

Integrated Parasite Management of Sheep. National Overview of the Need, Available Tools and the Fit With Industry

J. Schröder

Meat & Livestock Australia, North Sydney, NSW 2060

Abstract . The parasite, the host and the environment need to be considered in integrated parasite management (IPM). Parasite management needs to be integrated with the farm's husbandry program. There is an extensive body of knowledge on IPM accumulated over the past 5 decades and the measures have been demonstrated to be effective, yet sheep parasite control is still overly dependent on the use of chemicals, which is not sustainable. Concerns about residues and resistance mandate a more rational use of this resource. Adoption of IPM for sheep needs to be improved, but faces the difficulties of complexity, the need for customisation and a shortage of skilled advisers.

The need

In the broadest sense, IPM encompasses a range of manipulations of either the **host** (e.g. increased genetic host resilience through selecting for low faecal worm egg count [FWEC] (Williams *et al.* 2009) or dag score, increased host resistance through protein supplementation (Coop *et al.* 1995; Coop & Holmes 1996; Kahn *et al.* 2000) and managed exposure to parasite antigens, or breech conformation modification), the environment (e.g. pasture spelling, zero grazing, tilling, or decontamination with an alternate host) (Barger & Southcott 1975; Southcott & Barger 1975; Bailey *et al.* 2009) or, to a lesser extent, the parasite (e.g. reintroducing susceptible nematodes to replace a resistant population (Van Wyk & Van Schalkwyk 1990), or sterile male technologies for insects). When IPM was introduced more than 50 years ago for crop protection (Zalucki *et al.* 2009), the intention was that parasite numbers would be monitored and chemicals only applied when pest burdens reached economically intolerable intervention thresholds. It stemmed from a realisation that reliance on chemicals alone is not sustainable and that other avenues for reducing the harmful effect of pests ought to be explored. It implies a relaxation of historically high pest control expectations and a preparedness to tolerate a certain number of pests or parasites (Zalucki *et al.* 2009).

A less than optimistic perusal of the literature and industry practice may lead one to conclude that there is in fact little "integration", because chemicals remain the cornerstone of most parasite control programs in the sheep and cattle industries. In practical terms, therefore, IPM translates into more rational use of chemicals, mainly to delay selection for resistance and, to a lesser extent, reducing the risk of residues in food and fibre. The realities of consumer antipathy to chemical residues and established resistance of both endo- and ectoparasites of sheep and cattle to most chemical groups, make finding a cleverer way of using all current and new molecules to our future advantage inescapable.

Australia's need for IPM has been acknowledged at a national level for quite some time. A coordinated approach called Sustainable Control of Internal Parasites of Sheep (SCIPS) in the late 1990's led to Australian Wool Innovation funding an IPM project for sheep over a period of five years, with a total budget in excess of \$2.5m, from 2003 (Anon. a). The project commenced with a national awareness and adoption survey of sheep producers' parasite management habits. Identified knowledge gaps were addressed in a series of research investigations. IPM programs were tailor made and tested on 23 commercial demonstration properties in the major sheep-producing areas of the country.

A concurrent survey of the cost of endemic diseases, funded jointly by MLA and AWI, revealed that internal parasites of sheep and cattle cost Australian producers \$408m annually, with >80% of this cost attributable to lost production, despite the annual expenditure of \$70m on control measures (Anon. 2006).

The IPM-s producer survey indicated that there was room for improved adoption of husbandry practices such as changing flock structure to a greater portion of wethers, which contribute fewer nematode eggs to the overall pasture contamination, in a wool enterprise, or a shorter joining season, which simplifies the shifting of weaners to rested / safer paddocks, or alternating sheep and cattle. Adoption of FWEC monitoring (for more efficient timing of drenches – 44% of respondents) and drench resistance testing (to ensure use of an effective chemical – 18%) also left considerable room for improvement (Anon. a.). In this regard, parasite management needs not only to consist of an integration of different control methods, but to be integrated with the general farm management program (breeding, selection, feed budgetting and husbandry), so that it is not forgotten or neglected.

Available tools

The IPM-s research added valuable information to the available body of knowledge on parasite ecology and paddock preparation and resulted in the award of three PhD and one Master's qualifications. The demonstration farms showed that implementing regional IPM programs, which exploited currently available technology and resources, resulted in greater profitability through limiting production loss due to parasites, with a substantial reduction in the amount of chemical used. The treatment costs saved by reduced usage of chemicals was largely offset by an increased need for data collection and interpretation, implying that IPM requires a change in the way in which treatment decisions are made.

An effective, holistic IPM program for one property is unlikely to work on another, or on the same property during a different season, without customisation and/or some adjustment. Local circumstances and the availability of resources such as alternate hosts (e.g. cattle) and extra or pre-prepared paddocks will determine the extent to which host alternation and rotational grazing can be employed to reduce pasture larval challenge. Seasonal and geographic variations in rainfall, sunlight and temperature influence pasture growth and parasite phenology, both in the free-living and parasitic stages and, hence, the timing of monitoring, drenches and paddock shifts. Host factors such as flock composition, breed and selection strategy are bound to vary between enterprises. And then, all other IPM measures can be diminished by inadequate provision for the hosts's nutritional requirements. The use of professional advice clearly recommends itself.

Australia has historically established itself professionally as a trend-setter where strategic sheep parasite control and IPM is concerned and the availability of a web-based resource such as WormBoss[®] (Anon. b.) has done much to enhance our country's international reputation (a large number of visits to the WormBoss website is from overseas users. J Littlejohn, pers. comm.). There are numerous parasite management measures at our disposal which can be logically integrated in a sustainable approach, as has been successfully demonstrated (Anon. a.). These include evidence-based selection and timing of effective chemicals, host treatment thresholds, host breeding and selection for parasite resistance, flock structure to accommodate differences in physiological status, such as pregnancy and lactation, and multi-species grazing management to limit exposure to infestation while ensuring sufficient levels of nutrition and adequate provision of a chemical refuge for non-parasitic worms.

The fit with industry

But the rate of implementation remains disappointing. Large scale field studies which will yield statistically significant and convincing results are today beyond the financial means of most research organisations and cannot replicate the multi-factorial diversity represented by individual farm management systems. Many producers apparently remain self-sufficient and reluctant to change without experiencing an epiphany under their own conditions. Skilled advisers are too few in number, inexperienced in robust whole-farm IPM delivery and its benefit-cost analysis and insufficiently engaged to effect changes in on-farm mindsets and practices. Servicing the national sheep industry by facilitating IPM adoption at farm level in all regions constitutes our ultimate and thorniest challenge.

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Email: jschroder@mla.com.au