Final report

PDS: Supporting sheep producers transition to non-mulesed sheep

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Abstract

The practice of mulesing, to reduce susceptibility of sheep to breech flystrike, represents a significant welfare issue that is increasingly becoming less acceptable by retailers and consumers. This is an issue for both the red meat and wool industries. Many sheep producers who would like to cease mulesing lack the confidence to do so and raise a number of concerns including the difficulty getting contractors to crutch NM sheep, more work and more costs. The PDS project aimed to support sheep breeders to utilise existing tools and management strategies available to transition to a non-mulesed flock in a supported learning environment.

Four "Towards non-mulesed sheep" producer groups were established in 2021 and 2022 across Victoria and in NSW. After an initial planning workshop a three-year group program followed which included on-farm meetings and skills training. Group members identified key issues and evaluated options to assist them move towards a non-mulesed flock in the demonstration sites.

Core producers (53) developed their own property specific, integrated plan to move to a non-mulesed flock (or maintain their non-mulesed (NM) flock). They demonstrated a large increase in knowledge, skills and confidence as a result of participation in four regional discussion groups and 11 demonstration sites. Half of the producers made or were intending to make changes to their management calendar and 69% to their breeding /selection programs. Around 36% of producers had recently ceased mulesing at the start of the project (2021), 20% ceased mulesing all lambs during the project and the remainder 44% intend to cease once they had fully implemented changes identified in their plans.

The demonstrations sites provided valuable information on strategies to breed more flystrike resistant sheep and management options to make managing NM sheep easier. Sire evaluations demonstrated that large reductions in breech wrinkle could be made in one generation without sacrificing wool cut. Tail docking method demonstrations showed that the choice of hot knife did not make much difference to dag score or crutching ease. Dag management demonstrations in Victoria clarified that worms were the major cause of dag in weaners during winter/early spring and not the feed-base. More regular WEC testing and improved worm control in NM or M weaners had a net benefit of $5/head per year. Feeding fibre (hay) in winter/early spring as a dag preventative strategy did not reduce dag, however reduced weight gains by 2 kg giving a net loss of $12/head.

Incorporating breech flystrike and worm resistance traits in sheep breeding programs will ultimately reduce the need for mulesing while balancing other production traits. This will also have benefits of reduced reliance on fly chemicals and drenches, reducing costs and the risk of chemical resistance.

Executive summary

Background

The practice of mulesing, to reduce susceptibility of sheep to breech flystrike, represents a significant welfare issue that is increasingly becoming less acceptable by retailers and consumers. This is an issue for both the red meat and wool industries. The Meat Industry Strategic Plans (MISP 2020, SISP 2015-2020) have identified that continuous improvement of animal welfare and sheep health well-being is a key priority to ensure consumer and community support for the industry's products and practices.

Many sheep producers who would like to cease mulesing lack the confidence to do so and are fearful of not being able to manage without it. Common concerns expressed by producers about running NM sheep include difficulty crutching (and getting contractors) NM sheep if they are wrinkly or daggy, more work/more crutching/more monitoring, potential use of more fly chemicals to prevent breech strike, risk of increased chemical resistance and perhaps lower sale price for surplus sheep. Many say they are not sure if their sheep type or they themselves are ready for the move to NM.

The project provided group members the opportunity to run a small trial with their own sheep to evaluate options to assist them move towards a non-mulesed flock. Improving their knowledge of breech strike risk factors, management and genetic options, improve their confidence and allow them to identify and plan further management changes they need to ultimately be able to cease mulesing across the whole flock.

Objectives

To support sheep breeders to utilise existing tools and management strategies available to transition to a non-mulesed flock.

1. By June 2024, in Victoria and southern NSW: 40 sheep producers (core group members: 4x10) will:
   a. develop their own property specific, integrated plan to move to NM sheep
   b. conduct 2-3 trials on farm per group to evaluate some element of their plan
   c. evaluate the challenges/opportunities, costs/benefits of running NM sheep and explore future marketing and value chain opportunities.
   d. (at the end of project) identify/plan for any further management changes required to move towards ceasing mulesing across the whole flock in the future.
   e. conduct a (triple bottom line) cost benefit analysis of this practice change.

Objective 1 was achieved successfully. Over 40 core producers (53) were involved in the groups and 11 demonstrations were conducted. Producers developed their own integrated plans at the start and reviewed plans at the end of the project. Producers listed costs/benefits of any changes they had made/intending to make. Cost benefit analyses were conducted for practices evaluated in the demonstration sites.

2. Implement a series of skills and training development activities to increase the confidence of 40 core and 40+ observer producers to transition to non-mulesed flocks.
   By June 2024, achieve an adoption target of:
   a. 25% of core producers ready to cease mulesing
   b. 75% of core producers have a 5-year plan to transition to non-mulesed (beyond the life of this project)
   c. 25% of observer producers have a 5-year plan to transition to non-mulesed

Objective 2 was successfully achieved. Over 40 core producers (53) participated in the series of information and skills training sessions. Over 40 observer producers (385) attended workshops, on-farm field days or a core group meeting where skills training activities were conducted.

- 36 % of core producers had ceased mulesing just prior to the PDS project.
- 20 % of core producers ceased mulesing all lambs during the project.
- 44 % of core producers intended to cease mulesing.
- 100% of core producers developed a plan to move to /maintain a NM flock.

3. Conduct an annual field day and other activities to showcase the demonstration site results and encourage adoption of key practices by 20 attending producers (ie. 20 producers/field day, additional to the core group).

Objective 3 was successfully achieved.

Methodology

Four "Towards non-mulesed sheep" producer groups were established in 2021 and 2022. They were located in South West, North East, North West Victoria and the South West slopes NSW groups. Each group was associated with a local "producer advocate" who had multiple years of experience running a NM flock.

An initial workshop was conducted with each group for members to develop their own plan to transitioning to a NM flock. A three-year group program followed which included on-farm meetings, and skills training. Group members identified their key issues and went on to evaluate options to assist them move towards a non-mulesed flock in the demonstration sites.

Results/key findings

Core producers (53) developed their own property specific, integrated plan to move to a non-mulesed flock (or maintain their NM flock) at the start of the project. Core producers demonstrated a large increase in knowledge, skills and confidence through participation in the four regional discussion groups and 11 demonstration sites. Half of the producers made or were intending to make changes to their management calendar and 69% to their breeding /selection programs. Around 36% of producers had recently ceased mulesing at the start of the project, 20% ceased mulesing all lambs during the project and the remainder 44% intended to cease once they had fully implemented changes identified in their plans.

Five key issues were identified by producers, in relation to management of NM sheep, and different practices evaluated in the demonstration sites. The main findings were:

- **Sire evaluation** - Two demonstration sites highlighted that breech wrinkle can be dramatically reduced by 0.5-0.6 score in one generation by using sires with low EBWR ASBVS (-0.5 or -0.6), compared to of sires with high EBWR (+0.5 or +0.6) and that other key profit driver traits can be maintained when keeping a balanced breeding approach. This change can be at no additional cost however the benefits will be easier crutching, lower flystrike risk and reduced reliance on fly chemicals.
- **Tail docking method** – Three demonstration sites showed that there was very little difference between 3 hot knives and elastrator rings on the amount of wool cover over the tip of the tail or dag/urine scores or crutching ease. Producers concluded that the choice of docking method comes back to personal preference and that there are other, more

important factors affecting ease of management of NM sheep such as tail length, breech wrinkle and dag management. Producers did highlight the need for consistency when tail docking, in particular tail length and the use of pain relief as being very important for lifetime benefits.

- **Dag management** – Two demonstration sites indicated that more frequent WEC testing and improved worm control enabled greater weight gains in weaner sheep by 2 kg over winter/early spring and reduced dag score from 2.6 to 1.8. The net benefit was +$5.18/head per year.

  The site that also fed fibre (good quality vetch hay) to one group of weaners found that this reduced weight gains by 2 kg and had no impact on dag score. Feeding hay to weaners, who had good worm control, resulted in a net loss of -$12/head. The combination of feeding hay, but not improving worm control, resulted in a nets loss of -$17/head.
- **Comparison of running a small mob of NM sheep with M sheep** – One site found that the NM mob had a higher proportion of lambs that required crutching in spring (due to dag), and a higher incidence of flystrike, than the M mob. It took twice as long to crutch the NM lambs. The producer concluded he has to make further progress with genetics (reduce breech wrinkle further) to move to NM across the whole flock.

  Extrapolating from the demonstration site, the net benefit/cost of running NM ewes compared with a M mob was estimated to be -$0.90/ewe cost to +$5.00/ewe benefit per year.
- **Visual breech wrinkle scores for lambs** –There was no difference in the lamb breech wrinkle scores using the standing method or the cradle method. This gives producers confidence that they can apply the visual scores for lamb breech wrinkle, which are depicted in a standing position in the Visual Scores Guide, when assessing lambs in the marking cradle.

Benefits to industry

The practice of mulesing, to reduce susceptibility of sheep to breech flystrike, represents a significant welfare issue that is increasingly becoming less acceptable by retailers and consumers and poses risks to meat and wool markets. This PDS project was successful in assisting producers develop their own integrated plan to move to /manage NM sheep and make relevant changes to their management and breeding programs to accommodate this transition process.

Genetic approaches such as incorporating traits for barer breeches, reduced dag and worm resistance into sheep breeding programs will ultimately overtime remove the need for mulesing. This will also have benefits of reduced reliance on preventative chemicals and drenches, reducing costs and the risk of chemical resistance.

Future research and recommendations

The extension model piloted in this project, across 4 groups in different environments, had a large impact on practice change with the participating producers. This program could be made available to more interested producers through future MLA PDS projects or as a Profitable Grazing Systems supported learning package.

Publications/extension messages about dag management need to include findings from this PDS on the cost/benefit of feeding fibre. The preliminary work conducted in this PDS highlighted that this practice could be a major cost with no benefit for mulesed or NM sheep. There are opportunities to

reduce dag and increase weights gains in weaner sheep with improved worm control. These findings are relevant to all sheep producers.

There are some instances where the green pasture could be a factor causing dag. More research is required to investigate what components and which pasture species could cause scouring (once worms have been ruled out), and what the management options might be.

The need for new research work on the effect of tail length on dag, was raised by producers. Producers felt there was a research gap as the old tail docking length work was conducted in regions where dag was not an issue. Sheep genetics are also very different now to when the old work was conducted.

PDS key data summary table

Project Aim:
To support sheep breeders to utilise existing tools and management strategies available to transition to a non-mulesed flock.

For details of benefit & costs for a specific practice see section 5. Economic evaluation	**Comments**		**Unit**
Practice 1. Improved worm control to reduce dag (don't feed fibre) More regular WEC testing (esp for weaners), perhaps 1 extra drench in winter, 2kg weight gain, reduced dag score.	Net benefit		$5.18 /head per year
Practice 2. Run NM sheep (vs M sheep) Possible wool premium, 1 extra crutch, slower to crutch, perhaps apply extra fly chemical.	Net cost to Net benefit		-$0.90/head to + $5.00/head per year
Number of core participants engaged in project		53	
Number of observer participants engaged in project		385	
Core group no. ha		67,905	
Observer group no. ha		54,260	
Core group no. sheep		328,450	hd sheep
Observer group no. sheep		317,260	hd sheep
Core group no. cattle		10,663	hd cattle
Observer group no. cattle		-	hd cattle
% change in knowledge, skill – core	*Breech strike risk factors:*	*69% to 86%*	17% increase
% change in confidence – core	*Managing NM sheep*	*5.7 to 7.8/10*	21% increase
% change in knowledge, skill – observer (Q. how much has your knowledge increased by?)	*Breech strike risk factors, tools, strategies:*	7.3/10	Measured at end of event only (from 60 completed evaluation sheets)
% practice change adoption – core	*Changes to Management calendar*	41 %	
% practice change adoption – core	*Changes to Breeding program*	69 %	
% practice change adoption – core	*Ceased mules/plan to*	100 %	
% practice change adoption – observers	*Change not specified*	77 %	
% of total sheep (or ha) managed that the benefit applies to	*645,710 sheep (estimate 129,142 weaner sheep)*	100 %	
Key impact data			
Practice 1: Net $ benefit / sheep (all weaner sheep managed) per year	**$669,000**		
Practice 2: Net $ benefit /sheep (all sheep managed) per year	**-$581,139 to +$ 3,228,550**		

Table of contents

1. Background

1.1 The Problem and Impact

Flystrike (both breech and body) is estimated to cost the Australian wool and sheep meat industries around $200 million per year (Lane *et. al.,* 2015). This figure includes the cost of preventative measures, treatment and lost production. The review by Lane *et al.* (2015) does not attribute the relative economic cost of breech strike compared with body strike.

L. cuprina is by far the most important fly species accounting for at least 90% of all strikes. There are a number of important risk factors such as: susceptibility of the sheep, weather conditions and management.

The practice of mulesing, to reduce susceptibility of sheep to breech strike, represents a significant welfare issue that is increasingly becoming less acceptable by retailers and consumers. Preventing flystrike and phasing out the practice of mulesing is a major goal of the industry and its agencies, Australian Wool Innovation (AWI) and Meat and Livestock Australia (MLA), and they are actively looking for alternative and effective welfare-friendly measures. Development of a flystrike vaccine and genetic approaches such as incorporating breech strike resistance into sheep breeding programs will ultimately remove the need for mulesing. In the meantime, around 75% of sheep breeders have adopted the use of pain relief for lambs at mulesing.

Non-mulesing is on the rise. Since the introduction of genetic indicator traits for breech-strike resistance fifteen years ago (ie. breech wrinkle, breech cover, dag), more and more sheep breeders are seeking Merino rams with these traits in addition to their desired wool or carcase productivity traits. More properties have been able to cease mulesing each year due in large part to the national flock being able to shift away from breeding highly susceptible Merino sheep.

The amount of wool sold from non-mulesed (NM) sheep in Australia is currently around 21.5% of total wool production and steadily increasing (AWEX, 2024). This is up from the 14% in 2021. An additional 3% of total wool sold was declared as ceased mulesing (CM). Around 52% of the NM wool produced was 20.5 micron and finer, 12 % fell into the 20.6 – 24.5 micron category and 36% was broader than 24.5 micron (AWEX, 2020).

Premiums paid for Australian Merino wool declared as coming from non-mulesed (NM) sheep doubled from 2016 to 2018 (AWEX, 2018). In 2016, for 19-micron categories, non-mulesed wool received premiums of 13c/kg, but in 2018 that had risen to 48c/kg. During 2019, despite the downward price trend, non-mulesed wools held their value when other wool types prices slumped. Non-mulesed wool received a premium as high as $2/kg extra at auction which was driven by the demand in Europe by retail brands looking for ethically produced wool. However, for those breeders who have ceased mulesing, receiving a price premium has not been the major motivation to do so (Lindon, 2018).

Numerous wool integrity schemes such as Authentico, Sustainawool, Responsible Wool Standards, ZQ, are available for producers with non-mulesed wool to participate in to develop connections, trust and transparency with the value chain. There is potential to receive further premiums for non-mulesed wool by participating in these schemes. There are also opportunities to forward sell wool and manage price risk.

Mulesing is also an issue for the red meat industry. Many prime lamb dams are mulesed first cross, composite or Merino ewes, and non-mulesed ewes generally sell at a discount in saleyards, due to the perceived risk of flystrike. There may be opportunities for breeders to prevent any discounting

and even obtain premiums for non-mulesed sheep by selling direct to re-stockers or processors. There is demand from retail brands for ethically produced lamb. Processors such as JBS source 1st and 2nd cross lambs from non-mulesed flocks for their "Farm Assured" brand which can give producers a 20c/kg premium. Large retailers in the UK such as Tesco and Sainsbury have clear policies prohibiting lambs from mulesed flocks.

1.2 Producer questions around transitioning to a non-mulesed flock

Many producers who would like to cease mulesing lack the confidence to do so and are fearful of not being able to manage without it. Common concerns expressed by producers (to the project team) about running NM sheep include difficulty crutching (and getting contractors) NM sheep if they are wrinkly or daggy, more work/more crutching/more monitoring, possibly use of more fly chemicals to prevent breech strike, risk of chemical resistance and perhaps lower sale price for surplus sheep. Many say they are not sure if their sheep type or they themselves are ready for the move.

Even without making large changes in genetics, some sheep breeders have been able to cease mulesing after re-assessing the relative flystrike risk in their environment for their genotype and adjusting their management calendar (eg. time of crutching /shearing etc). Ceasing mulesing has not necessarily increased their reliance on chemicals to prevent flystrike, increased costs nor resulted in discounts on sheep sold to re-stockers.

Sheep breeders that have ceased mulesing are located across a wide geographic area and have a wide range of sheep genetics (Lindon, 2018). Their experiences indicate there is potential for other breeders in their district to have a go at ceasing mulesing, at least on a small trial basis, particularly if their sheep are relatively plain bodied.

This project aimed to support producers to develop their own integrated, property-specific plan to transition to cease mulesing, improve knowledge and skills and improve their confidence to be able to implement their plan. Everyone is at a different point on the pathway to non-mulesed. It is only after individuals can objectively review their management and benchmark where their sheep sit genetically, that they can plan appropriate changes.

The project provided group members the opportunity to run a small trial with their own sheep to evaluate options to assist them move towards a non-mulesed flock. This will improve their knowledge of breech strike risk factors, management and genetic options, improve their confidence and allow them to identify and plan further management changes they need to ultimately be able to cease mulesing across the whole flock. The risk of breech strike is likely to change annually, seasonally and over time with changing climate. A deeper understanding of risk factors for their sheep, farm, farm system and region will support them changing practices over time in response to changing risk. The project will also allow producers to identify new market opportunities for their wool and meat and to calculate the cost/benefit to their business of ceasing mulesing and any associated changes they make to the enterprise.

The Meat Industry Strategic Plans (MISP 2020, SISP 2015-2020) identified that continuous improvement of animal welfare and sheep health/well-being is a key priority to ensure consumer and community support for the industry's products and practices. Work in this area has also been identified as a priority by regional Southern Australia Livestock Research Council (SALRC) committees.

1.3 Target audience

The need for this project had arisen from consultation with numerous sheep producers across many groups and networks. Work to improve animal welfare, sheep health and well being had also been identified as a priority by SALRC. This project targeted producers who were considering ceasing mulesing and wanted to learn more about what this might involve for their business and get support to develop a transition plan. The project also attracted some producers who had recently ceased mulesing but still felt they needed to improve their knowledge, skills and confidence to refine their plans and management systems. Four groups of producers formed specifically for this project. Three groups were located in Victoria and one group was in the South West Slopes of NSW. The project target was to have 10 producers per group to form the "core group" of 40. The groups were located in different regions in Victoria (North East Vic, South West Vic, North West Vic) and NSW, representing different production systems, environments and flystrike risk factors.

A local "Producer Advocate" was also part of each group. These 4 producers had successfully transitioned to running non-mulesed flocks and each had at least 10 years of experience and data to support producers participating in the group in their district.

1.4 Results of demonstrations

The specific topics/questions studied in the demonstration sites were determined by the core group members after the first planning workshops were conducted. The results were used by the host producers and other core group members to evaluate any changes they were considering making to their enterprise. The results and learnings were also made available to other observer producers via field days and media.

2. Objectives

This project supported sheep breeders to utilise existing tools and management strategies available to transition to a non-mulesed flock.

1. By June 2024, in Victoria and southern NSW: 40 sheep producers (core group members: 4x10) will

- *a.* Identify their breech strike risk factors (environmental, genetic, management), understand how these are affected by season and changing climate, and develop their own management strategy (5-year plan) to reduce this risk.
- *b.* Support the establishment of 2-3 trials on farm per group to evaluate some element of their 5-year plan towards running a non-mulesed mob.
- *c.* Evaluate the challenges, costs/benefits, opportunities of running non-mulesed sheep in comparison to mulesed sheep and explore future marketing and value chain opportunities.
- *d.* (at the end of project) Identify/plan for any further management changes required to allow them to move towards ceasing mulesing across the whole flock in the future.
- *e.* conduct a (triple bottom line) cost benefit analysis of this practice change.

Objective 1 was achieved successfully. Over 40 core producers (53) were involved in the groups.

At the first workshop, participants developed their own property specific, integrated plans to reduce the risk of breech flystrike and help them transition to NM/manage NM sheep. At the end of the

project, participants reviewed their plans and identified any changes to management or genetics they were intending to make.

A least 2 demonstrations were established by each group, with a total of 11 demonstrations overall.

Participants conducted their own SWOT analysis at the first workshop to identify challenges and opportunities associated with moving to a NM flock. At the final meeting, they listed likely costs/benefits of any changes they had made or were intending to make to their enterprise to help them move to /manage NM sheep.

Several cost benefit analyses have been included in this report based on practices evaluated in the demonstration sites. A summary of potential cost and benefits is also provided which includes a range of practice changes, identified by participants, that may be required to transition to/manage a NM flock.

2. *Implement a series of skills and training development activities to increase the confidence of 40 core and 40+ observer producers to transition to non-mulesed flocks.*
   By June 2024, achieve an adoption target of:
   a. 25% of core producers ready to cease mulesing
   b. 75% of core producers have a 5-year plan to transition to non-mulesed (beyond the life of this project)
   c. 25% of observer producers have a 5-year plan to transition to non-mulesed

Objective 2 was successfully achieved. Over 40 core producers (53) participated in the series of information and skills training sessions. Over 40 observer producers (385) attended workshops, on-farm field days or a core group meeting where skills training activities were conducted.

- 36 % of core producers had ceased mulesing just prior to the PDS project.
- 20 % of core producers ceased mulesing all lambs during the project. In addition, four producers trialled running a small mob of NM Merino lambs, two ceased mulesing wether lambs but not ewes, and one ceased mulesing all first-cross lambs they bred but not their Merinos.
- 44 % of core producers intended to cease mulesing.
- 100 % of core producers had a 5-year plan to transition to a non-mulesed flock or for those already ceased mulesing had a plan to make modifications to their current system to assist them manage their NM sheep.
- On average, across the 4 regions, around 77% of observer producers intended to make a practice change that would aid the transitioning to NM sheep, as a result of attending an event. For the observer producers we didn't capture if they had a 5-year plan to transition to non-mulesed as they may have only attended 1 event.

3. *Conduct an annual field day and other activities to showcase the demonstration site results and encourage adoption of key practices by 20 attending producers (ie. 20 producers/field day, additional to the core group).*

Objective 3 was successfully achieved for the SW Victoria and South West Slopes NSW group regions. An annual public event (field day or workshop/seminar – 2 per region) was held to showcase demonstration site results from these regions. Over 20 observer producers attended each event in each region.

Only one public event was held for each of the NE and NW Victorian groups as these group had a delayed start due to Covid-19 restrictions in place in Victoria at the start of this project. Over 20 observer producers attended the NE Vic field day and 5 attended the NW field day. On occasions observer producers also attended core group meetings.

3. Demonstration Site Design

3.1 Methodology

3.1.1 "Towards NM Sheep" Producer groups - facilitation

The project involved the establishment of 4 producer discussion groups which were called "Towards non-mulesed sheep" groups. The SW Victoria and the SW slopes NSW groups (core groups) were established in February 2021 and linked up with their local "producer advocate". The core group members were producers who were interested in ceasing mulesing and included some producers who had recently ceased and wanted support to manage this and future changes. "Observer" producer networks started to be established at this time via social media and the MLA and SheepMetriX websites.

The NE Victoria and the NW Victoria "Towards NM Sheep" groups were due to commence with their planning workshop in winter 2021 but this was delayed due to Covid-19 restrictions in Victoria. The NE Victoria group met in November 2021 and the NW Victoria group in February 2022, which delayed start of any demonstration sites for these 2 groups. These groups were also linked with a local producer advocate.

An initial workshop was conducted with each group where members developed their own "Transitioning to NM" management plans. The relevant local producer advocate spoke at these workshops.

The one-day planning workshop was an essential part of the group process to:

- Allow the key issues/challenges about moving to a NM flock to be identified by the producers and discussed.
- Set the scene for information/activities to be covered in future meetings and ideas for demonstration sites.
- Allow producers to start preparing their 5-year, property specific integrated plan to move towards a non-mulesed flock and identified the key areas that may require changes to be made.

The practical workshop featured:

- The producer advocate shared their experiences (their story/case study) with ceasing mulesing and any wool or sheep/lamb marketing opportunities they had obtained. An example SWOT analysis was then done by the group using the producer advocate's information.
- Producers used a range of information & tools to:
    - Assess Flystrike risk periods for their property/environment (Flyboss tools)
    - Review their current Flystrike Management calendar & look at the impact on flystrike risk from changing shearing and crutching time and impact of not mulesing (Flyboss Compare management tool).

    - Assess Flystrike susceptibility of their current sheep phenotype and genotype (eg. breech cover, breech wrinkle, dag) (Visual Sheep Scores booklet, 2019, AWI/MLA).
    - Identify any changes required to ewe selection/classing strategies and ram genetics and where they can get the required traits for breech strike resistance (DNA Flock Profile tool, ASBVs/MERINOSELECT/RamSelect and discussions with producers already not mulesing etc).
      (at later sessions they also learnt how to set up a Ram Team Manager (RamSelect) to benchmark their current ram team and monitor future ram purchasing decisions to achieve their breeding objectives and be proactive in ram selection decisions to reduce wrinkle).
    - Conduct a SWOT analysis (for their current enterprise moving to NM).
    - Develop and document their individual Flystrike Management Plan for running non-mulesed sheep. This summarised their integrated approach to flystrike management (ie. Management; Selection & Breeding; Chemical use) and any other factors they needed to consider in the transition to NM sheep.
- Group members identified areas where they wanted more information, discussion or skills training and this guided the content and timing for the on-farm meetings which were subsequently conducted for each group as a two-year program.
- Group members identified issues/practices they wanted to investigate in demonstration sites.

The two-year group program included seasonally relevant on-farm meetings (to discuss issues and practice skills such as sheep breech score assessments), zoom meetings and guest speakers. The first year program aimed to provide more structured learning and skills training and involved more sessions than the second year. Results from demonstration sites were also discussed at meetings as they became available. At the end of each year, group members reviewed their property specific plans they had developed at the first workshop.

The group process, that followed the one-day workshop, was important to allow producers to share experiences, discuss, review and adjust management decisions during the project. As producers have different management calendars, they could compare and apply the learnings from the different plans/strategies implemented and impact on costs, labour infrastructure or benefits and opportunities. They were also kept up to date with the results from the demonstration sites which focussed on more specific parts of the system.

3.1.2 Demonstration sites

Group members identified issues/practices they wanted to investigate in demonstration sites. While groups did not all run the same demonstrations, the issues that they were interested in resolving were similar.

