Final report

EPDS- Increasing Lamb Survival

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Abstract

Increasing lamb survival rates is a high priority for the sheep industry providing both economic and welfare benefits. The Western Plains BestWool/BestLamb (BWBL) group identified lamb survival as a high priority and were keen to implement the outcomes of recent research findings and measure the impact on twin lamb survival in their environment. The group of sheep producers identified three key strategies that they wanted to put to the test, mob size, shelter and ewe condition.

Mob-size trials conducted over three years demonstrated that smaller mobs, averaging 45 ewes had greater lamb survival (86 -90 %) than larger mobs averaging 113 (82- 83 %). In the final year of the project, a second property measured a 7 % higher lamb survival in the smaller mob of 64 ewes (77 % lamb survival) compared to the larger mob of 100 ewes (70 % survival).

A shelter trial conducted in 2021 achieved a 10 % higher lamb survival in a more sheltered paddock, with rushes and additional shelterbelts than the less sheltered paddock (82% compared to 70%).

Ewe condition trials demonstrated that ewes in higher condition score (3.5) prior to lambing produced more lambs than ewes in lower condition (2.8). Increases in lamb survival ranged from 6% to 29% for the higher condition score mobs.

Group members gained skills and experience through group condition scoring activities, paddock walks assessing feed on offer, a temporary electric fencing demonstration to divide up paddocks for smaller lambing mobs and a lamb autopsy workshop.

An evaluation with group members showed improvements in knowledge, attitude and skills of all parameters measured. The Western Plains BWBL group members are now implementing changes around ewe mob size, managing ewe condition and better use of shelter for twin-bearing ewes.

Executive summary

Background

Twin lamb survival continues to be a major challenge for the Australian sheep industry. In 2016 the Western Plains Best Wool/Best Lamb (BWBL) group experienced a challenging lambing year mainly due to weather resulting in significant lamb losses across ten farms. The group identified several management strategies to investigate with the aim of improving lamb survival in twin bearing ewes.

Objectives

The aim of the project was to demonstrate and measure increased lamb survival with the Western Plains BWBL group members by 5%-7% through improved management of mob size, ewe condition, Feed On Offer, shelter and disturbance at lambing.

The objectives were to:

1. To demonstrate the impact on lamb survival by applying best practice (Lifting Lamb Survival Paddock Planning and National Lambing Density Protocols) i.e. optimal stocking rate, mob size, ewe condition, feed on offer, shelter and paddock size.
2. To increase the knowledge and skills of producers to fine tune their lamb production systems and further lift their lamb survival.
3. To achieve attitude and behavioral change among non-adopting producers through extension of project outcomes.

The objectives for mob size, ewe condition and shelter were met. The objectives relating to the impact of FOO and disturbance were not demonstrated as the group were unable to provide a host producer for these trials.

Methodology

Demonstration sites were conducted on four properties with twin-bearing ewes:

Demonstration 1: The impact of ewe condition on lamb survival: ewes were drafted into two mobs comparing lamb survival from ewes in high condition and lower condition.

Demonstration 2: The impact of mob size on lamb survival: temporary electric fencing was used to subdivide paddocks to allow for more lambing mobs. Mob sizes averaging 45 were compared to mobs averaging 113 twin bearing ewes.

Demonstration 3: The impact of paddock shelter on lamb survival: achieved through comparisons of lambing results in a more sheltered and less sheltered paddock with similar mob size and feed on offer.

Activities were held each year to increase skills and adoption including Feed On Offer (FOO) measurements, temporary electric fencing demonstrations, a lamb autopsy workshop and annual results presentations.

Results/key findings

Results from the demonstration align with lamb survival research and show ewes lambing in smaller mobs have higher survival rates compared with ewes lambing in larger mobs. Shelter also had an influence and ewes lambing in more sheltered paddocks had higher lamb survival rates compared to those with less shelter. The ewe condition trial conducted in the first two years found that condition had an impact on lamb survival in twin bearing ewes. The demonstration has shown there are welfare and economic gains to be made by influencing shelter, mob size and condition score of twin–bearing ewes.

Over the course of the demonstration, three training sessions were held including a lamb autopsy workshop, fencing subdivision session and a FOO and ewe condition scoring session. An annual results presentation/ discussion was conducted with the group and an annual Newsflash article shared through the BWBL and SALRC networks. The demonstration results were also shared on Agriculture Victoria social media and webpage. The three years of the demonstration included two years of significant limitations to group meetings due to COVID-19 restrictions. Data collection was undertaken by producers with reduced assistance from the project coordinators and meetings were held opportunistically when restrictions eased.

All producers involved in the demonstration indicated they would or had already adopted demonstrated practices, particularly smaller mob sizes and managing FOO to maximise lamb survival. Increases in producer knowledge and skills were also measured.

Benefits to industry

Producers supported through the demonstration of management practices proven to increase on farm productivity are much more likely to adopt the research outcomes and implement on farm change.

The key benefit to industry is the increased adoption of practices proven to increase productivity and profitability. All producers engaged in the project indicated they have or intend to adopt management practices demonstrated, which will lead to increased twin lamb survival. Results of the project were disseminated to the wider industry increasing knowledge and awareness, with limited ability to measure the broader impact.

PDS key data summary table

*Complete all sections of the key data summary table **applicable** to your project. Refer to the 'Engagement and Adoption Performance Metrics' section of your Agreement for key metrics that are nominated for your project.*

Project Aim:
The aim of the project is to lift lamb survival by 5% to 7% through the combination of paddock size, mob size, stocking rate, ewe condition score and improved shelter.

	Comments	Increased survival	Unit
Production efficiency benefit (impact) Reproductive efficiency – lamb survival of twin bearing ewes %	*Mob size* *Ewe condition* *Shelter*	3-7% 6-29% 12%	Lamb survival in twin-bearing ewes
Increase in income **Mob size** **Ewe condition** **Shelter**		 $876-$2,044 $1,752-$8,486 $2,760	 Extra lambs per 100 ewes
Additional costs (to achieve benefits) **mob size**	materials and labour- temporary fencing	Yr 1 $3,202 Yr 2- 10 $1,760	
Net present value 5% **mob size**		**$8,965**	
Number of core participants engaged in project		5	
Number of observer participants engaged in project		8	
Core group no. ha		4,000	
Observer group no. ha		14,700	
Core group no. sheep		10,533	hd sheep
Observer group no. sheep		72,000	hd sheep
Core group no. cattle		2,053	hd cattle
Observer group no. cattle		1,768	hd cattle
% change in knowledge, attitude skill & motivation – core & observer	*Management of mob size, ewe condition, shelter*	35% 25% 31% 25%	K 6.3-8.5 A 6.7-8.4 S 6.4-8.4 M 7.1-8.8
% practice change adoption – core & observer	*% adopting at least 1 practice* *Mob size* *Ewe condition* FOO Shelter Disturbance	100% 75% 24% 50% 50% 37%	 25%-100% 38%-62% 50%-100% 25%-75% 25%-62%

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1. Background

The Western Plains BWBL group is a farmer discussion group located in south-west Victoria. The group has been operating for 27 years with the aim of increasing sheep productivity and improving livestock production systems through evidence-based science and research. The group's principal focus is on prime lamb production.

Most of the group run self-replacing composite ewes for prime lamb production. Most members had pregnancy scanning rates of between 155% to 175% indicating a high proportion of twins. The survival rate of these lambs was between 70% and 82%. In 2016 the group participated in a Lifting Lamb Survival (formerly Lambs Alive) program. Analysis of lambing data collected (Table 1) estimated potential gains in lamb survival for the group would be in the order of 3% to 5% with changes to key management practices.

Table 1: Western Plains lamb survival rates compared to other producer groups in Victoria

Lambs Alive Group Reproductive Performance 2016					
Group	**Total Ewes**	**Total Foetuses**	**Lambs Marked**	**Foetus/Lms Lost**	**Survival %**
Pigeon Ponds	35336	51804	42653	9151	82.3%
Western Plains	34651	51128	40085	11043	78.4%
Barwon	33986	47349	37421	9928	79%
Greta	22170	33010	25352	7658	77%
Total	**126,143**	**183,291**	**145,511**	**37,780**	**79.4%**
Percentages		**145.3%**	**115.4%**	**20.6%**	**79.4%**

The natural environment of the Western Plains group is open wind-swept plains country and with lambing taking place in July and August, this presents members with some challenges in keeping newborn lambs alive. The aim of this project was to investigate management strategies that could lead to improved lamb survival and marking rates.

