MEAT & LIVESTOCK AUSTRALIA

OJD on farm

A Preliminary study on the potential cost at slaughter of OJD vaccination site lesions to the Australian sheep industry

National Ovine Johne's Disease Control and evaluation Program

Project number OJD.032
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ABSTRACT

This report presents the results of a pilot project to predict the risk of discounts being applied in Australia due to OJD vaccination site lesions as vaccine use expands. This includes a review of discounting in New Zealand as well as a preliminary survey of the prevalence of lesions and actual discounts applied to slaughtered vaccinates in Australia. Information from New Zealand suggests that the greatest discounts are applied to trimmed high value lamb carcases that are destined for export in whole carcase form as a result of downgrading to a lower quality grade. In Australia the greatest risk of discounting is likely to be in purebred merino lambs sold into the prime lamb market, but the low proportion exported as carcases would limit the discount applied. The prevalence of lesions observed was 18% for mutton and 65% for lamb carcases. The value of the trim removed was insignificant, the labour cost of its removal was nil and no carcase was downgraded to a lower value grade. However this study was conducted at a time of low sheep supply in carcases vaccinated at the recommended site and caution should be exercised in extrapolating these results to oversupplied market situations or in sheep vaccinated at alternate sites.

EXECUTIVE SUMMARY

This report assesses the risk of discounts being applied to slaughtered sheep carcases as a result of the presence of OJD vaccination site lesions as the use of vaccine expands to control the on-farm impacts of OJD in Australia. It reviews the literature on discounts as applied in New Zealand and examines the actual discounts applied to 20 sale lots of vaccinates slaughtered in Australia.

At the time the project was commissioned by MLA, vaccine use in Australia was limited but expanding. Anecdotal reports from New Zealand had suggested that discounting of vaccinates because of the existence of lesions was very real. It was therefore timely to assess the risk of a significant reduction in the value of Australian sheep meat if vaccination against OJD was to become widespread.

As expected there was little reliable objective survey data on the prevalence or degree of discounting in New Zealand due to vaccination site lesions. What is available suggests that the greatest discount is applied to trimmed high value lamb carcases that are destined for export in whole carcase form as a result of downgrading to a lower quality grade. However this is likely to overestimate the current discount in New Zealand as the proportion of both lamb and mutton exported as carcases has fallen significantly since this report was written. Despite this, anecdotal reports suggest that the perception of the risk of discounting is sufficient to limit the use of vaccine by the New Zealand industry.

In Australia a number of factors will act to minimise the degree of discounting applied to vaccinated carcases. These include; our ability to avoid vaccinating slaughter lambs due the greater use of crossbreeding in our lamb industry; the relatively small expected prevalence of lesions in vaccinated mutton carcases as a result of the long interval between vaccination and slaughter; and the low proportion of our sheep meat that is exported in whole carcases form. However the recent trend for pure Merino lambs to be slaughtered as prime lamb could mean that an increasing proportion of high value lamb will contain lesions that will require trimming. This trend should be monitored.

The results of the pilot survey support the conclusions of the review. The prevalence of lesions was high (65%) in lambs slaughtered within 6 months of vaccination but was low (18%) in mutton sheep vaccinated 12 months or more before slaughter. Despite this there was an insignificant value of carcase removed as trim, there was no additional labour cost associated with the trimming, nor was there any downgrading of trimmed carcases to lower value grades.

The results of this work will be of benefit to producers, processors and policy makers. It predicts that OJD vaccination site lesions will not be a significant cost to producers or the processing industry and will represent only a very small proportion of the total cost of OJD control by vaccination. However because of its preliminary nature this project examined only a small number of vaccinated sale lots in a market experiencing a severe undersupply of slaughter sheep. It is recommended that the processing industry's response to lesions be monitored at a time of better market supply. Further all sale lots were vaccinated at the recommended site high on the neck behind the ear and the costs may be greater if producers vaccinate at alternate sites. It is recommended that the importance of, and reason for, using the recommended site of vaccination be highlighted to producers.

ACKNOWLEDGEMENTS

We wish to acknowledge the contribution of producers, agents and abattoirs for their assistance in conducting this work. Many producers advised they were sending vaccinated sheep direct to slaughter with enough notice to allow co-ordination of data collection. When it was realised that insufficient sheep were being sent direct to slaughter local agents and sheep buyers co-operated in identifying and keeping separate sheep purchased at the local Bathurst and Blayney saleyards so that staff could attend the kill. Abattoir management and floor staff assisted with data collection on the chain without which this project would not have been possible.

Finally the technical assistance provided by Geoff Shanahan, a ranger at the Central Tablelands Rural Land Protection Board who attended several kills at short notice is gratefully acknowledged.

Table of contents

1. BACKGROUND AND INDUSTRY CONTEXT

Ovine Johne's Disease (OJD) first became an industry issue back in the early to mid 1990's, when producers in the tablelands region of NSW began reporting significant mortalities from the disease in their long term infected Merino flocks. Following an early call from some industry sectors to attempt to eradicate the disease by destocking infected flocks, a 6-year National OJD Program (NOJDP) was commenced in 1998 with the aim of determining the best methods for managing the disease at both the flock and industry level. As part of the NOJDP a trial to determine the efficacy of Gudair^{tm}, a killed *Mycobacterium paratuberculosis* (Map) vaccine was commenced in 1999 (Eppleston et al 2003). In addition to the trial the vaccine was supplied under permit to owners of heavily infected flocks that had been experiencing large OJD-related losses. Following encouraging results from the NOJDP-funded vaccination trial the product was registered in 2002 for use by the wider industry and since the completion of the NOJDP, vaccine use has been actively encouraged within industry as the only tool that that has the potential to significantly reduce the on-farm impact of the disease and the risk associated with the purchase of restocker sheep.

Results from the vaccination trial showed that the prevalence of both clinical cases of OJD and the shedding of Map is reduced by around 90% by vaccination at 2-4 months of age in heavily infected flocks. However one 'negative' outcome from this trial was the development of lesions at the site of vaccination. Two months after vaccination up to 50% of vaccinates had developed lesions, but the prevalence fell to around 20% by 2 years after vaccination, and remained at that level till the end of the trial when the animals were 4 years of age. Some of the lesions were large and ranged in size up to a diameter of 45 mm. Similar reports of vaccination site lesions (Collet and West, 2001) were available from overseas countries where vaccine had been used and some, particularly New Zealand, had reported that significant discounts were applied to vaccinates at slaughter as a result of these lesions.

As a result, when it was obvious that the use of vaccine was going to increase in Australia, MLA commissioned a review of the impact of vaccination site lesions on the value of vaccinates at slaughter in New Zealand and the potential for discounting to be applied in Australia. In addition a preliminary survey into the prevalence and actual costs of lesions in the Australian sheep meat industry was conducted. The results of this review and survey are provided in this report.

