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Sustainable internal parasite control of sheep in Australia☆

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ABSTRACT

Within Australia, sheep are managed under diverse conditions. Because of considerable differences between these areas, it is difficult to make universal recommendations about what constitutes a 'sustainable' worm control programme, although some broad principles apply. However, to be effective and profitable in the longer term programmes should cost-effectively prevent unacceptable production losses, but also avoid practices that encourage rapid selection for anthelmintic resistance. Recently, the practice of treating sheep with anthelmintics onto areas known to have low residual populations of worm larvae (low 'refugia') has been highlighted as a way of increasing selection for anthelmintic resistance. Consequently, a variety of strategies to increase refugia populations have been proposed. These strategies will vary considerably according to the patterns of infection, predominant parasites and distribution of rainfall in a given area, and key inputs to the farming system, such as the cost of labour.

1. Introduction and background

In 2011, Australia produced approximately 7% of the world's lamb and mutton and 25% of its wool from 73 million sheep, the majority of which were merino or merino cross-breeds. Although this was a comparatively low population, compared to a peak of 180 million in 1970 and 117 million in 1999 (ABS, 2012), the value of sheep meat production has increased considerably relative to the production of wool (Table 1). For example, in the 2010–11 financial year the gross value of sheep and lamb production was AUS$2.86 billion, compared to $2.67 billion for wool, and the value of meat production has been greater than for wool production since 2008–09 (ABS, 2012).

This paper briefly reviews features of profitable sheep farms in Australia and discusses attributes of programmes for the sustainable control of gastro-intestinal nematode parasites. This discussion focuses on programmes based on the epidemiology of the main parasites in the high winter rainfall areas of south-eastern Australia, and how they differ from modifications recently proposed for flocks in Western Australia. The latter has areas with a similar total rainfall, but generally much shorter growing seasons and different pastures. The effect of this is to dramatically decrease residual populations of infective larvae that survive over summer, often referred to as being 'in refugia', compared to south-eastern Australia.

2. Features of profitable sheep farms and importance of gastro-intestinal nematodes

Sustainable worm control practices should contribute to the overall profitability and success of the farm enterprise, and so it is important that advisers and parasitologists are aware of the major determinants of profitability for sheep farms in their area. This enables them to tailor advice to individual farms, ensuring control programmes are practical and avoid unnecessary costs or lost production. Importantly, these programmes should enhance the profitability and financial sustainability of their clients.

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Table 1
Australian sheep production in 1999–2000 and 2010–11.[a]

Measure		1999–2000	2010–11
Sheep population (million)		117	73
No. of sheep farms (sheep only and beef-sheep)		24,084	17,895
Shorn wool production (tonnes)		640,000	350,000
Gross value of production: (AUS$ billion)	Wool	2.18	2.67
	Sheep-meat	1.05	2.86
	All agriculture	29.92	46.02

[a] Australian Bureau of Statistics (ABS, 2012).

Financial data has been collected from grazing enterprises in Victoria for over 30 years, through the 'Livestock Monitor Farm Project' (Anon, 2012). This data is used to analyse the characteristics of more profitable farms and allow participating farms to 'benchmark' themselves against similar enterprises. Thus, the key factors influencing farm profitability for grazing enterprises in the high rainfall areas of south-eastern Australia are well understood (Lean et al., 1997; Anon, 2012). More profitable farms, the top 20% as judged by enterprise gross margin/ha/100 mm of rain, consistently apply more fertiliser and have higher stocking rates. Consequently, they produce more meat or wool per hectare, at a lower cost of production, than average farms (Table 2).

Results from benchmarking projects consistently show that animal health costs are not a major proportion of total enterprise costs. For example, in 2010–11 they were $40/ha, or 18% of total costs on average wool producing farms compared to $36 ha^{-1} on the top 20% of farms (Table 2). Consequently, attempting to reduce these costs usually has little impact on farm profitability, but can significantly increase the risk of unacceptable production losses, especially from poor control of internal parasites which is the most economically significant disease problem for Australian sheep producers (McLeod, 1995; Sackett et al., 2006).

3. Characteristics of nematode infections and control programmes

In Australia, sheep are managed under diverse conditions; from semi-arid, where nematode infections are generally not a problem, to areas of higher rainfall. Within the latter areas, rainfall varies from 450 mm to over 1100 mm per annum, and preventive worm control programmes are consistently required.

Some major characteristics and management issues for sheep enterprises in each of the three main production zones in Australia are summarised in Table 3. Within the higher rainfall areas ('sheep-cereal' and 'high rainfall' zones), the distribution and amount of rainfall determines patterns of infection and which parasites predominate. For example, *Haemonchus contortus* and *Trichostrongylus colubriformis* are of most concern in areas with summer-dominant rainfall, such as the New England region in northern NSW and south-east Queensland (Southcott et al., 1976; O'Connor et al., 2006). *Teladorsagia circumcincta* infections assume more importance in the uniform and winter-dominant rainfall zones, including the highlands and slopes of NSW (Donald et al., 1978), Victoria (Anderson, 1972, 1973; Young, 1983), south-east South Australia (Brown et al., 1985; Pullman et al., 1988) and the south-west of Western Australia (Wroth, 1995a,b; Woodgate and

Table 2
Key physical and financial indicators for wool and sheep meat enterprises in south-west Victorian flocks in 2010–11 (Anon, 2012).

Measure	Wool flocks		Prime lamb flocks	
	Average	Top 20%[a]	Average	Top 20%[a]
1. Physical performance				
Stocking rate (DSE[b]/grazed ha)	15.0	18.7	15.6	20.6
Lamb marking percentage	72%	73%	101%	95%
Wool production (kg clean/grazed ha)	34.1	39.4	22.1	30.6
Lamb production (kg/grazed ha)	–	–	83	122
Average fibre diameter (μm)	18.6	18.1	26.1	24.9
2. Enterprise costs				
Pasture ($/ha)	49	68	62	91
Supplementary feed ($/ha)	6	4	9	27
Animal health ($/ha)	40	36	37	42
Total enterprise costs ($/ha)	219	269	227	326
3. Gross margin and cost of production				
$/DSE	37	45	41	47
$/ha	550	803	628	922
$/ha/100 mm rainfall	57	85	66	101
Cost of production ($/kg product[c])	11.75	10.97	4.99	3.54

[a] Ranked according to gross margin per hectare per 100 mm of rainfall.
[b] DSE = dry sheep equivalent (a 45 kg sheep).
[c] Clean wool for wool flocks or lamb carcass weight for prime lamb flocks.