COSTS - BENEFIT ANALYSIS OF QUALITY ASSURANCE IN AUSTRALIAN WOOL PRODUCTION

Martin Bent[1], John Stanton[1], Anna Senior[2] and Lindy Coss[2]

[1] Muresk Institute of Agriculture, Curtin University

[2] Centre for Agribusiness Management, Muresk

Northam, Western Australia 6401

ABSTRACT

Low average returns to producers have been a feature of the Australian wool sector, particularly over the last five years. Quality assurance (QA) has been considered by many in the industry as a possible way to improve prices through increasing the "customer's" confidence in the product. Several QA schemes have emerged. Adoption has not been as widespread or as immediate as hoped. One of the incentives to adopt QA might be the expectation of a financial benefit. This paper presents the results of a survey into actual and anticipated costs and benefits of QA as perceived by adopting and non-adopting Australian wool growers and a statistical analysis of wool price differentials at auction that can be attributed to a QA mark.

Key words: quality assurance, wool, cost-benefit analysis

INTRODUCTION

Wool has been a major agricultural product in Australia for more than a century,. Its significance has waned slightly in the first half of the 1990s due to growth in other agricultural commodities (Table 1) and a decline in prices after removal of the floor price in 1991 (Figure 2).

For many years wool has been a principal export from Australia. In recent times its eminence has been eclipsed by grains, by minerals (particularly gold and iron ore) and by manufactured goods. Nevertheless wool still accounts for approximately 5% of total export income. Worth approximately $4.5 billion p.a., wool exports remain one of the more valuable groups of Australian exports.

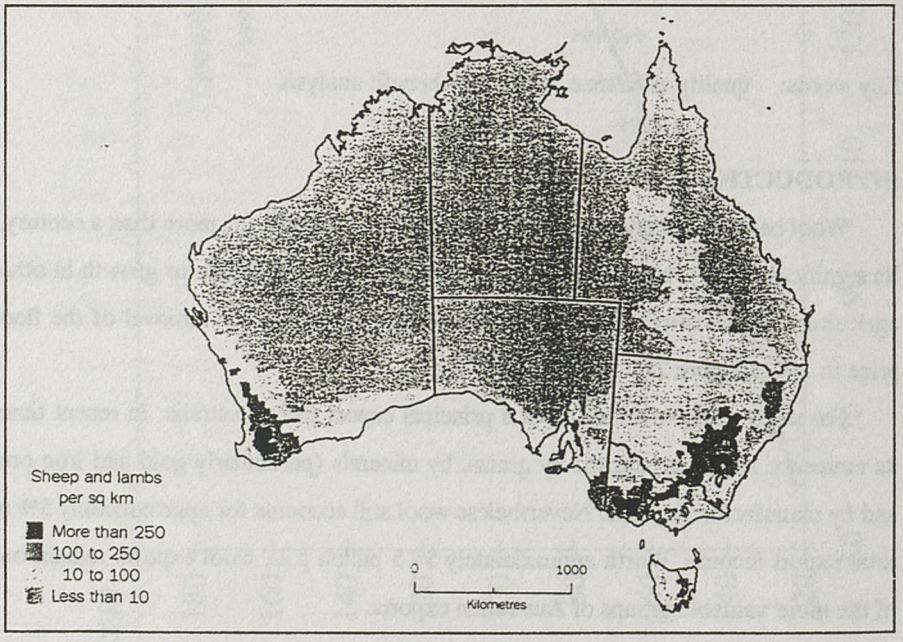
Table 1 Value of Australian agricultural commodities 1990 -96 ($Au billion)

Year	1991/2	1992/3	1993/4	1994/5	1995/6
Total Crops	9.08	9.87	10.74	11.52	11.13
Total Livestock (slaughtered)	5.72	5.74	6.03	6.85	6.62
Wool	4.18	2.98	2.57	2.45	3.32
All agricultural commodities	21.16	20.86	21.99	23.55	23.75

Source: McLenna (1997)

Wool production occurs over a substantial area in Australia (Figure 1). The Merino breed is predominant. These sheep are either run on large pastoral stations grazing principally on natural vegetation or they form an integral part of mixed cropping and pasture systems. Recent relatively low wool prices have meant that the role of the sheep flock has sifted to assisting in weed and disease control and maintaining soil fertility for the cropping enterprise. The emphasis on production of prime lamb for meat has increased.