Lamb mortalities represent a major loss of production and are estimated to cost the Australian sheep industry more than $1 billion each year. On average, 20% of lambs born will die prior to marking, and about 80% of these deaths occur in the first three days of life (Hancock et al. 2019).

The Western Plains group was highly dissatisfied with the loss of 20% to 25% foetuses and as a result were interested to do their own on farm research into lamb survival. The group believed that 800 lambs saved per year (across 12 farms) would result in an $80,000 ($100 per lamb) increase in income across the group in the first year, with anticipated improvements in subsequent years. The demonstration considered achievable and acceptable practices that could be directly applied by group members with minimal expense and input.

2. Objectives

The objective was to provide Western Plains group members with a greater understanding of factors that impact the survival of lambs during gestation, birth, and post-birth. The aim was to demonstrate increased lamb survival of 5 -7%.

<u>The specific objectives were:</u>

To demonstrate across four trial sites the impact on lamb survival of each of the following factors; mob size, ewe condition, feed on offer (FOO), shelter and disturbance at lambing time.

1. To demonstrate the impact on lamb survival of applying best practice management (Lifting Lamb Survival Paddock Planning and National Lambing Density Protocols) ie: optimal mob size, ewe condition, feed on offer, shelter and minimal disturbance.
2. To increase the knowledge and skills of all producers to fine tune their lamb production systems including ewe reproduction management and optimal lamb survival strategies to increase lamb survival rates.
3. To achieve practice change for 70% of group members through extension of the project outcomes.

Objective 1 was achieved by demonstrating the impact of mob size, ewe condition , and shelter on lamb survival. Nine trials were conducted across five host producer farms. The target was to lift lamb survival rates by 5-7% across the group. Lamb survival was 3-8% higher in the smaller mobs, 6-29% higher in the ewes averaging 3.5 CS than those averaging 2.8CS and 12% higher in ewes with more shelter in 2021.

Feed on offer (FOO) and impact of disturbance were not trialled as initially planned due to a shortage of trial hosts and difficulty designing a demonstration that didn't impact ewe welfare.

Objective 2 was achieved through group and one-on-one extension and skill development sessions. Survey results demonstrated that knowledge had increased on average from 6.3/10 to 8.5/10 and skills from 6.6/10 to 8.4/10 across the areas of ewe reproductive performance and lamb survival strategies. These results were impacted by COVID-19 restrictions which occurred through trial years 2 and 3, causing a number of extension activities to be cancelled.

Objective 3. There was a drop in member attendance in years two and three (to around eight attendees) due to COVID-19. All producers attending the final workshop had adopted or intended to adopt new practices. The impact of mob size was especially evident in the results and led to 100% adoption of this practice. In final group discussion, members highlighted mob size as the most significant and easiest practice to implement.

3. Methodology

The project was conducted over three lambing seasons from 2019 - 2021 (Table 2) across five sites in Western Victoria. All host producers commenced lambing in July, lambs were marked in September and mobs were inspected daily with data collected.

Table 2: Trials undertaken across the three years

Trial	Yr 1 2019	Yr 2 2020	Yr 3 2021
Mob size	x	x	x
Ewe Condition	x	x	
Shelter			x

Protocols were developed for each host site clearly outlining the host activities, tasks and responsibilities. A calendar of events with timelines for site hosts and group members was also developed and an Excel spread sheet was designed for trial hosts and members to collect data.

Host producers provided the paddocks, ewe mobs scanned in-lamb with twins, collected lambing and production data, labour to set up and monitor the sites, and materials and equipment for fencing and site establishment. Agriculture Victoria and the Group Coordinator also provided labour and input throughout the trial period.

The project was designed for group members to inspect the trial sites each year and potentially assist with subdivision of paddocks to understand the process. FOO assessments were also planned. These activities took place in 2019, the first year of the trial, but the following years were impacted by COVID-19 restrictions and the group was not able to meet to undertake this work.

3.1 Demonstration set up

3.1.1 Mob size (Site 1- Years 1,2 & 3)

Site 1, located at Bookaar, Victoria conducted the mob size trial for the three years (Table 3). Temporary electric fencing was used to split mobs into smaller groups for lambing.

(Site 2 -Year 3)
Site 2 commenced in Year 3 (Table 3) so data from this trial was only collected for the final year of the project. This host was interested in the effect of mob size as well as the impact of feed on offer (FOO) on lamb survival. The trial site was located near Camperdown in southwest Victoria.

Figure 1. Temporary electric fencing used to subdivide paddocks for the mob size trials

Table 3: Site set up for the mob size demonstrations, 2019, 2020, 2021

Year	Site	Breed	Treatment	# mobs	Ave. pdk size Ha	No. ewes (Av)	Ave. stocking rate/ ha (dse/ha)	CS	FOO at lambing Kg DM/Ha
2019	1	Composite	Smaller mobs	6	4.5	36	20	2.5-3	N/A
			Larger mobs	3	12.5	90	18	2.5-3	N/A
2020	1	Composite	Smaller mobs	14	5.9	43	18	3.5 - 4.0	2000 - 2500
2021	1	Composite	Smaller mobs	8	5.6	45	20	4.0	2100
			Larger mobs	5	12.8	113	22	4.0	2100
2021	2	White Suffolk	Smaller mob	1	14	64	11.5	2.8 - 3.1	1200
			Larger mob	1	20	100	12.5	2.8 - 3.1	1600

3.1.2 Ewe Condition (Site 3 Years 1 & 2)

The condition score (CS) trial was established in 2019 and 2020 at Site 3, near Camperdown in Western Victoria (Table 4). Twin-bearing ewes from one mob were drafted into a high condition (3.5 CS) and low condition (approximately 2.8 CS) mob prior to lambing. Lambing data was collected at marking. Ewes were again condition scored at marking. FOO was similar in both treatment paddocks prior to lambing and at marking.

Table 4: Trial information for the ewe condition demonstrations in 2019 and 2020

Year	Site	Stock class	Breed	Group	Pdk size Ha	No. ewes	Stocking rate dse/ ha	CS
2019	3	Twin bearing ewes	First Cross	Treatment 1	15	85	16	3.5
				Treatment 2	15	80	16	2.75
2020	3	Twin bearing ewes	First Cross	Treatment 1	15	80	16	3.5
				Treatment 2	15	80	16	2.8

3.1.3 Shelter (Site 4 Year 3)

The original plan for the shelter trial was to set up lambing paddocks with duplicate mobs using both straw/hay bale shelter and grass row shelters during lambing to measure the impact on lamb survival (Table 5). Although group members were interested in trialing shelter, they failed to provide a demonstration site. As a result, the shelter trial was later redesigned using a property in southwest Victoria located at Drysdale near Geelong. Paddocks with existing tree plantations and a native rush (*Juncus subsecundus*) growing throughout were used, as well as strategically placed artificial shelter in the form of large hay bales.

One paddock (Mob 1) was assessed as having more shelter than the other as it had more trees and rushes as well as the protection of shedding which served to buffer the prevailing south-westerly winds. Additionally, six large round hay bales were placed in an area observed to be a preferred sheep camp.

A second shelter demonstration was established in 2021 using in-paddock phalaris hedgerows. However, the ewes encountered suspected grass tetany prior to lambing and the trial was abandoned.