The following five issues were investigated:

- Sire evaluation – How quickly can I reduce breech wrinkle and maintain/improve other key profit drivers if I use rams with lower ASBVs for EBWR?
- Tail docking methods - What impact does tail docking method (type of hot knife used) have on ease of crutching and dag/urine in NM sheep?
- Dag management - What are the key drivers of dag in sheep – is it worms or feed-base? Does feeding fibre help reduce dag?

- Comparison of running a small mob of NM sheep with M sheep – Are my sheep ready? Am I ready to move to NM? What extra management do I need to run NM sheep?
- Visual breech wrinkle scores for lambs – Is there a difference if I measure this while the lambs are in the marking cradle or standing?

Protocols for the methodology to be used in the demonstrations were developed by the project team in consultation with the demonstration site host producers. The specific methodology used at each site is included with the detailed results for each site in Appendix 7.1. These protocols can be used by other producers or their advisers who want to conduct similar demonstrations.

3.2 Economic analysis

Producers are all at different stages on the path to running NM flocks so the practice changes they may need to make will vary. Hence the benefits and costs will vary.

At the end of the project, through discussions and in the post-project survey, producers were asked to list any changes to management, breeding/selection or other aspects of their business they have made or were intending to make to implement their transition plans. They were also asked whether there were any extra benefits/cost savings or extra costs/loss of income associated with the changes. This information was documented to provide a range of potential costs and benefits other producers may need to consider when developing their own property specific plans.

An economic analysis was done for the more specific practices being evaluated in the demonstration sites.

3.3 Extension and communication

The key extension and communication activities for this project revolved around the facilitation of four producer groups that met over 2-3 years of the project (see appendix 7.2). The group model was used to allow members to discuss concerns, share experiences/learning, visit other properties, improve knowledge/skills/confidence and evaluate different practices.

To promote the project, and results of the demonstration sites, to the wider farming community the following activities were part of the communication plan.

- Annual field day/workshop in each group's region (ie. 2 per group)
- Presentation at conferences – Bestwool/Bestlamb Victoria, MerinoLink NSW, South West Slopes Sheep Breeder Association.
- Case studies featuring results of demonstration sites or core group members.
- In-depth article on project/core producer for printed/electronic the media (and possibly for MLA Feedback magazine).

3.4 Monitoring and evaluation

3.4.1 Core Group

A pre-project survey was completed by core group members at the start of the one-day planning workshops. This included questions to assess their knowledge of flystrike risk factors/management practices and confidence about running non mulesed sheep. The survey used was based on the standard MLA PDS template with questions customised to suit the project.

A post-project survey was completed by core group members at their final meeting/workshop. The same knowledge and confidence questions were asked. In addition, questions were included about practice adopted/intending to adopt as a result of participating in the project.

Other metrics collected were number of core group members, hectares managed and livestock numbers. Productivity metrics planned to be collected were labour efficiency, sheep mortality %, lamb growth rates, incidence of flystrike (see Appendix 7.3). Profitability metrics planned to be collected were cost benefit analysis – for example net benefit or cost per head to run a NM versus M sheep.

All members of the groups have been categorised as "core" group members, not just those who ran demonstration sites.

3.4.2 Observer producers

At all public events (field days/seminars), evaluation sheets were completed by participants. Participants at these events have been categorised as "Observer" producers.

Metrics collected included number of people attending, hectares managed, livestock numbers, change in knowledge score, and any intended practice changes.

It was not possible to conduct pre and post project surveys with the observer producers as they were not a structured group that met regularly.

4. Results

4.1 Demonstration site results

During the project, eleven demonstration sites were conducted by core group members across Victoria, and the South-West Slopes region of NSW. The target was achieved which was to run 8-12 sites, that is 2-3 sites per group. A summary of the topics and locations is shown in Table 1.

Table 1. Summary of demonstration site locations and topics.

Topic	Locations
Sire evaluation - Low vs High EBWR ram teams	SW Slopes NSW – Harden NE Victoria - Baynton
Tail dock method	SW Slopes NSW – Jugiong SW Victoria – Langi Logan NW Victoria – Mt Dryden
Dag management	SW Victoria , Dunkeld NE Victoria – Baynton
Trialling a small mob of NM sheep	SW Slopes NSW – Jugiong, Murringo, Harden (no data – just observations) NW Victoria – Mt Dryden SW Victoria – Tarranlea (no data – just observations)
Breech wrinkle scoring method	SW Slopes NSW – Harden
Total demo sites	**11**

The key results for each demonstration site topic are presented in this section. As there was such a large number of sites, range of topics and methodology, the detailed results from each demonstration site are included in Appendix 7.3.

Productivity metrics collected, where relevant for demonstration sites, included labour efficiency/time, sheep mortality %, incidence of flystrike, lamb growth rates, worm egg counts (WECs), dag scores and wool cuts. Profitability metrics collected where relevant were any extra benefits/cost savings or extra costs per head.

4.1.1 Sire evaluation

Q. How quickly can I reduce breech wrinkle and maintain/improve other key profit drivers if I use rams with lower ASBVs for EBWR?

Young, NSW

- Progeny from two different sire groups were evaluated at this site. The difference between the ASBVs of the sire groups for EBWR was 1.0, while all other production ASBVs were similar.
- Using low EBWR (-0.6) rams compared to high EBWR ASBV (+0.4) rams can dramatically reduce breech wrinkle score in one generation. The overall difference between the lambs from the two sire groups was 0.5 wrinkle score. The average visual breech scores at marking were 1.4 and 1.9. Given that half the DNA comes from the sire and the difference between the ASBVs of the sire groups for EBWR was 1.0, 0.5 difference is realistic.
- The range in breech wrinkle score of the progeny was also reduced. The visual breech wrinkle score of the progeny from the low EBWR sire group ranged from 1 to 3, while the progeny from the high EBWR sire group ranged from 1 to 5. The distribution of the breech scores resulted in 3.4% and 27% being above 2.5 score in the low and high EBWR mobs respectively.
- This gives breeders management and breeding tools to manage the transition to non-mules.
- There was also little difference between the weaning weights and greasy fleece weights of the two sire groups, with only 1.2 kg and 0.2 kg difference respectively.
- The results of this demonstration are a guide only as the impact of birth and rear type have not been taken into consideration.

Baynton Victoria

- Progeny from two different sire groups were evaluated at this site. The difference between the ASBVs of the sire groups for EBWR was 1.2. While the SM (Sustainable Merino) and FP (Fibre Production) indexes of the 2 groups were similar, there was a small difference in individual ASBVs.
- Using low EBWR (-0.6) rams compared to high EBWR (+0.6) rams can dramatically reduce breech wrinkle score in one generation. The overall difference between the lambs from the two sire groups was 0.6 wrinkle score.
  The average visual breech scores at marking were 1.9 and 2.5 for the low and high EBWR sire groups, respectively. As half the DNA comes from the sire and the difference between the ASBVs of the sire groups was 1.2, a 0.6 difference is a realistic result.
- The range in breech wrinkle score was also reduced. The breech wrinkle score of the progeny from the low EBWR sire group ranged from 1 to 3, while the progeny from the high EBWR sire group ranged from 1 to 4. The differences in distribution of the breech scores highlights how quickly sheep can be bred that will have lower breech flystrike risk (ie. below score 3), and be easier to crutch, which will assist producers to manage the transition to non-mules.

- Information on greasy fleece weight, fibre diameter and hogget liveweights are still to be collected. This data is essential to be able to calculate relative gross margins for the two groups and compare the economic impact of changing ram source.

4.1.2 Tail docking method

Q. What impact does different tail docking methods have on ease of crutching and dag/urine in NM sheep?

Young, NSW

- This site compared docking tails with rings, a straight hot knife at two different angles (straight and on a 45-degree angle), a Tepari Patesco rolling anvil hot knife and Steinfort (u-shaped) hot knife Version 1. The lambs in the trial were from one mob of single born lambs out of maiden ewes, selected to reduce the impact of early life effects. Each treatment had 100 lambs (both male and female).
- A visual tail cover scoring system (1-5) was developed by SheepMetrix to objectively assess the amount of wool cover on the docked tails so the different tail docking methods could be compared.
- The trial lambs had an average breech wrinkle score of 2.3 at marking. Lambs were not mulesed.
- General comments from participants were that no tail docking method stood out to be significantly better than the other visually at weaning.
- There were some differences in the effect of the tail docking methods on tail cover score observed at 200 days of age (post weaning). On this sheep type (with a moderate breech wrinkle average score of 2.3), the Tepari knife resulted in tails with the lowest tail cover score of 2.8, while the rings resulted in tails with the highest tail cover score of 3.8.
- There was no consistent trend with the dag score of lambs and the tail docking method used.
- There was no correlation between tail cover score and the dag score of lambs. More work needs to be done to validate whether tail cover score is the best method to assess the appearance of the tail after docking and its significance on dag and flystrike.
- There is not enough difference to indicate any of the tail docking methods was better than the other regarding dag and urine. The bigger impact appears to be how well the tail area is crutched or shorn.
- The general observation from the core project participants was that consistency in tail length and the tail docking procedures was important for longer term benefits when going NM.

Langi Logan, Vic

- This site compared docking tails with rings, a straight hot knife, a Te Pari Patesco rolling anvil hot knife and Steinfort (u-shaped) hot knife model year 2021.
- Lambs were sourced from two different mobs (sire groups) to use in the demonstration. At lamb marking, average breech wrinkle scores were 2.5 and 3 for lambs from sire group 1 and sire group 2, respectively. Lambs were not mulesed.
- There was no major difference in the effect of the tail docking methods on tail cover score when observed 110 days after marking. However, the ring method may be an inferior

method to use on lambs that have higher breech wrinkle as this method resulted in a higher tail cover score for lambs from sire group 2.
- There was no consistent trend with the dag score of lambs and the tail docking method used.
- The way the tail wool cover appeared seem to be due more to variation in wrinkle between lambs rather than the treatments.
- There was no obvious difference in crutching ease between the different tail docking methods.
- The host producers concluded that the tail docking method is a relatively small part of the story about managing NM sheep - there are other factors that contribute more to ease of management such as breech wrinkle and dag.

Mt Dryden, Vic

- This site compared docking tails with a standard/straight hot knife, a Te Pari Patesco rolling anvil hot knife and Steinfort (u-shaped) hot knife model year 2021. Rings were not used in this comparison.
- Lambs had an average breech wrinkle score of 1.5 at marking. Lambs were not mulesed.
- There were small differences in the effect of the tail docking methods on tail cover score when shorn lambs were observed 210 days after marking. On this sheep type, using the Te pari and Standard knives resulted in tails with a lower tail score than the Steinfort knife.
- There was no correlation between tail cover score and the dag score of lambs. More work needs to be done to validate whether tail cover score is the best method to assess the appearance of the tail after docking.
- The wool cover on tails appeared to be due more to variation in wrinkle between lambs rather than the treatments. How well the tail area was shorn also influenced the appearance from a distance.
- There was no obvious difference in crutching ease or shearing ease between the different tail docking methods.
- The producer will move to using a Te Pari Patesco knife in future as he felt it gave a better result with respect to less wool on the tip of the tail based on the PDS results.

4.1.3 Dag management - Clarifying causes of and options to reduce Dag

Dunkeld, Vic.

- This site investigated using a long-acting (LA) drench on Merino weaners in winter compared with the normal farm practice of a short-acting oral drench, to help determine whether worms were primarily responsible for dag or whether it was the feed-base. A third treatment of a short-acting drench plus a trace element injection (Multimin) was included to see if this improved weaner growth rates or reduced dag.
- All sheep on the property are non-mulesed. The producer ceased mulesing in 2017. The sheep are relatively plain with low breech wrinkle scores (estimated to be an average of score 2).
- An important part of the methodology was to take WEC samples every 30 days to monitor worm burdens and check if the long-acting drench was effective. This is more regularly than most producers collect WEC samples for their weaner sheep.

- The long-acting drench mob remained worm free during the trial whereas the other 2 mobs required a second oral drench (day 30 of trial) and a third drench at end of the trial (day 130), which could have been given earlier if conditions were not so wet, which prevented sheep from being yarded and drafted to sample WECs from individual mobs.
- The long-acting drench mob had a higher daily weight gain (+2kg) over the trial period (130 days in winter-early spring) and also a lower average dag score of 1.8 compared with the Control and Multimin mobs which were dag score 2.6 and 2.3 respectively.
- The producer commented the majority of dag in 2022 appeared to be worm related, however is very interested in trialling some loose licks and/or mineral supplements (based on some blood/liver testing) in the future together with the LA drench to alleviate the worm aspect.
- The producer plans to take WEC samples more frequently in future in the weaners such as every 30 days, rather than the 6-8 weeks that he normally takes them, allowing earlier detection of increasing worms enabling more timely management to for both worms and dag.

Baynton, Vic.

- This site investigated using a long-acting (LA) drench on Merino weaners in winter compared with the normal farm practice of a short-acting (SA) oral drench, to help determine whether worms were primarily responsible for dag or whether it was the feed-base. In addition, feeding fibre (good quality vetch hay) was investigated to see if this could reduce dag. Sheep treated with a SA or LA drench were allocated to one paddock. In another paddock, sheep treated with a SA or LA drench were allocated and provided with vetch hay. After each 30 day period when sheep were weighed and WECs taken, the paddock and mobs were swapped to remove any paddock effect. They hay was moved to stay with the mob that was being fed fibre.
- All sheep on the property are mulesed. The producer is aiming to cease mulesing once they are confident they can reduce dag and have made progress on reducing breech wrinkle. For these mulesed weaners, it was estimated that body wrinkle was around 3.0.
- An important part of the methodology was to take WEC samples every 30 days to monitor worm burdens and check if the long-acting drench was effective. This is more regular than most producers in the group collect WEC samples for their weaner sheep.
- Over the trial period, the LA drench mobs had higher weight gains of 1.6-2.0 kg than the SA drench mobs.
- Feeding fibre did not reduce dag and reduced weight gains in the weaners. Within a drench treatment, adding fibre reduced weights gains by 2.2 – 2.6 kg. The reduced weigh gain would be due to sheep substituting good quality pasture for the hay. The best weight gain was in the LA mob which was 4.2 kg heavier than the SA + fibre mob.
- Dag was kept to a minimum by improved worm control. The producers commented that the weaners had much lower dag than what they would normally see in winter/early spring with their usual WEC/drench program. Hence, it was concluded that most of the dag issue was worm related (particularly in 2022).
- The producers in the group plan to take WEC samples more frequently in future in the weaners such as every 30 days, rather than the 6-8 weeks that they normally take them. This will allow earlier detection of increasing WEC and keep on top of the worms and dag.

4.1.4 Trialling a small mob on NM sheep

Mt Dryden, Vic.

- At this site a mob of 150 ewe lambs were not mulesed at marking and were run with a mob of mulesed lambs to compare impacts on dag, crutching ease, flystrike, and management. Sheep were relatively plain bodied with an average breech wrinkle score of 1.5
- The NM mob had a higher proportion of lambs that required crutching in spring (due to dag), and a higher incidence of flystrike, than the M mob. (NB: no M or NM lambs had any fly chemical applied before crutching).
- It took twice as long to crutch the NM lambs as the M lambs.
- The producer concluded he has to make further progress with genetics (reduce breech wrinkle further) to move to non-mulesed across the whole flock.
- Still weighing up what any extra costs could be if they run a NM mob. A higher proportion of lambs may require crutching or alternatively need to have fly chemical applied.

Jugiong, NSW

- This site continued to mules their ewes but did not mulese their wether lambs as they were sold by 12 months of age. This allowed them to get some idea of what it is like to manage NM sheep for the early portion of their life. This has been carried out on the 2022 and 2023 drops.

Harden, NSW

- This property left lambs non-mulesed, which were under a breech wrinkle score of 2.5, and kept them in a small nucleus mob. They continued to mules the lambs considered more at risk with a wrinkle score 3 or above. This has been carried out on the 2022 and 2023 drops.

4.2 Economic analysis

4.2.1 Demonstration sites

The benefits and costs that were able to be measured from the specific practices being evaluated in the demonstration sites have been summarised in Tables 2, 3, 4 and 5. If a monetary value could be assigned to the benefit or cost then a net benefit or cost in terms of $/sheep has been calculated.

Table 2. Sire evaluation – low EBWR vs High EBWR rams.

Benefits	Costs
• Reduction in breech wrinkle of 0.5 score o easier crutching (30% more sheep crutched per day – savings in shed staff- 25c/sheep) o reduced risk of breech flystrike o reduced need for fly chemical ? (eg. 80c/sheep 1 less application of Clik)	• Potentially have to buy more expensive rams if need to get those with EBWR ASBV in upper percentiles (and if trying to maintain CFW, FD etc) - this will depend on where the starting point of the flock is, the environment that the enterprise is being run and the overall breeding and production objective.

Benefits	Costs
• Other key traits were maintained in this Demonstration - fleece weight, fibre diameter, weaning weights. • Reduced BWR facilitates transition to NM – but the impact of NM vs M was not compared in this demonstration as progeny from both sire groups were M.	• Ram purchase price can vary depending on the year and demand for certain production and welfare traits.
Benefit: cost: Could be cost neutral or +$ 1.05/sheep from weaning to hogget age.	

Table 3. Tail docking method for NM lambs

Benefits	Costs
• No major difference in impact on the demonstration properties of different tail docking hot knives or rings on o Tail cover score - amount of wool on end of tail o Dag or Urine score o Crutching ease o Flystrike incidence • For sheep with higher breech wrinkle (3 or above) it was considered that using a hot knife may be more effective at reducing wool on the end of the tail than rings.	• No major difference in labour/time to use different tail docking hot-knives or rings. Some producers find the Tepari Patesco knife heavy and more difficult to use than a straight hot knife. • Tepari Patesco rolling anvil knife more expensive to purchase than a straight hot knife. Steinfort knife price was not available as not commercially available yet. • All treatments had pain relief with Meloxicam (75c/10 kg lamb), so no difference in costs. • If using "Num-nuts" device to apply rubber rings there is the cost of NumOcaine (lignocaine) at 67 c/head. Device costs around $400.
Benefit: cost: Could be cost neutral (after equipment purchased)	

Table 4. Dag management – Clarifying causes of and options to reduce dag

Benefits	Costs
• Taking WEC samples every 30 days in weaner sheep during winter/early spring allowed faster response time with any follow up drenching required. • Improved worm control in weaners: o increased weight gains by up to 2 kg/head - valued at $2.00/kg LWT = $4.00/head o lowered dag score by 1 score (from 2.6 to 1.8) = lower flystrike risk in spring, quicker to crutch/less weaners to crutch, reduced amount of wool	**Improved worm control** • 1-2 additional WECs during winter/early spring @ cost of $35/sample = $70 spread over 600 weaners = 12c/head • Perhaps 1 extra short-acting drench required @ 70 c/head plus yarding & labour **Feeding fibre (hay)** • Fibre reduced weight gain by 2kg compared to not feeding fibre, when worm control was improved = loss of $4.00/head

downgraded. Reduced loss of wool value – estimated value of $2.00/head **TOTAL BENEFITS = $6.00/head over the winter period**	• Combination of poorer worm control & fibre reduced weight gain by 4 kg = loss of $8.00/head • Vetch hay @ $330/bale ($1/kg), plus labour to feed out, & 7 kg/head eaten = $7.00/head. **TOTAL COSTS** improved worm control only **= $ 82c/head** **TOTAL COSTS** feed fibre with or without improved worm control **= $11.82 or $15.00/head**
Benefit: cost: **Improved worm control (no fibre) = + $5.18/head per year net benefit** **Feeding fibre but not improving worm control = - $ 17.00/head per year net loss**	

Table 5. Running a small mob of NM vs M sheep

Benefits	Costs
• Opportunity to participate in Wool Integrity schemes, and declare NM or CM on National Wool Declaration to increase wool sale value. Price premium range $0.50-2.00 kg/clean. *If cut 3.5kg/head CFW @ $0.50-2.00 extra = $1.75 - 7.60/head* • Opportunity to sell surplus ewe or wether lambs to re-stockers who are also NM/CM to prevent loss of sale value. • Save on cost of mulesing ($1.00) at marking & Trisolfen (86c) = $1.86/head (or 31c/ewe per year if kept for 6 years). **TOTAL BENEFITS = $2.06 to $7.95/head per year**	• NM Ewes – may require additional crutch/ year (ie. add pre-lamb crutch) @ $2.00/head. May not be required if shearing program is every 6-8 months. • Depending on breech wrinkle and dag scores – could be slower to crutch (eg. 30% fewer sheep crutched per day – extra cost for shed staff @ 25c/head) • NM Ewes may require fly chemical (eg. when weaning lambs) to protect until crutching time (depends on time of lambing & shearing regime) @ 70c/ewe • More monitoring **TOTAL COSTS (worst case scenario) = $ 2.95/head per year**
Benefit:cost: **Running NM ewes = - $0.90/ewe loss to +$5.00/ewe benefit per year.**	

4.2.2 Practice changes and potential benefits/costs to consider in the transition to NM sheep

Producers are all at different stages on the path to running a NM flock. They have different breech flystrike risk factors, timings of operations and sheep genetics. The practice changes they may need to make will vary as will the benefits and costs.

At the end of the project, through discussions and in the post-project survey, producers were asked to list any changes to management, breeding/selection or other aspects of their business they have made or were intending to make to implement their transition plans. They were also asked whether there were any extra benefits/cost saving or extra costs/loss of income associated with the changes.

Their responses are summarised in Table 6 to provide other producers a range of potential costs and benefits they may need to consider when developing their own property specific plans.

Table 6. Practices changed by group members and impact to their business

Practice	Benefit	Cost
Ceased mulesing flock	RWS premium Can get $3/kg clean premium depending on species (micron etc)	Membership fee & on-farm audit
More monitoring /surveillance	Not seeing as many breech struck because we are looking at it more; better survival	More work/time
Increased WEC testing More frequently WECs especially in weaners (eg every 30 days)	Seeing less daggy sheep. Improved animal health. Increased growth rates. Reduce stock losses. Can use cheaper drench options if have no resistance – save 12c/head.	$35/bulk WEC sample
More strategic crutching/shearing -timing more critical for NM Crutching ewes twice Crutch own sheep -bought crutching trailer Moved to 8 mths shearing/not adding extra crutch	Reduced flystrike risk. Save $3/head doing it ourselves & can get timing right Optimise wool length, staple strength	Extra workload -do clean up ourselves prior to crutching. Extra crutch -$1.40/hd + rousie = $2/hd total. Cost of shearing - $10/head
More strategic fly chemical use. Testing maggots for chemical resistance	More effective timing. Aware of it, if have an issue – chemical rotation	Extra chemical application for fly prevention - $1/head
Breeding plainer sheep – lower breech wrinkle More focused on EBWR, DAG, WEC ASBVs in ram selection Start Breech scoring own ram breeding nucleus Do DNA flock profile on young ewes	Easier to crutch. Reduced flystrike risk. Less reliance on fly chemicals & drenches - less risk of resistance Will be able to move to NM when ready Benchmark where flock sits re EBWR, WEC, CFW etc	
Breech & body scoring at lamb marking- keeping records/data for breeding ewes	Faster genetic progress in ewe base	
Classing out daggy ewes (repeat offenders - hypersensitive scouring).	Less dag - extra wool valued at $5/head	

	Easier to crutch – save 50c/head. Reduced flystrike risk.	

4.3 Extension and communication

4.3.1 Core Group meetings

Core group members got involved in the project through personal contact from producer advocates, other producers, group facilitators and wool brokers.

The number of producers engaged in the four core groups were as follows:

- South West Slopes NSW - 12
- South West Victoria – 12
- North East Vic -16
- North West Victoria – 13
  TOTAL of 53 core producers.

Core group statistics on hectares managed and livestock numbers are in the section on Evaluation and Monitoring.

At the planning workshops, core producers were asked what were their key concerns about moving to NM/managing NM sheep. The concerns were similar across the regions and were as follows (in order of most frequent answer to the less frequent):

- Getting shearers to crutch NM sheep, increased cost to crutch
- Dag management/increased dag
- Increased workload/labour required, extra crutching required
- Risk of breech flystrike
- Decrease in wool cut (or increased micron) if change genetics
- Reduced sheep sale value
- Chemical resistance

Producers were provided with a comprehensive manual at the “Transitioning to NM Sheep” planning workshop which also contained a range of MLA and AWI publications. The manual also had sections where they recorded information about their own enterprise and any changes they may need to make to management or genetics. A one-page 5-year integrated plan template was included in the manual where they could record a summary of any changes they had identified in each section of the manual. They were also provided with a set of A4 laminated sheets with visual breech scores (from Visual Sheep Scores booklet Ver 3 2019, AWI, MLA) to be able to use later on when sheep were in the race or at lamb marking to benchmark where their flock sat with respect to the breech flystrike risk indicator traits. This information allowed them to determine if they needed to review their breeding/selection strategy. Some group members, who had not been purchasing rams with ASBVs or had used ASBV but had changed studs, followed up from the workshop with conducting a DNA flock profile on their ewes.

The two-year group program included seasonally relevant on-farm meetings (to discuss issues and practice sheep breech score assessments), zoom meetings and guest speakers. Results from demonstration sites were also discussed at meetings as they became available. At the end of each year, group members reviewed their property specific plans they had developed at the first

workshop. A summary of group meetings are shown in Table 7. The majority of activities were face-to-face. We also ran a couple of zoom meetings for some guest presenters on specific topics that were relevant to all group members to save on travelling and give all groups an opportunity to interact.

Table 7. Summary of core group activities

Year 1	**SW slopes NSW**	**SW Vic**	**NE Vic**	**NW Vic**
Planning workshop	Mar 2021	Mar 2021	Nov 2021	Feb 2022
Other sessions	2 on-farm & 1 zoom	3 on-farm & 1 zoom	2 on-farm & 1 zoom	2 on-farm & 1 zoom
Year 1 review	Feb 2022	Feb 2022	Mar 2023	May 2023
Year 2	2 face to face	1 zoom 2 face-to-face	2 on-farm	2 on-farm
Year 2 review	Nov 2022	April 2023	Mar 2024	May 2024
Final workshop	Mar 2024	April 2024	Mar 2024	May 2024

An example of topics covered during the core group meetings were as follows:

- Late Autumn/Winter
  - Worm control, dag management, monitoring WECs.
  - Assessing Visual breech scores for DAG
  - Zoom webinar: Managing worms and dag with the Paraboss team – customised webinar prepared for the 4 core groups. (recorded - see link - https://www.dropbox.com/s/wbjt2fdulxizwwk/Managing%20worms%20and%20dags.mp4?dl=0)
- Late winter/early spring
  - Review relative risk for fly strike in response to seasonal conditions/BOM forecasts.
  - Monitoring weaner sheep.
  - Management of ewes pre-lambing (need for pre-lamb crutch?, WECs etc).
  - Breeding and selecting sheep for flystrike resistance
    - Using the DNA flock profile tool to benchmark your ewe base (EBWR, WEC, CFW, FD etc).
    - Ram selection – using ASBVs and RamSelect.