Figure 1 Sheep and lamb distribution (Australia 1995)

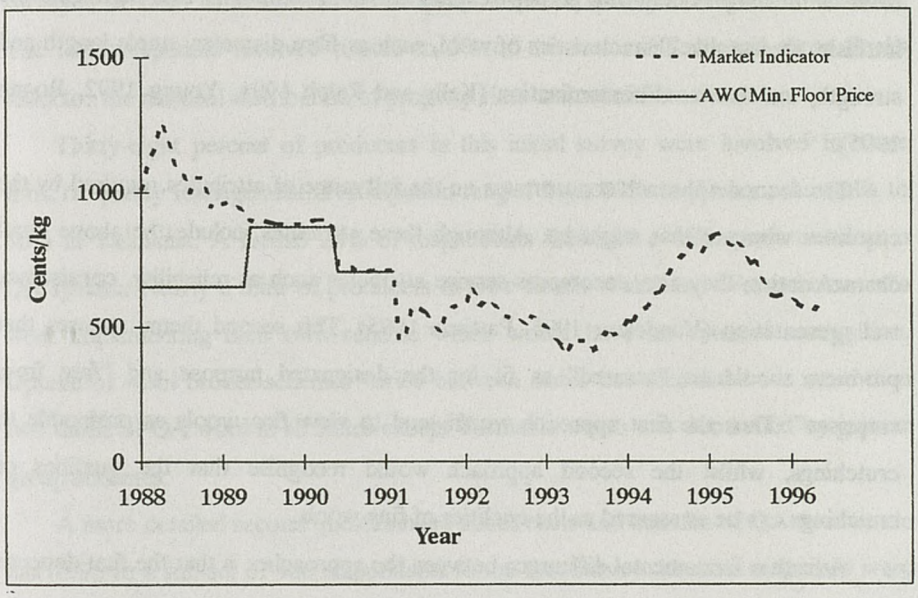


Source: McLenna (1997)

Economic performance

As with most enterprises, the profitability of wool production is sensitive to product prices. Throughout the late 1980s, the Australian Wool Corporation (AWC) guaranteed a minimum floor price for wool. In 1991, with large stockpiles of wool, this price support policy was deemed infeasible and the floor price was removed. Apart from a brief period around the start of 1995, wool prices have not returned to pre-1991 levels (Figure 2).

Figure 2 Australian indicator price for wool 1988-1996 (¢/kg)



Source: Westfarmers Dalgety (various years)

Table 2 Financial performance of sheep farms 1988-95 ($Au '000/farm)

Year	88/89	89/90	90/1	91/2	92/3	93/4	94/5
Return to capital & management	28	9	-33	-39	-31	-27	-16
Net farm income	51	37	-4	-8	-4	-1	10
Debt	86	98	99	115	118	137	123
Farm Capital	1,055	1,019	955	850	810	796	871

Source: ABARE (91-96) Australian Farm Surveys Report 1996 Canberra

The average effects of these low prices on profit margins, asset values and the debt levels of sheep producers across Australia are shown in
Table 2. These low profit margins have prompted consideration of strategies, including improvements in wool quality, for increasing the prices obtained for wool.

Quality Assurance

Unfortunately a consensus on what is meant by the term "quality" has been missing from the literature and from debate within the Australian wool industry. Two main themes are evident and perhaps explain the confusion. The first highlights the intrinsic, measurable characteristics of wool, such as fibre diameter, staple length and strength, and levels of contamination (Kelly and Ralph 1991, Young 1992, Rogan 1995).

The second approach concentrates on the full range of attributes required by the customer whoever that might be. Although these attributes include the above wool characteristics, they also encompass service attributes such as reliability, consistency and presentation (Vandeleur 1995, Pattison 1995). This second theme stresses that products should be "assured" as fit for the designated purpose and "free from surprises". Thus the first approach would tend to view fine wools as preferable to crutchings, whilst the second approach would recognise that the qualities of crutchings can be as assured as the qualities of fine wools.

A further fundamental difference between the approaches is that the first depends on measurements of samples of product whilst the second approach depends on the design of production and handling procedures to ensure a particular outcome.

A number of quality assurance (QA) schemes have been introduced into the Australian wool sector. The principal focus of these schemes has been to address the problem, which had been repeatedly emphasised by processors, of contamination by non-wool and dark wool fibre (Australian Wool Corporation 1993). Few of the current schemes are certified to internationally recognised standards, such as the ISO 9000 series or the equivalent Australian Standard 3900 series.