Table 5: Trial information for the shelter demonstrations in 2021

Year	Site	Stock class	Breed	Group	Pdk size Ha	No. ewes	Stocking rate/ ha	CS	FOO at lambing Kg DM/Ha
2021	4	Twin bearing ewes	Composite	Treatment	20	63	7	3.5	1800
				Control	20	64	7	3.5	1800

3.2 Measurements and timing

Measurement for each site included:

- Ewe numbers in each trial – start and finish of lambing
- Feed on offer (FOO) – prior to, start and finish lambing

- Condition scores - start and finish of lambing
- Paddock areas and stocking rates - start of lambing
- Scanning and lambing numbers and percentages
- Dead lambs collected daily and cause of death recorded

3.3 Economic analysis

Economic analysis was undertaken for each demonstration through a comparison of the number of lambs produced in the treatment mobs (i.e. smaller mob size, higher condition score, increased shelter) with the status quo 'control' mob. The additional lambs were valued at $146, estimated using the net value of an extra lamb calculated by Young et al. (2014) with a corresponding lamb price (from a twin bearing, maternal) of $9 /kg/HSCW.
The mob size demonstration had additional analysis through partial discounted cash flow budgets over ten-years to identify the costs and benefits of erecting temporary fences to increase lamb survival, a method described in Malcolm et al. (2005).
Although the producer observed that lambs were also heavier in the higher condition mob, lambs were not weighed, so the benefit of larger lambs could not be included.
The cost of establishing shelter was not included in the shelter demonstration. Shelter was provided by tussocks and existing shelterbelts and shedding.

3.4 Extension and communication

Planned communication and extension activities included the following:

- 2 social media posts/ year (on AgVic Facebook and/or Twitter)
- 1 media article based on annual outcomes / year
- 1 group field day or major engagement event including skill development sessions (FOO and/or CS assessment or lamb autopsy workshop)/ year
- Meeting to review the demonstration and discuss how the project is performing and any modifications for next year's methodology/ year
- 1 fact sheet

3.5 Monitoring and evaluation

Monitoring and evaluation included:

- Surveys to benchmark KASA (knowledge, attitude, skills and aspirations) undertaken by the group prior to commencing the demonstration and at its completion.
- Evaluation of group activities using a typical feedback form.
- Annual group review of the demonstration to discuss how the project is performing, results and levels of adoption by the group and required changes to implement improved lamb survival rates.
- Estimates of costs and benefits of the practice demonstrated.

4 Results

Table 6 summarises the results across the three years of the demonstration. Smaller mob sizes had 3-7 percent higher lamb survival than larger mobs. Higher condition score mobs at lambing had greater lamb survival than mobs in lower condition (6% in 2019 and 29% in 2020). In 2021 the high shelter paddock had a 12% higher lamb survival.

Table 6: Summary of lamb survival rates for all trials

	Lamb survival - all trials		
Trial and treatment	**2019**	**2020**	**2021**
Mob size (Site 1) smaller	87%	90%	86%
Mob size (Site 1) larger	82%	-	83%
Difference	*5%*		*3%*
Mob size (Site 2) smaller	-	-	77%
Mob size (Site 2) larger	-	-	70%
Difference			*7%*
Condition Score high	82%	92%	-
Condition Score low	76%	63%	-
Difference	6%	*29%*	
Shelter low	-		70%
Shelter high	-		82%
Difference			*12%*

4.1 Mob Size

The three years of mob size trial data is summarised in Table 7. Each trial achieved greater lamb survival in smaller mobs than larger mobs, aligning with expectations.

Table 7: Summary of mob size data across sites and years

Site	Treatment	No Mobs	Av. Mob size	Av. Marking	Av. Lamb Survival	Av. Ewe Deaths	Av. Dries
				Year 2019			
1	Smaller mobs	6	36	174%	87%	1.5	1.3
	Larger mobs	3	90	164%	82%	2	6.7
	Difference		*54*	*10%*	*5%*	*0.5*	*5.4*
				Year 2020			
1	Smaller mobs	14	42	180%	90%	0.9	-
				Year 2021			
1	Smaller mobs	8	45	173%	86%	1	-
	Larger mobs	5	113	165%	83%	1	-
	Difference			*8%*	*3%*	*0*	
2	Smaller mobs	1	64	155%	78%	-	-
	Larger mobs	1	100	140%	70%	-	-
	Difference			*15%*	*8%*		

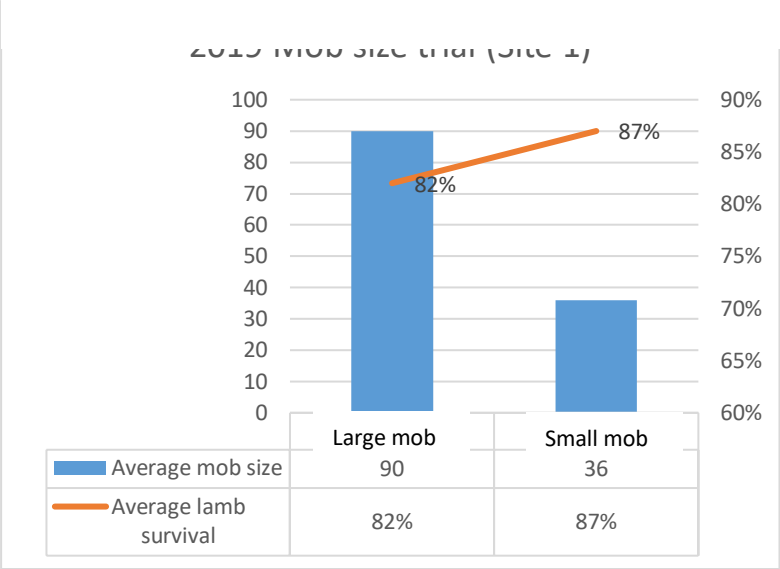
Year 1 (2019)

In Year 1, the smaller treatment mobs averaged 10% higher marking percentage than the control mobs and 5% higher lamb survival (Fig 2). There were six smaller mobs averaging 36 ewes and the three control mobs averaged 90 ewes. The marking percentage was 174% across the six smaller

mobs and 164% across the larger mobs. Lamb survival rates averaged 87% for smaller mobs and 82% for larger mobs.

Lamb deaths in both groups were largely attributed to dystocia or mismothering, with a small percentage of deaths attributed to poor weather (exposure). Ewe deaths were also recorded on some properties and interestingly the smaller mob size averaged slightly lower ewe deaths rates (1.5 compared to 2). There were also fewer dry ewes at marking averaging 1.3 (smaller mobs) compared to 6.7 (lager mobs).

Figure 2. Lamb survival results - mob size Year 1 (2019)



Year 2 (2020)

In Year 2, the Mob Size trial again demonstrated that smaller lambing mobs support very high lamb survival, however there were no large mobs for comparison as the producer saw the benefits in year 1 and subdivided all lambing paddocks. Fourteen mobs of twin bearing ewes lambed in small groups ranging from 36 to 65 ewes. The consistently high lamb survival rates reinforced the benefits of smaller mobs for twin lamb survival, averaging a marking rate of 180% and 90% lamb survival. Table 8 shows both 2019 and 2020 lambing results, which allows a comparison to the 2019 control group. Smaller mob sizes in both years had higher lamb survival.

Table 8: Site 1 Mob size results for 2019 and 2020

	2019	**2019**	**2020 (all small mobs)**
	Small Mobs	**Larger Mobs**	**Small Mobs**
Av. Mob size	35.8	90	42.7
Av. Marking %	174%	164%	180%
Av. Lamb survival	87%	82%	90%
Av. Ewe deaths	1.5	2	0.9
Av. Dry ewes	1.3	6.7	-

Year 3 (2021)

In year three, results from the mob size trial at site 1 again indicated that smaller mob sizes have higher lamb survival. Lamb survival averaged 86% in the smaller mobs of twin bearing ewes compared to 83% in the bigger mobs (Fig. 3).

A second host property joined the trial in Year 3 (Site 2) also found higher lamb survival rates in the smaller mob (78%) compared to the larger mob (70%). The control contained 100 twin bearing ewes and the treatment mob contained 64 twin bearing ewes.