  Several guest speakers spoke to the groups on this topic including: Chloe Bunter and Emma McCrabb, MLA, Narelle Sales, NSW DPI and Sally Martin, SheepMetrix.
- Spring
  - Lamb Marking - selection and application of pain relief options at marking (and mulesing while phasing out mulesing), best practice techniques for docking and castration (with particular attention to tail length),
  - Assessing/recording breech cover and breech wrinkle on lambs in the cradle.

    - Method for evaluating progeny if running sire evaluations.
- Early summer
    - Weaning /Weaner management nutrition, growth rates, worm control, fly control and monitoring.
    - Review relative risk for fly strike in response to seasonal conditions/ BOM weather forecasts (eg. using Ag360 model predictions)
    - Preventing fly chemical resistance & Testing maggots for fly chemical resistance (Narelle Sales, DPI NSW).

The group process, that followed the one-day planning workshop, was important to allow producers to discuss, review and adjust management decisions during the project. They could compare and apply the learnings from the different plans/strategies implemented and the results from the demonstrations sites which focussed on more specific parts of the system.

The success of the group extension is discussed in the section on Monitoring and Evaluation.

4.3.2 Public Events - field days/workshops

The program team organised field days to promote the results of the demonstrations sites to the wider farming community and also were invited to attend some events as guest speakers.

A wide range of networks were used to promote the events

- MLA
- AWI
- BestWool/Bestlamb – email newsflash
- MerinoLink
- SW Slopes Sheep Breeders
- Consultants
- Local Vets
- Wool Brokers - Wool Integrity scheme reps.
- Media - SheepCentral
- Twitter
- Podcast – Commodity Conversations, by Mercardo
- SheepMetriX eNewsletter

The events are listed below. The numbers of people who attended the events is also listed. The evaluation of the events (where this information could be collected) is discussed in the section on Monitoring and Evaluation.

2022

Public events, in the form of seminars/workshops, were held in the 2 regions where the PDS groups and sites were more established – SW Slopes NSW (Young, 29/06/2022) and SW Vic (Dunkeld, 26/10/2022). At these events an update on the PDS results were given by the host producers.
NB: The NE and NW Victoria groups were not able to commence their demonstrations until late winter/spring 2022, as the groups started late due to Covid-19 restrictions.

- "Transitioning to non-mules" seminar, Young, NSW (29 June 2022)- presentations by 3 project team, 3 SW Slopes Core Group members, 1 PDS producer advocate and other guest speakers.
  (60 people attended).

2 news articles (The Land) & 1 podcast (Commodity Conversations, by Mercardo) resulting from the Young Seminar.

- "Transitioning to a non-mulesed flock" seminar, Dunkeld, Vic (26 Oct 2022)- presentations by project team, 3 SW Victoria Core Group members including the PDS producer advocate, MLA and other guest speakers.
  (35 people attended – 50 registered but some didn't attend due to Victorian floods).

The project was also promoted via:

- MerinoLink conference, Wagga, NSW (7 June 2022) -presentation by Lucinda Eddy, SheepMetriX.
  (250 people attended, plus a number of people attended the conference virtually).

2023

Public events were able to be held in all the 4 group regions as all groups now had demonstrations sites established.

- South West Slopes group on-farm field day (16/6/2023), "SummerHill" Young - held to present all PDS results and display sheep (Fig. 1). PDS site host property demonstrated and develop skills for producers to improve and record key traits for NM flocks, breech neck body wrinkle off shears, fleece traits, FROT, COLOUR, DAG (10 attended).
- SW Victoria group field day, presentation at Bestwool/Bestlamb conference, Bendigo (20/6/2023) – 2 repeat presentations made on experiences and PDS results from the SW Victoria group, by Lisa Warn and 2 SW Vic Core Group members/producer advocate.
  (120 people attended the 2 concurrent sessions)
  The project fact sheet was distributed and session recorded for the BWBL website (see link - https://agriculture.vic.gov.au/support-and-resources/networks/bestwoolbestlamb/bestwoolbestlamb-conference-videos/2023-conference-presentations#h2-7).
  An AWI "The Yarn" podcast interview was recorded at the BWBL conference.
- NW Victoria group on-farm field day (6/10/2023), held at demonstration site host's property, Mt Dryden, to present all PDS results and display tail dock demonstration sheep (11 attended).
- NE Victoria group on-farm field day (11/10/2023), held at producer advocate's property, Mansfield, to present all PDS results and display NM sheep (44 attended). Mark Ritchie discussed his experiences moving to a NM flock 6 years ago. Program included presentation of demonstration site results and practical hands-on breech wrinkle scoring (crutched sheep) (Fig. 2).

2024

- SW Slopes NSW group had an on-farm field day (20/03/2024) in conjunction with a Livestock Technology Expo in Young. SheepMetriX were guest speakers and presented an overview of the MLA PDS project and demonstration site results.
  (100 people attended).

Figure 1. "Transition to non-mulesed flock" South West Slopes Field day held at "SummerHill" Young, 16/06/2023

Figure 2 . "Transition to non-mulesed flock" NE Vic Field day held at property of producer advocate Mark Ritchie, "Delatite Station" Mansfield, 11/10/2023

4.3.3 Other promotional activities

- The project team created awareness of the project via personal contact with a wide range of groups/networks– SALRC, Bestwool/Bestlamb groups/facilitators, Wool brokers (Nutrien, AWN, Techwool), Loddon Valley Merino association, Sheep Producers Australia, WoolProducers Australia, and AWI.
- A Project fact sheet with QR code (linked to MLA website) was created for people to register to receive demonstration site updates and notification of field days. This was handed out at all events and a copy of the fact sheet is on the MLA PDS website.
  The project summary, updates and coming events were available on the MLA website. https://www.mla.com.au/extension-training-and-tools/search-pds/pds-data/supporting-sheep-producers-transition-to-non-mulesed-sheep/
- Lisa Warn was invited to be part of AWI's advisory panel for development of AWI's 1 day workshop "Stratefly", which is about helping producers develop their own plan to move to a NM flock. The "Stratefly"workshop began being piloted in February 2024.
  Learnings and results from this MLA PDS were able to be shared with the advisory panel.
- The project team have assisted with the (re)development of a position statement and member recommendations for the small ruminant special interest group of the Australian Veterinary Association.

- The project team have been contacted by other service providers who would like us to run a similar program in their region & discussions have been had with MLA as to how this demand may be serviced in future.
- We were also consulted by consultants from Aggregate during the planning phase of their MLA PDS on the same topic. Aggregate's MLA PDS has now commenced and we have been liaising with Peter Harvlant (Aggregate, Wagga) to see how we can collaborate/support each other and run some joint events. We have also communicated with Georgia Reid (AgPro Management, WA) who is running a similar MLA PDS in WA.
- We were consulted by Rachael Trengove, co-ordinator of the upper North Farming Systems group, South Australia. They were holding a field day (25/06/2024) on transitioning to non-mulesed sheep. We discussed the experiences of the Vic and NSW producers in our groups, their key concerns, and learnings from demonstration sites.
- Media releases were written by the project team:
    - Article to create awareness appeared in SheepCentral (13/1/2022), SALRC newsletter (14/02/2022), Bestwool/Bestlamb newsflash, NSW SheepConnect & Sheep Sustainability Framework. https://www.sheepcentral.com/mla-project-to-aid-non-mulesing-sheep-producers/
    - Dunkeld workshop promo - SheepCentral (12/09/2022), BWBL newsflash, MLA website & Twitter (Sept-Oct 2022). https://www.sheepcentral.com/non-mulesed-flock-option-to-be-outlined-at-dunkeld-workshop/
    - Dunkeld workshop report featuring Dr Joan Lloyd (Tail docking & pain relief) – SheepCentral (7/12/2022) https://www.sheepcentral.com/correct-lamb-tail-length-message-reinforced-at-dunkeld/
    - Project & demonstration site update – SheepCentral (30/01/2023) https://www.sheepcentral.com/finding-your-own-approach-to-a-non-mulesed-sheep-flock/
    - NW Vic and NE Vic field days promo - BWBL newsflash, MLA website & Twitter (Sept 2023).
    - Articles in Sally Martin's SheepMetriX newsletter about project and demonstration sites in NSW. https://www.sheepmetrix.com.au/projects-trials-1
- Media releases were written by journalists:
    - "The Land newspaper, 07 /07/2022 (Appendix 7.4)
- Twitter posts
    - 11 tweets posted throughout the project to promote the project, field days and workshops totalling 8,231 impressions and 425 engagements. For the breakdown of the reach of each post see Appendix 7.5.

4.4 Monitoring and evaluation

4.4.1 Core group

Producer Engagement

A total of 53 producers were engaged in the 4 core groups. The number of producers in each core group, and their stock numbers, are summarised in Table 8**.**

Table 8. Core Group farm details

Group	No. engaged	Ha's managed	No. of Ewes	Lambs turned off/year	Total sheep	Total cattle
SW Slopes NSW	12	20,181	38,850	24,200	78,350	1,871
SW Vic	12	14,350	49,350	36,550	106,000	2,700
NE Vic	16	21,314	57,230	41,050	99,200	5,342
NW Vic	13	12,060	25,500	14,350	44,900	750
Total	**53**	**67,905**	**170,930**	**116,150**	**328,450**	**10,663**

Knowledge, skills and confidence

Producers improved their knowledge of breech flystrike risk factors (environmental conditions, sheep breech indicator traits, tail length) and protection periods provided from some management options (crutching/shearing, different chemicals and factors affecting chemical efficacy). On average, their knowledge score, for the same questions in the pre and post surveys, increased from to 69% to 86% (Table 9).

Producers increased their knowledge of strategies to move to/manage NM sheep. On a scale of 1 (no increase) to 10 (very big increase), they indicated that there was a large increase in their knowledge, as a result of the PDS, with an average score of 8 (Table 9).

Producers increased their skill in identifying/breeding more breech strike resistant sheep. They indicated that there was a large increase in their skill, as a result of the PDS, with an average score of 8 (Table 9).

Some specific skills and tools that producers got to practice using were:

- Visual breech scoring – breech wrinkle, breech cover, dag and urine. Use of body/neck wrinkle for mulesed sheep.
- DNA flock profile – how to take TSU samples, interpreting results (7 Vic producers undertook their own DNA flock profile).
- Sheep Genetics database – how to search for rams to meet your breeding objective with a focus on incorporating relevant breech/animal health traits while balancing other production traits.
- RamSelect – how to use to track genetic gain in ram teams.
    - All NSW core producers have a RamTeamManager to track ram genetics
- ParaBoss websites – Flyboss, WormBoss.
- Ag360 – flystrike risk maps

- eID technology and how it can be used to collect data to aid selection/classing ewes (eg. at lamb marking to record BWR, BCOV scores or in young ewes to record dag and identify repeat offenders) or evaluating progeny from sire groups (eg. BWR, dag, GFW, FD).
- Fly Chemical resistance testing – test kits given out and producers were made aware of AWI funded testing by Narelle Sales at DPI NSW. Three producers in the SW Victoria group submitted samples for testing.

Producers improved their confidence in managing NM sheep. When asked in the pre and post surveys "how confident are you that your planned management calendar/animal health program will prevent breech flystrike in a NM flock?" their score increased from 5.7/10 to 7.8/10 (Table 9).

Table 9. Results of evaluation for the Core Groups

Group	**Pre knowledge/ skills score**	**Post knowledge/ skills score**	**Pre confidence score** *(out of 10)*	**Post confidence score** *(out of 10)*	**Satisfaction with PDS** *(out of 10)*	**Value of PDS in assisting manage sheep enterprise** *(out of 10)*	**How well has PDS increased your:** *(scale of 1 to 10 – with 10 = very large increase)*	
							knowledge of strategies to move to/manage NM sheep	**skill in ID/breeding sheep more breech strike resistant**
SW Slopes NSW	70%	73%	5.3	7.8	8.8	8.4	8.0	8.2
SW Vic	69%	88%	6.3	7.5	8.1	8.6	7.5	7.8
NE Vic	70%	92%	6.0	8.0	9.4	9.4	8.7	8.1
NW Vic	68%	91%	5.0	8.0	8.2	8.3	7.6	7.8
Average	**69%**	**86%**	**5.7**	**7.8**	**8.6**	**8.7**	**8.0**	**8.0**

Comments on the PDS

All core group members said they would recommend this PDS to other producers.
The average satisfaction score for the PDS was 8.6/10.
The average value score that the PDS had for assisting them to manage their sheep enterprise was 8.7/10 (Table 9).

Some producers provided comments about what they got out of being involved in the PDS.

- Gave us great information on how to manage moving forward to NM our sheep; Great completing program in groups with other farmers.
- The more we learn the better equipped we are to look at sheep differently with more knowledge.
- Valuable comparing the different tail docking methods
- Great help for management ideas
- Small group of producers with varying experiences and ideas provided a good learning environment with thought provoking discussion.
- Great to get on farms & share ideas with other producers
- Great tips for genetic & management to reduce dags & selecting for less wrinkle; Need to push genetics harder as permanent & cumulative solution eg. dag management. We will all be able to use the upcoming ASBV for flystrike.
- Been beneficial to be involved in the group for 3 years to see seasonal changes & the impacts your decisions can make over time.

- Right conversation to be having & the more involved the better for both individuals & industry. Would be good to see more current research data on tail length data and impact on dag.
- Everyone in the group is at different stages so allows you to get knowledge based on their stage of NM; Going to a different farm each time is fantastic to see how everyone does things.
- Great group of like-minded wool producers who are going through the same process in different environments & management. Sharing info was mind provoking.
- Small group with facilitator works well.
- Didn't attend all sessions but found a lot of the content useful.
- Very relevant to my business
- A lot of good information for someone on the path to non-mulesing (sessions could possibly been closer together)
- Picked up handy info from talking to other producers; good guest speakers
- Informative & gives info you may not think of.

Practice change

At the start of the project, all core producers developed their own property specific, integrated plan to transition to a NM flock, or their plan to assist them manage NM sheep for those producers that had recently ceased mulesing. Their plans outlined any changes to their management calendar, lamb marking practices, breeding/selection, marketing strategies or any other changes to their business.

Around 36 % of producers had already ceased mulesing at the start of the project, 20 % ceased during the project (not including a few more who ran some NM trial mobs) and the remainder intended to once they had made further changes to their sheep genetics and felt their sheep were ready and they got more confident (Table 10).

As a result of the PDS, 41 % of producers had made or intended to make changes to their management calendars and 69% had made or intended to make changes to their breeding /selection programs (Table 10). The specific practice changes that individual producers mentioned are summarised in Tables 11 and 12 (each dot point belongs to a producer).

Table 10. Proportion of producers who made or intend to make changes to their enterprise as a result of being part of this PDS.

Group	**Plan prepared to assist transition to/management of NM sheep** (% of producers)	**Cease Mulesing** (% of producers)			**Changes made/intend to management calendar** (% of producers)	**Changes made/intend to breeding/ selection program** (% of producers)
		Pre project	**During project**	**Intend to**		
SW Slopes NSW	100 %	25 %	17 %	58 %	42 %	75 %
SW Vic	100 %	42 %	25 %	33 %	33 %	75 %
NE Vic	100 %	38 %	13 %	49 %	44 %	63 %
NW Vic	100 %	39 %	23 %	38 %	46 %	62 %
Average	**100%**	**36 %**	**20 %**	**44 %**	**41 %**	**69 %**

Table 11. Changes made/intend to Management Calendar by individual producers in groups:

Group	Practice change
SW Slopes NSW	• Crutching young ewes slightly earlier • Moving lambing dates; Change to 2 shearings per year.; More WEC testing; Making smaller paddocks for better management. • Still refining calendar. Being more vigilant & monitoring stock more.
SW Vic	• Question fly chemical application, product rotation. • Change fly chemicals used; question use of feeding fibre to reduce dag. • Don't have fixed times for applying fly prevention chemicals - be more seasonal. • More strategic crutching & extra crutch; More flystrike focus. • Using crutching and chemical applications in line with "flywave" timing.
NE Vic	• Fine tune crutching dates. • More WECs • Crutching ewes twice; more WEC monitoring. • Timing of crutching-ensuring this is done strictly on time. • Moving to 8mth shearing - not adding extra crutch • Crutching ewes & hoggets twice; improving nutrition of weaners; more WECs; Refine mgt calendar & adjust depending on season.
NW Vic	• Take WECs more frequently - every 30 days - for weaners. • Need to maintain critical timing of operations for NM sheep • WEC testing more frequently on weaners. • More WECs • Regular WEC checks in weaners.

Table 12. Changes made/intend to breeding /selection program by individual producers in groups:

Group	Practice Change
SW Slopes NSW	• More pressure on breech wrinkle • Breeding plainer/ less wrinkle sheep. Breech & body scoring at lamb marking - keeping records/data for breeding ewes; DNA flock profile for breech & body wrinkle. • Made changes throughout project & will continue to. CM wethers & aim to go fully NM eventually. • Moving to more plain body in the NM stud family & wanting to change the commercials slowly. • Looking at DAG & EBWR more; classing out daggy ewes.
SW Vic	• Use more ASBVs to select rams; use rams with less BWR. • Select rams on EBWR & BCOV ASBVs; Cull daggy ewes. • Ram selection - looking at DAG, WEC & breech scores. • Harder selection on dag. • Focus more on EBWR ASBVs; Breech score our ewes. • High focus on LDAG ASBV, WEC, YEMD & YFAT. • More focus on dag and breech wrinkle selection for self-replacing ewes and rams. Starting to breed own rams to have more control over genetic direction.
NE Vic	• Purchase plainer bodies rams & reduced ASBVs for EBWR; Join BWR score 4/5 ewes to meat rams. • Continue to select plainer bodied sheep. • Lower breech scores • Start culling dag score 4 & 5 ewes, if repeat offenders -sell. • Plainer breeches; finer micron

	• Will start BWR/Dag scoring own ram breeding nucleus; will use independent culling to remove worse animals.
NW Vic	• Consider more EBWR ASBVs. • Use relevant ASBVs for ram purchasing. Think about finishing mulesing when making breeding decisions. CM my 1st cross ewes in 2023, intend to CM the Merinos in future. • Will put a little more emphasis on breech wrinkle. • Continued selection of rams with low breech wrinkle, lower micron & plainer types. Ran a trial mob of NM Merino ewes in 2022. • Cull more on dag; Do a DNA flock profile to see where we sit.

Other comments from groups during the project.

- SW Slopes NSW Group participants often commented on the tail docking demonstration was most interesting/useful demonstration with other discussions and interest around tail length.
- Other participants found value in mulesing ewes and not mulesing wethers to better understand management of NM animals while they build confidence.
- Producers across all groups who have trialled running NM sheep have noticed more care is needed with running NM animals up to about 18 months of age then it isn't as obvious in regard to different management practices between Mulesed and Non-Mulesed mobs as adult sheep.

4.4.2 Observer producers

Observer Producer Engagement

A total of 385 "Observer" producers attended field days, workshops, conferences or a core group meeting. The number of observer producers that attended an event in each core group region are summarised in Table 13**.** In addition, other people who attended the field days included wool-brokers, stock agent, consultants and agency staff.

Table 13. Observer producers engaged in activities in the Core group regions

Core group region	Observer producers who attended		Total Observer Producers
	Field day/ workshop/conference	Core group meeting	
SW Slopes NSW	(i) 60 (ii)10 (iii) 100	6	176
SW Vic	(i) 21 (ii) 120	6	147
NE Vic	38	8	46
NW Vic	9	7	16

Observer producers – changes in knowledge and skills

Each event was evaluated where possible. At the large conference events it was not possible to get producers to complete an evaluation sheet specific to this PDS.

Changes in knowledge of observer producers who attend field days/workshop was captured. Results from evaluation of events are summarised in Tables 14 and 15. Observer producers attending the SW Victoria and SW slope NSW events in 2022/23, felt they had a large increase in their knowledge

of factors affecting breech strike, tools available to breed more flystrike resistant sheep and strategies to manage NM sheep. On a scale of 1 (no increase) to 10 (very large increase) their average rating ranged from 7.1 to 7.7 (Table 14). Around 85-100% of producers felt they had learnt something new and these topics are listed below Table 14.

The majority of observer producers attending the NW and NE Victoria events in 2023, felt they had increased in their knowledge of these topics. Note, the evaluation question was slightly different and just asked them to state if their knowledge had increased or stayed the same (Table 15).

We are not able to provide pre and post project scores for knowledge/skills or confidence as observer producers attend a one-off event.

Practice change

The proportion of observer producers who intended to make some change to their enterprise, as a result of attending an event, ranged from 63 -100%, (Tables 14 and 15). The practice changes they described are listed below each event (below Table 14 and 15). The impact that the PDS results (and the associated information, skills and tools promoted) had on the producers is apparent as there are numerous mentions of making changes to tail docking practice, worm/dag management and breeding/selection.

Table 14. Field day/workshop Evaluation

Event	**Ha's covered** (from producers completed sheet)	**# sheep (ewes)**	**# producer participants**	**# advisor participants**	**Average satisfaction score with this event**	**How much do you feel you increased knowledge of**			
						Factors affecting breech strike	**Tools avail. breed/select for more flystrike resist sheep**	**Strategies manage sheep with reduced reliance on Mules**	**Intent to change %** (producer)
Workshop SW Vic Dunkeld 26/10/22	25,080 (16 people completed evaluation)	77,100	21	14	8.5/10	7.1/10	7.4/10	7.4/10	63%
Field day SW slopes NSW 16/6/23	7390 (6 people completed evaluation)	18,180	10 (83% still mules)	-	9.3/10	7.5/10	7.7/10	7.7/10	100%

SW Victoria workshop additional feedback

- 95% were confident after the day to begin planning to implement strategies to reduce reliance on mulesing.
- 85% of producers involved learnt something new
    - tail docking length; caudal folds; importance of tail length for ewe health
    - tail docking methods, gas knife differences
    - importance of worm burdens; larval hypersensitivity
    - producers' experiences
    - RWS wool accreditation
    - Where to head to from here
    - Ag360 tool

- 63% of producers plan to make changes (26% not sure)
    - more selection pressure on BWR in ewe hoggets
    - better worm management
    - genetic selection
    - more emphasis on selecting for low dag
    - aim for NM
    - purchase rolling anvil gas knife for tail docking
    - cut tails longer
    - further breeding towards NM

SW Slopes NSW field day additional feedback

- Producers said most valuable part of the field day was the hands-on practical demonstrations of visual scoring for wrinkle and dag and info on eID tag implementation.
- 100% were confident after the field day to begin planning to implement strategies to reduce reliance on mulesing.
- 100% of producers involved learnt something new
    - Scoring for visual traits (dag, urine, wrinkle)
    - How to identify fleece rot
    - Relationship between neck and breech wrinkle scores and effectiveness of different hot-knife styles/techniques
- 100% of producers plan to make changes
    - Try using various hot-knifes
    - Try managing a small mob of non-mulesed wethers as a trial of changes to management
    - More scoring
    - Keep an eye on urine and dag
    - Increase the amount of data collected as a result of implementing eID for individual data capture.

Bestwool/Bestlamb Conference Evaluation (20/6/2023)

The SW Victoria group field day was a presentation at the Bestwool/Bestlamb conference, Bendigo (20/6/23) – 2 repeat presentations made on experiences and PDS results from the SW Victoria group, by Lisa Warn and 2 SW Vic Core Group members/producer advocate. Around 120 people attended the 2 concurrent sessions.

The conference was evaluated but organisers did not ask for specific feedback on individual presentations. However, there was some feedback obtained that specifically relates to the MLA PDS presentations.

Some responses to the following question:

What have you heard today that you are likely to implement in your business?

- Dag management
- More WECs and better worm practices to reduce dag
- Look more into genomics for worms and dags
- Dag Management
- Look at mulesing/tail docking practices where possible to dag score & reduce some of these practices
- Tail length
- Dag scoring in our nucleus
- Not mules

Table 15. Field day evaluation

Event	Ha's covered (from producers completed sheet)	# sheep (ewes joined)	# producer participants	# advisor participants	Average satisfaction score with this event	Value to enterprise rating	How has your knowledge changed (increased or stayed same) ?			Intent to change % (producer)
							Factors affecting breech strike	Tools avail. breed/select for more flystrike resist sheep	Strategies manage sheep with reduced reliance on Mules	
NW Vic field day - Mt Dryden 6/10/23	6,290 (7 people completed evaluation)	12,875	9	2	8.7	8.4	57 % said increased	86 % said increased	86 % said increased	71%
NE Vic field day - Mansfield 11/10/23	22,890 (29 people completed evaluation)	75,000	38	6	8.5	8.4	90% said increased	83% said increased	97 % said increased	74% (& 22% not sure)

NW Vic field day: Participants proposed changes to business/sheep enterprise.

- Put more selection pressure on daggy mature sheep
- Look more into ASBVs
- Have another look at Sheep Genetics website to improve ram selection & use flock profile report
- Ram selection for low breech wrinkle
- Access more data on my flock & any incoming rams

NE Vic field day: Participants proposed changes to business/sheep enterprise.

- Do breech wrinkle scoring (x3 people)
- Tail docking method
- Move to 2 crutchings for ewes (add 1 pre-lamb,) (x 3 people)
- Dock to best practice tail length
- Take extra WEC tests
- Working towards NM
- Modify breeding objective
- Improve dag and fly control
- Use dag score in selection & dag ASBV
- Reduce dag in the flock
- Moving more to cross-bred ewes

5 Conclusion

5.1 Key Findings

All core participants in this PDS were motivated to transition to, or maintain, a non-mulesed flock. The key driver was to maintain their future markets for wool or sheep meat and meet consumers demands rather than to seek price premiums. They wanted to be on the "front foot" with a plan and be ready to cease mulesing if the practice was ever banned.

The extension model used in this PDS project was successful in providing guidance for producers to develop their own property specific, integrated plan to move to a non-mulesed flock (or maintain a NM flock), and the ongoing support to assist them to make any practice changes they identified. The project team knew there was an extension gap and created a one-day planning workshop and manual to pull together in an integrated way, all the key industry publications and tools on fly control, worm control and breeding more breech flystrike resistant sheep. While most of these resources are freely available/accessible from MLA and AWI not all producers were aware of them.

Core producers demonstrated a large increase in knowledge, skills and confidence as a result of participation in four regional discussion groups and 11 demonstration sites conducted in this project. Half of the producers made or were intending to make changes to their management calendar and 69% to their breeding /selection programs. Around 36% of producers had recently ceased mulesing at the start of the project, 20% ceased mulesing all lambs during the project and the remainder 44% intended to cease once they had fully implemented changes identified in their plans.

The demonstration sites addressed the producers' frequently asked questions and provided valuable information on strategies to breed more flystrike resistant sheep and options to make managing NM sheep easier.