This paper presents some of the results of a study into the early uptake of QA in Australian wool production. The study was intended to assist the WA Wool Strategy Group in improving the adoption of QA. Some general lessons about QA may be drawn from this case study.

METHOD

An estimation of the costs and benefits of QA in wool was conducted in two parts. The first part was based on surveys of wool producers across Australia. The second part of the study involved detailed statistical analysis of data from wool auctions to determine the size of any price differential received for QA wool.

Survey of wool producers

Approximately 6000 members of the Kondinin Farm Improvement Group were surveyed in 1995 to determine the adoption levels of quality management schemes. The 1445 responses received related to 3% of the national flock and these flocks reflected the national distribution of property sizes and wool fibre diameter.

Thirty-eight percent of producers in this initial survey were involved in some form of quality management. Participation ranged from 29% in Western Australia to 50% in Tasmania. A further 24% of respondents indicated a willingness to adopt a QA system. Nearly a third of producers in New South Wales and Western Australia were implementing their own scheme which would have no external recognition. Uptake of wool broker schemes varied between states but accounted for more than two thirds of QA wool in all states except Tasmania which was dominated by grower group schemes.

A more detailed second questionnaire about costs and benefits of QA was sent in late 1995 to a sub-set of 400 respondents to the first survey. Useable responses were received from 145 QA adopters and 41 non-adopters. Respondents were categorised by flock size and proportion of farm income derived from wool as shown in Table 3.

Table 3 Distribution of flock size and farm specialisation in sample

	Flocks < 4000 sheep		Flocks 4000+ sheep	
	QA adopters	Non-adopters	QA adopters	Non-adopters
Wool marginal (wool <25% of farm income)	22	11	7	2
Mixed farming (wool 25-75% of farm income)	45	11	45	11
Specialist wool (wool >75% farm income)	7	3	19	3

Price benefits for QA wool

In common with other wool, QA wool has a range of measurable characteristics. Thus, whilst QA wool will command a range of prices because of this variation, a price differential may be anticipated between the price of QA and non-QA wools of a given specification on a particular day.

Data from auctions at Fremantle in Western Australia for the period January to July 1995 were selected for analysis. This period represented the only time when a reasonable number of QA sale lots had been auctioned. QA sale lots were differentiated from non-QA lots by finding "ClipCare" or "StaQuality" in the bale brand. Other QA lots could not be identified in the data base and were thus included in the non-QA population. The analysis was conducted only on lots sold at auction. Lots that were passed in or withdrawn and sales by private treaty were thus excluded from the analysis. There was an insufficient number of lots of Spinners and Average Topmaker styles present at Fremantle during this period, and only Best and Good Topmaker styles were analysed. In total, 10,700 sale lots were analysed over 31 sale days, of which 435 lots were identified as quality assured.

The analysis of prices was undertaken by first removing price differences due to wool characteristics using a modified version of the AWEx pricing model developed by Stanton and Coss (1995). The model was run on each day of selling to overcome market changes between days. Residual prices from QA and non-QA sale lots were then compared.

RESULTS

The costs of implementing a QA programme can be divided into (a) initial, or set-up, costs and (b) recurrent cost which will be incurred each year. Wool producers were asked to identify cost incurred (by QA adopters) or anticipated (by non-adopters) in the first year and in subsequent years of operating a QA scheme.

Initial costs

A substantial proportion of expenditure on modifying facilities, own / regular farm labour and training costs were identified as initial costs. Some of the own, regular farm labour was clearly a recurrent cost. Additional paid labour, packaging

and crutching cost were also categorised as recurrent. The distinction between these two categories was more marked in the anticipations of non-adopters than in the experiences of QA adopters, probably due to some set-up costs spilling over into the second year of operating a QA scheme.

A summary of initial costs (Table 4) clearly shows:

- economies of size, with costs per 1000 sheep lower on farms with larger flocks;
- non-adopters of QA anticipated much higher costs than the costs experienced by QA adopters. It is not clear from this study whether the early adopters adopted because they were confronted with lower costs or whether non-adopters were fully cognisant of the true costs of participation.
- some producers incurred or anticipated no extra costs of setting up for QA.

