



Managing Breech Flystrike



Australian Wool
Innovation Limited

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Forward



Standards of animal health and welfare are attracting greater attention from consumers, governments, retailers and special interest groups, both within Australia and overseas.

There has been growing international concern regarding the flystrike prevention procedure of mulesing. Mulesing is the process in which the skin around the lamb's breech is surgically removed to decrease the risk of blowfly maggot infestation (flystrike). This has been the focus of an animal activist campaign and has had an impact on international retail stakeholders in North American and European markets.

Unfortunately, flystrike remains a significant health and welfare risk to Australian sheep. Nor is it a simple issue to resolve as the procedure is highly effective in reducing flystrike. Sheep across Australia's diverse environments could be subjected to flystrike if they are not mulesed and no other management strategy or breech modification alternative is applied.

Assisting sheep producers and the industry address and resolve this issue is a very high priority for Australian Wool Innovation (AWI) with flystrike prevention being AWI's highest R&D priority. AWI is targeting investment and activity in many different areas designed to assist the industry to move forward in a sustainable, productive and positive fashion.

Introduction

Flystrike costs the Australian sheep industry \$280 million annually and is a serious risk for all sheep producers. Flystrike represents a significantly adverse state of animal welfare for sheep.

Flystrike also impacts the profitability of the enterprise, not only from loss of productivity from the individually struck animals, but also through the increased amount of time and cost of treating and preventing flystrike. Reducing the risk of flystrike has immense benefits to the health and wellbeing of sheep, the people who work with them and business/farm productivity.

There are five types of flystrike; both body breech and tail strike are seen as the most prevalent and important ahead of poll and pizzle strike. Early last century it was understood that wrinkles increased the likelihood of flystrike. The mules operation was developed by JHW Mules in 1929 to address flystrike around the breech. The Joint Blowfly Committee recognised in 1940 that 'The mules operation must not be regarded as an alternative to breeding towards plain breeched sheep' however, the operation was so successful at reducing breech strike that there was almost 100 per cent adoption by woolgrowers with Merinos by the 1980s.

As we move into the 21st century, consumer and community expectations are changing and there is emerging pressure from some retailers for producers to reduce their reliance on mulesing to control breech strike.

There are a wide range of management and breeding options currently in use. Different combinations of the available tools will suit producers in different enterprises and regions with varying risk of flystrike incidence. Irrespective of the preferred combinations an individual producer decides upon, it is essential that producers plan their own approach carefully to ensure that is effective for their fly risk and fits in well with other farm operations.

This publication, in conjunction with FlyBoss (www.flyboss.org.au) is designed to help producers reduce their flock's flystrike risk and develop an effective flystrike control plan.

Chapter 1

What you need to know and where you are at

Recommendations:

- Understand the basic biology of the blowfly that causes strikes.
- Know the predisposing environmental factors.
- Know the predisposing sheep traits.
- Know the relative risks of indicator traits (dags and wrinkles).
- Know when the high fly pressure is for your area.
- Assess the risk your flock is at.

Fly traps can determine fly presence but shouldn't be used to reduce fly numbers.



Figure 1.1: Immature life stages 1, 2, 3 and 4 of *Lucilia cuprina* (see Figure 1.2). Photo: S De Cat and J Larsen, The Mackinnon Project, University of Melbourne