Figure 3. 2021 Site 1 lamb survival

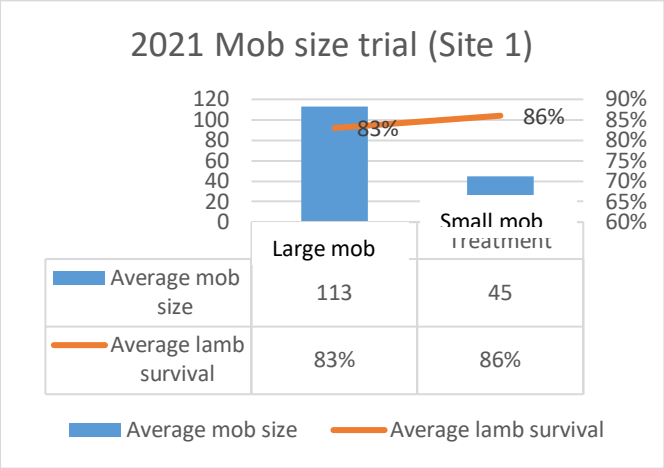
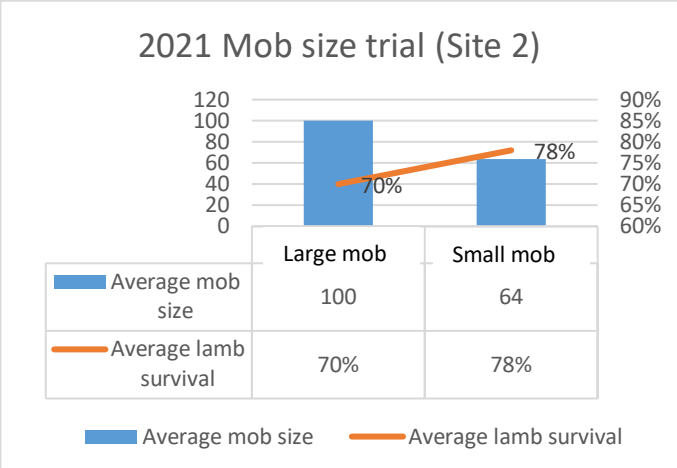


Figure 4. 2021 Site 2 lamb survival



4.2 Ewe Condition

Year 1 (2019)

In Year 1, twin-bearing ewes in higher condition going into lambing (CS 3.5) produced 12% more lambs at marking and 6% higher lamb survival than ewes in lower condition (CS 2.75) (Table 9).

Table 9: Ewe condition trial results 2019

2019	Treatment 1: Higher CS	Treatment 2: Lower CS	Difference
No ewes	85	80	5
Stocking rate Ewes/ha (15ha)	15.3	14.4	0.9
Condition score in	3.5	2.75	0.75 CS
Condition score out	3.15	2.82	0.33 CS
Marking %	**165%**	**153%**	**12%**
Lamb survival	**82%**	**76%**	**6%**
Ewe deaths	4	5	1
FOO going in (kgDM/ha)	1,850	1,850	Nil
FOO going out (kgDM/ha)	1,6 00	1,600	Nil

The higher condition treatment marked 165%, compared to 153% for the lower condition mob. This equated to 82% lamb survival for ewes in better condition compared to 76% for ewes in lower condition.

Between lambing and marking, there was a slight gain in condition amongst the lower condition score mob to average 2.8 CS, whilst the higher condition mob lost condition to average 3.15 CS.

The producer also observed that the ewes in higher condition mob produced noticeably larger lambs. However unfortunately the lambs were not weighed to verify the difference.

Ewe deaths were more than anticipated in the higher condition ewes, which was likely to have been caused by calcium deficiency.

Year 2 (2020)

Higher condition score ewes going into lambing had a 29% higher lamb survival and produced 58% more lambs at marking in Year 2 (Table 10). The higher condition ewes had 92% lamb survival compared to 63% in the lower condition mob. Ewes with less condition also had twice the number of dry ewes (10).

Table 10: Lambing results for condition score Year 2

2020	Treatment 1: Higher CS	Treatment 2: Lower CS	Difference
No ewes	80	80	5
Av. condition score in	3.5	2.8	0.7
Condition score out	3.1	2.8	0.3
Marking %	**184%**	**126%**	**58%**
Lamb survival	**92%**	**63%**	**29%**
Ewe deaths	2	2	0
Dry Ewes	5	10	5

At lamb marking, the lower CS ewes, had maintained an average 2.8 CS (Fig. 5), however the higher CS ewes had lost condition by an average of 0. 4 CS (Fig. 6). It is likely that this loss was due to ewe lactation leading to increased lamb weights in the higher CS mob. Unfortunately, lambs were not weighed to verify this.

Figure 6. Low CS ewes pre-lambing and at marking

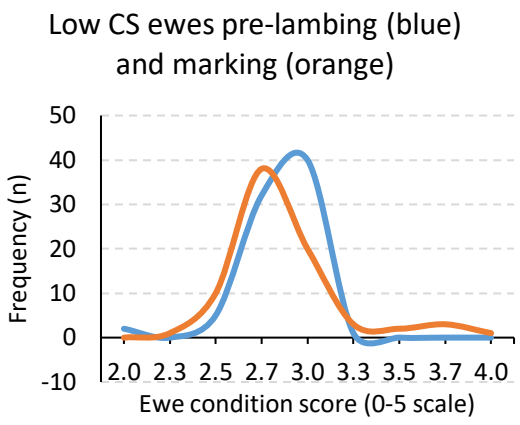


Figure 5. High CS ewes pre-lambing and at marking

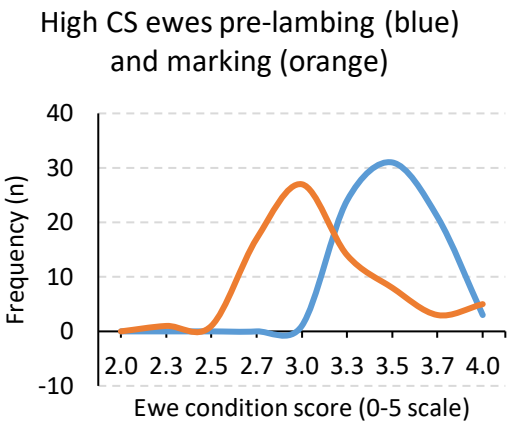
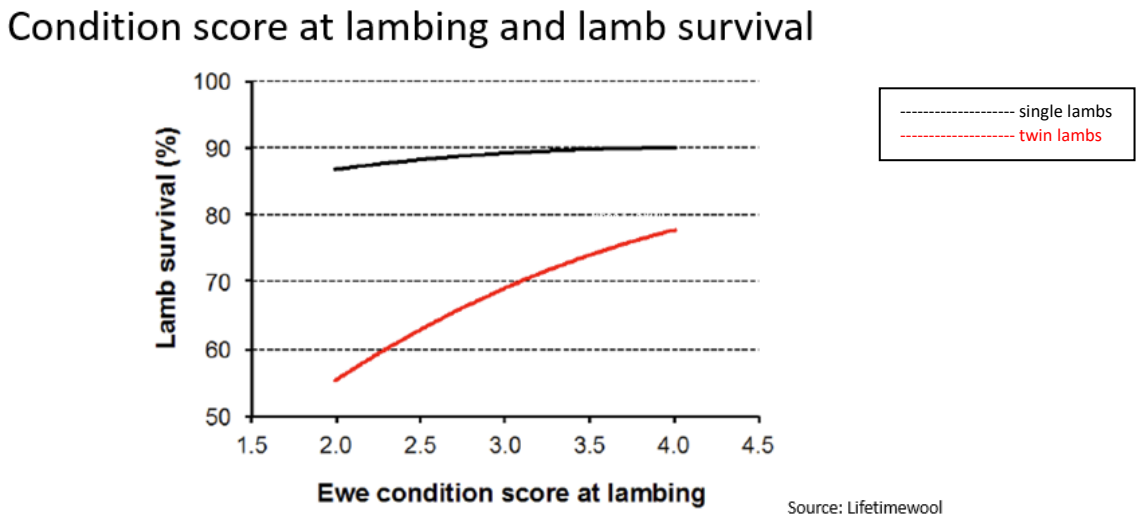


Figure 7. Ewe condition score session with group

The results from the condition score demonstration replicated the findings from Lifetime Wool research (Fig. 8), which increases producer confidence as they implement management changes.

Figure 8. Ewe condition score at lambing and lamb survival (Source: Lifetime Wool)



4.3 Shelter

The more sheltered mob achieved 12% higher lamb survival and a 24% higher marking rate when compared to the lower sheltered mob (Table 11).