At the start of the project, producers greatest concern was in relation to crutching ease and being able to get contractors to crutch NM sheep particularly if sheep were wrinkly or daggy. This was exacerbated by the general issues relating to shearer availability as the project started during Covid - 19 restrictions. Risk of breech flystrike was lower down the list of concerns as producers felt if they could crutch/shear on time, or use fly prevention chemicals at the right time, this risk was manageable. Interestingly, at the end of the project, after a wet summer, there was more discussion about incidence of flystrike and risk of chemical resistance, particularly in the SW Victoria group.

Tail docking method emerged as a significant area of interest to producers in all regions. The demonstration sites showed there was very little difference between 3 hot knives or rings on the amount of wool cover over the tip of the tail or dag/urine score or crutching ease. Producers concluded choice of docking method comes back to personal preference and that there are other, more important factors affecting ease of management of NM sheep such as tail length, breech wrinkle and dag management.

Reducing dag in both M and NM sheep was another area of great interest. The PDS provided producers with methodologies for how to clarify what the main causes of dag are in their environment/sheep. The demonstration sites highlighted that worms were the major cause and not the feed-base. More regular WEC testing and improved worm control in weaners had a net benefit of $5/head. Feeding fibre (hay) in winter/early spring did not reduce dag score and actually reduced weight gains by 2 kg. Feeding fibre, a common practice in the higher rainfall areas with improved pastures, could be costing producers $12-17/head. Long term strategies to reduce worms and dag

were adopted by core producers such as focussing on DAG and WEC ASBVs when selecting rams, recording dag score in ewes and classing out daggy ewes that are repeat offenders.

5.2 Benefits to industry

The practice of mulesing, to reduce susceptibility of sheep to breech strike, represents a significant welfare issue that is increasingly becoming less acceptable by retailers and consumers, posing a risk to meat and wool markets. Preventing flystrike and phasing out the practice of mulesing is a major goal of the industry and its agencies, Australian Wool Innovation (AWI) and Meat and Livestock Australia (MLA), and they are actively looking for alternative and effective welfare-friendly measures. While there is work on development of a flystrike vaccine, genetic approaches such as incorporating breech strike resistance into sheep breeding programs will ultimately remove the need for mulesing. This will also have benefits of reduced reliance on fly chemicals and drenches, reducing costs and the risk of chemical resistance.

This PDS project was successful in assisting producers develop their own integrated plan to move to /manage NM sheep and make relevant changes to their management and breeding programs. This project piloted an extension model which was evaluated across 4 groups in different environments and shown to have a large impact. This program could be made available to more interested producers either through future MLA PDS projects or as a Profitable Grazing Systems supported learning package. A key part of the success of the program was the ongoing support it provided the producers to review and implement their plans and not just attend a one-day workshop.

Feeding fibre to sheep in winter/early spring in an attempt to reduce dag is a common practice in the higher rainfall areas with improved pastures of perennial ryegrass or phalaris. The preliminary work conducted in this PDS highlighted that practice could be a major cost with no benefit for mulesed or NM sheep. There are opportunities to reduce dag and increase weights gains in weaner sheep with improved worm control. These findings are relevant to all sheep producers. However, there as some instances where the pasture could be a factor causing dag. Apart from the known impact of some perennial ryegrass endophytes on scouring, little is known about other components of green pastures that could be responsible. More research is required to investigate what components and which pasture species could cause scouring (once worms have been ruled out), and what the management options might be.

The need for new research work on the effect of tail length on dag, was raised by producers. A review of the old research in NM sheep (presented by Dr. Joan Lloyd to the producers) reinforced that docking at 3-4 joints resulted in faster healing after marking, reduced flystrike and other animal health benefits. However, producers felt there was a research gap as this work was conducted in regions where dag was not an issue. Some producers felt that docking at 2 joints was less problematic for dag.

6 References

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7 Appendix

7.1 Demonstration site detailed results

7.1.1 South West Slopes NSW group.

7.1.1.1 Demonstration 1: Sire Evaluation

Aim: Evaluate progeny from rams with lower and higher Early Breech Wrinkle (& DAG, WEC) ASBV's:

- How quickly the breech wrinkle score of the flock can be reduced using genetics?
- Observe the impact of using low EBWR rams compared to high EBWR rams
- Observe the impact on other production traits

A ram's genetic potential is evaluated through the measurement and visual assessment of its progeny. This demonstration will evaluate either single mated rams or syndicate mated rams allocated to the two groups (high or low EBWR).

Method:

Using the individual rams in the ram team ASBVs, allocate high EBWR and low EBWR rams to groups while aiming to keep other key traits of the groups (syndicate) as close as possible. Join the high/low syndicate rams to two mobs of ewes, ideally randomly allocated across age. If one age group is available this would be preferable. Join the ewes for 5 weeks, identify the groups and then run them together up until lambing. Lamb the two groups separately, mark and identify the lambs before running mobs together again.

Results:

A mob of 2018 drop ewes were randomly split into two mobs. The ram syndicates (5 rams in each syndicate) shown below in Table 1 were joined to the two mobs of ewes for 6 weeks. The differences between the two syndicate ASBVs are shown in Table 1, there was 1.0 EBWR ASBV difference between the two sire groups, all other ASBVs were kept as close to each other as possible.

Table 1: High and low EBWR syndicate ASBV averages

Sire Group	Ave Price	ycfw	yfd	yss	ysl	pwt	ywt	yemd	yfat	ebwr	nlw	DP+	MP+
High EBWR	$2,600	22.6	-1.9	0.1	5.9	4.4	6.9	0.3	-0.1	0.4	6.6	184.2	183.0
Low EBWR	$1,470	24.1	-1.1	1.6	9.8	5.1	7.7	0.6	0.0	-0.6	4.0	177.0	172.4
Average	**$2,035**	**23.4**	**-1.5**	**0.8**	**7.9**	**4.8**	**7.3**	**0.4**	**-0.1**	**-0.1**	**5.3**	**180.6**	**177.7**
Difference	$1,130	-1.4	-0.8	-1.5	-3.9	-0.6	-0.8	-0.3	-0.1	1.0	2.6	7.2	10.6

Lamb marking results (6th October 2021): At lamb marking all progeny were tagged and breech scored for wrinkle and cover. Table 2 shows the number and percentages of progeny for each wrinkle score for the two sire groups (high and low EBWR). The overall difference between the two sire groups was 0.5 wrinkle score. Given that half the DNA comes from the sire and the difference between the ASBVs of the sire groups was 1.0, 0.5 difference is realistic.

Table 2: The number and percentage of wrinkle scores for the high and low EBWR sire groups

Breech Wrinkle Score	*High EBWR Group*	*Low EBWR Group*	*High EBWR Group %*	*Low EBWR Group %*
1.0	69	107	21.5%	40.7%
1.5	110	107	34.3%	40.7%
2.0	56	40	17.4%	15.2%
2.5	28	5	8.7%	1.9%
3.0	27	4	8.4%	1.5%
3.5	17	0	5.3%	0.0%
4.0	8	0	2.5%	0.0%
4.5	5	0	1.6%	0.0%
5.0	1	0	0.3%	0.0%

Table 3: Average EBWR for the high and low EBWR sire groups

Treatment/Sex	Count Breech Wrinkle	Average Breech Wrinkle	Average Breech Cover
High Breech	**322**	**1.9**	**3.4**
Female	163	2.0	3.1
Male	159	1.9	3.7
Low Breech	**263**	**1.4**	**3.3**
Female	134	1.4	2.9
Male	129	1.4	3.7
Total/Average	**585**	**1.7**	**3.4**
Difference H/L		**+0.5**	**+0.1**

The distribution of scores across the two sire groups are shown in Figure 1. The Low EBWR group had 100% of progeny either 3 score or below while the High EBWR had 10% of progeny above 3 score.

Some of the differences within this demonstration could be attributed to the number of twins and singles in each group, as we have not been able to account for birth and rear type in the data collection or analysis. By using one age group of dams we have tried to eliminate the dam age effect. The sex difference between the two sire groups is reported in Table 4 and the pregnancy scanning results are reported in Table 5.

Figure 1: Distribution of wrinkle score across the high and low EBWR sire groups

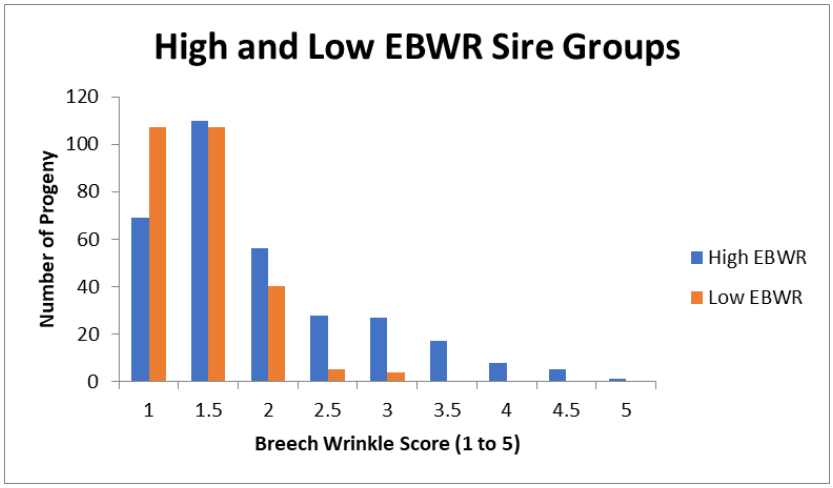


Table 4. Sex difference across the high and low EBWR sire groups

Sire Group	Female	Male	Total
High Breech Rams	163	159	322
Low Breech Rams	134	129	263
Total	**297**	**288**	**585**

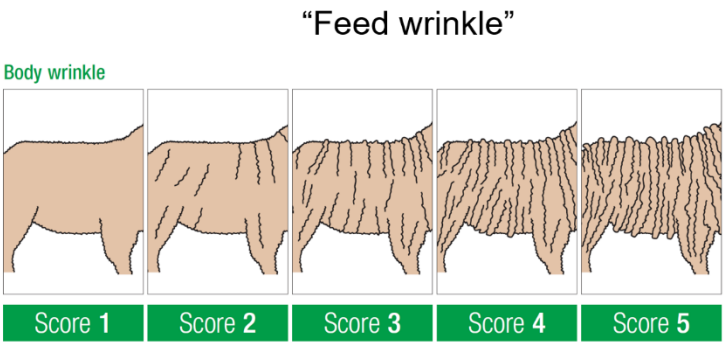
Table 5. Pregnancy Scanning across the high and low EBWR sire groups

	Maiden Preg Scan_2021			
Sire Group	**Dry**	**Single**	**Twin**	**Total**
High EBWR Rams	19	137	193	349
Low EBWR Rams	22	151	178	351
Totals	**41**	**288**	**371**	**700**
%	**Maiden Preg Scan_2021**			
Sire Group	**Dry**	**Single**	**Twin**	**Total**
High EBWR Rams	5%	39%	55%	349
Low EBWR Rams	6%	43%	51%	351
Totals	**41**	**288**	**371**	**700**

An important note to make here is that we should be selecting for genes to reduce wrinkle and not the environment. The effects of the environment and nutrition a lamb is born in, can have an effect on wrinkle. Keep in mind "Feed Wrinkle" vs "Genetic Wrinkle" when selecting sires. "Feed Wrinkle" still needs to have management strategies. The list below highlights the differences – generally the more feed you have the higher the "Feed Wrinkle".

- → Single or twin (a twin could have a lower wrinkle score, -0.3 to -0.5)
- → Born in a drought (-0.5 to -1.0)

→ Dam Age – from a maiden dam (-0.1 to -0.2)



Need to select for genes, NOT nutrition

Source: Visual sheep scores (2019), AWI, MLA.

There was also little difference between the weaning weights and greasy fleece weights of the two sire groups (Table 6) with only 1.2 kg and 0.2kg difference respectively. A second fleece weight was collected in June 2023 with the same results as the June 2022 shearing.

Table 6. Weaning weight summary (November 2021) plus greasy fleece weights (June 2022 and June 2023) - high and low EBWR sire groups

2021 drop	Count	Breech Wrinkle @ Marking	Breech Cover @ Marking	Ave WWT (kg)	Ave GFW (kg) June 2022	Ave GFW (kg) June 2023
High Breech	322	1.9	3.4	22.0	2.6	3.5
Low Breech	263	1.4	3.3	20.8	2.4	3.3
Total/Average	**585**	**1.7**	**3.4**	**21.5**	**2.5**	**3.4**
Difference H/L		**+0.5**	**+0.1**	**+1.2**	**+0.2**	**+0.2**

Figure 2. Weaning weight collection – November 2021

Conclusions:

- Using low EBWR (-0.6) rams compared to high EBWR (+0.4) rams can dramatically reduce breech wrinkle score in one generation. The overall difference between the lambs from the two sire groups was 0.5 wrinkle score. Given that half the DNA comes from the sire and the difference between the ASBVs of the sire groups was 1.0, 0.5 difference is realistic.
- The range in breech wrinkle score was also reduced. The breech wrinkle score of the progeny from the low EBWR sire group ranged from 1 to 3, while the progeny from the high EBWR sire group ranged from 1 to 5. The distribution of the breech scores resulted in 3.4% and 27% being above 2.5 score in the low and high EBWR mobs respectively, giving breeders management and breeding tools to manage the transition to non-mules.
- There was also little difference between the weaning weights and greasy fleece weights of the two sire groups, with only 1.2kg and 0.2 kg difference respectively.
- The results of this demonstration are a guide only as the impact of birth and rear type have not been taken into consideration.

7.1.1.2 Demonstration 2: Tail Docking Methods

Aim: Evaluate effectiveness of different tail docking methods on:

- Incidence of breech flystrike
- Dag score
- Crutching and shearing:
    - The amount of dag & loss of wool value
    - Crutching and shearing ease

Method: Each lamb was tagged with electronic Identification (eID) at marking and randomly selected for each treatment group from a large mob of single bearing maiden ewes. All lambs are run as one group with different tail docking methods noted against the eID. The tail docking methods used within the trial were:

- Standard hot knife (Leader)
- Standard hot knife (Leader) cutting at a 45-degree angle
- Te Pari hot-knife
- Steinfort hot knife Model year 2021 (for trial not commercially available yet)
- Rings with NumNuts

Table 1: Tail docking method treatment group summary

Treatment Group	Treatment/Method	Tag Range	Pain relief used
1	Leader hot knife, used at a 45-degree angle	22866 – 22965	Metacam
2	Leader hot knife used as a straight cut	22966 - 23065	Metacam
3	Elastrator rings –NumNuts applicator used	23069 – 23168	Metacam + numnuts
4	Steinfort hot knife (Model year 2021)	23169 - 23269	Metacam
5	Te Pari hot knife	23270 - 23372	Metacam

The demonstration was set up at lamb marking time. At lamb marking 100 lambs were allocated to each treatment with approximately 50:50 male to females. Three data collection activities were carried out.

- Lamb Marking – EBWR and BCOV sores 09/09/2021
- Weaning – WWT 28/10/2021 and tail scores (tail wool cover)
- Pre-crutching – DAG & URINE scores 21/01/2022

Notes taken at marking – the hot knife provided a cleaner cut of the tail when it was kept clean and the temperature of the hot knife was seen to be important as having it too hot resulted in more bleeding.

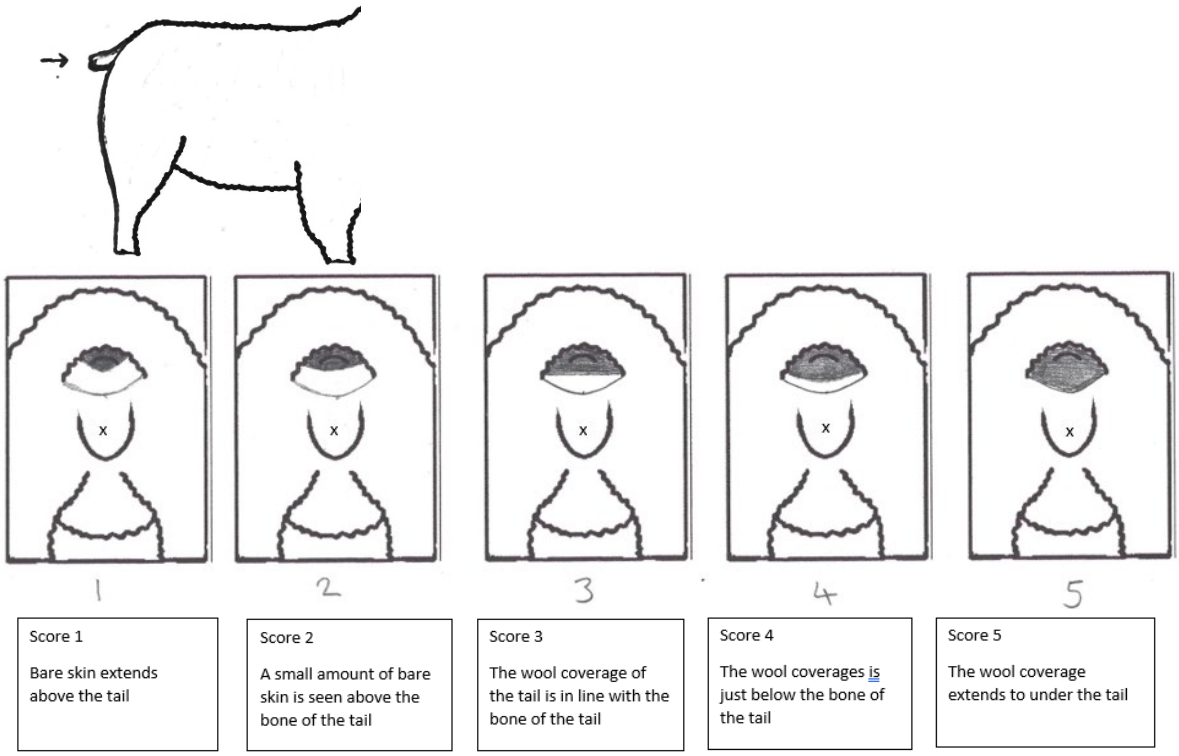
Figure 1. Sam Moorfield and Lucinda Eddy (front), SheepMetriX, breech wrinkle and cover scoring lambs at Marking, September 2021

Tail scoring – Following the group on-farm meeting at weaning, discussions were had on how best to determine if there are any differences in appearance of the tails between each treatment group. A protocol was developed using a 1-5 visual score system, to provide some objective assessment of the impact of the different tail dock methods.

Protocol for tail scoring:

When scoring the tail, lift it so it is 90 degrees to the body. Be careful not to grab/pull it by the wool so the skin can sit naturally, to determine how much wool coverage there is. If the wool is in line with the bone of the tail this is a score three. If there is any bare skin above the bone, it is considered a score 1 or 2 depending on how far the bare skin extends. When the wool extends below the bone of the tail when help at 90 degrees this is scored 4 or 5. When there are any noticeable flaps of skin on the tip of the tail, these are often scored 4 or 5 depending on severity (Figure 2).

Figure 2: Tail scoring method developed for use on the demonstration sites.



Results:

Lamb marking: The average across all the treatment groups for breech wrinkle was 2.3 (with one treatment 2.4) and breech cover was also very close ranging from 3.9 to 4.1. A summary of data collected at lamb making is shown in Tables 2, 3 and 4.

Table 2. Breech Wrinkle (measured to 0.5 of a score) and Breech Cover scores (measured to the nearest whole score) for different tail dock treatment groups.

Treatment	Count	Ave Breech Wrinkle Score	Ave Breech Cover Score
Hot Knife straight cut	100	2.3	3.9
Leader Hot Knife 45 angle	100	2.3	4.1
Rings with NumNuts applicator	100	2.3	3.9
Steinfort Knife (Model year 2021)	100	2.4	4.0
Te Pari Knife	103	2.3	4.0
Grand Total	**503**	**2.3**	**4.0**

Table 3. Distribution of sex between each treatment group, alongside the Breech Wrinkle and Breech Cover scores.

Treatment/Sex	Count	Ave Breech Wrinkle Score	Ave Breech Cover Score
Hot Knife straight cut	**100**	**2.3**	**3.9**
FEMALE	50	2.2	4.1
MALE	50	2.4	3.7
Leader Hot Knife 45 angle	**100**	**2.3**	**4.1**
FEMALE	58	2.3	4.3

Treatment/Sex	Count	Ave Breech Wrinkle Score	Ave Breech Cover Score
MALE	42	2.3	3.7
Rings with Numnuts applicator	**100**	**2.3**	**3.9**
FEMALE	58	2.3	4.2
MALE	42	2.3	3.5
Steinfort Knife (V)	**100**	**2.4**	**4.0**
FEMALE	51	2.4	4.4
MALE	49	2.5	3.6
Te Pari Knife	**103**	**2.3**	**4.0**
FEMALE	49	2.3	4.4
MALE	54	2.3	3.7
Total/Average	**503**	**2.3**	**4.0**

Table 4. Average breech scores across sex and treatments

Treatment	FEMALE		MALE	
	Ave Breech Wrinkle Score	Ave Breech Cover Score	Ave Breech Wrinkle Score	Ave Breech Cover Score
Hot Knife straight cut	2.2	4.1	2.4	3.7
Leader Hot Knife 45 angle	2.3	4.3	2.3	3.7
Rings with Numnuts applicator	2.3	4.2	2.3	3.5
Steinfort Knife (V)	2.4	4.4	2.5	3.6
Te Pari Knife	2.3	4.4	2.3	3.7
Averages	**2.3**	**4.3**	**2.4**	**3.6**

Weaning: At weaning a weight was captured and any fly strike and dag was noted. There were only 33 that presented with Dag at weaning (7%), not a significant percentage to report. Ideally for Dag scoring to be of benefit you require between 30% to 40% of the mob affected. Other comments noted were 2 weaners with fly strike and 6 with urine stain. Table 5 presents a summary of the weaning data collected.

Table 5. The average weaning weight, weight percentage, count and number of comments recorded for each treatment.

Treatment	Count	Average Weaning weight (kg)	Weight %	Count *Comment
Hot Knife straight cut	93	26.3	102	5
Leader Hot Knife 45 angle	95	25.3	98	16
Rings with Numnuts applicator	95	26.6	103	8
Steinfort Knife (V)	93	25.1	97	3
Te Pari Knife	96	25.6	99	8
Total/Average	**472**	**25.8**		**40**

**Comment refers to any noticeable flystrike, dag or urine stain.*

Weaners were drafted into their treatment groups at weaning and penned for the "Towards NM Sheep" Group participants to inspect (Figure 3). General comments from participants were that no docking method stood out to be significantly better than the other visually at weaning.

Figure 3. Southern NSW TNM Group – weaning inspection at Benangaroo – 28th October 2021

Figure 4. Inconsistent tail length was something we observed within and between treatments. The group did discuss capturing tail length data at shearing if time permitted.

Figure 5. Te Pari Knife – results at weaning

Figure 6. Straight Knife used at 45 degrees - (very little difference between 45° and straight cut).

Figure 7. Steinfort hot knife (Model year 2021)

Figure 8. Rings

Pre-Crutching: Prior to crutching all the weaners were Dag scored and the ewes Urine scored. To collect the score, all weaners had their tail lifted to maintain consistency across the treatment groups. Tables 6 presents pre-crutching Dag and Urine scores for each of the treatment groups.

Table 6. The average scores for Dag and Urine stain recorded for each treatment group. Note that only the urine scores were only taken on the female portion of animals.

Treatment	Count	Average DAG	Average URINE *
Hot Knife straight cut	89	1.6	2.3
Leader Hot Knife 45 angle	95	1.8	2.2
Rings with NumNuts applicator	93	1.5	2.3
Steinfort Knife (Model year 2021)	92	1.7	2.0
Te Pari Knife	91	1.7	2.2
Grand Total	**460**	**1.7**	**2.2**
* On females only			

Table 7. All scores to date for each different treatment group, including dates data was recorded.

Treatment	EBWR 9-9-21	BCOV 9-9-21	DAG 21-1-22	URINE 21-1-22	Body WR 11-3-22	Breech WR 11-3-22	Tail cover 30-3-22	2nd DAG 3-6-22
Hot Knife straight cut	2.3	3.9	1.6	2.3	3.0	3.4	3.6	2.3
Leader Hot Knife 45 angle	2.3	4.1	1.8	2.2	3.0	3.5	3.4	2.6
Rings with Numnuts applicator	2.3	3.9	1.5	2.3	3.0	3.5	3.8	2.5
Steinfort Knife (V)	2.4	4.0	1.7	2.0	2.7	3.4	3.3	2.2
Te Pari Knife	2.3	4.0	1.7	2.2	2.9	3.3	2.8	2.5
Total Average	**2.3**	**4.0**	**1.7**	**2.2**	**2.9**	**3.4**	**3.4**	**2.4**

Second Dag Scoring - A second dag score was measured in winter 2022 when the mob presented enough challenge post shearing (Figure 9). Table 8 compares the treatment groups first and second dag scores alongside tail scores.

Table 8. Comparing the average Dag scores for each treatment group with the average tail scores, sorted on the second dag scores

Treatment	DAG 21-1-22	2nd DAG 3-6-22	TAIL 30-3-22
Steinfort Knife (V)	1.7	2.2	3.3
Hot Knife straight cut	1.6	2.3	3.6
Te Pari Knife	1.7	2.5	2.8
Rings with Numnut applicator	1.5	2.5	3.8
Leader Hot Knife 45 angle	1.8	2.6	3.4

Total Average	**1.7**	**2.4**	**3.4**

Figure 9. Dag Scoring images at second dag challenge.

Conclusions:

- General comments from participants were that no docking method stood out to be significantly better than the other visually at weaning.
- There were some differences in the effect of the docking methods on tail cover score observed. On this sheep type (with a moderate breech wrinkle average score of 3.4), the Tepari knife resulted in tails with the lowest tail score of 2.8, while the rings resulted in tails with the highest tail score of 3.8.
- There was no consistent trend with the dag score of lambs and the tail docking method used.
- There was no correlation between tail score and the dag score of lambs. More work needs to be done to validate whether tail score is the best method to assess the appearance of the tail after docking.
- There is not enough difference to indicate any of the tail docking methods was better than the other regarding dag and urine. The bigger impact appears to be how well the tail area is crutched or shorn.

7.1.1.3 Demonstration 3: Breech Scoring Method

Aim:

To evaluate the impact of different scoring methods on early breech wrinkle and breech cover score. Does scoring in the marking cradle differ from scoring free standing for early breech wrinkle and what are the potential impact on data quality?

The Visual Sheep Scores guide for EBRW depicts lambs standing but for EBCOV they are depicted in the cradle. The question was raised that perhaps placing lambs in the cradle will give a different visual score as the skin might be stretched out more and hence could underestimate the EBWR score.