2. PROJECT OBJECTIVES

The objectives of the project as listed in the trial contract are as follows;

1. Review the major market sectors for Australian sheep meat, their potential for discounting due to the presence of vaccination site lesions and to estimate the likely number of carcases entering those markets now & in the future.

2. By December 2003, 30 sale lots of adult vaccinates destined for export & domestic mutton markets and 3 sale lots of vaccinated lambs (if available) will be assessed at slaughter to determine the prevalence of vaccination site lesions and the degree of any discounts that are applied due to either carcase trimming or market diversion.

3. PART 1 – REVIEW OF THE POTENTIAL FOR DISCOUNTING DUE TO VACCINATION SITE LESIONS IN THE AUSTRALIAN SHEEP-MEAT MARKET.

3.1 Background

Reports coming from New Zealand in particular suggested that there may have been significant discounting at slaughter of sheep carcases previously vaccinated against OJD. However most of this information was anecdotal in nature and few reliable data sets collected from scientifically designed surveys were available. Given the significant differences between the sheep industries of the two countries a literature review was conducted to determine the real impact of lesions in New Zealand and to compare and contrast the New Zealand and Australian sheep industries in an attempt to determine whether the lesions resulting from the increasing use of Gudair^{tm} in Australia were likely to become a major cost to our industry.

Because a traditional literature search using libraries and the internet produced few published reports of the impact of lesions, direct contact with the New Zealand industry, including industry representative organizations, abattoirs and suppliers of veterinary vaccines was necessary. In Australia a small phone survey of sheep abattoirs in south eastern NSW was conducted during 2003 to determine their experiences to-date and attitudes to handling vaccinated carcases.

The review was submitted to MLA in September 2003 as Milestone 2. It is reproduced below.

3.2 Introduction

Gudair^{tm} vaccine was registered for use in Australia for the control of OJD in April 2002 and its use is expanding within the Australian sheep flock. Its usage is likely to continue to expand as OJD policy changes to encourage vaccination as a means of controlling the disease, particularly in the high prevalence regions.

While the current vaccination trial (MLA 009 – Eppleston et al, 2003) has indicated the value of the vaccine for controlling OJD in Australia, one disadvantage following its use has been the development of persistent lesions at the site of vaccination. The existence of vaccination site lesions has been reported previously overseas in sheep and cattle.

Lesions could represent a cost to the sheep industry either on-farm or at slaughter. On-farm, anecdotal evidence indicates that there are no apparent detrimental effects of lesions even though the possibility exists for fly strike in the small proportion of lesions that subsequently break open. Although some shearers have reported that vaccinated sheep are sensitive over the injection site when shearing the neck region, no reports of the lesions interfering with shearing have been received. At slaughter however additional trimming of carcases and market diversion because of vaccination site lesions and the presence of TB-like enlarged pre-scapular lymph nodes has been reported in New Zealand with JD vaccines.

This review aims to document the magnitude and extent of discounts due to vaccination site lesions in New Zealand, and to use this information to predict whether similar discounts could be applied either now or in the future in the Australian sheep meats market. This information together with the survey component of this project should provide the sheep industry with objective information on the potential for carcase discounts due to vaccination site lesions.

3.3 The nature of the injection site lesion

The development of lesions at the injection site following vaccination against JD has been recognised in sheep and cattle for many years (Sigurdsson and Tryggvadttir, 1949; Doyle 1964; Chiodini et al 1984). Both live and attenuated strains of *Mycobacterium Paratuberculosis* (*Map)* have been used in vaccines

for the control of JD in farm animals but there appears to be little difference in the pathology of lesions induced by the two types (Collet and West 2001). All paratuberculosis vaccines however have used oil-based adjuvants to better elicit an ongoing immune response in treated animals. Oil is non absorbable and an irritant which serves to increase antigen persistence by causing the development of lesions at the injection site (Hope, 1995). Indeed some authors have proposed that the development of an injection site lesion is a pre-requisite for effective immunity (Doyle, 1964).

Two types of lesion can develop following vaccination with JD vaccine

– in the tissue surrounding the site of vaccination itself, and

– in the lymph nodes draining the injection site, particularly in the pre-scapular region.

Both types of lesion have been investigated and described (Collet and West 2001). Macroscopically the injection site lesions consist of walled-off cavities filled with thick creamy pus-like material (Figure 1). When cut open on the abattoir chain this material can closely adhere to the surrounding carcase tissue requiring additional washing for its removal. These lesions can often migrate away from the primary injection site and involve deeper muscle and connective tissue often in close apposition to the transverse processes of the cervical vertebrae (Johnstone, 1992).

The pre-scapular lymph nodes on the side of vaccination can be significantly enlarged weighing up to 10 times the weight of nodes from the opposite side (Collet and West 2001). Histologically, both the injection site lesions and the enlarged draining lymph nodes consist of fibrocaseous nodules with foci of granulomatous inflammation containing areas of amorphous necrotic debris and oil droplets. The oil droplets often contain acid-fast organisms.

Both injection site and lymph node lesions have implications in terms of potential carcase discounts. Both can require carcase trimming to remove the contaminants contained in the lesion, and where carcases are sold whole, for aesthetic reasons. Enlarged lymph nodes can also be mistaken for tuberculosis lesions and for exporting countries where TB has not been eradicated, such as New Zealand, removal of these lesions before export is a critical quality issue necessary for avoiding costly trace back investigations from export markets.

3.4 The nature of carcase discounts

The total cost to a sheep industry of vaccination site lesions at slaughter can in simple terms be considered as the product of 3 factors;

the magnitude of the discount applied to affected carcases,

the proportion of carcases entering the market that are vaccinated, and

the prevalence and severity of lesions on vaccinated carcases.

It is difficult to collect accurate data on any these statistics. The New Zealand Food Safety Authority indicate that carcase downgrades and trimming are a quality issue to be managed by the meat processing sector and that no statistics are available on the magnitude of additional trimming due to JD vaccine lesions in New Zealand (Clear, pers. comm.). R Campbell (pers. comm.) reports that there is considerable variation in risk management strategies within the New Zealand processing sector. For example Canterbury Meat Packers take a no risk approach and have a policy of not accepting vaccinated sheep for slaughter. Other works will accept vaccinates but use a vendor declaration system to flag the need for additional inspection for vaccinated lines. Feedback from representative bodies in New Zealand (Meat NZ and Meat Industry Associations) would indicate that from their perspective there is little problem associated with lesions on carcases.

In general, discounts could be applied in several ways. Carcases could be diverted to another lower value market, or the additional trimming required in the abattoir to remove the lesions may generate either a reduced sale weight on which animal value is calculated, or generate an additional labour cost of

trimming. If the sheep are owned by the abattoir following purchase in the saleyards or paddock, the labour cost of trimming if small would be most likely absorbed by the abattoirs. In the event of lesions becoming a significant issue, abattoirs could allow for the additional processing cost in the price they offer producers. On the other hand, if the sheep were sold over-the-hook and were still owned by the producer the cost could be easily passed directly back to the producer in additional processing charges.