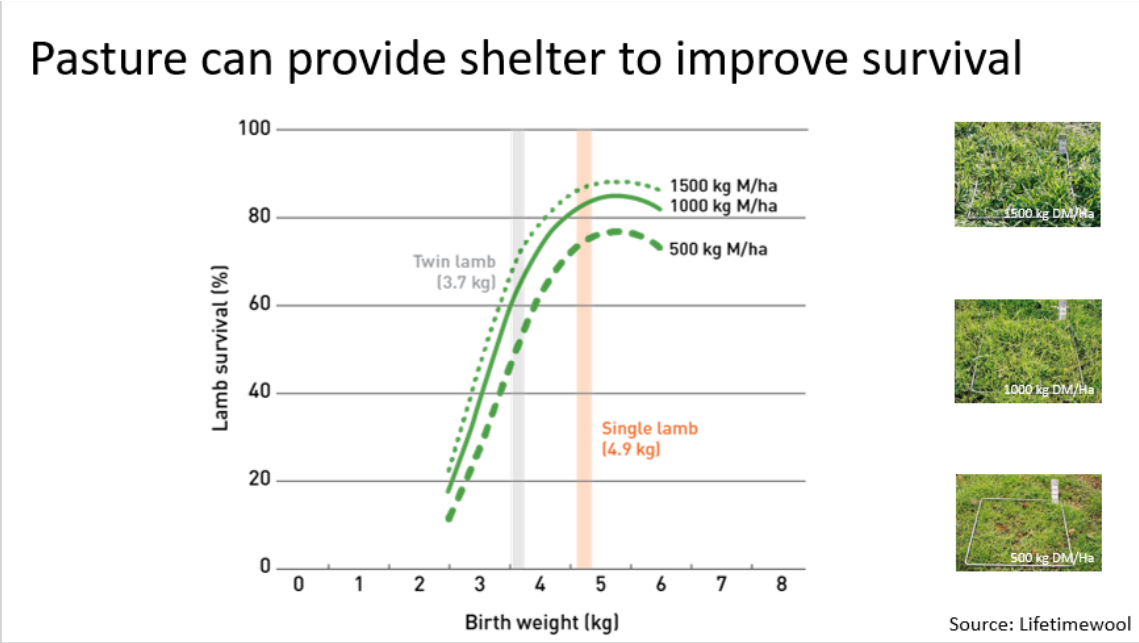
Table 11: Shelter demonstration lambing results Year 2

Shelter trial	Mob 1 (Middle)- more sheltered	Mob 2 (Western)- less sheltered	Difference
No ewes	64	63	
Scanning %	200	200	
Potential lambs	128	126	
Number of lambs	105	88	17
Marking %	164%	140%	24%
Survival %	82%	70%	12%
Ewe deaths	2	5	3
No. lambs lost	23	38	15

Figure 9. Lambs sheltering amongst tussocks

Lifetime Wool research (Fig 10) shows that pasture itself can provide useful shelter for lambs if it is the right height and density and can influence lamb survival particularly in twin bearing ewes.

Figure 10. Impact of pasture shelter on lamb survival- Lifetime Wool



4.4 Economic analysis

Mob size

The economic impacts of erecting temporary fences to increase lamb survival in a farm system were assessed using partial discounted cash flow budgets over ten-years as described in Malcolm et al. (2005).

Value of the extra lamb

When a change is made to a farm system, it is the marginal changes that matter. In this analysis, the focus is on the marginal change to lamb survival as a result of reducing ewe mob size. Young et al. (2014) estimated the net value of an extra lamb from increased lamb survival. The corresponding lamb price received and net value of an extra lamb (from a twin bearing, maternal) were developed using the method described by Young et al (2014) (Table 12).

Table 12. Net value of an extra lamb ($/hd) for the corresponding price received ($/kg cwt)

$/kg cwt	$/hd
$5.0	$73
$6.0	$91
$7.0	$110
$8.0	$128
$9.0	$146

The number of extra lambs surviving because of the smaller mob size was estimated as the difference in marking percentage between the smaller mob size treatment and the status quo (larger mob) in 2021 (Table 13)

Table 13. Total number of animals, marking rate and extra lambs on the case study farm in 2021

Parameter	Small Mob size	Status quo
Total ewes	359	565
Total lambs marked	621	933
Marking rate	173%	165%
Marginal marking rate	7.8%	
Marginal lambs marked	28	

Investment cost

It was assumed that it would take two people, two days, working eight hours per day to erect and disassemble the temporary fencing at a rate of 50 dollars per hour. These labour cost would be incurred each year of the analysis period.

Temporary fencing material included wire, posts, insulators and an energiser. It was assumed that the fencing material was purchased in the first year of the analysis and had a salvage value of $0 at the end of the analysis. An annual cost of 10% of the initial investment in fencing material was incurred from year 2 in the analysis to account for the replacement of broken materials (Table 14).

Table 14. Estimated costs of an investment in temporary fencing on the case study farm

Analysis year incurred	Year 1	Year 2-10
Fencing material	$1,602	$160
Fencing labour cost	$1,600	$1,600
Total	**$3,202**	**$1,760**

Key performance measures

The economic performance of the erecting temporary fencing was compared with the status quo system. The key measure of profitability and economic performance was net present value. Net present value (NPV) reflects the net benefits over the life of the investment adjusted to present value by discounting using the opportunity cost of the capital invested. For this analysis, a 5% (real) discount rate was used to compare the NPV of the project to alternative investments.

Sensitivity Testing

Sensitivity to average lamb price, lamb marking percentage and labour cost were examined using a discrete scenarios.

The lamb price scenarios were developed using 10-years of Livestock Farm Monitor project data (Agriculture Victoria 2021) from south west Victoria and defining high ($9/kg cwt), most likely ($7/kg cwt) and low ($5/kg cwt) price scenarios as the 0.95, 0.5 and 0.05 lamb price percentiles respectively.

Three different hourly labour rates were tested: $50/hr, $60/hr and $75/hr

Three different increases to lambing marking percentages were tested : 7.8%, 5% and 3%. The increase to lamb marking percentage is the difference between the small mob size and the status quo.

Results

Profitability is indicated by the stream of annual net benefits having a positive NPV at the required rate of return of 5% real p.a. At the current rate of extra lamb marking and labour cost, an investment in temporary fencing is more profitable than an alternative investment earning 5% for all lamb price scenarios (Table 15).

Profitability was most sensitive to changes in the extra lamb marking percentage achieved. When the extra lamb marking percentage dropped to 5% a lamb price of $7/kg cwt and above was needed to be competitive with the required rate of return. If the smaller mob size achieved a marking rate 3 percentage points higher than the status quo all lamb price scenarios were unprofitable (appendix 8.4).

Labour was a significant component of the cost of the temporary fencing. The investment would remain profitable if labour costs increased by 50% to $75/hr and lamb prices remained at or above $7/kg cwt (appendix 8.4).

Table 15. The effect of lamb price received on the net present value of an investment in temporary fencing over a 10-year period.

Lamb price scenario	high	most likely	low
Average price received ($/kg cwt)	$9	$7	$5
net present value at 5% (real) discount rate	$16,797	$8,965	$916

Ewe condition

In 2019, the higher CS mob produced an extra 12 lambs per 100 ewes than the lower condition score mob. This led to $1,752 increased lamb value per 100 ewes than the lower condition mob (Table 16), with extra lambs valued at $146 (Young, 2014).

In 2020, the higher condition score mob produced an extra 58 lambs per 100 ewes, valued at $26,864. This was $8,468 more than the value of lambs produced in the lower CS mob ($18,396).

Unfortunately, lambs were not weighed at marking, however the producer's observations that lambs in the higher CS mob were larger than lambs in the lower CS mob suggests that the difference in lamb value between treatments may be larger. Additionally, no value was placed on the extra condition of the high CS treatment at lamb marking, which would require less feeding than the lower condition score mob in preparation for joining the following year.

Table 16. Estimated value of lambs per 100 ewes for higher CS and lower CS treatments

Treatment	Av. Ewe condition prior to lambing	Av. No. lambs/ 100 ewes	Av. Value of lamb/100 ewes ($146/lamb*)
2019			
Higher CS	3.5	165	$ 24,090
Lower CS	2.75	153	$ 22,338
Difference	*0.75*	*12*	$ 1,752
2020			
Higher CS	3.5	184	$ 26,864
Lower CS	2.8	126	$ 18,396
Difference	*0.7*	*58*	$ 8,468

*Value of extra lambs (Young 2014) based on $8/kg Cwt for a twin maternal lamb

Shelter

The more sheltered mob produced the equivalent of 24 more lambs per 100 ewes than the less sheltered mob. This was valued at an extra $2,760. The extra benefit does not consider the cost of establishing shelter.

