A benefit-cost analysis of the mules operation to the Australian sheep flock

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Summary

This paper reports a benefit-cost analysis of the value of mulesing to Australian sheep producers. It was estimated that the average Australian sheep producer receives a benefit of approximately $1.84 per sheep each year from mulesing their lambs. If flocks did not routinely mules their lambs, it was predicted that they would need a significant increase in on-farm labour. The high cost of this labour would necessitate the use of alternative preventative measures, mainly chemical treatments, to prevent flystrike. This would significantly increase the total chemical residue load in the Australian wool clip.

Keywords

Mulesing, cost-benefit

Introduction

Outbreaks and the impact of blowfly vary widely across Australia and from season to season and flock to flock. There is a also multitude of control, treatment and prevention options available to Australian woolgrowers, and so making a realistic estimate of the value of the mules operation to the Australian wool industry is quite difficult.

To conduct this benefit-cost analysis, it was decided that an appropriate method would be to compare the impact of blowfly strike between flocks that use the mules operation versus those that didn't, in each of the 3 main woolgrowing regions of Australia. The costs of the alternative management options for each of these regions were then extrapolated across the Australian flock.

Materials and methods

Three model farms were constructed, reflecting an average sheep farm in each of the three main regions where wool is produced in Australia. The model farms followed a typical management calendar for each of these regions. Each model farm was designed to reflect the impact that flystrike has on these farms in a 'typical' year and the appropriate farm management responses to the risk of flystrike for each region. The annual blowfly control strategy for each model farm was discussed with woolgrowers living in these areas to ensure a representative model was constructed.

The size and flock structure for the three model farms was based upon a 'Profile of Australian Wool Producers' (Martin, 1998). Each model farm was a self-replacing flock in which all lambs were either mulesed to the 'best practice' recommendations for the area, or not mulesed (ie. there were 2 treatments options for each model farm). The details of the flock size and structure in each model farm are summarised in Table 1.

The withholding periods for blowfly treatment products were observed for each of the model farms and the prevalence of flystrike was not allowed to exceed that expected in a well managed flock in each region. It was also assumed that chemical treatments were fully effective, meaning that there was a negligible prevalence of flystrike once flocks were treated before or during a risk period.

The analysis did not account for the off-shears treatment for lice that was used by up to 30% of flocks in 1990. This would lower the prevalence of flystrike in those flocks still using this practice.

A cost was allocated to all management activities, animal health treatments and production losses that occurred for each treatment flock in each region. An MS-Excel spreadsheet model was then constructed to calculate the economic difference between the farm system that utilised mulesing to reduce the risk of flystrike, compared to a farm system that used other methods of blowfly prevention and control.

Costs

Wool prices were based on average long-term wool prices from mid-1991 to March 2001. The average fibre diameter for each flock was derived from the average for wool clips sold from each of the 3 regions (Martin 1998). The cost of crutching and mulesing were obtained from contractors in each region, and the costs of all chemical treatments were obtained from the Geelong Wesfarmers Dalgety's merchandise store in September 2000.

Table 1. Details of the flock structure and management of the 3 model farms.

	Model 1 - the high rainfall zone	Model 2 - the sheep wheat belt	Model 3 - the pastoral zone
Flock structure			
Ewes	1295	1480	2625
Wethers	740	185	1500
Hoggets	740	740	1500
Lambs/weaners	825	1295	1875
Total flock size	3700	3700	7500
Time of lambing	August-Sept	June-July	May-June
Time of shearing	Dec- Jan; hoggets first shorn in Oct	Aug-Sep; lambs are first shorn as hoggets in Aug	Feb-Apr; lambs first shorn the following year as rising 1 y.o.
Average fibre diameter	20µ	21µ	23µ
Lamb marking %	71%	86%	72%
Age ewes cfa[a] (yrs)	6	5	Rising 6
Age wethers cfa	3½	2½	3½-4

[a] culled for age

The economic loss suffered when sheep died from flystrike was valued at the expected farm gate price, plus the full fleece value of the sheep. Whilst struck sheep are likely to die when fleeces are less than full length, it is unlikely that a sheep of similar fleece value or length would replace the dead sheep. Therefore, a dead sheep with its' 'lost' fleece represents a significant opportunity cost. Dead lambs/weaners were valued at $13.