The average discount applied is likely to vary considerably depending on factors such as whether the product is high value lamb or lower value mutton, whether the product is intended for export or domestic consumption, whether the carcase is sold whole or as cuts, and on the degree of trimming normally carried out by the abattoir. Discounts are also reported to vary between works and within works at different times (West, pers. comm.)

3.5 The impact of lesions on carcase value in New Zealand

3.5.1 Historical aspects

Neoparasec, a JD vaccine manufactured in France using the live Weybridge strain of *Map* was first licensed for use in New Zealand in 1987. The then suppliers, May and Baker (now Rhone Merieux), advised producers that injection site lesions could occur but at that time it was envisaged that only restocker lambs would be treated. However farmers and meat processors became concerned following the adverse effects that were appearing in vaccinated lambs being sent for slaughter in the years following its registration (de Lisle and Montgomery, 1988).

Most slaughter lambs produced in New Zealand are bred in self-replacing Romney based flocks so that farmers retain some replacement ewe lambs and send the remaining ewe lambs and all wether lambs to slaughter. Neoparasec was initially registered for use in lambs at marking at 2-4 weeks of age and at this early age farmers could not identify replacement lambs so often all ewe lambs were vaccinated. This of course resulted in vaccinated lambs entering the high value export lamb market.

As a result, several actions were taken to minimise the number of vaccinated ewe lambs being sent for slaughter (Rhone Merieux 1994). Firstly, the recommended maximum age of vaccination was extended to 4 months, which in general allowed farmers to vaccinate at weaning when they were better able to identify replacement ewes. Secondly additional advice was provided to minimise lesion development. This included recommendations that the vaccine be injected subcutaneously and not intramuscularly, and administered high on the anterior neck where lesions can be more easily trimmed. Thirdly regulations requiring farmers to sign a ‘contract to use’ and to identify vaccinated sheep with a distinctive earmark was introduced in 1993. Additionally farmers were required to notify abattoirs when a line of vaccinated sheep was sent to allow for extra inspection and trimming of carcases.

Anecdotally, farmers also responded by not vaccinating their flocks preferring to live with the losses associated with OJD rather than the impact of vaccination site lesions at slaughter (West, pers comm.; Florence, pers comm.). In general losses reported in New Zealand flocks, especially those based on British breeds, are lower than those reported in Australian merino’s so that the cost of the disease is smaller than in Australia (Bush et al., 2003; West and Thompson, 2003). Marshall (2000) reports that many New Zealand veterinarians feel that injection site lesions are a major limiting factor preventing wider use of vaccine.

Gudair^{tm} was registered in New Zealand in 2001 and at the time of writing Neoparasec had been withdrawn from the market. This change may well reduce the impact of vaccination lesions in New Zealand lamb further as Gudair was registered without a maximum age of administration so farmers can now vaccinate later after they have made their selection decisions. However this may also reduce the efficacy of the product.

There is only one report comparing the lesions resulting from vaccination with Neoparasec and Gudair (West and Thompson, 2003). In that trial, lambs from a British breed flock and a Merino flock were vaccinated with either Gudair or Neoparasec and lesions were monitored for prevalence and size over the 5 years of the trial. No difference between the 2 vaccines was reported in terms of the prevalence of lesions but the mean size of lesions was smaller in sheep treated with Gudair from 13 months post

vaccination (pv) in the British breed flock but no difference was detected in the Merino flock. As most lambs are killed before 13 months of age this will be of little benefit in vaccinated slaughter-lambs but there may be smaller lesions on vaccinated mutton carcases, at least in crossbreds.

3.5.2 The magnitude of discounts reported in New Zealand

There are frequent anecdotal reports from New Zealand suggesting that the discounts applied to some vaccinated sheep can be significant. However there are very few published reports of the magnitude of this discount.

In a major report to the New Zealand livestock industries on the cost of JD control options, Brett (1998) reviewed current information on the cost of lesions at slaughter. In that analysis Brett used information from the only known study of discounts applied to JD vaccinated carcases in New Zealand (Buchanan et al., 1998). In that report Buchanan examined the impact of lesions on only 2 slaughter lines, one of 82 lambs and one of 97 ewes. Of the 82 lambs only 10 (12%) required trimming and only 2 of these (2.4%) were downgraded. Of the 97 ewes, 33 (34%) were trimmed and only 9 of these (9%) were downgraded. In terms of cost the average discounts applied to the downgraded lamb and ewe carcases were $8.54 and $9.23 per downgrade respectively.

In another report Anderson and Whitford (1998) calculated the cost of a clostridial vaccination site lesions on the neck of 3 sale lots of Romney lambs through a New Zealand export works. In this study 11 to 64% of carcases were downgraded to a lower grade resulting in a discount of $12 to $15 per carcase downgraded. While these lesions were not due to JD vaccination it illustrates the potential for discounting in the New Zealand lamb market as a result of carcase downgrading due to vaccination site lesions and agrees with the magnitude of discounts reported by Buchanan et al. (1998).

In Buchanan's survey the cost of trimming was calculated as the labour cost of an additional trimmer and represented about 7 cents per head in the line. If all vaccinated sheep cost an additional 7 cents per head to slaughter then this would represent a significant cost to industry. However it is not clear whether this cost as reported by Buchanan is representative for all New Zealand industry. In Australia most export works routinely trim carcases heavily and it is likely that most of the lesions would be removed during this process and the 2 major sheep export works in NSW (Goulburn and Dubbo) have indicated that from experience to-date they would not need to employ additional staff for this purpose (Table 3).

While these discounts are significant it should be emphasised that they cannot be used as a reliable measure of average discounts applied in New Zealand. One slaughter line each of ewes and lambs cannot be considered representative especially given the variation that is reported to occur both between and within abattoirs (West, pers comm.; Peterson, pers comm.). A survey involving more sale lots over a larger number of abattoirs throughout the year is required to determine the real level of discounts applied in New Zealand, but as this is unlikely to occur anecdotal evidence from industry personnel and representative bodies needs to be considered.

3.5.3 The proportion of carcases discounted

In general, downgrades are only applied to animals destined for export in the form of whole carcases (Brett 1998). Carcases that are to be traded as primal cuts or boned out product would not be discounted in cents per kilogram applied to the whole carcase but would attract only minimal losses due to the additional trimming. Using data on the prevalence of downgrading in Buchanan's small survey and the proportion of carcases likely to be exported in whole form, Brett (1998) estimated that only 3.5% of cull lambs from dual purpose flocks, 10% of Merino lambs and 4% of all cull ewes would be discounted to the level reported by Buchanan. For carcases destined for the domestic market or for export as chilled cuts she concluded that they would only receive a small discount due to trimming and did not include it in her analysis.