Table 18: Estimated value of lambs per 100 ewes for the more sheltered and less sheltered mobs

Treatment	Av. Mob size	Av. No. lambs/ 100 ewes	Av. Value of lamb/100 ewes ($146/lamb*)
More shelter	64	164	$ 18,860
Less shelter	63	140	$ 16,100
Difference	*1*	*24*	$ 2,760

*Value of extra lambs (Young 2014) based on $8/kg Cwt for a twin maternal lamb

4.5 Extension and communication

Project communication and extension activities over the three-year demonstration are included below (Table 19). COVID-19 restrictions impacted engagement with the demonstration as groups were unable to meet face-to-face for 11 months between April 2020- March 2021 then a further six months between July 2021-Dec 2021.

Table 19: Extension and communication activities

Date	Activity	Details
Jun 2019	Condition score and feed budget group activity	11 attendees
Jul 2019	Temporary electric fencing session	9 attendees
Nov 2019	Factsheet on lamb survival demonstration- uploaded to AgVic demo webpage	Circulated to 3,500 subscribers
Jan 2020	Presentation to group - Year 1 results	8 attendees
Feb 2020	'Newsflash' newsletter article - Lamb survival the focus of on-farm demonstration	Circulated to 3,500 subscribers
Feb 2021	Infographic on project results - 2020 update shared with group	
Feb 2021	'Newsflash' newsletter article - Year two demonstration trial results confirm survival management strategies	Circulated to 3,500 subscribers
Mar 2021	Presentation to group - Year 2 results	25 attendees
Apr 2021	Social Media - Facebook post and Tweet - Increasing lamb survival	
Apr 2021	SALRC Newsflash Increasing Lamb Survival Enhanced Producer Demonstration Site	
June 2021	One-on-one lambing review sessions aimed to help members explore and identify areas that may improve lamb survival. (Undertaken when groups were unable to meet, though 1:1 sessions were a possibility)	6 members used this opportunity
Sep 2021	Lamb autopsy workshop on-line	8 attendees Score: 8.8/10
Feb 2022	Presentation to group - Year 3 results	8 attendees

Mar 2022	'Newsflash' newsletter article - Final year of producer demonstration site shows management can influence lamb survival	Circulated to 3,500 subscribers

4.6 Monitoring and evaluation

At the final group workshop, the Western Plains BWBL group all agreed they had learnt new knowledge and skills around management of twin-bearing ewes, leading to greater lamb survival. Members have implemented or plan to implement changes to their existing practices around ewe mob size and paddock size, managing condition and feed on offer for pregnant ewes, and better use of shelter for twin-bearing ewes.

Knowledge, Attitude, Skills, Attitude, Adoption

A pre and post evaluation survey on the demonstration was completed with members of the Western Plains BWBL Group. This evaluation measured changes in knowledge, attitude, skills, aspirations (motivation) and adoption (KASAA) for five objectives shown below (Figs. 11-19). The surveys involved producers rating their current level of knowledge, skills, aspirations from 1-10 against each of the demonstration objectives. They also indicated their use of specific practices pre and post demonstration to indicate adoption.