Method:

Scores were assessed visually using the Visual Sheep Scores Guide. The scoring methods were:

- Standing unrestrained
- Restrained in the lamb marking cradle

Each lamb was tagged with an electronic tag (eID) and early breech wrinkle (EBWR) scored whilst standing in the pen. Once all lambs were tagged and scored within the pen, they were randomly caught and placed into a marking cradle. Once in the cradle each lamb was scored again for EBWR score on another device so the person scoring is unable to see the lamb's previous score, reducing any bias.

Results:

Comparing the data set between the standing breech scoring and cradle breech scoring we found there were 3% of scores missed (5/194 lambs). This may not be significant however the rotating lamb marking cradle provides a more thorough opportunity to collect data on each lamb maximising data capture on each lamb as opposed to the standing method used.

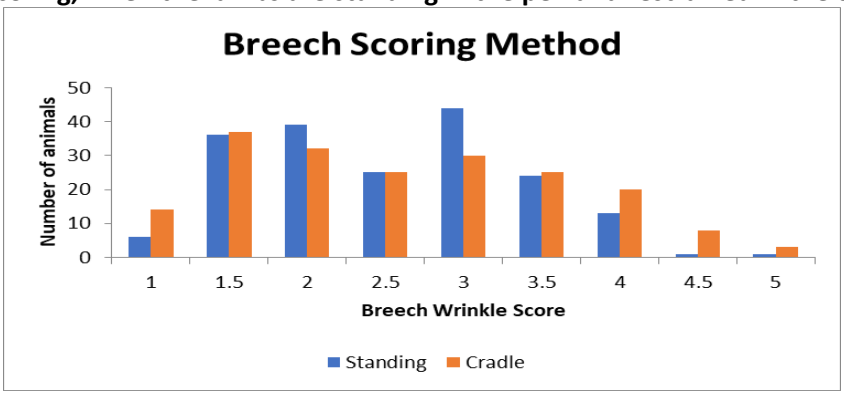
The was only 0.1 breech score difference, on average, between the two methods (Table 1). The distribution of the scores for the two scoring methods is shown in Figure 1.

Overall, the there was little difference between the two methods when considering average scores. However, the advantages with the cradle method are knowing each lamb will be assessed and providing the opportunity to collect breech cover at the same time.

Table 1. Comparing the average breech wrinkle scores (EBWR) of the same lambs standing in the pen and when restrained in the marking cradle.

2021 drop	Average EBWR standing	Average EBWR cradle
Female	2.5	2.6
Male	2.6	2.6
Total	**2.5**	**2.6**

Figure 1. The distribution of breech wrinkle (EBWR) scores between the two different methods of scoring; when the lambs are standing in the pen and restrained in the cradle.



Conclusion:

Overall, the there was little difference between the two methods when considering average scores. However, the advantages with the cradle method are knowing each lamb will be assessed and providing the opportunity to collect breech cover at the same time. The Visual Score guide for EBWR in lambs in a standing position can be successfully extrapolated to how the breech wrinkle on lambs appears in the cradle at marking time without underestimating the score.

7.1.2 Victorian groups.

7.1.2.1 Demonstration 1: Tail Docking Methods

Group/site: South West Victoria, Langi Logan.

Aim: Evaluate effectiveness of different tail docking methods on:

- Incidence of breech flystrike
- Dag score
- Crutching and shearing:
    - The amount of dag & loss of wool value
    - Crutching and shearing ease

Method:

At marking on 27/10/21, 80 - 90 ewe and wether lambs were randomly assigned into each treatment group. All were single born lambs.

Lambs from 2 mobs (two different sire groups) were used. Sire group 1 were polled rams from the same source and had a lower visual breech wrinkle score than Sire group 2 rams which were horned. The rams did not have ASBVs. (NB: The producers are changing their ram source to enable them to breed plainer bodied sheep but the new ram source was not used in this trial. The new ram source has ASBVs including that for EBWR).

Lambs were identified in their treatment groups with an eID ear tag and a coloured ear tag (non-RFID).
All lambs were non-mulesed.

The tail docking methods used for the trial were:

1. Rings/NumNuts - with Numocaine and Metacam pain relief
2. Standard hot knife (straight)- with Metacam
3. Te Pari Patesco hot knife (with rolling anvil) - with Metacam
4. Steinfort hot knife (u-shaped) Model year 2021 - with Metacam

All tails were docked to the same length (ie. best practice: tip of vulva in ewes/equivalent length in wethers). Dr John Steinfort (Steinfort AgVet) performed all the tail docking so that it was consistent length for all treatment groups. Lambs were treated with CLIK after tail docking.

At marking the following traits were recorded with a Tru-test stick reader:

- Sex
- Breech cover
- Breech wrinkle

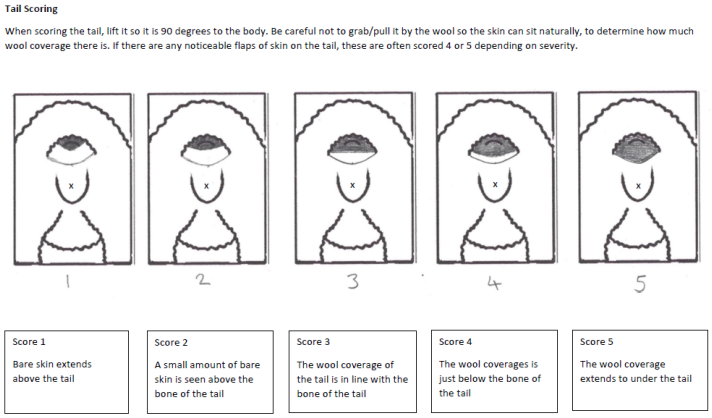
Ewes (dams) and their lambs were run as one mob after marking until weaning. Lambs were randomly split into 2 mobs to graze forage rape or bean stubble over summer. In winter, wether lambs were drafted off and run as a separate mob on pasture.

Assessments made after marking were:

- Tail scores (16/2/22) - recorded for the ewe lambs that had been grazing bean stubble, by Lisa Warn and the host producers. The tail scoring method that was being trialled in this project was developed by Sally Martin and Lucinda Eddy, SheepMetrix (Figure1).
- Dag scores (16/2/22) - recorded on the 2 mobs of lambs (ewes and wethers in each mob), that were grazing forage rape or stubble, by the host producers.

- Crutching (end Feb 2022) - feedback was obtained from the shearers about ease of crutching the lambs and if they noticed any difference between the lambs with different tag colour. Shearers were not told what treatments the coloured tags represented.
- Dag scores (12/10/22) - recorded on the wether lambs (weaners) by the host producers.

Figure 1. Tail scoring system used developed by L.Eddy & S.Martin.



Results:

All the results collected to date are summarised in Table 1.

Lambs from Sire group 1 were around 0.5 breech wrinkle score and 0.5 breech cover score lower than lambs from Sire group 2. These were some bonus traits that came with the polled rams from the same source.

There appeared to be no major difference in the effect of the docking methods on tail cover score. The exception were Sire group 2 lambs that had rings applied which had the highest tail cover score.

Lambs grazing the forage rape over summer had a higher dag score than those grazing bean stubble.

There was no consistent trend with the dag score of lambs and the tail docking method used.
At the 16/2/22 assessment, lambs (on forage rape) from both sire groups that had been docked with the Te Pari knife had the highest dag score, whereas the other 3 methods had similar results.
At the 12/10/22 assessment, Sire group 1 wethers that had been docked with the Te Pari knife had the lowest dag score, while Sire group 2 wethers that had been docked with the Leader knife had the lowest dag score.

The way the tails appeared seem to be due more to variation in the amount of wrinkle between lambs rather than the treatments.

Feedback from shearers at lamb crutching was that they didn't notice any difference between the lambs, with different coloured tags, with respect to ease of crutching around the tail.

Table 1. Summary of measurements on lambs at marking, pre-crutching and at 12 months of age.

Treatment	Sire group	No. lambs	EBCOV 27/10/21	EBWR 27/10/21	Tail score (ewes) 16/2/22	Dag score forage rape 16/2/22	Dag score Stubble 16/2/22	Dag score (wethers) 12/10/2022
Rings	1	53	3.0	2.5	3.5	2.3	1.4	3.7
Steinfort (Model year 2021)	1	52	3.0	2.4	3.5	2.2	1.3	3.7

Te Pari Patesco	1	53	3.1	2.5	3.5	2.7	1.3	3.3
Standard (Leader)	1	51	3.2	2.6	3.5	2.2	1.4	4.1
Rings	2	38	3.7	3.0	3.9	2.1	1.3	3.6
Steinfort (Model year 2021)	2	36	3.8	3.2	3.1	2.2	1.4	3.3
Te Pari Patesco	2	32	3.6	3.0	3.3	2.7	1.2	3.6
Standard (Leader)	2	37	3.6	3.0	3.3	1.8	1.1	3.1

Conclusions:

- There was no major difference in the effect of the docking methods on tail cover score. However, the ring method may be an inferior method to use on lambs that have higher breech wrinkle as this method resulted in a higher tail cover score for lambs from sire group 2.
- There was no consistent trend with the dag score of lambs and the tail docking method used.
- The way the tails appeared seem to be due more to variation in wrinkle between lambs rather than the treatments.
- There was no obvious difference in crutching ease between the different tail docking methods.
- The host producers concluded that the tail dock method is a relatively small part of the story about managing NM sheep - there are other factors that contribute more to ease of management such as breech wrinkle and dag.

7.1.2.2 Demonstration 2: Tail Docking Methods

Group/Site: North West Victoria group, Mt Dryden.

Aim: Evaluate effectiveness of different tail docking methods on:

- Incidence of breech flystrike
- Dag score
- Crutching and shearing:
    - The amount of dag & loss of wool value
    - Crutching and shearing ease

Method:

At marking on 13/7/22, 50 ewe lambs were randomly assigned into each treatment group. All were single born lambs. The lambs were the progeny of the same ram team. Rams did not have ASBVs.

Lambs were identified in their treatment groups with an eID ear tag and a coloured ear tag (non-RFID).

All lambs were non-mulesed.

The tail docking methods used for the trial were:

- Standard hot knife (straight)- with Metacam pain relief
- Te Pari Patesco hot knife (rolling anvil type)- with Metacam
- Steinfort hot knife (u-shaped), model year 2021- with Metacam

All tails were docked to the same length (ie. best practice: tip of vulva in ewes/equivalent length in wethers). Dr John Steinfort performed all the tail docking so that it was consistent length for all treatment groups.

At marking the following traits were recorded:

- Breech cover
- Breech wrinkle

Ewes (dams) and lambs were run as one mob after marking until weaning. After weaning, lambs were run as one mob. No preventative fly chemical was applied at weaning.

Assessments made after marking were:

- Dag scores (18/10/22) - recorded by Wayne Burton.
- Crutching (Oct 2022) – only lambs that had dag or urine stain were crutched. Number of lambs requiring crutching recorded.
- Shearing (Dec 2022)
- Tail scores (8/2/23) - recorded by Lisa Warn and host producers
- Dag scores (8/2/23) - recorded by Lisa Warn and host producers

Results:

All the results collected to date are summarised in Table 1.

All groups of lambs had relatively low dag scores in October before crutching. Only lambs with some dag (or urine stain) were crutched. The Standard knife group had the lowest average dag score and hence the lowest number of lambs that required crutching, followed by the Steinfort group, with the Te Pari group having the highest average dag score and number of lambs crutched.

At lamb crutching in October (done by the producer), there was no obvious difference in crutching ease between the tail docking method (no difference noted between coloured tags on lambs). At shearing in December, shearers did not find any difference in shearing ease of different tag colour lambs/different tail dock method. They did comment that it took a couple of extra blows to shear these un-mulesed lambs in the trial compared with the mulesed lambs on the property.

When the lambs were assessed in February, the majority of lambs had no dag (ie. Dag score 1). The few lambs that did have dag were only score 2.

There was a small difference in the effect of the docking method on tail cover score, with the Steinfort knife having the higher tail score. A higher tail score did not correlate with a higher dag score of lambs (Table 1).

The producer observed that perhaps the tails docked with the Steinfort knife were slightly longer which may have confounded the dag results. However, this group didn't end up having the highest dag score or number of lambs that required crutching when assessed (Table 1).

There was variation in the amount of wool on the tail left by shearers across the treatment groups which did give the appearance of longer tails on some sheep.

Table 1. Summary of measurements made on lambs at marking, pre-crutching and after shearing.

Treatment	**Tag**	**No. lambs**	**EBCOV**	**EBWR**	**DAG score** 18/10/22	**No. Fly struck** 18/10/22	**Number Crutched** (% of group)	**TAIL score** 8/02/23	**No. lambs Dag score 1** 8/2/23	**No. lambs Dag score 2** 8/2/23
Steinfort (model year 2021)	White	50	2.6	1.3	1.7	1	19 (38%)	2.7	48 (96%)	2 (4%)
Te Pari	Black	50	2.6	1.4	1.8	0	21 (42%)	2.2	47 (94%)	3 (6%)
Standard	Blue	47	2.8	1.4	1.5	1	16 (34%)	2.4	44 (94%)	3 (6%)

Conclusions:

- There were small differences in the effect of the docking methods on tail cover score. On this sheep type, using the Te Pari and Standard knives resulted in tails with a lower tail score than the Steinfort knife.
- There was no correlation between tail score and the dag score of lambs. More work needs to be done to validate whether tail score is the best method to assess the appearance of the tail after docking.
- The way the wool cover on tails appeared seem to be due more to variation in wrinkle between lambs rather than the treatments.
- There was no obvious difference in crutching ease or shearing ease between the different tail docking methods.
- The producer will possibly move to using a Te Pari Patesco knife in future as he felt it gave a better result with respect to less wool on the tip of the tail based on the PDS results.

7.1.2.3 Demonstration 3: Running a small mob of non-mulesed sheep

Group/Site: North West Victoria group, Mt Dryden.

Aim: To trial running a small mob of non-mulesed sheep to compare with mulesed sheep to evaluate impact on:

- Incidence of breech flystrike
- Chemical use
- Dag score (and urine score)
- Crutching and shearing:
    - The amount of dag and loss of wool value
    - Crutching and shearing ease
    - Need for additional crutching

Method:

On this farm, the normal farm practice is to mules Merino ewe and wether lambs at marking. Wether lambs are sold as lambs to restockers who currently prefer to purchase mulesed wethers.

At marking on 13/7/22, a mob of 150 ewe lambs were left un-mulesed for this trial. All were single born lambs. The lambs were the progeny of the same ram team. Rams did not have ASBVs. (NB: these were the same 150 lambs that were used in the tail dock method trial on the same property).

Non-mulesed lambs were identified in their treatment groups with a RFID ear tag and a coloured ear tag (non-RFID).

All other Merino ewe and wether lambs on the property were tagged with a RFID tag, docked with a standard straight hot knife and were mulesed. A mob of 283 mulesed ewe lambs formed the "Control" mob. They were from different ram teams to the NM lambs, but of similar genetics.

For pain relief the mulesed lambs received Tri-solfen and the NM lambs received Metacam.

Both groups had the same tail length (ie. best practice: tip of vulva in ewes/equivalent length in wethers).

At marking the following traits were recorded on the NM lambs:

- Breech cover
- Breech wrinkle

This information was not collected for the mulesed lambs but it can be assumed these visual traits would be similar to the NM lambs as there was no real difference in the genetics of the rams used.

At weaning (late Sept 2022), lambs were vaccinated and drenched but did not receive any fly chemical protection. Non-mulesed (150) and mulesed (283) ewe lambs were run together after weaning. After weaning, lambs were observed for incidence of breech flystrike and dag score.

Only lambs that had dag or urine stain were crutched on 18 October 2022. All lambs were shorn in December 2022.

Results:

The results collected to date are summarised in Table 1.
Both groups of lambs had relatively low average dag scores in October before crutching. However, at this time, 1.4% of NM lambs were observed to be flystruck on the breech compared with none of the M lambs. Also, 38% of NM lambs required crutching due to them having a dag score of 2 or more (and a few had urine stain) compared with 23% for M lambs. All lambs were then jetted with CLICK-ZIN on the breech to provide fly protection up until shearing in December.

Lambs grazed lucerne over summer/early autumn and remained relatively dag free. They were moved onto a phalaris pasture in May 2023 and the producer noticed that some started to get daggy and a higher proportion of NM lambs were fly struck on the tail. The risk of flystrike was thought to be low at this time of year so these cases were unexpected.

Table 1. Summary of measurements made on lambs at marking, pre-crutching and after shearing.

Treatment	No. lambs	EBCOV	EBWR	DAG score 18/10/22	No. Fly struck -breech 18/10/22	Number Crutched (% of group) 18/10/22	*No. lambs with Dag 8/2/23	No. Fly struck on tail 18/5/23
Non-mulesed (NM) (average of tail dock method lambs)	147	2.7	1.4	1.7	2 (1.4%)	56 (38%)	8 (5%) score 2	6 (4%)
Mulesed (M)	283	-	-	-	0	65 (23%)	-	1 (0.15%)

**8/2/23: the majority of lambs had no dag. The few lambs that had dag were only score 2.*

The producer found that it took twice as long to crutch the NM lambs due to dag being stuck on wrinkle. The only 2 lambs that had flies soon after weaning (ie. when assessed on 18/10/22) were the NM lambs and the producer commented that he would have had a lot more in a couple of weeks time if they hadn't been crutched when he did. The other option would have been to apply fly chemical to the daggy lambs if not able to crutch then. Hence, this represents one of the cost differences in moving to a non-mulesed enterprise.

The NM and M ewe lambs were not able to be run together until after weaning (late Sept), so this needs to be taken into consideration when interpreting the results for number of NM lambs with dag/crutched and flystruck in mid-October. Higher worm burdens pre-weaning may have contributed to the higher incidence of dag in the NM lambs. As all NM and M lambs were drenched at weaning and then run together in same paddocks, dag and strike data collected would not be confounded by other factors. The NM mob was also the focus of the tail dock method trial so they were set up as a separate mob.

The ewes with NM lambs had high worm burdens and had high WEC numbers since lamb marking. Ewes were drenched at lamb marking in July and again in September and lambs were drenched in September (weaning) and February 2023. The producer commented that the NM lambs were probably his worst lambs for the season overall, due to a set-back in early growth pre-wean. Lambs went onto a good ryegrass/clover paddock after the February drench to improve their growth.

Although his sheep are very plain, the producer does not feel that he has the genetics to move to non- mulesed immediately and will need to work in this space.

Conclusions:

- The NM mob had a higher proportion of lambs that required crutching in spring (due to dag), and a higher incidence of flystrike, than the M mob.
- It took twice as long to crutch the NM lambs as the M lambs.
- The producer concluded he has to make further progress with genetics (reduce breech wrinkle further) to move to non-mulesed across the whole flock.
- Still weighing up what extra costs could be if run a NM mob. A higher proportion of lambs may require crutching or alternatively need to have fly chemical applied. He also commented that his sheep were finer (instead of 19µm) there might be more premiums for NM wool. This is something else he is looking into.

7.1.2.4 Demonstration 4: Clarifying causes of and Options to Reduce Dag

Group/site: South-west Victoria group, Dunkeld.

Background:

This demonstration is relevant for flocks that have ceased mulesing or those still mulesing who have a high incidence of dag during winter and spring, particularly in the weaner sheep.

As there are several causes of dag, this demonstration will make use of a long-acting drench to rule out worms and possibly hypersensitivity as contributing factors. This leaves the feed-base and bacterial infections as possible causes of dag to investigate.
Note 1. Hypersensitivity scouring associated with an immune reaction to worm larvae is more likely to be an issue with (be expressed in) sheep older than 1 year old. There is some experimental evidence that use of a long-acting drench does not necessarily prevent hypersensitivity scouring as sheep are still being exposed to L3 larvae.
Note 2: Selecting rams with low DAG and low WEC ASBVs as well as culling ewes (from 2-3 years of age) that repeatedly have high dag scores (due to being genetically hypersensitive) is the long-term strategy to reduce dag in the flock.

Feed-base issues: in high rainfall areas, improved pastures of perennial ryegrass, or sometimes phalaris, are associated with scouring in sheep in winter to early spring. The reasons why this occurs are not well understood. Some possible causes could be - high quality lush feed (lack of fibre? high protein/nitrates?), sudden changes of feed-base/pasture type (shifting from dead feed to green or to different amounts of feed on offer or different species), and in the case of perennial ryegrass could be due to toxins produced by endophytes.

Aim:

To investigate factors that may be contributing to dag and the effectiveness of improved worm control or a mineral supplement during winter and early spring on

- Liveweight
- Dag score
- Crutching and shearing:
    - The amount of dag & loss of wool value
    - Crutching and shearing ease

Method:

In June 2022, a mob of 630, September 2021 drop ewe weaners were selected for the trial. All sheep on the property are non-mulesed. The producer ceased mulesing in 2017. The sheep are relatively plain with low breech wrinkle scores (estimated to be and average of score 2).

The initial bulk WEC sample, taken from the whole mob, was 540 e.p.g and indicated that the sheep required drenching.

The trial started on 23/6/22. At the start of the trial the following occurred:

- The 630 ewe weaners were randomly drafted into 3 treatment groups of 210 sheep in each.
- RFID tag - this was linked to a treatment code so weaners could be automatically drafted later-on by RFID tag into treatment groups for WEC sampling. This also allowed the downloaded weaner liveweight data to readily sorted into treatment groups.
- Weights recorded.
- Dag scores recorded. Weaners were dag free at the start as they had been recently shorn.
- Treatments administered to weaners.

Treatments evaluated were:

- Control/short-acting (SA) – standard farm practice worm control with short-acting oral drenches. Drenched to maximum weight with Triple acting drench at the start.
- Multimin (SA+ MM) – same as the Control plus a Multimin injection at the start. Multimin is a trace mineral supplement which contains Zinc, Manganese and Selenium.
- Long-Acting (LA) – short-acting oral drench (primer) Zolvix, plus a long-acting injectable drench (LA Moxydectin) at the start and an exit oral drench on completion of trial. The use of long-acting drench was included to rule out worms as a cause of scouring.

On this farm, fibre (hay) is provided to sheep during winter as standard practice in an attempt to reduce scouring/dag as it was thought the high quality improved pastures may be a contributing factor. Hence, a with and without fibre treatment was not included in this demonstration.

The 630 ewe weaners were run in the same mob and were rotationally grazed around 3 paddocks.

Follow up bulk faecal samples were taken every 30 days from each treatment group to monitor WECs. On one occasion in September, the yards were too wet to get the sheep in to draft into treatment groups so a bulk WEC sample was taken out in the paddock for the whole mob of 600.

Sheep liveweights were recorded when they were yarded for WEC samples.

Following the results of the Day 30 WEC (July) the Control and Multimin mobs were drenched a second time with a triple active oral drench.

The Day 60 WEC in August (only tested LA and Control mob) showed that the second drench for the Control and Multimin mobs was effective at holding worm pressure through late July and August, and that the long-acting drench was still effective in the LA mob.

The Day 90 WEC in September was a bulk from the combined mobs as the yards were too wet to unnecessarily yard and draft. At a count of 60 e.p.g the producer deemed it was not worthwhile to put them under further stress to get the 3 individual results.

The final treatment mob WECs were taken in early November (around Day 130 of trial) along with an individual weight and dag score on all ewes. The LA mob received an exit drench of Zolvix at the end of the trial and the Control and Multimin mobs received their third short-acting oral drench based on the high WEC results.

Results:

Sheep in the 2 short-acting treatment groups were drenched twice during the trial based on the WECs results. The long-acting group did not require follow up drenching during the trial period.

A summary of the worm egg count results are shown in Figure 1. Following the results of the Day 30 WEC (July) the Control and Multimin mobs were drenched again on 1/8/22 with a triple active oral drench. At day 90 (September) as only a bulk sample could be collected in the paddock, it is possible that the Control and Multimin mobs could have had a higher WEC than the 60 epg bulk sample indicated. The WECs for the Control and Multimin mobs increased to 780-810 epg by the end of the trial (Day 130). This would indicate that these 2 mobs may have required a third short-acting drench at Day 90 to prevent this escalation in WECs. The long-acting drench was effective at keeping WECs at low levels in the LA mob during the trial and the WECs were still relatively low, at 150 epg, by the end.

The producer commented there was obviously a high worm pressure in the weaners grazing rotation and suspected 1 of the 3 paddocks was ‘dirtier’ than the other 2 hence the spikes in WECs at different times.

The Long-acting mob had a higher daily weight gain over the trial period and also a lower average dag score than the Control and Multimin mobs (Table 1).

Figure 1. Effect of treatment on Worm Egg Count (WEC) results during the trial.

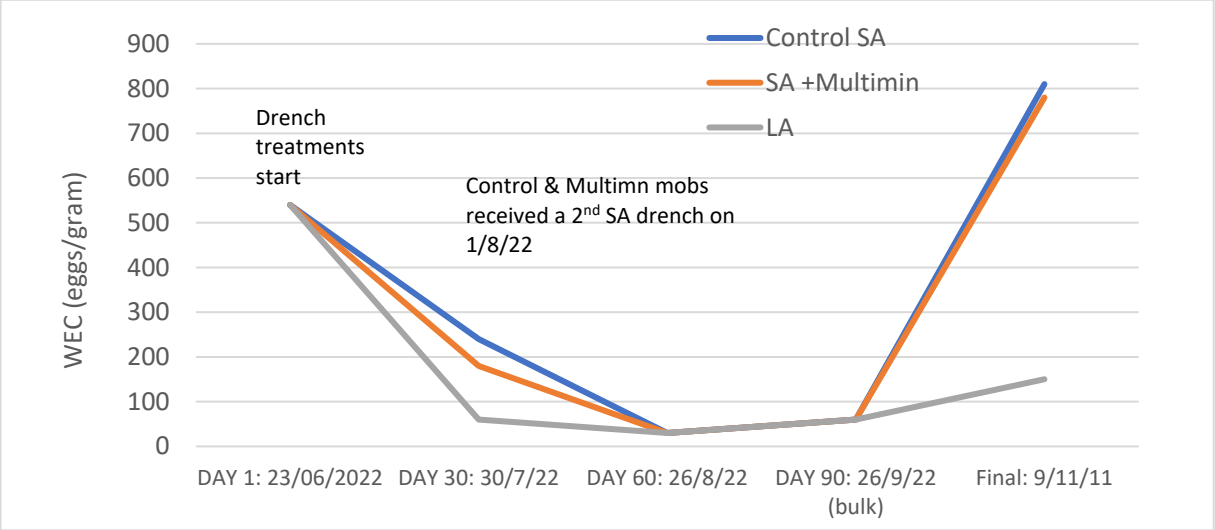


Figure 2. Weaner sheep at the start of the trial showing that they had no dag at the start.