A farm labour was assumed to be worth $15/hr, based on an average annual wage of $30,000 per labour unit. It was assumed that the average labour unit worked 200 days a year for 10 hours a day (2000 hours).

Effect of flystrike on wool production and wool value

When a sheep is fly-struck, there are many effects on its wool production.

The amount of wool clipped off during treatment of flystrike is assumed to be 200 g of wool for adults and 100 g for lambs. The analysis assumed that 50% of struck sheep that are treated would have the affected area clipped. Adult sheep and lambs affected by blowfly strike were assumed to produce 200 g and 100 g less wool at the following shearing, respectively.

Sheep that are struck also produce wool of lower value. This loss is caused by several factors, including reduced staple strength and the physical appearance of the fleece. Occasionally, affected sheep will lose their entire fleece due to a break in the wool induced by the stress of flystrike and subsequent infection. The analysis assumed that all struck sheep that survived would lose 20% of their fleece value.

Fertility

Ewes and rams that are struck suffer from a loss of fertility. No cost was allocated for the impact this would have in a flock in each scenario.

Deaths
A variable number of sheep that are treated for flystrike will still die. With small flocks and vigilant owners, this figure will be lower compared to large flocks and/or less vigilant owners, or where the manager has more pressing farm responsibilities. Deaths in treated sheep were assumed to be 10% for all model farms.

Increased dags and crutching
Larsen *et al.* (1995) assumed that sheep with increased breech soiling ('dag') required significantly more labour to remove the dag prior to shearing. Their analysis demonstrated that the greater area crutched on more severely affected sheep removed more high value fleece wool, causing losses from decreased wool income. Increased dag also makes sheep more susceptible to breech strike. It was assumed that only sheep in the high rainfall zone suffered from these high levels of dag that required different management.

Inspection costs
An important activity for farm management during periods of flystrike risk is the regular inspection of all mobs at risk of flystrike. This is an important activity, as it enables the grower to treat affected animals, monitor the prevalence of flystrike and assess if chemical treatment of a mob is needed. The cost of inspection depends on the cost of farm labour and the time spent inspecting the flock. The cost varies considerably throughout the year, being highest when competing farm activities require labour when the risk of flystrike is high.

The inspection costs and time taken to inspect a flock of sheep was based on comments from the farmers consulted in each region. Significant variation in cost is likely to occur between farms and flocks, but the median of the estimated inspection and times and labour inputs into jetting treatments was used.

Results

The estimated benefits of mulesing for each model farm in the 3 regions are shown in Tables 1 and 2. There was a considerable benefit from mulesing reducing the required labour and the amount of chemical applied to the flock to control blowfly strike (Table 4).

The total sheep numbers in Australia were taken from the August 2000 projections of the Australian Wool Production Forecasting Committee. Sheep numbers in each of the three regions was then estimated from Martin (1998), and the benefits of the model farms extrapolated to the entire region (Table 5). A number of sources suggest that only 60% of eligible sheep are mulesed in Australia (cited by Beck *et al.,* 1985). This means that the estimated net benefit of mulesing for the entire Australian sheep flock is approximately AUD$100-130 million.

Discussion

Obtaining an accurate estimate of the benefit:cost ratio of mulesing is very difficult to determine. However, this study, using modeling of 3 typical farms in the major wool growing regions of Australia, has estimated the benefit at $1.84 per head per annum. This confirms the considerable benefit that the mulesing operation provides for the Australian wool industry, and the risks inherent in any moves to restrict the practice.

The highest benefit from mulesing was found to accrue in the sheep wheat belt.

Table 2. Estimated benefits from mulesing in 3 regions ($).

	High rainfall	**Wheat belt**	**Pastoral zone**
Per head	1.31	2.23	1.22
Per flock	4,831	8,251	9,136
Benefit: Cost ratio	10.8:1	13.2:1	12.6:1

Table 3. Benefit of mulesing for different sheep classes for each regional model farm ($).