Figure 11. Knowledge pre, post and change

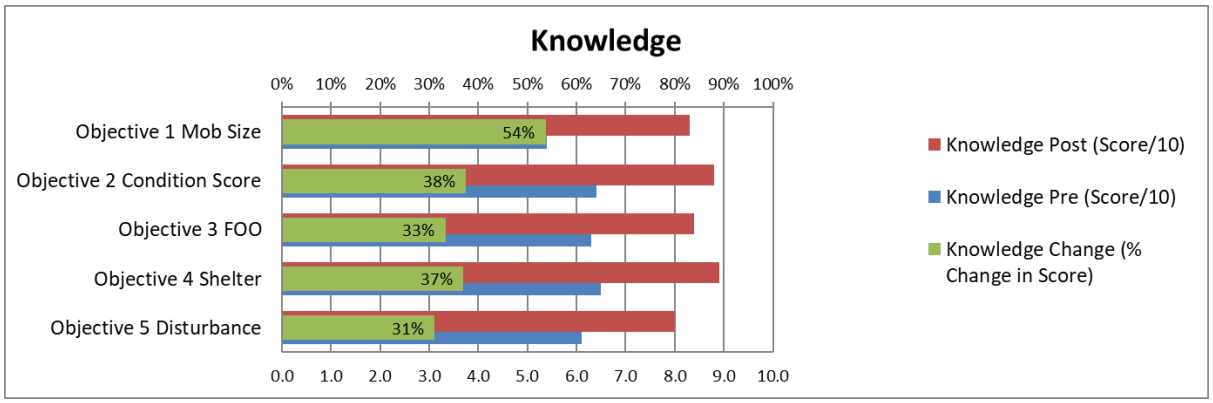


Figure 12. Attitude pre, post and change

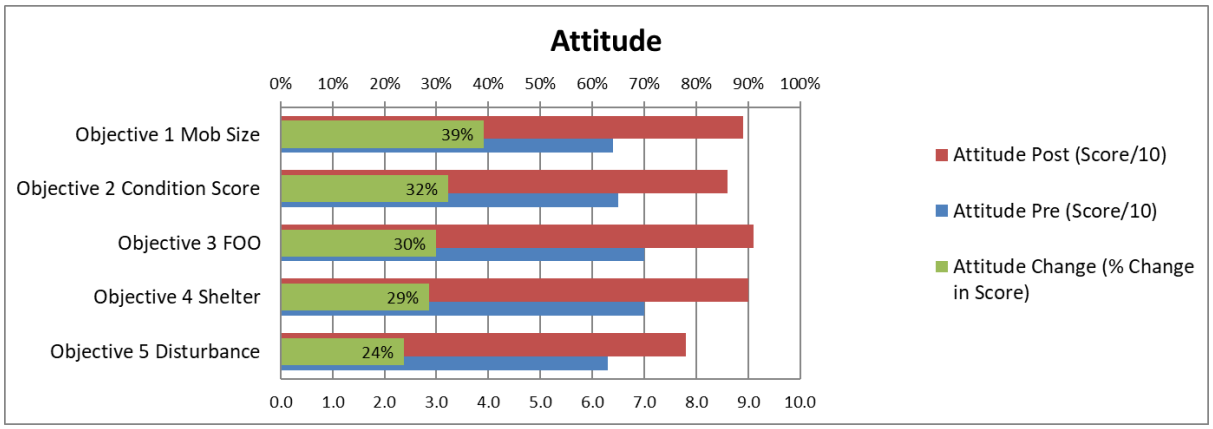


Figure 13. Skills pre, post and change

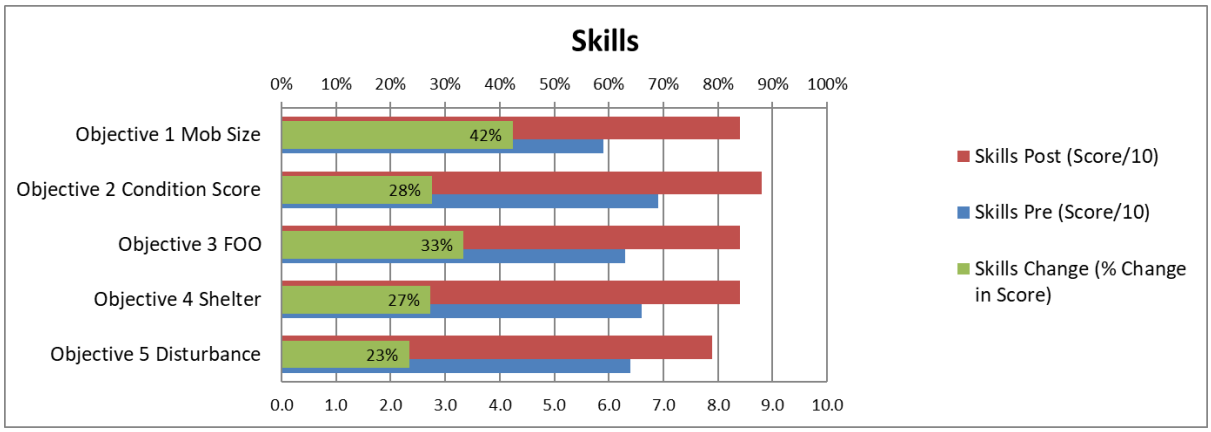


Figure 14. Motivation pre, post and change

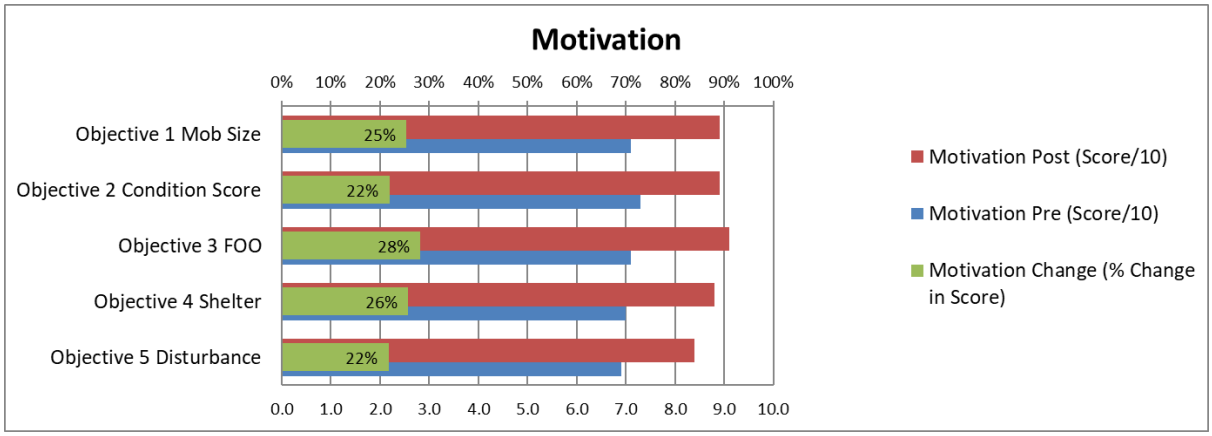


Figure 15. Do you manage mob size to maximise lamb survival rates prior to the demonstration?

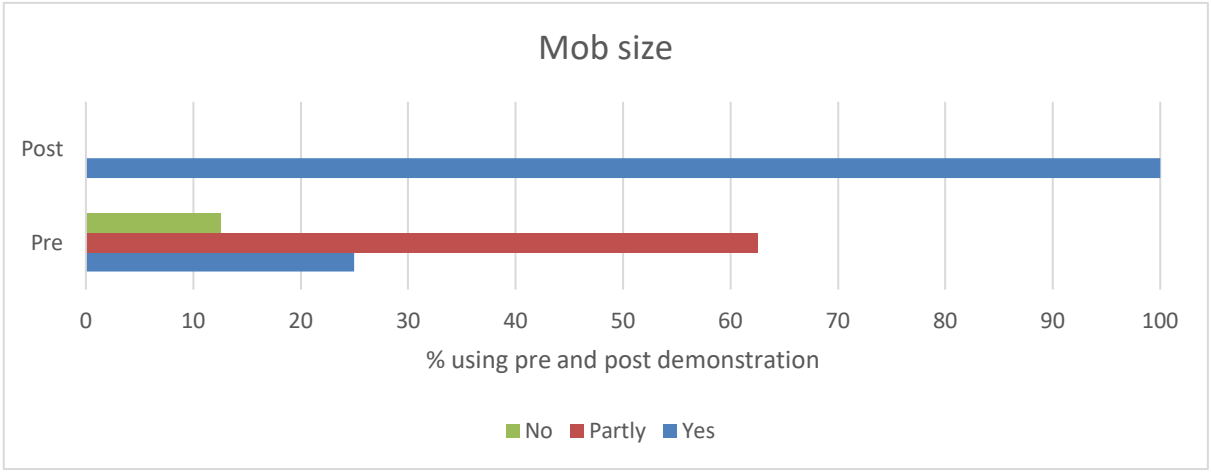


Figure 16. Do you manage ewe condition to maximise lamb survival rates (eg: separating ewes based on condition and feeding accordingly)?

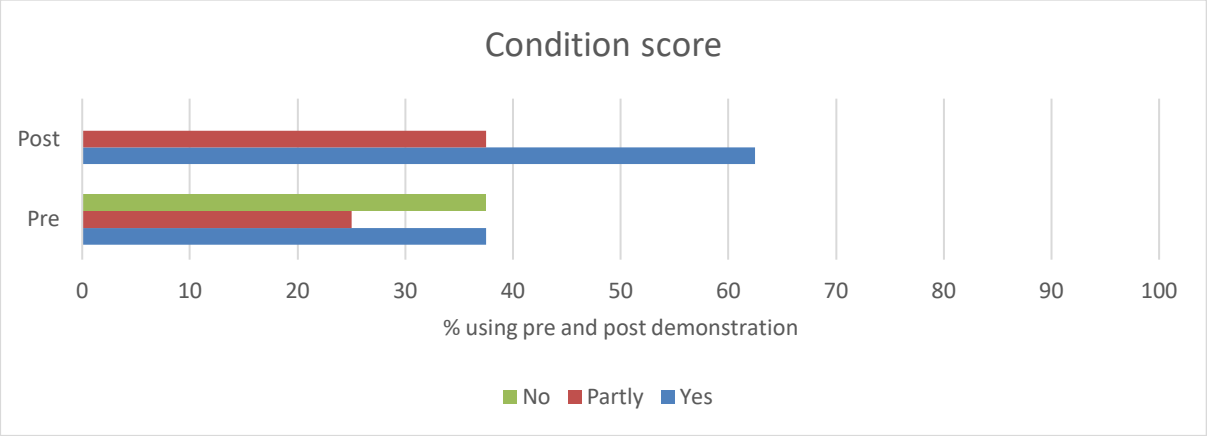


Figure 17. Do you manage FOO to maximise lamb survival rates?

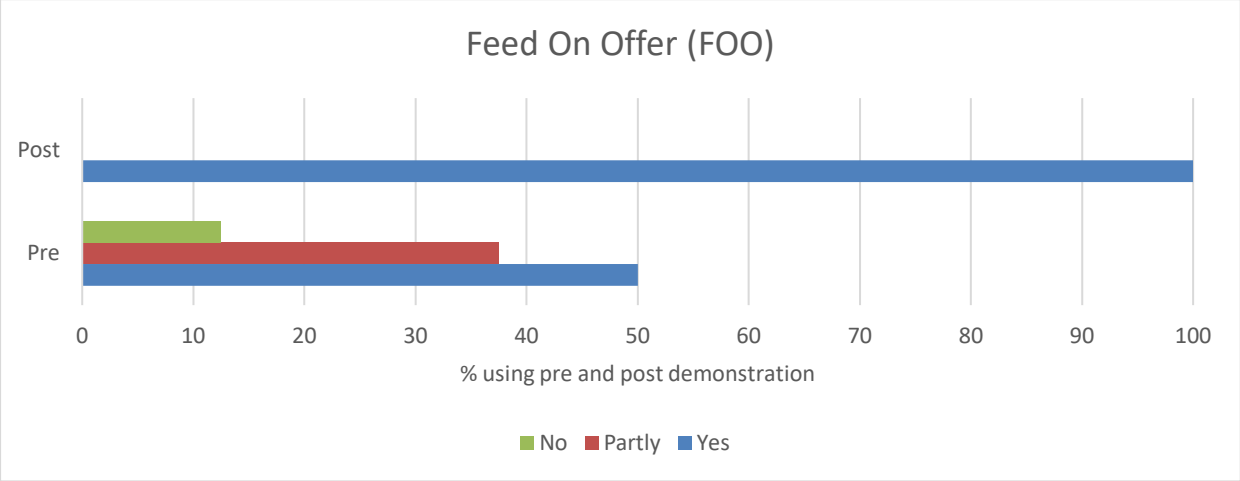


Figure 18. Do you prioritise shelter for lambing ewes?