Table 1. Liveweight gains and dag scores of trial sheep

Treatment	Number of sheep	Weight gain from 23/6/22 – 9/11/22	Dag score 9/11/22
Control (short-acting Triple drench)	210	15.6	2.6
Multimin (short-acting Triple drench + Multimin)	210	15.3	2.3
Long-Acting (LA moxidectin + Zolvix)	210	17.2	1.8

Conclusions:

- The Long-acting mob had a higher daily weight gain over the trial period and also a lower average dag score than the Control and Multimin mobs.
- The producer commented the majority of dag in 2022 appeared to be worm related, however is very interested in trialling some loose licks and/or mineral supplements (based on some blood/liver testing) in the future together with the LA drench to alleviate the worm aspect.
- The producer plans to take WECs more frequently in future in the weaners such as every 30 days or so, rather than the 6-8 weeks that he normally takes them, to be able to pick up earlier if the WECs are increasing and keep on top of the worms and dag.

7.1.2.5 Demonstration 5: Clarifying causes of and Options to Reduce Dag

Group/Site: North-east Victoria group, Baynton.

Aim:

To investigate factors that may be contributing to dag and the effectiveness of improved worm control or feeding fibre (vetch hay) during winter and early spring on

- Liveweight
- Dag score
- Crutching and shearing:
    - The amount of dag & loss of wool value
    - Crutching and shearing ease

Method:

In June 2022, a mob of 200, August 2021 drop weaners were selected for the trial. All sheep on the property were mulesed. For these mulesed weaners, it was estimated that body wrinkle was around 3.0.

The producers want to get on top of dag and move to plainer sheep before they cease mulesing. (The current ram source have ASBVs for a range of traits but not for EBWR or DAG. The producers are also evaluating rams from a new source that have low EBWR ASBVs).

The initial bulk WEC sample in July 2022, taken from the whole mob, was 600 e.p.g and indicated that the sheep required drenching.

The trial started on 8/7/22. At the start of the trial the following occurred:

- The 200 ewe weaners were randomly drafted into 4 treatment groups of 50 sheep in each.
- Each treatment group was tagged with a different colour ear tag (non-RFID).
- RFID tag - this was linked to a treatment colour tag so weaners could be manually drafted later-on into treatment groups for WEC sampling. This also allowed the downloaded weaner liveweight data to readily sorted into treatment groups.
- Weights recorded.
- Dag scores recorded. Weaners were relatively dag free at the start as they had been recently shorn.
- Drench treatments administered to weaners.

Treatments evaluated were:

- Control/short-acting (SA) – standard farm practice worm control with short-acting oral drenches.
- Long-Acting (LA) – short-acting oral drench (primer) Zolvix, plus a long-acting injectable drench (LA Moxydectin) at the start and an exit oral drench on completion of trial.
  The use of the long-acting drench was included to rule out worms as a cause of scouring.
- As the demonstration was investigating worm control and feeding fibre the above 2 treatment groups were repeated for a mob that was to receive hay in their paddock.
- The 4 treatment groups are summarised in Table 1.

Table 1. Treatments applied at Baynton

Tag colour	Treatment	Initial Worm control
White	SA	Zolvix 4mL/hd
Blue	LA	Moxiguard 2mL/hd + Zolvix 4mL/hd

Red	SA + Fibre (vetch hay)	Zolvix 4mL/hd
Purple	LA + Fibre (vetch hay)	Moxiguard 2mL/hd + Zolvix 4mL/hd

Two similar, adjoining paddocks were selected for the demonstration (called Redhill and Corner). The pastures consisted mainly of phalaris/clover/ryegrass with some weeds.

Each of the 2 drench treatment mobs (100 sheep) were allocated to a paddock and run together. In one of the paddocks, vetch hay was placed in a hay feeder as the fibre source. The treatment groups were run in their allocated paddock for one month before the treatment groups /paddocks were swapped over. The hay feeder was moved to the other paddock to remain with the " + Fibre" group of sheep. Paddocks were swapped to allow for any variation in paddock factors such as different levels of worm contamination or different pasture species that may affect the sheep.

Stock condition/health and pasture mass (kg DM/ha) were monitored to make sure the stocking rates/grazing pressure was even in each paddock.

Follow up bulk faecal samples were taken every 30 days from each treatment group to monitor WECs. Sheep liveweights and dag scores were recorded when they were yarded for WEC samples.

The Day 30 WECs (2nd August) indicated the 2 Control/SA mobs required drenching. It was about 2 weeks later (17/8/22), by the time the WEC results came back and the sheep could be yarded again, when these 2 mobs were drenched a second time with a short-acting drench (Vetmec Dual).

The Day 60 WEC (7th September) was zero for the SA and the LA mobs. The WEC for the SA mobs was probably taken too soon after the second drench to pick up new worm eggs (ie. previous WEC was taken 36 days prior to Day 60 WEC but drench only occurred 21 days prior and the drench used can give 7 days protection. Minimum time from L3 larvae to egg laying is 18 days).

The final, Day 90 WEC (11 October) indicated rising WEC numbers for all groups and that the LA drench was starting to run out. Final weights and dag scores were collected the same day.

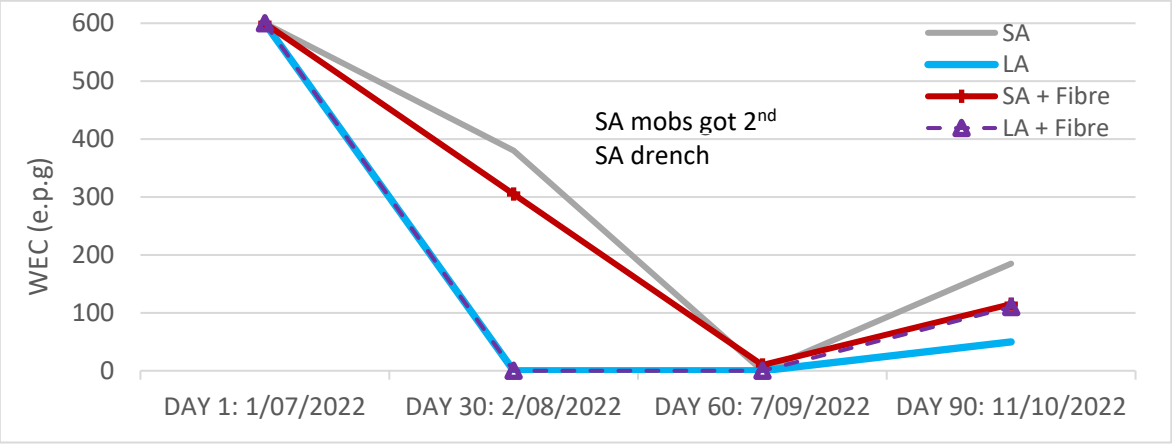
Approximately 2 round bales of vetch hay (660 kg in total) were used during the trial for 100 sheep.

Results:

Sheep in the 2 short-acting treatment groups were drenched a second time during the trial based on the WEC results. The long-acting group did not require follow up drenching during the trial period.

A summary of the worm egg count results are shown in Figure 1. Following the results of the Day 30 WEC (August) the Control/SA mobs were drenched again on 17/8/22 with a short-acting drench Vetmec Dual. The long-acting drench was effective at keeping WECs at low levels during the trial.

Figure 1. Effect of treatment on Worm Egg Count (WEC) results during the trial.



Over the trial period, the Long-acting drench mobs had a higher weight gain of 1.6-2.0 kg than the Short-acting drench mobs (Table 2). Within a drench treatment, adding fibre reduced weights gains by 2.2 – 2.6 kg. The reduced weigh gain would be due to sheep substituting good quality pasture for the hay. The best weight gain was in the LA mob which was 4.2 kg heavier than the SA + fibre mob.

There was no major difference in dag score between treatments (Tables 2 and 3). As the SA mobs were being monitored closely for WECs they were drenched a second time before WECs escalated and this possibly prevented an increase in dag. Feeding fibre had no effect on dag score.

Table 2. Liveweight gains and dag scores of trial sheep

Treatment	Number of sheep	Weight gain from 8/7/22 – 11/10/22	Dag score 11/10/22
Control/SA (short-acting Zolvix drench)	50	12.2	2.1
Long-Acting (LA moxidectin + Zolvix)	50	13.8	2.0
Control/SA + FIBRE (short-acting Zolvix drench)	50	9.6	2.1
Long-Acting + FIBRE (LA moxidectin + Zolvix)	50	11.6	1.9

Table 3. Percentage of sheep in each dag score category as at 11/10/22

Treatment	Dag score				
	1	**2**	**3**	**4**	**5**
Control/SA	22 %	55 %	14 %	8 %	0 %
Long-Acting	24 %	57 %	10 %	8 %	0 %
Control/SA + FIBRE	23 %	54 %	17 %	4 %	2 %
Long-Acting + FIBRE	30 %	54 %	14 %	2 %	0 %

Conclusions:

- Long-acting mobs had a higher weight gain over the trial period than the Short-acting mobs.
- Dag was kept to a minimum by improved worm control. The producers commented that the weaners had much lower dag than what they would normally see in winter/early spring with

their usual WEC/drench program. Hence, it was concluded that the majority of the dag issue was worm related (particularly in 2022).

- The producers plan to take WECs more frequently in future in the weaners such as every 30 days or so, rather than the 6-8 weeks that they normally take them, to be able to pick up earlier if the WECs are increasing and keep on top of the worms and dag.
- Feeding fibre did not reduce dag and reduced weight gains in the weaners.

Figure 2. NE Victoria Group members assessing body and neck wrinkle on trial sheep and discussing the Dag Management results at Baynton in March 2023 after trial sheep were shorn.

7.1.2.6 Demonstration 6: Sire Evaluation

Group/Site: North-east Victoria group, Baynton.

Aim: Evaluate progeny from rams with lower and higher Early Breech Wrinkle (& DAG, WEC) ASBV's:

- How quickly the breech wrinkle score of the flock can be reduced using genetics?
- Observe the impact of using low EBWR rams compared to high EBWR rams
- Observe the impact on other production traits

Method:

In March 2023, a mob of 2021 drop, maiden ewes were randomly split into two mobs and identified against their eID tag.

Rams were allocated to 2 teams based on their ASBVs for early breech wrinkle – High EBWR and Low EBWR. Rams in the low EBWR team had been purchased from a new ram source in 2022. New rams were all polled. The producers wanted to reduce breech wrinkle as they were planning to cease mulesing and were investigating the impact of changing studs on other key production traits. They were also looking to use poll rams, reduce WEC and DAG but maintain fleece weight and fibre diameter.

The ram syndicates were joined to the two mobs of ewes for 5 weeks. The differences between the ASBVs of the two syndicate are shown in Table 1. There was 1.2 EBWR ASBV difference between the two sire groups. An attempt was made to keep other ASBVs as close to each other as possible, but there was some variation. However, the Sustainable Merino (SM) and Wool Production (WP) indexes for the teams were similar.

Table 1: ASBV averages for ram teams allocated to the High EBWR and low EBWR sire groups.

Sire group	YCFW	YFD	YSS	YSL	YWT	YEMD	YFAT	WR	EBWR	LDAG	YWEC	SM index	WP index
High EBWR	32.6	-2.4	-1.3	8.8	5.7	0.1	-0.5	0.0	0.6	0.4	no data	142.7	182.5
Low EBWR	22.0	-1.2	1.1	10.3	10.2	0.4	0.4	0.2	-0.6	no data	4.3	145.8	170.4
Average	**27.3**	**-1.8**	**-0.1**	**9.6**	**8.0**	**0.3**	**-0.1**	**0.1**	**0.0**	**-**	**-**	**144.3**	**176.5**
Difference	10.6	-1.2	-2.4	-1.5	-4.5	-0.3	-0.8	-0.1	1.2	-	-	-3.0	12.1

After joining and up until the month pre-lambing, the two mobs of ewes were run together. Ewes were pregnancy scanned for singles or twins so could be allocated to a separate paddock pre-lambing based on that information and on sire group. The single bearing ewes were the ones used for progeny assessment. Pre-lambing, each mob of ewes was allocated to a separate lambing paddock.

At lamb marking (26/9/23), lambs from each sire group were tagged with an eID tag, identified on a Gallagher stick reader and their visual breech wrinkle scores recorded. They were then docked and mulesed. The 2 groups of lambs were run together following weaning in late October.

The trial weaners were shorn in April 2024 but fleece weight and micron data was not collected for the 2 groups as the producers decided the wool data would be more meaningful at the next shearing when they had more fleece. This data, and liveweight data, is due to be collected at the end of 2024.

Results:

The overall difference between the progeny from the two sire groups was 0.6 breech wrinkle score (Table 2). Given that half the DNA comes from the sire and the difference between the ASBVs of the sire groups was 1.2, a 0.6 difference is realistic.

Table 2. Breech wrinkle scores of progeny

Sire group	No. of progeny assessed	Average Visual breech wrinkle score
High EBWR	162	2.5
Low EBWR	180	1.9

Figure 1 shows the distribution of progeny breech wrinkle scores from the two sire groups. The Low EBWR group had 99.5% of progeny either 3 score or below while the High EBWR had 11% of progeny above 3 score. The Low EBWR group had 79 % of progeny with a score 1 or 2, while the High EBWR only had 52% of progeny with a score 1 or 2. Depending on the target breech wrinkle score for the flock, this highlights the differences in selection pressure that would need to be applied to ewes to reduce wrinkle if the rams with lower EBWR weren't used.

Figure 1: distribution of wrinkle score across the High and Low EBWR sire groups

Conclusions:

- Using low EBWR (-0.6) rams compared to high EBWR (+0.6) rams can dramatically reduce breech wrinkle score in one generation. The overall difference between the lambs from the two sire groups was 0.6 wrinkle score. Given that half the DNA comes from the sire and the difference between the ASBVs of the sire groups was 1.2, a 0.6 difference is realistic.

- The range in breech wrinkle score was also reduced. The breech wrinkle score of the progeny from the low EBWR sire group ranged from 1 to 3, while the progeny from the high EBWR sire group ranged from 1 to 4. The differences in distribution of the breech scores highlights how quickly sheep can be bred that will have lower breech flystrike risk (below score 3) and be easier to crutch, which will assist producers to manage the transition to non-mules.
- Information on greasy fleece weight, fibre diameter and hogget liveweights are still to be collected. This data is essential to be able to calculate relative gross margins for the two groups and compare the economic impact of changing ram source.

7.2 Communications plan

Communications plan – MLA PDS L.ADP.2031

Updated 23/03/23

Project details:

Project contact MLA	Sarita Guy
Project delivery partner	Lisa Warn, Lisa Warn Ag Consulting Pty Ltd. Mobile: 0418 748 607 Email: l.warn@iinet.net.au

Background

This project will support sheep producers to utilise existing tools and management strategies available to transition to a non-mulesed flock.

The practice of mulesing, to reduce susceptibility of sheep to breech strike, represents a significant welfare issue that is increasingly becoming less acceptable by retailers and consumers. Preventing flystrike and phasing out the practice of mulesing is a major goal of the industry. The Meat Industry Strategic Plans (MISP 2020, SISP 2015-2020, Read Meat 2030) have identified that continuous improvement of animal welfare and sheep health/well-being is a key priority to ensure consumer and community support for the industry's products and practices. Work in this area has also been identified as a priority by regional SALRC committees.

Sheep producers that have ceased mulesing are located across a wide geographic area and have a wide range of sheep genetics. Their experiences indicate there is potential for other producers in their district to have a go at ceasing mulesing, at least on a small trial basis. Many producers who would like to cease mulesing lack the confidence to do so and are fearful of not being able to manage without it. They are also concerned that they may need to use more chemicals to prevent breech strike and will run out of options if resistance occurs.

This project aims to support producers to develop their own management plan, improve knowledge, and skills to transition to cease mulesing and for some group members the opportunity to have a go with a small trial with their own sheep. This will improve their knowledge of breech strike risk factors, management and genetic options, improve their confidence and allow them to identify and plan further management changes they need to ultimately be able to cease mulesing across the whole flock. The risk of breech strike is likely to change annually, seasonally and over time with changing climate. A deeper understanding of risk factors for their sheep, farm, farm system and region will support them changing practices over time in response to changing risk. The project will also allow producers to identify new market opportunities for their wool and meat and to calculate the cost/benefit to their business of ceasing mulesing

Challenge/opportunity

Challenge:
Many producers would like to cease mulesing but have identified various challenges/threats such as:
- lack of confidence and fear of not being able to manage without it,
- concern about increasing reliance on chemicals and resistance,
- their current sheep genotype is not ready for this,
- possible price discounts when selling sheep to re-stockers
- difficulty getting shearers for crutching
-Mixed/lack of clarity in market signals

Opportunity:

Sheep producers that have ceased mulesing are located across a wide geographic area and have a wide range of sheep genetics. Their experiences indicate there is potential for other producers in their district to successfully make this transition. We have producer advocates who can tell their story: how they put plans in place to overcome the challenges and threats, the management changes they made and the new market opportunities for their wool and meat.

This communications plan will respond to the above.

Project objective(s)

By June 2024, in Victoria and southern NSW:
1. 40 sheep producers (core group members: 4x10) will
(a) Identify their breech strike risk factors (environmental, genetic, management), understand how these are affected by season and changing climate, and develop their own management strategy (5-year plan) to reduce this risk.
(b) Support the establishment of 2-3 trials on farm per group to evaluate some element of their 5-year plan towards running a non-mulesed mob. This could be comparing a small mob of non-mulesed sheep with a mulesed mob or evaluating progeny of rams selected for ASBVs for fly resistance.
(c) Evaluate the challenges, costs/benefits, opportunities of running a non-mulesed mob of lambs in comparison to a mulesed mob and explore future marketing and value chain opportunities.
(d) (at the end of project) Identify/plan for any further management changes required to allow them to move towards ceasing mulesing across the whole flock in the future.
(e) Conduct a (triple bottom line) cost benefit analysis of this practice change.

2. Implement a series of skills and training development activities to increase the confidence of 40 core and 40+ observer producers to transition to non-mulesed flocks. By June 2024, achieve an adoption target of:
• 25% of core producers ready to cease mulesing
• 75% of core producers have a 5-year plan to transition to non-mulesed (beyond the life of this project)
• 25% of observer producers have a 5-year plan to transition to non-mulesed

3. Conduct an annual field day and other activities to showcase the demonstration site results and encourage adoption of key practices by 20 attending producers (ie. 20 producers/field day, additional to the core group).

Comms objective(s)
1. Keep the “core producers” informed on progress of PDS sites and results. Facilitate the development of informal communication networks that may be maintained beyond the life of the project

2. Increase awareness & engagement of other regional producers (observer producers) in the project activities to motivate and enable them to develop a 5-year plan to transition to a non-mulesed flock.

3. Increase awareness, in the wider community/sheep industry, about the project, what the “core producers” are investigating in their PDS sites and the results when they become available.

Target audience

- Primary audience/Core & Observer producers

    - "Core" producers in the four "Towards non-mulesed Sheep" groups located in Vic & NSW.
    - "Observer" producers from regions where the four groups/PDS sites are operating.
- Secondary/Wider audience
    - SALRC - regional committees
    - Consultants/Agency extension staff/vets/stock agents in Victoria and NSW
    - Representatives from Animal health companies/Rural merchandise outlets. Companies sponsoring products.
    - Sheep producers who continue to the practice of muesling
    - Sheep producer networks in Vic (Bestwool/Bestlamb) and NSW (Sheep Connect, MerinoLink, South West Slopes Merino Breeders Association, Bookham Ag Bureau) & other states (Sheeps back WA, Sheep Connect Tas etc).

Key messages

- The practice of mulesing, to reduce susceptibility of sheep to breech strike, represents a significant welfare issue that is increasingly becoming less acceptable by retailers and consumers. To ensure continued access to markets, phasing out the practice of mulesing is a major goal of the industry
- It is possible to move to and successfully manage a non-mulesed flock.
- This Producer Demonstration Site (PDS) project is supporting sheep producers to utilise existing tools and management strategies available to transition to a non-mulesed flock.
- Producers will be supported to develop their own management plan and improve knowledge and skills to transition to cease mulesing. Through Producer Demonstration Sites, some producers will run a trial with their own sheep, and evaluate possible changes they may need to make to their systems to move towards running non-mulesed flocks.
- There are large variations between regions and sheep in the risk and incidence for breech strike. Each sheep producer needs to have a plan that is relevant to them.. Develop a well-considered detailed plan before starting the move.
- For more information about the project or to receive updates about the demonstration sites and relevant workshops/field days in your region, click here to complete the expression of interest form.

Audience	Message(s) (Targeted messages based on your key audiences)	Communications tactics (e.g. written producer case study, video)	Communications channel (e.g. Feedback magazine, media release)	Responsibility (eg name and company)	Timing
Primary - Core group producers	Develop a well-considered detailed plan before starting the move. Identify their breech strike risk factors. Identify practices to evaluate in demo sites. Skills training (scoring breech wrinkle, dag etc). Update group on demo site progress & results. Annual review of program. Producers review their 5-year plans - determine next steps.	Workshop with producer advocate Meetings on-farm. Webinars/zoom catch ups. Final workshop	Social media groups Media releases Producer interviews	Group co-ordinator (LW, HM, SM) Group co-ordinator (LW, HM, SM) Group co-ordinator (LW, HM, SM)	Start of program-2021 4 meetings/year (seasonally relevant) End of program – Nov 2023
Primary - Observer producers	Identify their breech strike risk factors (environmental, genetic, management). Awareness of tools and management strategies available, & PDS results. Improve knowledge & skills to build confidence. Be supported to contextualise it to their farm enterprise – case studies and group comms Project Updates	Workshops Field days	MLA flyers eNewsletter/emails	Group co-ordinator (LW, HM, SM) Group co-ordinator (LW, HM, SM)	Annually 6 monthly
Primary & Secondary	Awareness of project (engage more observer producers)		Bestwool/Bestlamb newsflash/SheepConnect newsletter. Media Release -eg.	Group co-ordinator (LW, HM, SM)	Start of project-2021

	Identify their breech strike risk factors (environmental, genetic, management).		Sheep Central, regional newspapers, social media		
	Awareness of tools and management strategies available, & PDS preliminary results.	Field days		Group co-ordinator (LW, HM, SM)	Annually
	Awareness of Project & PDS results	Webinars (MLA & state Sheep networks, WA PDS group)		LW, HM, SM	June 2023
	Awareness of Project & PDS results	Bestwool/Bestlamb Conference & Merinolink conference & South West Slopes Sheep breeders Assoc SA Livestock Advisor Updates.		LW/HM SM	June 2024 June 2024
	Awareness of tools and management strategies available, & PDS results.		MLA Feedback article – producer case study	LW	June 2024
	Examples of how producers made the move – their plan & changes they made to the business	Producer case studies		Group co-ordinator (LW, HM, SM)	June 2023
			Media Release -eg. Sheep Central, regional newspapers/social media	Group co-ordinator (LW, HM, SM)	June 2024

Secondary	Awareness of project (engage more observer producers)	Bestwool/Bestlamb Co-ordinators Conference		LW/HM	Mar 2022

7.3 Monitoring evaluation and reporting plan

PRODUCER DEMONSTRATION SITE MER – L.ADP.2031

PRODUCER GROUP NAME: Towards Non-mulesed Sheep

Project Objective (Key Result Area)

This project will support sheep breeders to utilise existing tools and management strategies available to transition to a non-mulesed flock.

Evaluation level[1]	Project Performance Measures	Evaluation Methods
Inputs – What did we do? *Describe the planned and expected inputs involved in your project*, including *funds, resources, development & projects structures*	• 40 core producers involved in 4 groups across Vic & NSW (10 per group) • 2-3 demonstration sites/region established from within each core group of producers • 40 additional producers observing demonstration sites. • Number of livestock involved (sheep & cattle owned by core producers - **to be confirmed**) • Area involved (Ha owned by core producers - **to be confirmed)** • MLA funds & all cash & in-kind contributions	• Records of group activities and project plans • Numbers of producers attending field days & get their contact/farm details • Keep records of all cash & in-kind contributions
Outputs - What did we do? *Describe the outputs planned/expected from your project*, *including engagement activities & products from demonstration sites*	• Workshops & group meetings held for core group & number of people who attended • Data obtained from 2-3 demo sites/group on impact of a practice change (implemented to assist the transition to cease mulesing) on sheep production and management. • Assessment of cost/benefit of options/practice change • Annual field days held. • Press releases/interviews	• Records of group activities and numbers attending. • Demonstration site data • Records kept of all inputs/treatments/labour involved • Evaluation sheets completed at field days to collect data on demographics, satisfaction with event, improved knowledge • Number of communication products produced and distributed.

[1] Note: The headings in column 1 are also listed in the PDS Final Report template.

	• Case study/fact sheets produced at end of project	
Changes in knowledge, attitudes and skills - How well did we do it? *Describe the changes in KASA that you are planning to achieve.*	• Change in knowledge/attitudes/skills of **core and observer** participants before and after project/activity *eg.* *- improved knowledge of factors affecting breech strike risk (environment, management, genetics)* *- improved knowledge of tools such as FlyBoss, DNA Flock Profile, RamSelect etc* *-improved skills in using visual sheep scores (breech traits).* • Experience of producers involved in the PDS – extent to which they found the project/ activity useful or of value. • What was most helpful in supporting capacity change? • Retention rate of core group members at the end of the project.	• Pre & Post survey of core producers (including question assessing KASA) • Survey on observer producers attending field days early on in project. • Focus group/ORID style discussion to assess this within the core group. • Focus group/ORID style discussion to assess this within the core group. • Document if/why people leave the project.
Practice changes – Has it changed what people do? *Describe the practice changes that you are expecting to achieve by the end of your project*	• Producer (core & observer) practice (eg timing of crutching/shearing, use of chemicals, breech modification, breeding objective) before and after project • The extent of practice change adoption (# of sheep) • Influence the project had on practice change achieved	• Pre & Post survey of core producers • Survey on observer producers attending field days – may have to do follow up survey of this group otherwise can only ask this group about their intention to change practice based on what they have learnt at field days. • Focus group/ORID style discussion to assess this within the core group.
Benefits – Is anyone better off? *Describe the benefits that you are expecting to achieve as a result of the project*	• Benefits from outcomes (value of any improved growth rate/meat production, wool production, reduced strike, decreased mortality rate, reduced chemical use, price premiums compared to baseline) • Costs to achieve outcomes (increased inputs, labour) • Benefit Cost and Sensitivity analyses at the business level • What are the unintended/unexpected benefits or consequences? • Project learnings, barriers / enablers to adoption	• Production data from demos sites - any additional benefits (producer mindset around change/confidence/networks). • Records of additional costs • Benefit cost analysis from data collected from demo sites • Focus group/ORID style discussion to assess this within the core group. • Focus group/ORID style discussion to assess this within the core group.
General observations / outcomes – Is the industry better off?	• Potential impacts (practice change & productivity) at the end of the project and well after the project has concluded (e.g. 2 years later) for the broader target audience	• Extrapolation of Benefit Cost analysis to sheep numbers in National flock (with adjustments for estimated numbers

	• BCA of broader industry impact (productivity, profitability, environmental & social)	already non-mulesed) to assess potential benefit to broader industry. • Post project survey (MLA responsibility)

7.4 Case studies

7.4.1 Producer case study: Impact of tail docking method

Transitioning to Non-Mulesed Sheep

Producer case study: Impact of tail docking method

Project overview

The Meat & Livestock Australia (MLA) funded "Transitioning Towards Non-Mulesed Sheep" Producer Demonstration Site (PDS) project, aimed to support sheep producers transition to non-mulesed (NM) flocks through utilising existing tools and resources available. Producers developed their own, property-specific transition plans and participated in regular group meetings to share experiences and improve skills.