Brett modelled the impact of vaccination using 1997 data, which indicated that 30% of lambs and 39% of mutton were exported in carcase form. The proportion of carcases discounted is likely to be considerably lower now as the proportion of lamb and mutton exports that are exported as whole carcases is falling in New Zealand. Most lamb exported in carcase form goes to the EU market, but the proportion of total lamb

exports shipped as unprocessed carcases has fallen from over 90% in 1970-71 to about 10 percent in 1999-2000 (MWESNZ, 2000). In the 12 months to September 2002, carcases made up only 7% of lamb exports continuing a trend towards the export of higher valued chilled product at the expense of whole carcases. There has been a similar reduction in the proportion of mutton exported as whole carcases. In 1999-2000 only 14% was exported in carcase form compared to the 39% Brett used in her analysis.

Brett concluded that for both dual purpose and Merino flocks the level of carcase discount will affect the economics of vaccination and without discounts it is economic to vaccinate when losses reach 1% compared to 2% when discounts do occur. However there may well be premiums paid for vaccinated stock destined for restocker sale, so the impact of vaccination on sheep value may well be beneficial in some markets.

3.6 Factors likely to affect the impact of vaccination site lesions at slaughter in Australia

Given the lack of objective information on the real cost of vaccination lesions to the New Zealand industry it is difficult to predict the potential impact in Australia as vaccination use increases. However there are similarities and some differences between the industries in the two countries that can be used to assess the potential impact. As discussed previously the total cost of vaccination lesions to the Australian sheep industry is dependent on the magnitude of discounts applied and on the number of carcases carrying lesions that require trimming. The number of carcases requiring trimming is in turn dependent on the number of vaccinates entering the slaughter market and the prevalence and severity of lesions they contain.

3.6.1 Factors affecting the magnitude of the discount applied

Based on New Zealand experience significant discounts are applied only when carcases that are destined for export whole are downgraded to a lower grade. There would appear to be 2 reasons for this; the poor appearance of carcases that have undergone extensive trimming, and a second driver in the New Zealand context is the likelihood that the lesions will be mistaken for TB on export markets.

Australia ships a similar proportion of its sheep meat exports in whole carcase form to New Zealand (see Tables 1 and 2). In terms of shipped weight, in 2002/03, 12 % of Australia's lamb exports and 28% of its mutton exports were in the form of whole carcases compared to New Zealand where 9% of lamb and 14% of mutton were in carcase form. Data on the number of carcases could not be obtained but in Australia with average carcase weights of around 20 kg, this represents approximately 650,000 lamb and 2 million mutton carcases. Consequently in terms of carcase exports there would appear to be a similar potential for the downgrading of whole carcases as occurs in New Zealand, particularly in the higher value lamb export market. However, Australia differs from New Zealand in that our livestock industries have undergone a tuberculosis eradication program and were declared TB-free from the early 1990's. While this does not eliminate the need to ensure that exported carcases are free of blemishes and lesions it may mean that it is less likely that importing countries would activate trace backs if lesions did escape detection prior to export.

For the remainder of the lamb and mutton kill, only the cost of additional trimming will apply in Australia and as noted in the New Zealand literature this discount is likely to be small. However if a high proportion of lamb and mutton slaughtered is likely to require trimming the meat-processing sector may react, particularly in times of plentiful supply of slaughter animals. The fieldwork component of this project (OJD.032) will better estimate the cost of additional trimming, but to date the major exporters have indicated that this will be small.

A small survey of the major sheep abattoirs in south eastern NSW (where most vaccine has been used) was conducted to determine their experience and attitude to the risk of vaccination lesions entering their processing chain. The results are presented in Table 3. In general, abattoirs that had knowingly killed vaccinates had not seen a problem on the kill floor. The exception was Fletchers who reported 2 incidences of poorly vaccinated sheep and they stressed the need to educate farmers to vaccinate using current recommendations especially for site of injection. All thought that their existing QA system for

removing carcase blemishes would take care of carcases JD vaccination site lesions and that no additional labour would be needed. For example, Fletchers routinely removes all pre-scapular lymph nodes and exports no whole carcases. It was interesting that Young abattoirs mentioned the high QA standards of their Pastoral Prime brand into premium domestic markets and Harden abattoir seemed very aware of the high standards required by their US market and repeatedly mentioned their 'no risk' OJD status. All works however indicated that they would monitor the impact closely as the proportion of vaccinates killed expands.

3.6.2 Factors affecting the number of vaccinates entering the market

The number of lambs vaccinated in Australia will depend on many factors, particularly the future direction taken by the industry in managing the disease. At present it would appear likely that regulatory controls will be reduced and producers will be asked to take more responsibility in adopting strategies to manage the impact of infection. There would appear to be 2 drivers for producers to adopt a vaccination program - disease control or prevention, and access to proposed trading benefits. If full deregulation is adopted this may well mean that only the disease control driver will operate with perhaps less vaccine used. On the other hand such a policy may well result in spread of the disease to more of the national flock meaning that a higher proportion of flocks will need to use vaccine to control the effects of the disease. The impact of these changes on the uptake of vaccination is unclear and is beyond the scope of this review. It is however reasonable to conclude that in the medium term a higher proportion of the Australian flock will be vaccinated than is the case at present.

Sergeant (2003) has calculated that at current vaccine prices the point at which producers are likely to adopt vaccination is where mortalities exceed 4% per annum. As mortalities due to OJD appear to be higher in self-replacing merino flocks and often exceed this level (Bush et al. 2003), it is likely that most vaccine will be used in self-replacing merino flocks. Wether wool producing flocks and crossbred ewe flocks particularly in a deregulated environment would not be expected to adopt vaccine at a high rate due to the small losses generally associated with these enterprises.

Traditionally the majority of lamb slaughtered in Australia is derived from crossbred production systems where only first cross (border leicester x merino) ewe lambs are likely to be vaccinated. All wether crossbreds and 2nd cross ewe lambs will be killed as lambs and will not be vaccinated This differs from the purebred lamb production system in New Zealand where a high proportion of ewe lambs are vaccinated before they can be differentiated into slaughter and breeding replacements.

However there is a current trend towards utilising purebred merinos for meat production. Historically only a small proportion of pure merinos entered the lamb supply chain, however this proportion has increased steadily so that in 2003, 4 million or 25% of the 16.5 million lambs killed in Australia were purebred merinos (Ball, pers comm.).

Often the supply of purebred merino lambs for slaughter has been opportunistic depending on good seasons in traditional merino raising areas of Australia. However more recently there have been several reasons to conclude that this proportion may increase in the future. These include low wool prices and high lamb prices resulting in an increasing percentage of income from sheep sales compared to wool, increased genetic selection for meat traits in Merinos and an increased use of dual purpose type merinos such as Dohne's, South African Mutton Merinos, and Dorpers.

Increasingly purebred merino breeders are electing to intensively finish wether lambs for sale at 10 to 12 moths of age (Ball, pers comm.). These animals are likely to be sold in the high value North American export market because Merino lamb can be grown out to the high carcase weights needed for this market without becoming over fat. However often the decision to sell these lambs for slaughter is not made until the animals are 6 months of age at a time when JD vaccination would have already occurred.