Table 4 Initial costs of QA

	Modifications		Regular farm labour		Training	
	QA adopters	Non-adopters	QA adopters	Non-adopters	QA adopters	Non-adopters
Average initial cost per holding - all farms	$ 694	$ 4392	$ 193	$ 433	$ 13	$ 204
Proportion of farms with cost	52%	73%	75%	76%	10%	29%
Average initial cost per holding - farms incurring cost	$ 1441	$ 6016	$ 256	$ 570	$ 133	$ 703
Average initial cost per 1000 sheep						
- flocks <4000 sheep	$ 378	$ 2670	$ 127	$ 424	$ 64	$ 438
- flocks 4000+ sheep	$ 210	$ 1183	$ 38	$ 70	$ 24	$ 65

The average costs of modifying facilities for adopters were strongly influenced by costs on two farms of $10,000 and $25,000. Although a slightly higher percentage of specialist farms incurred costs for modification, the modification costs per 1000 sheep were much lower than average principally because of the larger flock size but also because of the absolute level of spending per holding was lower (Table 5).

Table 5 Cost of modifying facilities by farm type

	Proportion of farms spending on facilities	Cost per holding	Cost per 1000 sheep
Wool marginal (wool <25% of farm income)	38%	$ 945	$ 466
Mixed farming (wool 25-75% of farm income)	53%	$ 1000	$ 274
Specialist wool (wool >75% farm income)	54%	$ 500	$ 84

Recurrent costs

Apart from the initial costs of QA, recurrent costs will be incurred every shearing or every year. In the first year these recurrent costs will be in addition to the initial set-up costs. Recurrent costs include costs of additional crutching, own farm labour, additional paid labour, extra packaging, other sundry items and any recurrent training.

The average recurrent costs per 1000 sheep experienced by adopters and anticipated by non-adopters are given in Table 6. It is notable that the percentage of each group incurring or anticipating a particular cost are reasonably similar. However the magnitude of the anticipated costs is at least twice as large as the actual costs experienced by adopters. This would seem to confirm the anecdotal reports that many adopters were surprised how much less they had to do to be accredited compared to what they had expected.

Table 6 Average recurrent costs per 100 sheep

	All QA adopters		All non-adopters	
	Cost per 1000 sheep	Percentage incurring cost	Cost per 1000 sheep	Percentage anticipating cost
Additional crutching	$ 92	38%	$ 317	56%
Own / regular farm labour*	$ 63	83%	$ 144	80%
Additional paid labour	$ 38	27%	$ 103	41%
Extra packaging	$ 29	28%	$ 67	29%
Other	$ 8	5%	-	-
Recurrent training	$ 5	10%	$ 37	29%
Average total recurrent costs	$ 235	84%	$ 667	83%

* regular farm labour at $10 per hour.

It should also be noted that about a sixth of both groups incurred or expected no recurrent costs. One reason for non-adoption given by some producers who anticipated neither initial or recurrent costs was that their broker did not handle QA wool. Clearly these producers did not think there was a sufficient price differential to prompt them to change broker.

Total Costs

The estimated total annual costs of quality assurance and the cost per kilogram of wool are given in Table 7. Total initial cost were amortised at a 5% discount rate to give an equivalent annual cost. Modification costs were amortised over ten years and labour and training costs were amortised over five years. Average cost per kilogram of clean wool appear to range from approximately 10¢ for QA adopters with larger flocks to 50¢ for non-adopters with small flocks. As these values represent averages within each group there will be producers with lower or higher costs.

Table 7 Total annual cost of QA

	Av. annual set-up costs (/1000 hd)	Av. annual recurrent costs (/1000 hd)	Total annual costs (/1000 hd)	Total annual costs (/kg clean wool)
All adopters in survey	$ 40	$ 240	$ 280	9.3¢
Adopters incurring costs				
- flocks < 4000 sheep	$ 100	$ 300	$ 400	13.3¢
- flocks 4000+ sheep	$ 40	$ 250	$ 290	9.7¢
All non-adopters in survey	$ 300	$ 670	$ 970	32.2¢
Non-adopters incurring costs				
- flocks < 4000 sheep	$ 550	$ 1000	$ 1550	51.7¢
- flocks 4000+ sheep	$ 200	$ 400	$ 600	20.0¢

Price differentials for QA wool

Although the analysis of price differentials paid for QA wool at Fremantle from January to July 1995 was inconclusive, positive price differentials of up to 10¢ per kilogram of clean wool were observed. It has been suggested that the limited volume and specification of QA wools at the early stages of adoption made it difficult for

buyers to assemble specified consignments comprising only QA wool (Stanton and Coss, 1996). The advantages of QA wool will decline dramatically if blended with non-QA wool.