Three "Towards NM Sheep" groups were run across Victoria and a fourth group was in the South West Slopes region of NSW. Producers had the opportunity to run a demonstration on their property to evaluate management and genetic options that could assist with moving to, and managing, a non-mulesed flock.

Why was 'tail docking method' an issue?

Tail docking method emerged as a major discussion point among all the groups. With the move to NM (and no tail stripping), producers anticipated that the wool on the end of the tail may increase the risk of dag accumulation and flystrike, and may take longer to crutch. Different tail docking methods were evaluated to see if any gave better results in terms of reduced wool on the end of the tail and impact on dag and crutching ease.

Demonstration site producers

Peter and Brendan Hinchliffe from Langi Logan, and Wayne Burton from Mt Dryden, in western Victoria conducted tail docking method demonstrations on their properties.

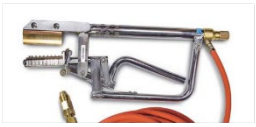
The Hinchliffes run a self-replacing superfine (16-17µm) Merino flock and ceased mulesing all lambs in 2020. With increased demand for NM wool and accreditation opportunities, they market their wool through the RWS integrity scheme and declare it as non-mulesed via the National Wool Declaration (NWD). While this wasn't the motivating factor to cease mulesing, they are keen to take advantage of any premiums which may occur from being accredited as NM.

They are continuing to refine their management calendar and make changes to ram selection to maintain the flock as NM. To breed more breech flystrike-resistant sheep, they are putting more emphasis on reducing breech wrinkle and dag.

Image 1. Tail docking methods evaluated in the PDS

Rubber rings & NumNuts applicator

Standard /Leader hot-knife



Te Pari Patesco hot-knife

Steinfort hot-knife (Model year 2021)

The Burtons run a self-replacing fine (19 µm) Merino flock and sell some wethers as lambs to re-stockers. Currently, all lambs are mulesed. The Burtons are working on their plan to cease mulesing in the future and have trialed running a small mob of NM ewe lambs to see what might be required. Their sheep are relatively plain bodied with an average visual breech wrinkle score of 1.5. They have regular buyers for their wether lambs, who prefer them to be mulesed, so this is another factor to consider in their transition plan.

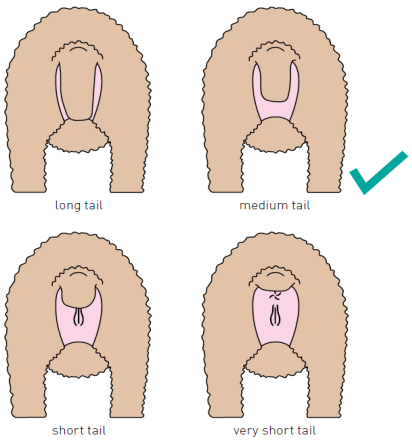
The Hinchliffes and Burtons used a standard straight hot-knife for tail docking at marking and wanted to see if the Te Pari Patesco rolling anvil knife or the Steinfort knife gave a better result on NM lambs.

Importance of tail length

Best practice tail length was promoted and used in all demonstrations. Docking at the 3–4th joint to cover the tip of the vulva, or the equivalent length in wether lambs, is the recommendation.

This tail length has been shown to reduce risk of breech flystrike and stain for lambing ewes. Shorter tails have issues with increased risk of flystrike, rectal prolapse, cancer in ewes, and are slower to heal.

Image 2. Correct tail docking length. (J. Lloyd, 2012)



Demonstration sites – methodology

Different tail docking methods were compared at the two Victorian properties (a third demonstration was conducted by a producer in the NSW group but results are not reported here).

Methods compared were a standard straight hot-knife (e.g. Leader), the Te Pari Patesco rolling anvil hot-knife, the Steinfort hot-knife (Model year 2021) at both properties and rubber rings with NumNuts applicator were also used at Langi Logan.

For all treatments, tails were docked to the same best practice length. All lambs received pain relief of meloxicam at marking. The one operator – Dr John Steinfort (Steinfort AgVet) – used the different methods to dock all tails at

the two demonstration sites. This reduced variation in tail length that may have resulted from having different operators. On each farm, a mob of single-born lambs from adult ewes were randomly allocated to each tail docking method. This mob of lambs was selected to reduce any variation in breech wrinkle influenced by variations in birth type and dam age. At Langi Logan, lambs from two different sire groups (with different breech wrinkle scores) were also compared.

Each treatment group was visually scored for a range of welfare traits that are important for non-mulesed flocks. These included Early Breech Wrinkle (EBWR) and Breech Cover scoring at marking, as well as dag and urine scores prior to crutching.

Visual scores were assessed based on the AWI and MLA 'Visual Sheep Scores' booklet (2019). The SheepMetriX team developed a tail wool cover score (1 to 5) to determine if the various tail docking techniques resulted in more or less wool coverage over the tip of the tail.

Results

Langi Logan

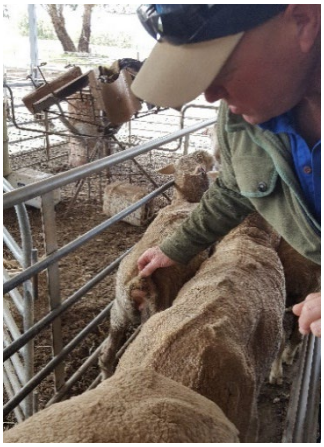
- There were no major differences in tail wool cover score for the four tail docking methods, when lambs were observed 110 days after marking. The ring method may be an inferior method to use on lambs with higher breech wrinkle as this method gave a higher tail cover score for lambs from sire group 2 (Table 1).
- There was no consistent trend with the dag score of lambs and tail docking method used.
- There was no obvious difference in crutching ease between the different tail dock methods.

Table 1. Effect of tail docking method on tail cover score and dag score at Langi Logan.

Treatment	EBWR 27/10/21	Tail score (ewes) 16/2/22	Dag score 16/2/22	Dag score 12/10/22
Sire Group 1				
Rings	2.5	3.5	2.3	3.7
Steinfort (2021)	2.4	3.5	2.2	3.7
Te Pari Patesco	2.5	3.5	2.7	3.3
Standard (Leader)	2.6	3.5	2.2	4.1
Sire Group 2				
Rings	3.0	3.9	2.1	3.6
Steinfort (2021)	3.2	3.1	2.2	3.3
Te Pari Patesco	3.0	3.3	2.7	3.6
Standard (Leader)	3.0	3.3	1.8	3.1

Image 3. Brendan and Peter Hinchliffe, Langi Logan, dag scoring the PDS weaners.

Image 4. Wayne Burton, Mt Dryden, assessing wool cover on tails of the PDS ewes (18 months of age) after shearing.



"We found the tail docking method is a relatively small part of the story about managing NM sheep. There are other factors that contribute more to ease of management such as breech wrinkle and dag.

"By measuring the early breech wrinkle scores at marking we were also able to see the impact of our new ram team (sire group 1) on the lambs. We were able to reduce EBWR by 0.5 a score."

- Brendan Hinchliffe, Langi Logan.

Mt Dryden

- There were minor differences in tail wool cover score for the three tail docking methods, when shorn lambs were observed 210 days after marking. On this sheep type, the standard and Te Pari knives gave a slightly lower tail score than the Steinfort knife.
- There was no real difference in dag score of lambs for the tail dock methods used.
- The wool cover on tails seemed to be due more to variation in wrinkle between lambs rather than the treatments. How well the tail area was shorn also influenced the appearance from a distance.
- There was no obvious difference in crutching ease or shearing ease between the different tail docking methods.

Table 2. Effect of tail docking method on tail cover score and dag score at Mt Dryden.

Treatment	EBWR score 13/7/22	DAG score 18/10/22	TAIL score 8/02/23
Steinfort (2021)	1.3	1.7	2.7
Te Pari	1.4	1.8	2.2
Straight	1.4	1.5	2.4

"Based on the PDS results, I will possibly move to using a Te Pari Patesco rolling anvil knife in future. I thought it gave a better result with less wool on the tip of the tail." - Wayne Burton, Mt Dryden.

Conclusions

There was no obvious difference in crutching ease of NM sheep between the different tail dock methods evaluated. There was no consistent trend with the dag score of lambs and tail docking method used.

Using the tail wool cover scoring system that was developed for this project, there were no major differences in tail wool cover and docking method. More work needs to be done to validate whether tail cover score is the best method to assess the appearance of the tail after docking.

Results may vary from farm to farm depending on the amount of wrinkle present on lambs and the person(s) carrying out tail docking. Taking extra care at marking is critical to ensure that procedures, such as tail docking, are performed to a high standard to ensure maximum animal welfare outcomes and ease of management later in life.

7.4.2 Producer case study: South west slopes group

Transitioning to Non-Mulesed Sheep

Producer Case Study: South West Slopes Group Project Overview

The Meat & Livestock Australia (MLA) funded "Transitioning Towards Non-Mulesed Sheep" Producer Demonstration Site (PDS) project, aimed to support sheep producers transition to non-mulesed (TNM) flocks through utilising existing tools and resources available. This was successfully achieved with the development of individual 5-year plans and also through holding regular group meetings and upskilling producers participants.

Each producer had the opportunity to run a demonstration on their property to identify key management practices involved with running a non-mulesed flock, as well as recognising various pathways of achieving this.

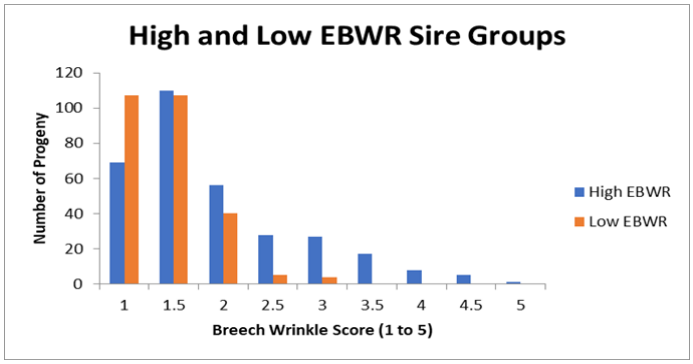
Key Findings

- It takes time to go non-mulesed and having a plan helps with long term management strategies.
- Management practices such as tail docking carried out at lamb marking, and how this is carried out can determines the lifetime management of the animals.
- Compared to mulesed animals, non-mulesed animals need to be monitored more in the first 18 months of life.
- NSW South West Slopes Project Group was very valuable with providing support and discussions for producers involved.

Sire Evaluation Demonstration – Jugiong, NSW

One producer ran a sire evaluation style demonstration, where rams were separated into two sire groups (5 rams per group), one with high Early Breech Wrinkle (EBWR) ASBV's and one with low EBWR ASBV's. Other ASBV trait values were kept as similar as possible between the two sire groups. Breech wrinkle has a moderate heritability of 0.38.

Figure 2 Distribution of Breech Wrinkle Scores for the progeny of the High and Low EBWR ASBV Sire



A key outcome from this demonstration was that lambs born from the sires in the high EBWR group had a range of 1 to 5 visual scores for breech wrinkle at lamb marking, while the lambs born from the low EBWR sire group ranged between 1 and 3 breech scores (See Figure 1).

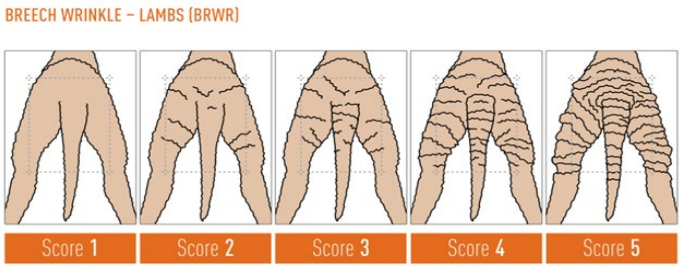
There were no major differences seen between the two progeny groups at weaning with only a 1.2kg difference. Fleece weights were also not notably different between the two progeny groups, with only a 0.2kg fleece difference.

"*I was surprised to see how quickly we can make some big changes within our flock, from breeding and ram selection." Robynn Sargent, Harden*

Following the Sire Evaluation demonstration, the host producer has begun looking at additional health and welfare traits when purchasing rams. These traits are important for moving to non-mulesed and include Early Breech Wrinkle, Dag, Worm Egg Counts and Fleece Rot.

Tail Docking Methods – Jugiong, NSW

Figure 2 Visual Score guide for breech wrinkle scoring at lamb marking, up to 10 weeks of age.



Another NSW producer ran a demonstration comparing five different tail docking methods. These included the Te-Pari Patesco hotknife, Leader hotknife – straight, Leader hotknife – used on a 45° angle, Rings with Numnuts applicator, Steinfort hotknife – Model year 2021.

A mob of single born lambs out of maiden ewes were randomly allocated to each tail docking method treatment. This mob of lambs was selected to reduce any impacts of 'feed wrinkle' on the demonstration results. Breech wrinkle influenced by the environment in which the lamb is born for example, variations in birth type and dam age; as twin born lambs naturally have less wrinkle than single born lambs.

Each treatment group was visually scored multiple times for a range of welfare traits that are important for non-mulesed flocks. These included Early Breech Wrinkle and Breech Cover scoring at marking, with body, neck and breech wrinkle scores collected off shears at a post weaning age (200 days of age), as well as two dag and urine scores when challenged (190 & 320 days of age).

Image 1 Lucinda Eddy capturing the first urine and dag scores on the demonstration mob, pre shearing.

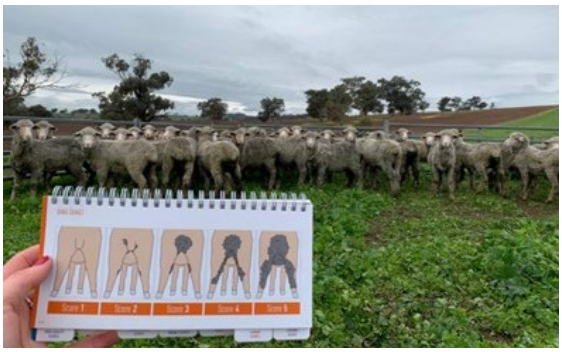
Visual scores were collected in accordance with the AWI & MLA 'Visual Sheep Scores' booklet. The SheepMetriX team also developed a tail coverage score (1 to 5) to determine if the various tail docking techniques resulted in more or less wool coverage over the tip of the tail.

Within this trial mob, there was a range of wool coverage over the tail for each of the different docking methods, with some tail docking methods being more favourable than others based on the scoring system that was developed for this project. It is important to remember that the outcome for this demonstration may vary from farm to farm depending on the amount of wrinkle present on the lambs and the person(s) carrying out the tail docking.

"*Having these wrinkle scores (early breech and off shears body and breech wrinkle scores) will allow us in the future to strategically join these ewes to our rams to assist our non-mules journey." Tom Macleay, Jugiong*

Additionally, many of the other producers involved within the project had anecdotal agreement that taking extra care at lamb marking is critical to ensuring that procedures, such as tail docking, are performed to a high standard to ensure maximum animal welfare outcomes and ease of management later in life.

Image 2 The Visual Score Guide for dag and the cohort of demonstration sheep scored for the second



"*If the tail was not docked evenly there was a fair bit of wool left covering the tip of the tail, we had a harder time managing these animals in later life. They were more prone to get breech strike or be daggy and need assistance." Mark Tiedemann, Young.*

Breech Wrinkle Scoring Methods – Harden, NSW

Another demonstration which was run in the NSW South West Slopes TNM group was comparing breech wrinkle scoring of the lambs standing freely versus in a rotating marking cradle. The findings from this demonstration was that there is no significant difference in the average scores produced from the two different scoring methods and the key to any visual scoring is consistency in the method and person scoring.

Table 1. Average early breech wrinkle (EBWR) scores by sex for the different scoring methods; standing versus in a rotating cradle.

2021 drop	Ave. EBWR standing	Ave. EBWR cradle
Female	2.5	2.6
Male	2.6	2.6
Total	**2.5**	**2.6**

It was observed that the advantages of scoring in the lamb marking cradle included knowing that each lamb will be assessed as they rotate past the assessor and provides the opportunity to capture additional data such as breech cover and sex.

Running A Small Non-Mulesed Flock – Young, Murringo & Harden, NSW

A number of the project participants ran a smaller non-mulesed mob while still having a larger mulesed mob, this enabled the producers to observe the different management and requirements in their environment and management systems. This approach was observed by multiple producers at various locations around the NSW South West Slopes region. Some common trends were seen when comparing their management procedures, with multiple producers finding that extra monitoring of the younger non-mulesed stock was necessary.

"In the non-mulesed mob we needed to take more care up to 18 months old, then we didn't seem to find many management differences between the mulesed and non-mulesed mobs." Linda Stewart, Harden

"Because we were monitoring our non-mulesed flock a bit more we were picking up other health issues sooner, particularly the worms this season (2023)." Mark Tiedemann, Young

Three of the five producers who tried running a non-mulesed mob were currently shearing 6-monthly. These producers found that there were no major changes that needed to be made to their overall management calendars in order to accommodate the non-mulesed flock.

*"Within our production system we are 6 monthly shearing, and there didn't seem to be much difference in the management of the two groups (*mulesed and non-mulesed mobs*), we didn't need to add an extra crutch." Angus Campbell, Harden*

Collectively, the project participants found that the amount of chemical used and additional labour and time needed for extra monitoring of stock depended greatly on the seasonal conditions and fly strike risk.

Project Outcomes

In conclusion, transitioning to non-mulesed does not have to be scary. It is essential to understand your starting position in relation to key breech fly strike indicator traits and to have short, medium and long term goals and strategies to work towards. Developing strategies to help make important management and selection decisions on farm will be an important step with planning your transitioning journey. Talking to other producers who have transitioned to non-mulesed who have been in similar situation, to hear and see what their journey was like, what their key challenges were and how they overcame them will assist in building confidence to start your journey.

Image 3 Hands on training with producers for assessing the visual wool quality scores at the project Field Day in 2023.

7.4.3 Producer case study: Mark Tiedemann

Transitioning to Non-Mulesed Sheep

Producer case study: Mark Tiedemann

Background

Mark Tiedemann of Summerhill Pastoral runs a 1,315ha mixed farming system located near Young, NSW. Mark currently manages 4,200 breeding ewes (Merino) from which he collects body weights, fleece data and reproduction information on to identify which ewes have the greatest genetic potential. The higher performing ewes are used in a small nucleus flock which Mark uses to breed his own Merino rams, while the lower performing ewes are joined to terminal sires. This allows Mark to remove undesirable genetics from his Merino flock while diversifying his income streams through a prime lamb enterprise. Additionally, through the data collection process and ram selection Mark has been able to improve fleece weights while reducing the overall micron within his commercial flock.

Mark's breeding objective focuses on breeding a dual-purpose sheep that is plain bodied, has good growth, fat and muscle while improving wool quality, increasing fleece weight and reducing micron. Mark's breeding program allows him to turn off wethers at a younger age and apply pressure to reproduction traits.

For the past 21 years, Mark has been selective when purchasing rams and semen to use within his breeding programs. This breeding objective has supported Mark's move to a non-mulesed enterprise in 2021, prompting him to identify other important welfare traits such as Dag and Worm Egg Counts (WEC), to now include in his breeding selections.

Image 3 Mark Tiedemann has been non-mulesed since the 2021 drop pictured.

Why did you choose to move to non-mulesed?

Mark's involvement with the Meat & Livestock Australia (MLA) funded Producer Demonstration Site (PDS) project "Transitioning to Non-Mulesed Sheep" within the South West Slopes (SWS) NSW Region promoted the decision to shift to non-mulesing, as he felt he would be supported by the other producers who were also making the transition. At the time the project commenced in January 2021, Mark also felt increasing pressure from the Sheep and Wool industry to refrain from mulesing his lambs, due to animal welfare concerns.

*"I thought we were going to have to (*go non-mulesed*) in the near future and figured it was time to make the change."*

Mark found it profitable to transition to non-mulesing when he did, as there were financial gains from wool premiums and a high demand from people seeking to purchase non-mulesed wethers, which drove sale prices up at the time.

"*The time was right, and I didn't like mulesing much anyway*."

What steps did you take to transition to non-mulesed? How long has it taken you to get there?

A breeding objective that strives to produce plainer bodied animals gave Mark an advantage during his transition as his stock were far less wrinkly at the beginning of the project, compared to others in the SWS NSW Group. With the commencement of the project in 2021, Mark felt confident with how plain his stock were and ceased mulesing on the 2021 drop. Since then, Mark has continued not to mules lambs born on his property.

*"I have been on a plainer bloodline for the past 21 years, and I probably could have done it (*gone non-mulesed*) a few years ago if needed, but I hadn't."*

What has been some benefits of going non-mulesed?

"It has helped to manage my worm burden as I lamb down in September and I was not able to move my ewe and lamb mobs because the mulesing wounds on the lambs needed time to heal after marking. Now I can move them to other paddocks after marking if I need to."

A surprising benefit Mark witnessed from moving to a non-mulesed flock was the flexibility to move the ewes and lambs to a new paddock sooner after lamb marking. Throughout the course of the project Mark received a significant amount of rainfall and witnessed a spike in worm burden at the time of lambing in September, which is a relatively late time to lamb down for the region. Having the option to move ewes with marked lambs off potentially contaminated pastures with ease has reduced the stress of this event. Mark's use of a long-acting pain relief at lamb marking proved advantageous as well, as it reduced the stress of the marking process, allowing them to quickly reunite with their mothers, improving the welfare of his stock overall.

Have you made any changes to your management since moving to non-mulesed?

"Not a lot has changed but I have moved the time of crutching."

Mark has routinely shorn his sheep every six months, and originally would crutch these sheep two weeks prior to shearing. However, since moving to non-mulesed, Mark has decided to change this to one month prior to shearing to reduce the risk of breech strike in his stock before shearing. Other than this minor change of date, Mark's calendar of operations has not been modified significantly.

Having a non-mulesed flock has meant that Mark now monitors his stock more routinely and therefore he is intercepting the occurrence of disease, flystrike and parasites earlier, particularly in his younger and more vulnerable stock, such as his wethers and weaners.

Knowing what you know now, what would you change about how you transitioned?

*"I don't think I would change anything because our sheep were already plain and I had you guys (*SheepMetriX and the SWS NSW Group*) around for support and guidance. It would be a different story if we didn't have plain body sheep already."*

Mark's transition was a smooth one due to the genetic foundations he had prior to the project commencement. His increased confidence from the support provided through the involvement with the SWS NSW Group and the SheepMetriX team further encouraged the move to non-mulesing.

What would you recommend to people who are thinking of going down the non-mulesed pathway?

"*It takes time! Make sure the sheep are plain and keep an eye on the shape and structure."*

Mark's recommendation for anyone thinking of heading down the non-mulesed pathway, is to ensure they have a plan and set targets and goals to meet, prior to ceasing mulesing. Mark also encourages that ease of management comes from "*keeping an eye on*" structure and conformation of stock.

7.4.4 Producer case study: Managing dag

Transitioning to Non-Mulesed Sheep

Producer case study: Managing dag

Project overview

The Meat & Livestock Australia (MLA) funded "Transitioning Towards Non-Mulesed Sheep" Producer Demonstration Site (PDS) project aimed to support sheep producers transition to non-mulesed (NM) flocks through utilising existing tools and resources available. Producers developed their own, property-specific transition plans and participated in regular group meetings to share experiences and improve skills.

Three "Towards NM Sheep" groups were run across Victoria and a fourth group was located in the South-West Slopes region of NSW. Producers had the opportunity to run a demonstration on their property to evaluate management and genetic options that could assist with moving to, and managing, a non-mulesed flock.

Clarifying causes and options to reduce dag

A common concern among all groups was crutching ease or getting contractors to crutch NM sheep, particularly if sheep had too much wrinkle or dag. There was also concern that being NM may lead to higher dag scores than in mulesed sheep. Apart from being a major risk factor for breech flystrike, dag increases costs of crutching and reduces income from soiled wool. Reducing breech wrinkle through breeding and selection, and investigating options to reduce dag, were priorities for many participants.

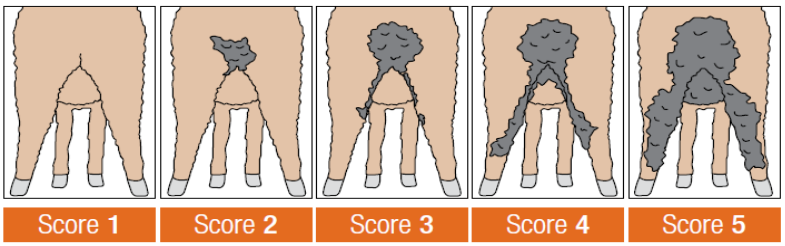
Many producers in the higher rainfall areas felt that their improved pastures may be a driver of dag in winter to early spring and wanted to evaluate if feeding fibre would reduce dag.

Scouring and consequent dag formation can have several causes. Identifying the cause of dag is important to work out appropriate management options. Causes of dag include:

- High worm burden – scouring associated with high worm egg counts (WECs) is most common in sheep less than 1-year-old and lambing ewes.
- Hypersensitivity scouring (low worm egg count scouring) – an immune reaction to worm larvae in some sheep. This is more likely to present in sheep older than 1-year of age. This condition is highly repeatable – the same sheep scour each year – and has a genetic basis.
- Bacterial infections or protozoan parasites.
- Diet/feedbase – forages that have been anecdotally associated with scouring include capeweed, forage oats and brassica crops. Perennial ryegrass, or sometimes phalaris, have also been associated with scouring in winter to early spring. The reasons why this occurs are not well understood. Some possible causes could be high quality lush feed (lack of fibre, high protein/nitrates), sudden changes of feed/pasture type (shifting from dead to green feed or to different amounts of feed on offer or different species), and in the case of perennial ryegrass can be due to toxins produced by fungal endophytes.
- Acidosis – from introducing grain too rapidly.

Selecting rams with low DAG and low WEC ASBVs as well as culling ewes (from 2–3 years of age) that repeatedly have high dag scores (due to being genetically hypersensitive) is the long-term strategy to reduce dag in the flock.