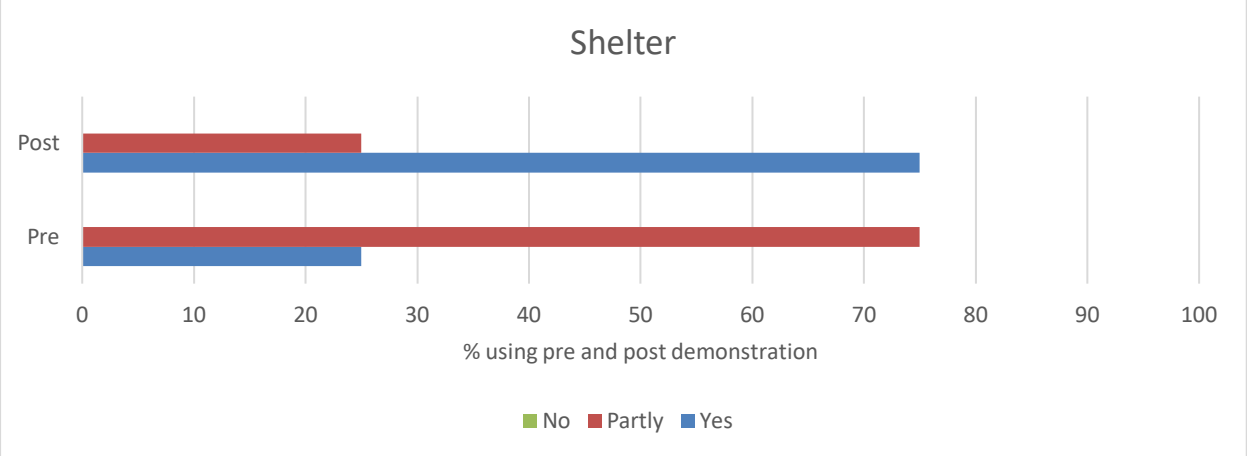
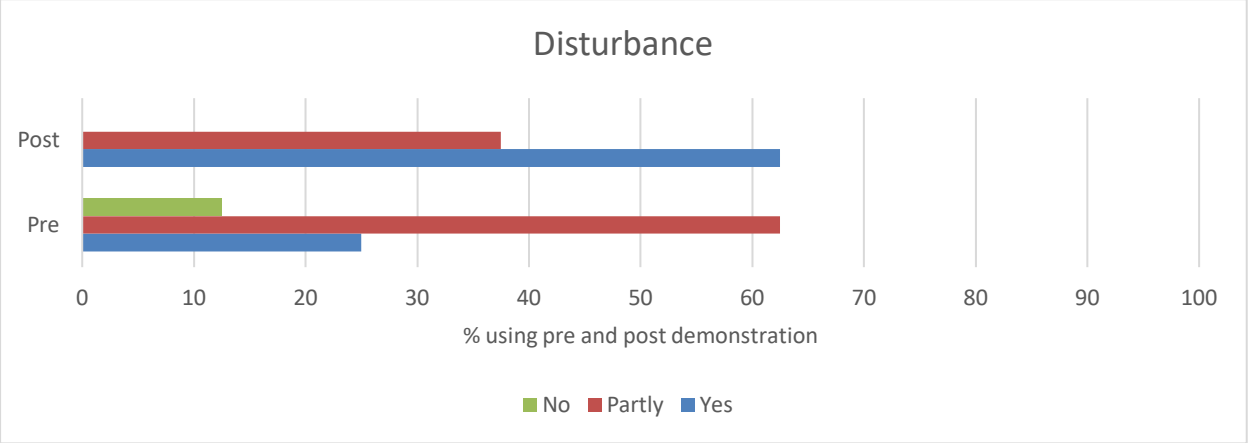


Figure 19. To what extent do you minimise disturbance during lambing?



Knowledge

Producers indicated their knowledge had increased across all parameters, ranging from a 31% to 54% (mob size) change in knowledge. Overall, the group had indicated a good initial knowledge of all parameters, which increased from an average 6.3/10 to 8.5/10.

Comments from producers include:

"It drives home the messages around lamb survival. Also, at the point of lambing- if you're missing (something in your system), you can address other factors and hope to offset issues"

"The data highlights the immediate mob size benefits- other things can take a longer time such as shelter."

Attitude

Average rating for attitude across all parameters increased from 6.7/10 to 8.4/10. This was an increase of 24% to 39% across the parameters measured.

Skills

Producers indicated their skills had increased across all parameters by 23-48%. Average skill level across the parameters increased from 6.4/10 to 8.4/10, with the biggest changes being in their ability to condition score ewes.

Comments from producers include:

"We can see the value in collecting data. Good to see the trends over time and without data collection it's much harder to do this."

Motivation

Producers indicated that their motivation to manage each parameter had increased between 22-28%. Motivation pre demonstration across all parameters was high averaging 7.1/10 and increased to 8.8/10.

Comments from producers include:

"These lamb survival factors have been drilled into us over the years but it's great to see in your own back yard.

Adoption

Adoption increased across all parameters with 100% of members surveyed managing mob size and FOO to maximise lamb survival by the end of the demonstration. There were also improvements in the management of ewe condition, shelter and disturbance.

Comments from producers include:

- *"Smaller paddocks and mobs are not only good for lamb survival but also greatly helps FOO and pasture management."*

What new skills have been learnt?

- Group members have improved condition score skills and all agreed that they would aim to ensure optimum condition score for all ewes at lambing, particularly those scanned in-lamb with twins or triplets. There was discussion that some lamb and ewe losses in the 2019 season may have resulted from ewes being underweight leading up to and throughout lambing.
- Members also learnt that smaller mob size increases the chances of lambs surviving in multiple bearing ewes and have improved skills in sub dividing paddocks with temporary electric fencing. Most group members are planning to increase the number of smaller paddocks used for lambing multiple bearing ewes. Prior to the demonstration some members were trialling smaller lambing paddocks and mob sizes which will now be extended to become usual practice as indicated by the evaluation.
- Members refreshed their lamb autopsy skills by way of an online lamb autopsy workshop. This was originally designed to be a face-to-face workshop but was modified due to COVID 19 restrictions. 100% of participants said they had learnt new skills at the workshop.
- FOO assessment and feed budgeting skills have also increased through pasture walks and group exercises on the nutritional needs of pregnant ewes and the development of feed budgets.

Additional comments from producers:

- *"Over the duration of the project we have lowered mob size, prioritised shelter and better managed ewe condition."*
- *"We are giving more attention to condition in our ewes."*
- *"Each year we increase the number of small paddocks to help keep mob sizes small."*
- *"Planting more trees to provide shelter".*
- *"We are now scanning to better manage our singles and twins."*
- *"I am making changes regarding paddock size, shelter and feed on offer."*
- *"I will be creating more shelter and making smaller lambing paddocks."*

5. Conclusion

This project has demonstrated that significant improvements can be made to the survival of lambs born to twin bearing ewes through better management of ewe condition, provision of shelter at lambing and reducing the size of the lambing mob.

The findings of the demonstration aligned with research trials on mob size (Hancock et. al.), ewe condition (Oldham et. al.) and shelter (LifeTime Wool) and provided reassurance to the producers involved that management adjustments could lead to increases in lamb survival they set out to achieve.

COVID-19 restrictions limited the number of group activities held over the three years and impacted the assistance available to hosts as they established trials. Nevertheless, the demonstration led to all participants adopting new practices. In the final debrief, the group identified reduction of mob size using temporary electric fencing was particularly achievable and cost effective.

6. Benefits to industry

Lamb survival is a high priority for the Australian sheep industry. It is important from many perspectives including animal welfare, productivity, and profitability. The Australian sheep industry is increasingly scrutinised by the wider community, and it is important to continue to address factors that challenges the social licence of sheep production systems.

There are clear benefits to the sheep industry if commercial farms adopt best practice, developed through extensive industry research and delivered through courses such as LifeTime Ewe Management, Lambs Alive and Bred Well Fed Well.

The benefit of being part of a demonstration, is that producers have an opportunity to test practices in a supported group situation, leading to greater adoption. In this case, every producer adopted components of the demonstration, with mob size being the most adopted practice.

The benefits are obvious for the participants involved but are harder to measure for the wider industry. The aim is to demonstrate the benefits to the wider industry through a variety of channels with the hope that the messages will motivate and stimulate changes to farming systems. Demonstrations can form a valuable component of this strategy.

7. References

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8. Acknowledgements

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