Due to these reasons it is likely that there will be an increase in the proportion of lamb carcases requiring trimming of JD vaccination site lesions into the future. Whether this translates to a significant cost to industry will depend on the cost of this trimming. At present where extensive trimming is routinely practiced and most lamb is exported in value added processed form rather than as carcases the discount associated with trimming is likely to be low.

In terms of the mutton trade it is almost certain that there will be an increase in the number of vaccinates entering the market. However most will be slaughtered as CFA animals 5-6 years after vaccination when the prevalence of lesions would have fallen, they would have been trimmed heavily for export in non-carcase form, or used domestically in the processed food trade. As a result any increase in costs as a result the projected increase in vaccinates entering the mutton trade should not be great.

3.6.3 Factors affecting the prevalence and severity of the lesions in vaccinates

Several factors may influence the prevalence and size of lesions in vaccinated carcases, which in turn will affect the proportion of vaccinated carcases requiring trimming and potentially attracting a discount. These include; time since vaccination, vaccination technique and site of vaccination.

Time since vaccination: In Australian Merinos the prevalence of lesions following vaccination with Gudair^{tm} declined from around 42% at 2 months post vaccination (pv) to become stable at around 20% from 12-30 months pv, however the mean size of the residual lesions did not decline with time (Eppleston 2003). In New Zealand West and Thompson (2003) report a reduction in size of lesions in a British breed flock but not in a merino flock. This reduction would simply suggest that a higher proportion of vaccinates sold as lamb would require trimming than those sold later as mutton.

Vaccination technique: Standard recommendations for vaccination hygiene such as the use of sterile equipment, the use of clean facilities and avoiding treating wet sheep are provided to producers. However the lesions reported following the use of JD vaccine are usually associated with the adjuvant and so these recommendations cannot reduce lesions of non-infectious origin. It is however important that producers follow good vaccination hygiene to minimise site lesions due to infection.

Site of vaccination: Gudair is registered for administration subcutaneously high on the neck and it is important that producers comply with this recommendation. At this site abattoirs are able to readily locate and remove lesions from a low value part of the carcase, and at this site the draining lymph nodes are located in the pre scapular region and these are routinely removed in many export works. If producers use an alternate injection site trimming of higher value product and other lymph nodes may need locating and trimming at a greater cost. Roger Fletcher (pers, comm.) has suggested that the importance of using the recommended site of injection should be highlighted to producers in extension material.

Vaccine suppliers recommend that subcutaneous injection will minimise the size and prevalence of lesions and short needles of only 6 mm are recommended to minimise the risk of penetrating into the muscle layer. However there is little data to support this and indeed Sigurdson (1949) noted that lesions infiltrated deep into underlying muscle despite subcutaneous administration and appeared to be related to dose of antigen. Marshall (2000) surveyed New Zealand veterinarians and found that while some believed that subcutaneous injection was important for minimising reactions others claim significant lesions develop even after they practice utmost care in vaccination technique.

3.6.4 Live sheep trade

The export of live sheep is a small but valuable market for Australian slaughter sheep with 6 million sheep valued at $400 million being sent live to the Middle East in 2002 (LiveCorp 2003). The potential for JD vaccination site lesions to affect this trade would appear small. Prior to shipping, any sheep with discharging lesions would be rejected prior to departure but this would be most unlikely due to the interval since vaccination in these 4-year-old plus sheep.

In terms of the destination market, the live sheep industry considers that small numbers of fibrous lesions would be of no concern but if large drafts of animals were detected with lesions there may be some adverse comments from buyers(A Brightling, pers comm.). This would be a quality issue to be managed by the industry and according to Brightling it would be unlikely that these sheep would be discounted. Previous complaints from export markets because of cheesy gland abscesses did not result in product discounts.

In terms of the number of vaccinates likely to enter the trade, most of the sheep exported live are Merino wethers generally sourced from Western Australia, western Victoria, South Australia and the Riverina.

However because of the recent drought sheep are likely to be sourced from all areas of Australia for several years into the future and any increase in vaccine use in these areas should increase the proportion of vaccinates being exported. However, because of the age of wethers exported only around 20% of these would be expected to carry lesions and it is unlikely that these would cause any additional cost to the live sheep trade.

3.7 Conclusions

The cost to industry of JD vaccination site lesions is determined by both the average discount applied and the proportion of carcases discounted. While there have been many anecdotal reports from New Zealand of the significant impact of JD vaccination site lesions on carcase value, there have been very few published reports documenting their monetary impact. Discounts of $9 per head have been reported in the form of whole carcase downgrades in extensively trimmed carcases destined for export in whole carcase form but there is no reliable survey data documenting the range or average discounts applied in that country. Further, downgrading occurs in only a small proportion of export carcases and carcases used domestically or exported in cut form that require trimming attract only minor discounts due to trimming. Despite this, anecdotal evidence from the New Zealand industry and veterinary practitioners suggests that vaccination site lesions have been considered a problem in that country.

In Australia, most vaccine will be used in Merino flocks because mortalities are greater in these flocks and few of our crossbred slaughter lambs will be vaccinated compared to New Zealand. The increased proportion of vaccinated mutton carcases is unlikely to cause a problem because of the interval since vaccination, the low proportion exported as whole carcases and the high degree of trimming in export works. However it is likely that in the medium term an increasing proportion of slaughter lamb will come from purebred Merinos increasing the prevalence of vaccinates entering the lamb market. It will be important that producers follow the recommendations for vaccination, particularly the site of treatment to allow abattoirs to locate and trim the few lesions that may occur.

3.8 Tables and figures

Table 1. Australian sheep meat production – 2001/2002

Market	No. head (x 10^6)	Weight produced (kt)	Weight exported (kt)	% exported	% exports in carcase form	Main destinations
Lamb	17.4	349	118	34%	12%	US 30%, EU 12%, PNG 12%
Mutton	14.5	276	166	60%	28%	S Arabia 30%, S Africa 23%, US 16%
Live export	6.4					

Source: Australian Commodities June 2003

Table 2. New Zealand sheep meat production – year ended 30 September 2002

Market	No. head (x 10^6)	Weight produced (kt)	Weight exported (kt)	% exported	% exports in carcase form	Main destinations
Lamb	24.7	414	299	82%	9%	EU 53% N Amer. 15% N Asia 15%
Mutton	4.6	107	62	70%	14%	EU 55% N Asia 17%
Live export	nil					

Source: Compendium of NZ farm production statistics, MWI economic Service April 2003

Table 3. Phone survey of abattoir experiences and attitudes to JD vaccination site lesions.

