At the time of that survey, the sheep population was approximately 10 million head in Rio Grande do Sul State, which today has been reduced to 4 million. The reduction in the sheep population was even more dramatic in Argentina and Uruguay (Fig. 1). Therefore, it can be concluded that the pessimistic scenario became reality. The anthelmintic resistance is widespread today, and the most recent surveys in Brazil show that multidrug resistance has become the rule (Almeida et al., 2010; Sczesny-Moraes et al., 2010; Veríssimo et al., 2012).