Participants in the second Kondinin Group survey were not asked to quantify price differentials but were asked if they thought QA wool values would be unaffected, slightly higher (or lower) or significantly higher (or lower) in the first and subsequent years of QA (for methodological background see Bent and Buckwell, 1993). Less than 10% of respondents expected prices to be significantly higher, but more than 50% expected QA wool prices to be slightly higher. Based on these observations, the costs and benefits of QA wool production were compared (below) using positive price differentials of 10¢/kg (a "slight" increase of 2-3%) and 35¢/kg (an "almost significant" increase of 8-10%).

Other benefits of QA

The statistical analysis of price differentials was based on the concept of comparing wool lots with identical characteristics and attributing any difference to the "QA" label. This approach implicitly assumes that the measured characteristics of the wool clip do not change when QA is adopted. Whilst it is reasonable to assume that characteristics of the wool on the sheeps' backs do not change, it does not automatically follow that the characteristics within the bales stay the same. Widespread change in attitudes of all staff and improvement in clip preparation were recorded in the producer survey.

Whilst an analysis of additionally measured wool characteristics indicate no significant difference between QA and non-QA wools (Stanton and Coss, 1996), the issue of changes in clip preparation cannot be conclusively resolved through this type of cross-sectional analysis but requires longitudinal or paired case studies.

A third of surveyed producers pointed to further benefits of QA due to improvements in farm efficiency and more than 50% of adopters thought that wool shed efficiency had improved. These potential benefits of changes in clip preparation and production efficiency have been omitted from the following results.

Benefit : Cost ratios of QA

Benefit:cost ratios were calculated based on the above results. Benefits were assumed to be an incremental annual net cash flow of the price benefits less the recurrent costs. This cash flow was discounted over ten years at 5%. The costs were the initial set-up costs.

Four different benefit scenarios were assessed. In the first two scenarios, immediate price differentials of 10¢/kg and 35¢/kg were assumed. In the third and fourth scenarios, prices were assumed to rise to 10¢/kg over 3 years or to 35¢/kg over 6 years (Table 8).

Table 8 Benefit:cost ratios for QA

Price differentials from QA:-	Scenario 1 10¢/kg throughout	Scenario 2 35¢/kg throughout	Scenario 3 Rising to 10¢/kg over 3 years; 10¢/kg thereafter	Scenario 4 Rising to 35¢/kg over 6 years; 35¢/kg thereafter
Adopters incurring costs				
- flocks < 4000 sheep	0.6	11.5	-0.3	6.8
- flocks 4000+ sheep	2.8	27.5	0.7	16.7
Non-adopters incurring costs				
- flocks < 4000 sheep	-1.4	0.5	-1.6	-0.3
- flocks 4000+ sheep	-0.3	5.3	-0.8	2.9

A benefit:cost ratio of less than 1 indicates an unprofitable investment. With the current, occasional price differential of 10¢/kg (Scenario 1) it would appear that QA is only worthwhile, on average, for the large adopters. If this differential took three years to establish (Scenario 3), then QA would not be worthwhile for average adopters and non-adopters incurring or anticipating costs. A 35¢/kg price differential would appear to be sufficient to make QA worthwhile for all except the small, non-adopters even if the differential grew to this level over six years.

From Table 8 it appears that some have adopted QA even though it is likely to be unprofitable. Possible explanations for this apparently irrational behaviour include the value that these producers attach to some of the other benefits mentioned above. Also a number of producers stated that it gave them satisfaction to do the job well. Some adopters recognised that QA was not currently cost-effective. But they felt that the future viability of the Australian wool industry depended on a significant improvement

in the reputation and quality of the product. They were prepared to make a small personal sacrifice to ensure a future for the industry.

A benefit:cost ratio greater than 1 suggests that it would be profitable to implement QA. In some circumstances, failure to adopt can be rational. First, there may be alternative investments with either higher or more certain return. Improvements in pasture management, breeding or selection are seen by some as preferable investments. Second, the benefit:cost ratios evaluate QA over a number of years. For some, the initial cash requirements of implementation may be a major hurdle. This is likely to be more so for specialist producers who have been experiencing several unprofitable years without the cross-subsidies that can occur on mixed holdings.