Question asked		Works							
		Dubbo	**Goulburn**	**Mudgee**	**Cowra**	**Young**	**Harden**	**Junee**	**Gundagai**
Markets supplied	*Export lamb*	Yes - none as carcases	Yes - 100% as carcases	Yes - 80% as carcase mainly to Middle East	No	No	Yes - 100% as carcases to Nth America	No	No
	Export mutton	Yes - none as carcases	Yes - 100% as carcases	Yes - 50% as carcases	No	No	No	No	No
	Domestic lamb	No	No	Yes - 100% as carcases	Yes - 75% as carcases	Yes - 95%	No	Yes - 90% as carcases	Yes - 30% as carcases
	Domestic mutton	No	No	Yes - 100% as carcases to Sydney Muslim market	Yes - 50% as carcases	Yes - 95%	No	Yes - 90% as carcases	No
Have you knowingly processed vaccinates?		Yes	Yes	Not aware of any	Yes - small number	No	No	No	No
Problems encountered?		Generally no. but 2 lots with problems - one with lesions on back required extensive trimming; Another with large lesions on neck - couldn't sell necks.	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Are you concerned?	Yes - technique important	Not at present - will monitor	No	No - routine trim will handle it	Yes - buy own stock thus exposed to loss, particularly with Pastoral Prime brand QA lamb	No - as only crossbred lambs processed	No	Only if not vaccinated on neck
Will you be identifying vaccinated lots before slaughter?	Not yet - will take routine approach.	No	No	No	No yet - will monitor	Not relevant	No	No
Will you put on additional staff to process vaccinates?	No	No	No	No	No	No	No	No
Do you routinely remove pre-scapular lymph nodes?	Yes	Only in mutton (due to CLA), not in lambs	Varies with order. Not for Middle East lamb carcases.	Yes	No		No	No
Other comments?	Encouraging vaccination generally. Stressed the importance for producers to use correct site and good technique		Vaccination technique important and should be stressed to producers	Will not be a problem if producers use recommended site and technique	Will continue to monitor situation as number vaccinates increase	Owner considers they are at no risk as they process no Merino lambs. Seemed conscious of QA risk.	Owner also a producer not in agreement with control program!	As only lambs are processed prevalence will probably be low. Will monitior future impacts but thinks only those vaccinated away from recommended site will need additional attention.

Figure 1. Two injection site lesions (on left) and two enlarged pre-scapular lymph nodes (on right) excised from merino carcases 3 years following vaccination showing the nature of their contents.

4. PART 2 – SURVEY OF THE PREVALENCE OF VACCINATION SITE LESIONS AND THEIR ASSOCIATED COSTS AT SLAUGHTER IN VACCINATED SALE LOTS.

4.1 Background

Gudair[tm] OJD vaccine was released under permit in Australia in early 2000 with limited availability. Some 50 flocks were using the product in the following year. Later in June 2002 Gudair[tm] was registered and its use expanded considerably. As a result several abattoirs in NSW had been processing vaccinated carcases and these numbers were expanding at the commencement of this survey. As a result an opportunity existed to collect actual data on the prevalence of injection site lesions in Australian Merino sheep and on the actual cost, if any, of processing these carcases in Australian abattoirs. This survey is described and reported below.

4.2 Materials and methods

4.2.1 Identifying vaccinated slaughter lines

Local sheep producers who had commenced a vaccination program were contacted either directly by mail (see appendix 1) or by local media, asking them to inform the project manager prior to them sending vaccinates directly to slaughter. Initially, only sales direct to abattoirs were monitored but later, when only a small number of direct sales were being advised, a system of monitoring sheep sold for slaughter through the local saleyards was developed with the cooperation of agents and buyers. These vaccinates were trucked & killed separately so that data could be recorded on the chain. Details on the sheep including age at slaughter, age at vaccination and time since vaccination were obtained from the owner of the sheep.

4.2.2 Collecting carcase data at slaughter

At slaughter relevant data was collected using a standard recording sheet (see appendix 2). A research person located near the beginning of the slaughter chain recorded the occurrence of injection site lesions and classified them by diameter. There was little variation in the location of the lesions and this is not reported.

Abattoir staff whose job it was to trim carcases were asked to carry out routine trimming of the neck region and to retain any trim taken due to the presence of lesions. These were later counted and weighed at the works. The weights recorded comprised both granulomatous lesion and surrounding tissue. No attempt was made to separate and weigh each component of lesion trim. In addition abattoir workers whose job it was to trim prescapular lymph nodes were asked to retain any enlarged nodes for later inspection, weighing and sampling if required.

4.2.3 Histopathological and bacteriological examination of injection site lesions

When carried out, excised vaccination site lesions were sent fresh to Orange Regional Veterinary Laboratory for bacteriological and histological examination to determine the nature of the lesion and whether secondary infection due to poor vaccination technique could have been involved.

Bacteriology consisted of a gram stain and routine aerobic and anaerobic culture (2 sale lots) and aerobic culture only (1 sale lot). For histopathological assessment the lesions were sectioned and stained with Haematoxylin and Eosin (routine stain) and Ziehl Neelsen (to identify acid-fast *M. paratuberculosis* bacilli).

4.2.4 Estimating the cost of lesions

Losses due to the presence of lesions can be attributed to 3 potential factors; 1) the value of meat removed as trim; 2) the labour cost of removing this trim; or 3) the downgrading of the carcase to a cheaper market grade as a result of trimming.

Because the proportion of trim that was non-lesion carcase tissue was not available an estimate of 20% was used to value the loss of carcase weight due to trimming. Hence the formula used to estimate the value of trim removed per slaughter lot was;

Total weight of trim x 20% x carcase value (price paid divided by average carcase weight)

Abattoir management was consulted to determine the additional labour cost, if any, associated with the trimming conducted on each sale lot and the prevalence and cost of carcase downgrading due to trimming.

4.3 Results and discussion

This project was designed as a preliminary survey only and the number of sale lots examined precludes any robust statistical analyses being conducted. However, despite this there are some trends that can be identified from the data presented below.

4.3.1 Prevalence of vaccination site lesions

Data on the prevalence and size of lesions are presented in Table 4. In adult sheep vaccinated 12 months or more before slaughter, 18% of carcases had identifiable vaccination site lesions on the slaughter chain. This proportion is similar to the 20% of live sheep identified with palpable lesions 30 months post vaccination in the 'intensive vaccination' trial (Eppleston et al 2003).

In the 2 sale lots killed as lambs 65% of carcases carried vaccination site lesions, most likely reflecting the short interval of around 6 months between vaccination and slaughter. Again this is consistent with the results from OJD.009 where up to 50% of vaccinates had palpable lesions 8 weeks post vaccination.

However amongst sale lots of mutton there was considerable variation in the prevalence of lesion (figure 2; range 1 – 30%). Although the data set was too small to calculate regression relationships there was no evident trend relating prevalence with age at vaccination or time since vaccination. Variation in vaccination technique may have contributed to the variation observed, but the laboratory assessments of the lesions reported below would suggest that infection due to unhygienic vaccination conditions was an unlikely cause.

A high proportion (average 34%) of the lesions identified were large, exceeding 25 mm in diameter. Grossly these were filled with a thick creamy-yellow pus-like material that if broken or cut could adhere closely to the surrounding carcase.

4.3.2 Cost of carcase trimming

Data on the weight and calculated value of the trim removed is presented in Table 5.

