Costs of Major Parasites to the Australian Livestock Industries

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Abstract—McLeod R. S. 1995. Costs of major parasites to the Australian livestock industries. International Journal for Parasitology 25: 1363–1367. A cost-benefit model is developed to estimate the costs of major parasites to Australian livestock industries and to evaluate the benefits from improving parasite management. The model disaggregates the Australian livestock industries into agro-climatic regions and various stock classes to estimate the total treatment and production loss costs of major parasites. Experimental trials and a computer simulation model are used to estimate the productivity of livestock under different treatment regimes. Using the model, the economic costs inflicted by cattle ticks, sheep gastrointestinal worms, sheep lice and sheep blowflies are discussed and the farm profitability resulting from improved sheep roundworm management is assessed.

Key words: Livestock parasite costs; cost-benefit model.

INTRODUCTION

Previous studies by Beck, Moir & Meppen (1985) and Collins D. (paper presented at the Rural Lands Protection Board District Veterinarians Annual Conference, NSW, 1992), have demonstrated that the costs major parasites impose on Australian grazing industries are substantial. However, this fact alone does not justify the allocation of considerable funding towards parasitological research (Morris & Meek, 1980). Undertaking research should reflect the ability of research outcomes to reduce control and production costs associated with the management of these parasites.

To assess the impact of parasites on various sectors of the Australian livestock industries and to examine the potential for researchers to reduce the costs these parasites inflict, a cost-benefit model is developed. The model integrates livestock demographic statistics, treatment cost and livestock productivity parameters to generate on-farm and aggregate treatment and damage costs of selected livestock parasites. Experimental data and computer simulations are used to estimate the productivity of livestock subject to various treatment strategies.

This paper outlines the structure of the model, describes the cost of selected grazing industry parasites, and demonstrates the improved farm profitability resulting from the improved management of sheep round worms.

COST-BENEFIT MODEL

In this section the components of the cost-benefit model and sources of parameter values are outlined. The model is contained in an Excel spreadsheet (Microsoft Corporation) and is readily available.

Structure of the Australian Livestock Industry

Sheep and cattle are separated into differing agro-climatic regions to accommodate the variation in the abundance of parasites within each of the livestock industries. The sheep industry is divided into pastoral, wheat-sheep and high rainfall zones following Australian Bureau of Agricultural and Resource Economics (ABARE) (1993). The Queensland cattle industry is divided into pastoral and South-East Queensland zones. Within each of the climatic zones sheep are further divided into ewe, wether, lamb, hogget and ram stock classes, while cattle are
Table 1—Sources of production loss estimates for treated and untreated livestock

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Uncontrolled Losses</th>
<th>Treatment loss estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle Tick</td>
<td>Sing et al. (1983); Mahoney &amp; Ross (1972)</td>
<td>Sing et al. (1983)</td>
</tr>
<tr>
<td>Sheep Worms</td>
<td>Barton &amp; Brimblecombe (1983); Beveridge et al. (1985); Brown et al. (1985); Thompson &amp; Callinan (1981); Anderson (1972, 1973); Morris, Anderson &amp; McTaggart (1977); Barger &amp; Southcott (1978)</td>
<td>McLeod et al. (1992)*</td>
</tr>
<tr>
<td>Sheep Blowfly</td>
<td>Bock et al. (1985)</td>
<td>Watts, Murphy &amp; Graham (1979); Dun &amp; Donnelly (1965); Ciba–Geigy (1979)</td>
</tr>
</tbody>
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*Annual Conference of the Australian Agricultural Economics Society, 1992, Canberra.

separated into breeding cow, bull, and yearling stock classes to accommodate differing susceptibility of stock classes to parasitism. Australian Bureau of Statistics (ABS) (1991) livestock statistics are used to define the percentage of livestock in each of these climatic regions and stock classes. Changes in flock/herd size can be included in the model by altering a flock/herd size index. In this analysis, 1994 ABARE (1994) flock/herd size estimates are used to estimate parasite costs.

Livestock product and prices
The live weights, fleece weights, stock replacement costs, wool prices and meat prices for cattle and sheep industries are obtained from ABS (1991), Australian Meat and Livestock Corporation (1991), Australian Wool Corporation (1990) and ABARE (1994). A price index in the cost-benefit model allows the user to update costs and include different price forecast estimates. In this analysis, ABARE (1994) 1994 average prices are employed.