	High rainfall	**Wheat belt**	**Pastoral zone**
Ewes	2.22	2.72	1.72
Wethers	0.71	0.39	0.52
Hoggets	0.27	1.44	0.87
Lamb/Wnr	1.60	3.13	1.35

Table 4. A summary of the benefits (%) of mulesing in each region (compared to flocks not mulesed).

	High rainfall	Wheat belt	Pastoral zone
Labour	34	25	30
Direct chemical cost	28	11	4
Production losses	37	62	65

Table 5. The benefit of mulesing across the Australian sheep population.

Region	Total sheep (million)	Benefit	
		Per head ($)	Per region ($m)
Pastoral	15.6	1.22	19.02
Sheep wheat	67.9	2.23	151.41
High rainfall	31.5	1.31	41.29
Total	115		211.7

This is due to the higher proportion of ewes in flocks in this area, a high cost of farm labor per sheep, more extensive farm operations and a high risk of fly strike.

The benefit was lower in the pastoral region due to the lower fly risk in these areas. However, the benefit will be considerably higher in this region in years of extreme fly risk, because sheep are unable to be mustered rapidly for jetting treatment, or easily inspected and treated in the paddock.

The value of mulesing was intermediate in the high rainfall regions of Australia. On farms in this area, significant numbers of sheep regularly become struck unless treated. Therefore, it is more common practice to routinely treat at-risk sheep before suitable periods for flystrike in these regions.

The main cost of increased flystrike in un-mulesed flocks was the increased demand on farm labour to manage the increased risk and prevalence of flystrike. Flocks with sheep that are not mulesed would need increased prophylactic treatment (jetting or spray-ons), and increased farm labour to monitor and treat struck sheep.

The impact of severe blowfly strike on individual affected sheep in un-mulesed flocks will be similar to affected sheep in mulesed flocks in the same region. This should remain the case whilst it is still cost-effective to treat and prevent fly strike in sheep flocks. However, there may be increased covert and early strikes in un-mulesed flocks before management responds with a preventative treatment, thus increasing the prevalence of affected sheep. A critical management factor in un-mulesed flocks would be more frequent inspection and rapid response with preventative treatments to limit the prevalence and impact of blowfly strike.

Importantly, in most years un-mulesed flocks would require a significantly greater amount of chemical applied to sheep, both for prophylactic and treatment purposes.

The benefit of mulesing accrues over the lifetime of the sheep. Thus, the longer a mulesed sheep remains within the flock, the longer the wool growing business accrues the benefit from the preventative effect of the mules. This analysis assumed flock structures where most ewes and wethers were retained for their commercial lives, which increases the estimated benefits of mulesing. In flocks where a higher percentage of sheep are sold as younger animals, the benefit of mulesing would be less.

Currently, there are no field populations of flies with resistance to the insect growth regulators. However, the increased frequency of use of chemicals against larger populations of flies may increase the selection pressure for chemical resistance amongst the blowfly population. This increased risk was not accounted for in this analysis.

If woolgrowers were unable to mules, they would need to make substantial changes to their farm management calendar to reduce the impact of blowfly strike. For example, crutching of daggy and stained sheep would have to be done earlier and the time of shearing would have to be selected to minimise the risk of flystrike rather than to optimise wool quality. The frequency of inspection for flystrike would also dramatically increase, especially during risk periods for strike. These changes would have significant costs, but were not included in this study.

The assumption that all hours of employment can be allocated a flat cost of $15/hr is an over-simplification. At many times, the true cost of farm labour is probably much lower, but in busy weeks of the year, where labour is scarce or other tasks are pressing, the true cost of labour is likely to be far higher. This is especially the case in the cropping belt where growers are often busy harvesting crops during the first fly wave of the summer period.

Another potential benefit of mulesing that was not considered in this analysis is the reduced speed of a flystrike epidemic compared to that in un-mulesed flocks. Fewer animals would be affected before the grower detected flystrike and responded with preventative treatment. The slower epidemic curve would allow a longer critical response time (‘window’) during which the effect of, and benefits from preventative treatment, remain near the optimum.

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