The value of non-lesion trim per carcase trimmed, calculated using the average carcase value, ranged from 0.4 – 6.9 (average 2.3) cents for mutton, and from 3.9 – 4.6 (average 4.3) cents for lambs. When expressed as a cost per carcase slaughtered (which accounts for the prevalence of lesions), this discount range fell to 0.02 to 2.2 (average 0.5) cents for mutton and from 2.4 – 3.1 (average 2.7) cents for lamb. On a per carcase basis this represents an average discount of only 0.01% for mutton and 0.04% for lamb.

Given that these discounts have been calculated using the average carcase value when the value of the neck region is considerably lower than the average it can be seen that the cost of trim is an insignificant contribution to the overall cost of using vaccine to control the on-farm impact of OJD.

Abattoir management advised that, at least in the sale lots monitored in this project, existing staff could carry out the trimming and no additional staff would be required. Hence the labour cost of trimming injection site lesions was nil. Abattoir management also advised that in the lots examined, no carcase was downgraded to a lower value market.

The value of excised enlarged prescapular lymph nodes was not calculated because of the small amount of trim recorded and because export works routinely removed these lymph nodes as part of the slaughter process.

4.3.3 Histopathology and bacteriology of trimmed lesions

In all, 16 injection site lesions were collected from 3 sale lots of mutton sheep and examined by histopathology and bacteriology (Table 6). The sheep examined were killed 18 months (2 lots) or 3 years (1 lot) after vaccination. The number of lesions examined was lower than planned because the cost per sample was considerably higher than that budgeted and because the results from those examined were consistent with no variation in bacteriological or histopathological outcomes.

Bacteriology identified scant numbers of acid-fast bacilli, with no gram-positive organisms or bacterial growth in aerobic or anaerobic culture. This would suggest that the lesions were not the result of secondary infection of the injection site. Histology revealed that all lesions examined consisted of a central area of caseous necrosis containing scant numbers of acid-fast bacilli surrounded by a thick fibrous capsule. The inner surface of the capsules contained macrophages and low numbers of giant cells surrounded by moderate numbers of lymphocytes. The central necrotic area contained holes and spaces consistent with the presence of lipid or oil and these contained a higher concentration of acid-fast bacilli. These observations are similar to the descriptions of Collet and West (2001).

Overall the lesions were chronic and consistent with necrosis resulting from injection of an irritant material and/or the result of an immune response to Mycobacteria with no inflammation suggestive of secondary bacterial infection.

Table 4. Prevalence of carcase lesions observed at slaughter

Product	Age at vaccin-ation	Age at slaugh-ter (years)	Years vaccin-ated	Number killed	Lesion diameter (mm)			Total with lesions	% with lesions	No with enlarged pre-scap LN's
					<10	10-25	>25			
Export mutton	lambs	3	3	171	6	16	24	46	27%	1
	lambs	3	3	149	16	14	8	38	26%	0
	lambs	3	2.5	159	1	7	8	16	10%	16
	hoggets	3-6	3	386	35	41	29	105	27%	26
	hoggets	4.5	4.5	29	0	1	0	1	3%	0
	adults	3.5	2	138	14	9	5	28	20%	0
	adults	3.5	4.5	42	5	1	2	8	19%	3
	adults	2-5	1.5	226	0	1	2	3	1%	7
	adults	5	1	101	8	3	5	16	16%	0
	adults	5	3	231	22	17	10	49	21%	0
	adults	2-3	2	378	3	15	3	21	6%	0
	adults	5	4	178	10	7	10	27	15%	12
	adults	2.5	1.5	202	25	21	15	61	30%	5
Domestic mutton	lambs	1.5	1.5	148	2	13	28	43	29%	5
	hoggets	4	3.5	159	7	10	27	44	28%	9
	hoggets	3-6	3	211	8	10	17	35	17%	2
	adults	5	4	78	12	8	12	32	41%	6
	adults	4	3	213	3	7	2	12	6%	1
Export lamb	lambs	10mths	.5	82	22	17	15	54	66%	0
Domestic lamb	lambs	10mths	.5	40	16	8	1	25	63%	0

Figure 2. Prevalence of lesions by sale lot.

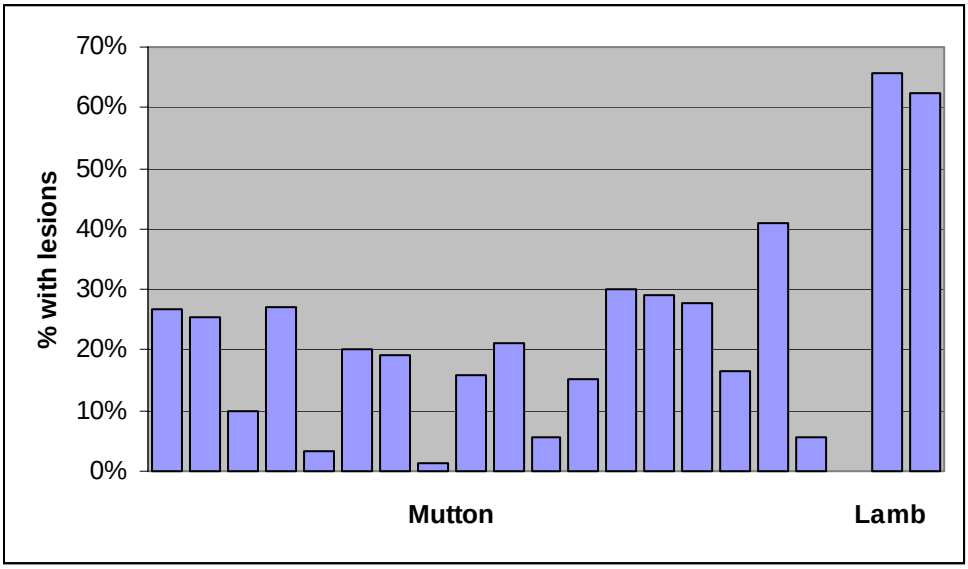

Table 5. Value of vaccination site lesion trim observed at slaughter.