Table 8 does not include those producers who incurred or anticipated no costs of QA for whom any price differential should make QA attractive. Some non-adopters who anticipated no costs stated that they had not adopted because their brokers did not operate a QA scheme.

CONCLUSIONS

A number of conclusions can be drawn from this study.

- Approximately a sixth of QA adopters and non-adopters incurred or anticipated no additional expenses for operating QA. Some of the non-adopters stated that their broker did not handle QA wool. Clearly a QA program has to be in place throughout the chain for benefits to accrue to the producer.
- Economies of scale are apparent. Average cost per sheep in large flocks (4000+) were about 70% and 40% of the costs in smaller flocks for adopters and non-adopters respectively.
- There are substantial differences between costs incurred by adopters and costs anticipated by non-adopters. Although early adopters are likely to be those who are confronted with lower costs, it is not clear how well informed non-adopters are of the costs of QA.
- Benefits of QA require further investigation. Price differentials should be monitored as QA wool makes up a larger proportion of total wool sales. Price

differentials across a range of styles require analysis. The benefits of improvements in clip preparation and farm efficiencies need further study.

- An immediate, small price differential of 10¢/kg would only appear to make QA attractive to those incurring no costs and to larger adopters. If the differential took three years to materialise, QA would not be worthwhile on average for adopters or non-adopters.
- A price differential of 35¢/kg would make QA worthwhile to all except the smallest non-adopters even if the differential grew to this level over several years.
- Potential economies of scale make larger producers the appropriate targets for promotion of QA. Adoption by larger producers will also speed up production of a critical volume of QA wool.
- The payback period for investment in QA varies depending on the magnitude and timing of benefits. To overcome short-term losses, cross-subsidy from other enterprises may be required. Mixed farms appear to be more appropriate targets for QA promotion than specialist wool producers. Other strategies to improve profit margins for specialist growers are probably required in the first instance.

REFERENCES

ABARE (1991-1996) *Australian Farm Surveys Report* (various years). Australian Bureau of Agricultural and Resource Economics, Canberra.

Bent, M (ed) (1993) *Livestock Productivity Enhancers - an Economic Assessment.* Wallingford: CAB International.

Bent, M and Buckwell, A (1993) *The Socio-Economic Effects of Bovine Somatotropin (bST) - A European Review* FBU Occasional Paper No. 20, Department of Agricultural Economics, Wye College.

Kelly, R and Ralph, I (1991) *Dissemination of results of raw wool marketing research, WA.* Wool Research and Development Corporation and Agriculture Western Australia.

McLenna, W (1997) *Year Book Australia*, Australian Bureau of Statistics, Canberra.

Pattison, R (1995) *The management of raw wool quality in the Australian wool industry.* Sheep and Wool Refresher Course, Agriculture Victoria, Melbourne.

Rogan, I (1995) *Wool quality - what is it really?* Australian Farm Journal (Wool) February.

Stanton, J and Coss, L (1996) "Identification of price benefits arising from the adoption of quality management". In *Quality Management in the WA Wool Industry*, - report to the Wool Industry Strategy Group, Centre for Agribusiness Marketing, Muresk. pp 19.

Vandeleur, P (1995) *Quality processes and their application in the wool industry*. Sheep and Wool Refresher Course, Agriculture Victoria, Melbourne.

Westfarmers Dalgety (1986-1996) *Annual Wool Digest*. Westfarmers Dalgety Ltd Research & Information Unit, Sydney, New South Wales.

Young, J (1992) *Wool quality : a grower's confession*. Proceedings of a national workshop on "Management for wool quality in Mediterranean environments", Agriculture Western Australia.

AUTHORS

Dr Martin Bent is Senior Lecturer in Agribusiness Management at Muresk Institute of Agriculture, Western Australia. He is currently seconded as CEO to the WA Pig Industry Investment Board. *Dr John Stanton* is Associate Professor of Wool Technology at Muresk Institute of Agriculture, Western Australia. He is currently seconded to the WA Wool Group of Agriculture Western Australia. *Anna Senior* and *Lindy Coss* were researchers at the Centre for Agribusiness Marketing, Muresk, at the time of this study.