Image 1. Dag scores (Visual sheep scores, AWI/MLA 2019)



Demonstration site producers

Edward Blackwell, from Dunkeld in south-west Victoria and Gerard, Belinda Ryan and Joe Druce from Baynton, in central Victoria, conducted dag management demonstrations on their properties.

The Blackwells run a self-replacing fine (19 µm) Merino flock and ceased mulesing all lambs in 2017. Around 40% of ewes are joined to a terminal ram for prime lambs. They lamb in September and shear in summer. They started their NM journey in 2007, when they participated in an AWI breech clip trial (as an alternative to mulesing). In 2008 they decided to leave a portion of lambs NM but tail stripped only. In 2009 they decided not to mules but only tail strip the whole drop. By 2017 they were confident they could manage the flock without tail stripping.

They have been purchasing plain-bodied rams and classing out ewes with high dag and wrinkle over the years to ensure sheep are more suited to being NM. Daggy ewes are identified and "repeat offenders" go into the terminal mob. They crutch their own sheep so they can identify sheep that are too wrinkly which also go into the terminal mob.

"We didn't want to become chemical reliant, so apart from fly chemical at marking, we don't blanket treat sheep. We are more reactive with fly chemicals if we need them. We wanted to treat the cause and not the symptoms. Flystruck sheep are also classed out.

"We wanted to focus on dag in the PDS as we felt we were not consistent enough with managing dag. It's a cost – sheep take longer to crutch, adds to flystrike pressure and loss of wool value. Even though we were a long way down path of NM and thought we were pretty good with WECs to keep on top of worms and drenches, we didn't know whether dag was due to worms, lack of fibre or plant morphology at the time of grazing. We focused on worm management to keep the demo simple." **Edward Blackwell, Dunkeld.**

The Ryans and Druces run a self-replacing fine (18 µm) Merino flock and a Coopworth flock turning off prime lambs. Currently, all Merino lambs are mulesed. Lambing is in August, shearing of adult sheep is in summer and weaners in April. They are working towards their plan to cease mulesing. More emphasis is being put on reducing breech wrinkle and dag to breed more breech flystrike resistant sheep. Maintaining fleece weight and fibre diameter are also priorities in the breeding objective. They are currently conducting a Merino sire evaluation demonstration to compare progeny from rams with lower EBWR ASBVs, and improved carcase traits, than their current ram source to evaluate the impact on wool traits.

"We wanted to focus on dag in the PDS as this is a big issue in our environment particularly in the weaner sheep. We need to get on top of dag before we can feel confident to cease mulesing. We do monitor WECs but wanted to rule out worms as a cause and see if feeding fibre in winter would reduce dag." Gerard Ryan, Baynton.

Demonstration sites – methodology

This demonstration is relevant for flocks that have ceased mulesing or those still mulesing who have a high incidence of dag during winter and spring, particularly in the weaner sheep.

The demonstration aimed to investigate factors that may be contributing to dag and the effectiveness of improved worm control, or feeding fibre, during winter and early spring on liveweight and dag score.

This demonstration made use of a long-acting drench to rule out worms as a contributing factor for dag. This left the feedbase and bacterial infections as possible causes of dag to investigate.

Image 2 Edward Blackwell, Dunkeld - PDS producer advocate and demo site host.

At Dunkeld, in June 2022, 630 ewe weaners (2021 drop) were randomly drafted into three treatment groups of 210 sheep and identified by their eID tag. Treatments compared were the normal farm practice short-acting drench (SA), a long-acting injection drench (LA) with an oral primer drench, and a short-acting drench with a mineral supplement injection (SA + Min). Sheep were run as one mob and rotationally grazed. Standard farm practice was to provide fibre (hay) in the paddock in winter, so the effect of fibre was not investigated.

At Baynton, in July 2022, 200 ewe weaners (2021 drop) were randomly drafted into four treatment groups of 50 sheep and identified by their eID tag. Treatments compared were the normal farm practice short-acting drench (SA) and a long-acting injection drench (LA) with an oral primer drench. Sheep were run together in one paddock. The drench treatments were repeated for sheep allocated to another similar paddock where they were fed fibre (good quality vetch hay) in a hay feeder. When sheep were weighed and WEC samples taken, the mobs and paddocks were swapped over and the hay feeder moved. This was done to ensure paddock variation in worm contamination didn't bias the results. (NB: sheep had adequate green pasture available during the trial).

On both properties weaners had been recently shorn so were dag-free. At the start of the trial, sheep were weighed and a worm egg count (WEC) determined. Drench treatments were then applied. Follow up WECs were taken from each treatment mob every 30 days and sheep were weighed (NB: at Dunkeld, a bulk WEC was taken from the three mobs in the paddock on 26/9/22 as it was too wet to yard the sheep). A second short-acting drench was administered to the SA mobs on both farms based on the follow up WECs. The LA mobs received an exit oral drench on completion of the trial. Visual dag scores were assessed at the end of the trial based on the AWI and MLA 'Visual Sheep Scores' booklet (2019).

Results

Dunkeld

- Sheep in the two short-acting treatment groups were drenched twice during the trial based on the Day 1 and Day 30 WEC results. The long-acting group did not require follow up drenching during the trial period (Figure 1).
- The WECs for the two SA mobs increased to 780–810 e.p.g by the end of the trial (Day 130). This indicated that these mobs may have required a third SA drench at Day 90 to prevent this escalation in WECs (individual mob WECs weren't available at Day 90).
- The LA mob had a higher daily weight gain over the trial period and a lower average dag score than the two SA mobs (Table 1).

Figure 1Worm Egg Counts (WEC) at Dunkeld.

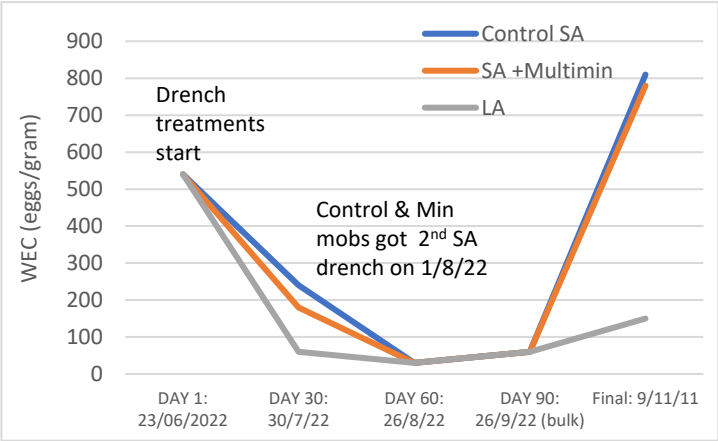


Table 2 Table 1 Weaner weight gains and dag scores at Dunkeld.

Treatment	Weight gain (kg) 23/6/22 to 9/11/22	Dag score 9/11/22
Control (short-acting Triple drench)	15.6	2.6
SA + Mineral injection (short-acting Triple drench + Min)	15.3	2.3
Long-Acting (LA moxidectin + Zolvix)	17.2	1.8

"The take away message for us was monitoring for WECS, which we thought we were good at, but we were a bit behind the 8-ball. A week in a weaner's life in the middle of August makes a difference as they can pick up worms very quickly and the dag starts to accumulate. We found that ruling out worms, with a long-acting drench, that not only were we getting a liveweight gain in the weaners but this reduced dag."

"We need to be more vigilant with worm egg counting. We don't want to blanket drench with long-acting drenches as this won't do drench resistance any good. We prefer to use short-acting drenches on weaners and hoggets as we can run them in to drench anytime. Need to do more WEC monitoring – rather than at 5–6 weeks need to come in at 4 weeks to prevent dag accumulating by springtime."

- ***Edward Blackwell, Dunkeld.***

Baynton

- Sheep in the two short-acting treatment groups were drenched twice during the trial based on the Day 1 and Day 30 WEC results. The long-acting group did not require follow up drenching during the trial period (Figure 2).
- Over the trial period, the two LA mobs had a higher weight gain of 1.6–2.0 kg than the SA mobs (Table 2).
- Within a drench treatment, adding fibre reduced weights gains by 2.2–2.6 kg. The reduced weight gain would be due to sheep substituting good quality pasture for the hay.
- The best weight gain was in the LA mob which was 4.2 kg heavier than the SA + fibre mob.
- There was no difference in dag score between treatments (Table 2). As the SA mobs were being monitored closely for WECs they were drenched a second time before WECs escalated and this possibly prevented an increase in dag.

- Feeding fibre had no effect on dag score.

Figure 2 Worm egg counts (WEC) at Baynton.

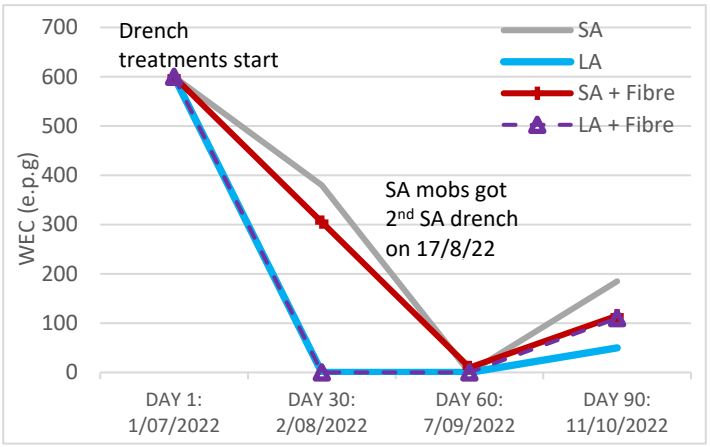


Table 3 Weaner weight gains and dig scores at Baynton.

Treatment	Weight gain (kg) 8/7/22 to 11/10/22	Dag score 11/10/22
Control/SA (short-acting Zolvix drench)	12.2	2.1
Long-Acting (LA moxidectin + Zolvix)	13.8	2.0
Control/SA + FIBRE (short-acting Zolvix drench)	9.6	2.1
Long-Acting + FIBRE (LA moxidectin + Zolvix)	11.6	1.9

"In the demo we found our weaners had much lower dag than what we would normally see in winter/early spring with our usual WEC monitoring and drench program. The majority of the dag issue (in 2022) was worm-related and not due to the pasture. Feeding fibre was of no benefit.

"We will do WECs on the weaners more frequently such as every 30 days or so, rather than the 6–8 weeks that we normally take them, to be able to pick up earlier if the WECs are increasing and keep on top of the worms and dag

- Gerard Ryan, Baynton.

"Now we have recorded dag scores on individual sheep, we will be able to see if the ewes with higher dag scores will be 'repeat offenders' and can class them out."

- Joe Druce, Baynton.

Image 3 Joe Druce and Belinda Ryan, Baynton – feeding fibre (vetch hay) to weaner sheep did not reduce dag but did reduce liveweight gains.

Conclusions

- The PDS methodology allowed the main cause of dag in the weaners to be diagnosed as being due to worms.

- Monitoring WECs every 30 days in winter/early spring allowed producers to keep on top of worms and prevent dag accumulating.
- Improved worm control increased liveweight gains by around 2kg during the trial period. This had a net benefit of $5.18/head per year.
- Feeding fibre did not reduce dag but did reduce weight gains in weaner sheep by 2.4kg on average. Feeding fibre, without improving worm control, had a net cost of $17/head.

7.5 Field day flyers

Examples of field day flyer used.

Transitioning to a Non-Mulesed Flock

Date: Wednesday 26 October 2022

Time: 9:00 am – 1:15 pm followed by lunch

Location: Sterling Place, 14 Sterling Street, Dunkeld, Vic

Register: https://www.trybooking.com/CCPZG by 19 October 2022

This is a free event but you must register for catering purposes.

Time	Topic	Presenter
9:00 am	Registration – tea and coffee on arrival	
9:20 am	**Welcome**	Lisa Warn, Project Manager "Towards NM Sheep"
9:30 am	**Market trends & Opportunities** • The market for NM wool/meat • What the Integrity schemes require (RWS, ZQ, Sustainawool, Authentico).	Robert Herrmann, General Manager Mercardo & Market Specialist Nutrien
10:00 am	**Producer experiences & challenges moving to NM**	Edward Blackwell, "Corea", Dunkeld
10:30 am	**Breeding for breech strike resistance & tools** • Indicator traits & Benchmarking where you are • How quickly can I progress? • Tools – RamSelect; DNA Flock Profile; ASBVs	Emma McCrabb, Senior development officer, Sheep Genetics, MLA.
11:00 am	Morning tea	
11:30 am	**Management & Decision Support Tools** • Timing of shearing/crutching; Chemicals • Dealing with Dag • Tools – FlyBoss, WormBoss, Ag360	Lisa Warn, Lisa Warn Ag Consulting
12:00 pm	**Pain relief options for lamb marking,** **Best practice tail length & docking method**	Dr Joan Lloyd, Joan Lloyd Consulting
12:30 pm	**MLA Producer Demonstration Sites - findings and experiences** • Tail docking methods • Dag management • Trialling a small mob of NM	Brendan Hinchliffe, Langi Logan Edward Blackwell, Dunkeld Hamish Robertson, Tarranlea
1.00 pm	**Wrap up - Where to from here?**	Lisa Warn
1:15 pm	Lunch	

For further information contact: Lisa Warn, M: 0418 748 607.

Producer Demonstration Site

mla MEAT & LIVESTOCK AUSTRALIA

Transitioning to Non-Mulesed Sheep

Producer Demonstration Site - Field Day

Wednesday 11 Oct 2023 | Time: **9:00 am – 12:30 pm**

'Delatite Station', 361 Delatite Lane, Mansfield, Vic (new shearing shed)

A practical workshop designed to provide you with the tips and tools to help move to and manage non-mulesed sheep.

Producer Demonstration Site (PDS)

The 'Transitioning to Non-Mulesed Sheep' PDS supports sheep producers in developing their own property specific plan to transition to a non-mulesed flock, using industry tools/ resources and peer to peer learning.

Topics to be discussed and demonstrated:

- Producer experiences with managing non-mulesed sheep
- Breeding flystrike resistant sheep
- Market opportunities for NM wool
- Managing worms and dag
- PDS result updates – incl. tail docking method
- Breech wrinkle scoring – practice session
- Inspection of new 8 stand shearing shed with latest AWI design features.

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Lisa Warn Ag Consulting Pty Ltd

SheepMetriX

This event is funded by Meat & Livestock Australia with the support of Lisa Warn Ag Consulting and SheepMetriX

For more information:

Lisa Warn – Lisa Warn Ag Consulting
0418 748 607
l.warn@iinet.net.au

This is a free event but your must register for catering purposes

To register go to: https://www.trybooking.com/CLTLB

RSVP by 6 October 2023

Field Day - Schedule

9:00 am	Arrive and Register (grab a coffee) *Delatite Station shearing shed*
9:30am	Welcome, Introductions and PDS overview *Lisa Warn (Lisa Warn Ag Consulting)*
9:45 am	Running a non-mulesed flock – breeding/selection and management, my experiences *Mark Ritchie (Delatite Station)*
10.15 am	The market for NM wool – trends and opportunities *Eamon Timms (Fox and Lillie)*
10:30 am	Managing worms and dag *John Webb Ware (Mackinnon group)*
11.00 am	Morning tea Inspection of new 8 stand shearing shed incorporating latest AWI design features
11:30 am	Transitioning to Non-Mulesed Sheep PDS Project – 'demo site results update: sire evaluations, managing dag, effect of different tail docking methods'. *Lisa Warn (Lisa Warn Ag Consulting)*
12.00 pm	Sheep yards - Breech wrinkle scoring
12:30pm	Finish

For more information:
Lisa Warn – Lisa Warn Ag Consulting
0418 748 607
l.warn@iinet.net.au

This is a free event but your must register for catering purposes
To register go to: https://www.trybooking.com/CLTLB

RSVP by 6 October 2023

Producer Demonstration Site

mla MEAT & LIVESTOCK AUSTRALIA

Transitioning to Non-Mulesed Sheep

Producer Demonstration Site - Field Day

Friday 6 Oct 2023 | Time: **9:00am – 12:30pm**

'Marenda Farm', 237 Scarsis Rd, Mt Dryden , Vic (shearing shed)

A practical workshop designed to provide you with the tips and tools to help move to and manage non-mulesed sheep.

Producer Demonstration Site (PDS)

The 'Transitioning to Non-Mulesed Sheep' PDS project supports sheep producers in developing their own property specific plan to transition to a non-mulesed flock, using industry tools/resources and peer to peer learning.

Topics to be discussed and demonstrated:

- Producer experiences with managing non-mulesed sheep
- Breeding flystrike resistant sheep
- Managing worms and dag
- PDS result updates
- Inspection of sheep - 3 different tail docking methods compared
- Breech wrinkle scoring – practice session.

Lisa Warn Ag Consulting Pty Ltd

SheepMetriX

This event is funded by Meat & Livestock Australia with the support of Lisa Warn Ag Consulting and SheepMetriX

For more information:

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0418 748 607
l.warn@iinet.net.au

This is a free event but your must register for catering purposes

To register go to: https://www.trybooking.com/CLVIJ

RSVP by 2 October 2023

Field Day - Schedule

9:00 am	Arrive and Register (grab a coffee) *Marenda Farm shearing shed*
9:30am	Welcome, Introductions and PDS overview *Lisa Warn (Lisa Warn Ag Consulting)*
9:45 am	Planning the transition to a non-mulesed flock – breeding/selection, management and PDS trials - my experiences *Wayne Burton (Marenda Farm)*
10.15 am	ASBVs – what they are and how to use them to achieve your breeding objective *Chloe Bunter (MERINOSELECT Development Officer, Meat & Livestock Australia)*
10:45 am	Morning tea
11.15 am	Managing worms and dag *Lisa Warn (Lisa Warn Ag Consulting)*
	Transitioning to Non Mulesed Sheep PDS Project – 'demo sites results update: sire evaluations, managing dag, effect of different tail docking methods'. *Lisa Warn (Lisa Warn Ag Consulting)*
11.45 am	Sheep yards DEMO 1: Inspection of PDS trial sheep and effects of different tail docking methods (3 hot knives evaluated – straight knife, Tepari rolling anvil and Steinfort knife) DEMO 2: Breech wrinkle scoring
12:30pm	Finish

For more information:

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0418 748 607
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To register go to: https://www.trybooking.com/CLVIJ

RSVP by 2 October 2023

Transitioning to Non-Mulesed Sheep

Production Demonstration Site - Field Day 2023

16th June 2023 | Time: **8:30am – 12:30pm**

'Summerhill', 4020 Murringo Road, Young, NSW, 2594

Producer Demonstration Site (PDS)

MLA's PDS program supports producers to adapt, validate and demonstrate the business value of integrating new management practices and skills into their local farming systems.

'Transitioning to Non-Mulesed Sheep' PDS is designed to support sheep producers with the transition to non-mulesing by developing a 5-year transition strategy, using tools and resources available and peer to peer learning.

Topics to be discusses and demonstrated

- Project Information & PDS result updates
- Use of Electronic Identification and data capture
- Demonstration #1 – Dag & Urine Scoring
- Demonstration #2 – Breech & Body Wrinkle Scoring

Producers will be provided with the opportunity to discuss and learn how to perform the techniques of dag scoring and urine scoring as well as off shears body, neck and breech wrinkle scoring. These are techniques which can allow for benchmarking tracking the flocks progression during the transition towards non-mulesed.

Lisa Warn Ag Consulting Pty Ltd

SheepMetriX

For more information:

Sally Martin - SheepMetriX
0400 782 477
hello@sheepmetrix.com.au

Lisa Warn – Lisa Warn Ag Consulting
0418 748 607
l.warn@iinet.net.au

Register here

RSVP by 9th June 2023

Field Day - Schedule

8:30am	Arrive and Registration *Summerhill Pastoral*
9:00am	Host welcome, introductions and PDS overview *Mark Tiedemann (Summerhill Pastoral) & Sally Martin (SheepMetriX)*
9:15am	Transitioning to Non Mules Project and Demonstration Outcome Update *Lucinda Eddy – SheepMetriX*
10:00am	Use of electronic identification (eID) and data capture *Sally Martin – SheepMetriX*
10:30am	Demonstration #1 – Dag & Urine Scoring *SheepMetriX Team (audience participation)*
11:30am	Demonstration # 2 – Body, Breech & Neck Wrinkle Scoring *SheepMetriX Team (audience participation)*
12:30am	*Meeting close/depart home*

For more information:

Sally Martin - SheepMetriX
0400 782 477
hello@sheepmetrix.com.au

Lisa Warn – Lisa Warn Ag Consulting
0418 748 607
l.warn@iinet.net.au

Register here

RSVP by 9th June 2023

7.6 Media articles

Copy of articles published in “The Land” newspaper 7 July, 2022.

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Breeding for non-mulesing

Deliberate selection for plain body rams

Bare breeches is the aim for second-generation Merino breeder Mark Tiedemann at Young.

BY STEPHEN BURNS

IT IS early days for Mark Tiedemann going non-mulesed, his quest to breed Merino sheep with bare enough breeches started a number of years ago, but the early indications having ceased mulesing last year is that it can be done with the right selection of rams and that is encouragement enough for him to continue.

The second generation Merino breeder manages a self-replacing flock on the 1300 hectare aggregation based at Summerhill, Young, in partnership with his wife Nicole and son Kye.

Rams are sourced from Centre Plus and Kambah Poll, and Mr Tiedemann classes his flock in consultation with Sally Martin, SheepMetriX, Young, with the classed-out ewes joined to Poll Dorset rams.

The grown sheep on Summerhill are shorn twice a year and average 6.5 kilograms of fleece measured at 17.5 micron.

Mr Tiedemann said his weaning percentage of 120pc plus is a consequence of the deliberate selection of plainer bodied rams with a balance of fat, wool cut, crimp and style.

So when he decided to stop mulesing, his basic criteria during ram selection had already moved his flock in that direction.

"I had been shearing for 28 years and had ideas about what I should be looking for," Mr Tiedemann said.

"Our rams were already a lot plainer because we were concentrating on our lambing percentage which is very important for us.

"We don't like mulesing, but flystrike is more cruel, and when we made the decision to stop mulesing, our sheep were already plain enough to manage without it."

With his balanced approach to breeding Merino sheep, Mr Tiedemann said he was still focusing on profit drivers like extra lambs weaned and wool while taking into account the various traits associated with reducing breech flystrike.

Traits like wrinkle score and breech cover, the amount of dag and urine stain, are good indicators to focus on to reduce the need to mules.

Mr Tiedemann is also recording the breech wrinkle score at lamb marking to see if there is any correlation with wrinkle score as the sheep grow.

After trialling a mob of wethers to see if he was on track to non-mulesing, Mr Tiedemann said last year's drop were the first complete drop on Summerhill which have not been mulesed.

"For some time, we thought non-mulesing was the best way for us to go, it is going to happen," he said.

"There has been a lot of talk about it, but we were encouraged by Sally Martin at SheepMetriX in Young to start with a small mob.

"If you are uncertain, that is the best way to go. And with our complete drop now non-mulesed, we haven't had any trouble with our weaners even through this wet season."

Besides trialling a mob of wethers before going wholesale on non-mulesing, Mr Tiedemann discussed his options with other breeders as well as his shearing team.

"It is very important to listen to their feedback and they have been helping us fine-tune our options," he said.

"Because we shear twice a year, we also thought non-mulesing is a better way to do things with our sheep.

"I have also been supported and encouraged by other people who have gone down this path, and with Sally leading a local demonstration group which involves leading breeders, I have the confidence I'm on the right track.

"The demonstration group is full of good information and the other breeders are very generous with their time and ideas."

More non-mulesing p69.

Mark Tiedemann is very happy with his non-mulesed maiden Merino ewes scanned for singles and November shorn.

A non-mulesed June-drop Merino showing bare breech.

Non-mulesed maiden Merino ewes, November-shorn.

> I have been shearing for 28 years and had ideas about what I should be looking for.
>
> **Mark Tiedemann, Summerhill, Young**

dramatically changed how interest," Dr Manning said. distances." mulesed wool in the market-

Transitioning an approach to non-mulesing

"IT'S something I've been thinking about for a while," Sally Martin said, when explaining her position with the MLA Producer Demonstration Project - the South West Slopes group demonstration sites, where sire evaluation (Low and High Breech Wrinkle sire groups), tail docking methods and Breech Wrinkle Scoring methods, are being trialled and demonstrated in the paddock.

Mrs Martin from SheepMetrix, Young, has paired with Lisa Warn, who together are coordinating four producer groups in Victoria and NSW, and she recently hosted a seminar in Young.

"The one thing I saw was that everyone who attended was positive about learning as much as they can to go down this path, the challenge is, we are not all starting at the same place and will need to take slightly different directions," she said.

Mrs Martin said the feeling during the seminar "was not a matter of if, but when", and sheep breeders are being responsive to the market and social signals.

"While some people will give up some fleece weight, most probably they will gain by producing more lambs," she said.

Sally Martin, SheepMetrix, Young, says moving to non-mulesing is a staged approach; some are in a position to stop, while others will take some time as it is not one size to fit all.

The balance comes from partitioning the energy across key profit driving traits, if a sheep is putting it into one area eg wool growth the other areas can miss out, it is all about balancing the energy ratio. .

Mrs Martin further noted it was important for Merino breeders to have a clear breeding objective, and work closely with your ram supplier, shearers, classer, stock agents and veterinarians in transitioning to non-mulesing - it is a team approach.

"Moving to non-mulesing is a staged approach, some are in a position to stop, while others will take some time as it is not one size to fit all," she said.

"It is often best to start with a trial of a small mob - even score your lambs and see the distribution of breeches scores within your flock."

But most importantly according to Mrs Martin is to use the pain relief products available for all operations associated with lamb marking.

"We should be using a combination of short acting and long acting," she said. "They are affordable and there should be no excuse for not using them."

– STEPHEN BURNS

7.7 Recorded Presentations

Reducing dags – fibre, worms and tail docking - presentation by Lisa Warn, Edward Blackwell & Brendan Hinchliffe at Victorian Bestwool/Bestlamb conference Bendigo 2023

7.8 Twitter engagement stats

Date	Topic	Impressions (times seen on twitter)	Engagements
07/07/2022	Project info with a pdf file attached	1,592	71
07/07/2022	NE Vic Group meeting photos & MLA guest speaker	562	43
24/07/2022	S. Martin Mercado podcast	754	26
29/09/2202	Dunkeld workshop promo	135	12
07/10/2022	Dunkeld workshop promo	930	60
10/10/2022	Dunkeld workshop promo	411	26
21/10/2022	Dunkeld workshop promo	1,137	32
30/01/2023	Sheep Central Article (via Sally Martin, SheepMetriX)	1,189	82
13/06/2023	SW Slopes field day promotion	1,108	53
27/09/2023	NW Vic field day promo	201	8
27/09/2023	NE Vic field day promo	212	12