Product	Age at vaccin-ation	Age at slaugh-ter (years)	Years vaccin-ated	Number killed	Weight Lesion Trim (kg)	Carcase Value ($/kg)	Total value of trim ($)	Value trim per trimmed carcase (cents)	Weight LN Trim (kg)
Export mutton	lambs	3	3	171	1.9	$2.41	$0.92	2.0	0.2
	lambs	3	3	149	1.2	$2.83	$0.68	1.8	0.0
	lambs	3	2.5	159	0.2	$2.52	$0.10	0.6	4.0
	hoggets	3-6	3	386	3.6	$2.79	$2.01	1.9	2.4
	hoggets	4.5	4.5	29	0.1	$1.92	$0.02	1.9	0.0
	adults	3.5	2	138	1.1	$1.68	$0.37	1.3	0.0
	adults	3.5	4.5	42	1.4	$1.96	$0.55	6.9	1.0
	adults	2-5	1.5	226	0.1	$2.35	$0.05	1.6	1.1
	adults	5	1	101	0.2	$2.00	$0.08	0.5	0.0
	adults	5	3	231	6.1	$2.26	$2.76	5.6	0.0
	adults	2-3	2	378	0.8	$2.05	$0.33	1.6	0.0
	adults	5	4	178	1.3	$2.22	$0.58	2.1	2.1
	adults	2.5	1.5	202	3.7	$2.63	$1.95	3.2	0.7
Domestic mutton	lambs	1.5	1.5	148	3.4	$1.40	$0.95	2.2	1.2
	hoggets	4	3.5	159	1.2	$2.54	$0.61	1.4	1.6
	hoggets	3-6	3	211	0.8	$2.12	$0.34	1.0	0.3
	adults	5	4	78	4.5	$1.90	$1.71	5.3	1.5
	adults	4	3	213	0.1	$2.49	$0.05	0.4	0.1
Export lamb	lambs	10mths	.5	82	3.3	$3.80	$2.51	4.6	0.0
Domestic lamb	lambs	10mths	.5	40	1.5	$3.23	$0.97	3.9	0.0

Table 6. Histopathology and bacteriology observations on injection site lesions.

Product	Age at vaccination	Age at slaughter (years)	Years vaccinated	Number killed	Specimen ID	Bacteriology			Histology	
						Gram stain	Anaerobic culture	Aerobic Culture	Oil droplets	Acid-fast bacteria
Mutton	lambs	1.5	1.5	148	1	-	-	-	+	+
					2	-	-	-	+	+
					3	-	-	-	+	+
Mutton	adults	2.5	1.5	202	1	-	-	-	+	+
					2	-	-	-	+	+
					3	-	-	-	+	+
					4	-	-	-	+	+
					5	-	-	-	+	+
					6	-	-	-	+	+
					7	-	-	-	+	-
Mutton	adults	4	3	213	1	nt	nt	-	+	+
					2	nt	nt	-	+	+
					3	nt	nt	-	+	+
					4	nt	nt	-	+	+
					5	nt	nt	-	+	+
					6	nt	nt	-	+	+

- = negative/not present + = positive/present nt = not tested

5. SUCCESS IN ACHIEVING OBJECTIVES

Objective 1. To review the major market sectors for Australian sheep meat, their potential for discounting due to the presence of vaccination site lesions and to estimate the likely number of carcases entering those markets now and in the future.

This objective was achieved.

Objective 2. By December 2003, 30 sale lots of adult vaccinates destined for export & domestic mutton markets and 3 sale lots of vaccinated lambs (if available) will be assessed at slaughter to determine the prevalence of vaccination site lesions and the degree of any discounts that are applied due to either carcase trimming or market diversion.

This objective was only partially achieved as only 20 slaughter lots were examined at slaughter. Drought conditions experienced during the duration of the study reduced the numbers of vaccinated sheep being sent to slaughter. However, the study was a preliminary investigation where no statistical analysis was to be attempted, and the consistency of the data suggests that outcomes are reasonably reliable, at least under market conditions of low sheep supply.

6. IMPACT ON MEAT AND LIVESTOCK INDUSTRY

The information compiled on the nature and impact of vaccination site lesions in New Zealand and the differences between New Zealand and Australian sheep-meat industries, together with the small survey of the response of the Australian processing sector to vaccinates slaughtered to-date, suggests that the existence of these lesions will not be a major cost to our sheep meat industries. However, because of the small number of sale lots examined and the undersupply situation existing at the time the project was conducted, caution should be taken in extrapolating these results to all market situations.

Based on these data sheep meat producers will be better able to assess the economics of vaccination relative to the likely market for that class of sheep.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Although there is little supportive objective data the perceived cost of OJD vaccination site lesions at slaughter in New Zealand appears to limit the use of OJD vaccination in that country. The main discounts occur in lambs destined for export in carcase form that are downgraded to a lower quality grade following trimming of lesions.

A larger number of mutton carcases are likely to be vaccinated in Australia in the future than in New Zealand due to our greater reliance on the Merino and the continued spread of OJD, but only a small proportion of these will need trimming due to the extended interval since vaccination. In Australia most of our lamb carcases have been derived from specific crossbreeding and these won't be vaccinated, however a trend to increasing lamb production from purebred Merinos is likely to increase the number of vaccinated lambs entering the market. Despite this, very few mutton or lamb carcases are exported whole so there is little risk of discounts due to downgrading being applied.

The cost associated with the weight of trim removed and the labour cost of its removal is low and in this study represented less than 0.05% of the value of each carcase slaughtered. As such this represents a minor proportion of the total individual or industry cost of implementing OJD vaccination control programs.

These conclusions relate specifically to market conditions at the time this survey was conducted, and in sheep vaccinated high on the neck. Caution should be exercised in extrapolating these observations to times of an oversupply of sheep, and in sheep vaccinated at alternative sites.

7.2 Recommendations

Given the small scale of this survey it is recommended that the cost abattoirs assign to vaccination site lesions should be monitored again at a time of greater sheep supply. It is suggested that this survey be repeated at an appropriate time in conjunction with a telephone questionnaire of abattoirs seeking information on their experiences with, and attitudes to, vaccination site lesions.

The importance of vaccinating high on the neck should be emphasised to industry. At this site abattoirs are able to readily locate and remove lesions from a low value part of the carcase, and at this site the draining lymph nodes are located in the pre scapular region which are routinely removed in many export works. If producers use an alternate injection site trimming of higher value product and other lymph nodes may need locating and trimming at greater cost.

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9. APPENDICES

9.1 Appendix 1 – Request for advice of sale of vaccinated sale stock

Are you sending OJD-vaccinated sheep direct to an abattoir? – If so please let me know.

I am conducting an MLA-funded trial to identify any impact of OJD vaccination site lesions on carcase value. We don't think it is going to be very great but the industry needs to have accurate figures on this if it exists.

Hence I would like to know, with as much advance notice as possible, when you are sending vaccinates to an abattoir. As most producers who have vaccinated will have received a notice on this trial please treat this as a reminder to let me know of any pending sales.

……

Please contact Jeff Eppleston on 63 311377 b/h or 63 323708 a/h as soon as you know vaccinates will be leaving your property.

9.2 Appendix 2. – Slaughter data record sheet

Kill Details

Date: Abattoir:

Kill ID Number killed:

Method of sale

Market destination Value

Other

Source details

Owner Property

Contacts Duration infection

Level infection

Other:

Sheep details

Born Sex Condition Score

Age at vaccination Age at slaughter Time since vaccination :

Other

Slaughter measurements

Palpated/on-chain Prevalence (Count)

Nil	0-10mm	10-20mm	20+mm	Total

Incidence of trimming

Lesion	Number	Weight	Comments
Injection site			
Lymph nodes			

Average carcase weight (kg): Histology? Yes/No

Abattoir comments

Labour cost of trimming?

Any whole carcase downgrades due to lesions/trimming?