Parasite treatment costs
A background to the various parasite treatment methods utilised by Australian livestock producers are described by Sing, Johnston & Leach (1983) for cattle tick, and in contributed papers at the Annual Conference of the Australian Agricultural Economics Society, 1992, for sheep roundworms (McLeod R., Collins D., Barnes E. & Dobson R.), sheep blowfly (Simmer R. & Collins D.) and lice (Taleb M. & Collins D.). The chemical, maintenance, depreciation and labour costs for the various treatment methods outlined in the above references are updated in this analysis using Primac Brisbane (Personal communication) and Aigost, NSW Agriculture (Personal communication) costing information.

Livestock productivity
The results of experimental trials and a computer simulation model (Barnes & Dobson, 1990) are used to determine the productivity of livestock subject to differing treatment programs. The experiments used to estimate the productivity of untreated and treated livestock are outlined in Table 1 for each of the selected parasites.

The national costs of livestock parasitism are calculated by aggregating the costs of parasitism from each of the agro-climatic regions. Within each of the agro-climatic regions, the costs attributable to each of the parasite treatment programs are combined using patterns of farmer treatment program adoption to generate regional parasite cost estimates. The current adoption of treatment strategies are derived from surveys by Collins (Personal communication).

The increased farm profit and industry benefits which result from a reduction in the treatment costs and/or the production losses caused by parasites can be estimated using the cost-benefit model. Prior to providing a case study that demonstrates how to estimate increased farm profitability, the treatment costs and production losses attributable to major parasites of the Australian livestock industries are discussed.

COST OF MAJOR LIVESTOCK PARASITES
The annual cost of cattle tick (Boophilus microplus), sheep roundworms (Haemonchus contortus, Ostertagia spp. and Trichostrongylus spp.), sheep blowfly (Lucilia cuprina) and sheep lice (Damasimia ovis) to the Australian grazing industry, derived from the cost-benefit model are presented in Fig. 1 below. Treatment and production loss costs associated with current levels of parasite control can be distinguished in the figure.

Sheep roundworms are found to inflict the greatest net cost on Australian grazing industries. The production loss associated with current roundworm treatment is significantly greater than treatment costs. In contrast to roundworms, blowfly and lice total annual costs are dominated by the cost of treating each of the parasites. The widespread adoption of
mulesing and dipping of sheep are largely responsible for large control costs.

The major treatment and production loss cost components for the 4 selected parasites are illustrated in Table 2. Control costs are categorised by chemical, labour and other cost components. The "other" category in Table 2 includes costs associated with repair and depreciation of cattle dips and sheep jetting races. In the case of lice, post-dipping sheep mortality is also included. Production loss costs are separated into meat loss, wool quantity loss, reduced fertility and mortality cost components. The cost attributable to each of these components is given in the table.

Cattle ticks are endemic in northern grazing regions of Australia where tick production losses are treated by dipping and vaccination. In this study, costs are only estimated for the Queensland herd due to a paucity of data for other tick-prone areas. Growers in Queensland are estimated to spend $41M on tick treatment and are subject to a production loss of $91M. Treatment costs comprise chemical, labour and other (dip repair and maintenance) components. Labour costs are particularly high, due to extensive mustering of cattle in large and remote grazing areas. In south east Queensland, cattle are assumed to be dipped 4 times per annum, whilst in the more extensive grazing regions cattle are estimated to be dipped twice each year.

Tick production losses largely result from meat quantity loss caused by tick worry and the death of cattle from tick fever. The reduction in meat quantity associated with tick infestation is estimated from trials of Sing et al. (1983). Stock mortality resulting from tick fever is estimated using the relationships derived by Mahoney & Ross (1972). Only cattle in the extensive grazing regions are assumed to be susceptible to tick fever where vaccination of cattle is less widespread compared to extensive vaccination in south east Queensland.

Using the costing model, sheep roundworms are estimated to cost the Australian grazing industry $222M per annum, making this parasite the greatest constraint on the Australian grazing industry. The production losses attributable to roundworms are most apparent in high rainfall areas which facilitate the rapid development of parasite populations. Significant numbers of these parasites cause decreased wool and live weights along with increasing mortality. Lambs are the stock class that are most susceptible to production losses.

The oral administration of anthelmintics is commonly used to reduce the number of parasites within sheep. The labour and chemical costs associated with current treatment levels is estimated to total $81M. The production loss associated with this level of treatment is estimated to be $141M, of which wool quantity loss is estimated account for $81M. The significant loss of wool associated with roundworm parasitism and large gross value of wool production are responsible for the magnitude of this production loss cost. A case study illustrating the improved farm profitability resulting from improved internal parasite control is presented in the next section.

Sheep blow fly costs are estimated using the productivity and control assumptions presented in Simmer & Collins (1992, conference paper cited above). Total blowfly costs are largely attributable to the significant treatment costs. The extensive adoption of crutching, mulesing and labour in conjunction with mustering sheep for jetting resulted in labour being the major blowfly cost component. The costs associated with production losses costs only represent 19% of the total costs attributable to this parasite. Wool quantity loss, reduced fertility and mortality losses are the principal causes of this loss.

The costs of sheep lice are derived from the control practice and production loss estimates outlined in Taleb & Collins (1992, conference paper cited above). The use of chemicals to control lice is widespread in the industry and is estimated to cost $31M. The "other" cost category is associated with dip repairs and depreciation, downgrading of wool

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<tr>
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<th>Cattle</th>
<th>Sheep</th>
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<tbody>
<tr>
<td>Ticks</td>
<td>7</td>
<td>55</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>Worms</td>
<td>20</td>
<td>26</td>
<td>44</td>
<td>115</td>
</tr>
<tr>
<td>Lice</td>
<td>14</td>
<td></td>
<td>39</td>
<td>4</td>
</tr>
<tr>
<td>Blow fly</td>
<td></td>
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<tr>
<td><strong>Total cost ($M)</strong></td>
<td>132</td>
<td>222</td>
<td>169</td>
<td>161</td>
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</tbody>
</table>

Table 2—Annual cost of major livestock parasites in 1994 ($M)
quality due to chemical residue and the post dip mortality of sheep. The production loss attributable to lice infestation comprises the downgrading of fleece value due to cotting and reduced fleece weight. They are estimated to cost $55M per annum.

**REducing Livestock Parasite Costs: Sheep Roundworm Control**

The cost-benefit model can be used to investigate the potential for reducing the cost parasites inflict on the Australian grazing industries. To illustrate this function of the model, a case study is undertaken.

*Strategic sheep roundworm control*

There are a range of internal parasites that cause production losses in the Australian sheep flock. In the winter high rainfall area, medium stomach (*Ostertagia* spp.) and black scour worms (*Trichostrongylus* spp.) are the roundworm parasites of major importance. In the past, these roundworms have been treated with frequent application of oral anthelmintics to reduce roundworm infection levels and consequent production losses.

In response to concerns about the development of parasite resistance to anthelmintics in this region, the "Drenchplan" strategic drenching program was developed and launched in the winter rainfall region by the CSIRO Division of Animal Health, NSW Agriculture and the Pastures Protection Boards (Davidson, 1987). The program incorporated the strategic drenching of sheep during summer, provision of worm free or 'safe' pasture and the use of efficient drenches.

The profitability resulting from the adoption of the "Drenchplan" program for ewes and lambs are illustrated in Fig. 2.

The high production loss costs associated with lambs and ewes on traditional drenching programs are readily apparent in Fig. 2. Under traditional management of roundworms, sheep are often drenched with inefficient chemicals and placed on pastures with high roundworm populations. Compared to the strategic management program, sheep in the traditional management program are subject to higher levels of roundworm infection and consequently higher production losses. By adopting a strategic treatment program a farmer would increase farm profits by approximately $4.9 per lamb and $0.9 for adult sheep. The cost reduction is primarily a result of the reduced production loss assumed for the strategic management program.

To calculate the reduced cost from the adoption of strategic worm control treatment costs, production loss and livestock product prices are combined in a budget. Morris & Meek (1980) provide a background for calculating the farm profitability from improved parasite management and the Meat Research Corporation (1993) indicate how these budgets can be used to estimate the industry benefits from reduced parasite costs.

**Conclusions**

The cost-benefit model described in this paper has shown that the cost of parasitism in the Australian livestock industries is substantial. Of the 4 selected parasites, sheep roundworms inflict the greatest cost to the Australian livestock industries. The magnitude of production losses and widespread incidence of these parasites are largely responsible for the substantial cost. The significance of costs associated with any of the parasites does not however, warrant research into livestock parasite research. The ability of research to reduce the costs associated with treatment or production losses needs to be evaluated. A model such as the one described in this paper can be used to estimate the likely cost reductions associated with parasites. The model is contained in a Excel spreadsheet and is readily available.

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**References**