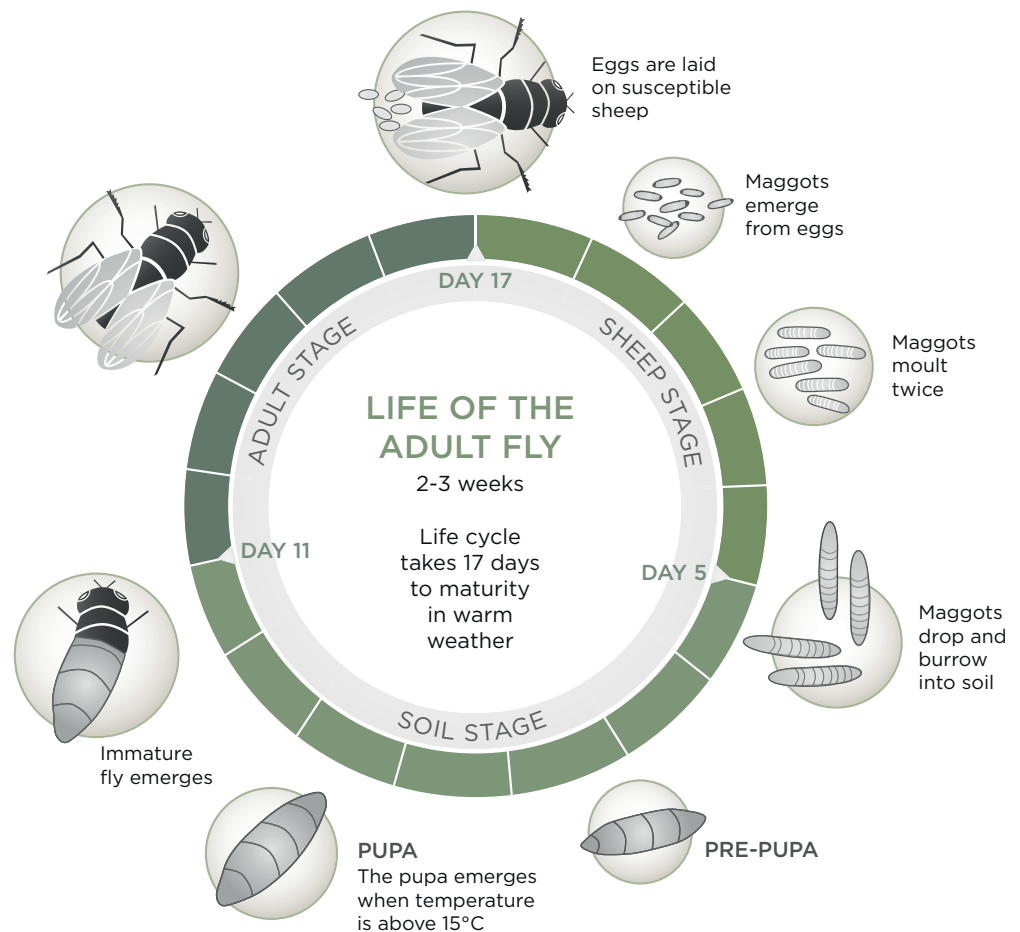


Figure 1.2: The lifecycle of *Lucilia cuprina*, the Australian sheep blowfly. Source: Levot (1999)

Biology of the Blowfly

The Australian sheep blowfly, *Lucilia cuprina*, is responsible for initiating over 90 per cent of sheep flystrikes in Australia. It preferentially, but not exclusively, breeds on live sheep. Once *L. cuprina* has initiated a strike, the resultant skin damage may attract secondary flies. There are a number of species that can be involved in secondary strikes and these flies usually cause more severe damage and can even lead to death of the animal.

Fly traps, for example Lucitrap™, are a useful tool to monitor fly activity, but do not reduce the occurrence of flystrike. Trapping can reduce fly populations by up to 50 per cent with heavy and constant trapping but this is ineffective in reducing the number of strikes if predisposing conditions are present.

Traps need to have the right bait and shape to ensure that they attract fly species involved in strikes rather than benign species that may compete with *L. cuprina*. Secondary flies will also out-compete *L. cuprina* on carrion and hence sheep and other carcasses are not a major contributor to overall flystrike levels.

Adult flies rarely live longer than a month, but in that month they are capable of laying up to 600 eggs. Eggs usually hatch into larvae in 12–24 hours and larvae grow from pin-head size to 10–15 mm in length in about three days (Figure 1.1). They then drop off the sheep to commence pupation a day or two later (Figure 1.2).

Larvae usually fall off the sheep at night or in the early morning, when ground temperatures are coolest, and burrow into the soil. This means that a large proportion will pupate and subsequently emerge as blowflies around sheep camps.

During their life, adult flies will normally not travel more than three kilometres from where they hatch. After hatching, the female fly needs a feed rich in protein, usually from wounds, existing strikes and carcasses, for her reproductive organs to mature. She needs a further feed of protein before egg laying.

Important environmental factors

TEMPERATURE

Studies have shown that the blowfly is relatively inactive below 15°C. It is most active between 26°C and 38°C. The longer the temperature remains above 15.5°C, the greater the chance of egg laying and the risk of strike. Egg laying and fly activity decline when temperature reaches 38°C and cease completely above 45°C.

WIND

Wind can affect the risk of flystrike in two ways. Wind speeds above 9 km/h will reduce flight activity and when wind speed exceeds 30 km/h flight activity ceases. Wind also can affect the speed at which sheep dry and stronger winds accelerate the drying of predisposed sites.

RAIN (MOISTURE)

The chance of flystrike increases after rainfall and significantly increases when there is enough rain to keep the sheep's skin moist for longer than two days.

SHEEP

Moisture is a key factor when flies select strike sites on a sheep. Moisture trapped between wrinkles can support a strike. Urine and faeces not only provide moisture, they also provide an attractant to sheep blowflies.

Trapping has little benefit in reducing flystrike levels but can highlight when flies are active.

Blowflies can lay up to 600 eggs and rarely travel more than 3 km from where they hatch.

Blowflies need optimum temperature, wind, moisture and predisposed sites in order to strike.

REGIONAL AND CLIMATE DIFFERENCES

Climate differences cause significant different relative risks of flystrike throughout the year. There is climatic variation between regions and between years at all locations; this strongly influences the risk of flystrike.

The relative risk of flystrike in a summer and winter rainfall period is shown in Figure 1.3 and Figure 1.4.

Due to high rainfall and warm temperatures coinciding in a summer dominant rainfall region, spring through to early autumn is the highest risk period. In a winter dominant rainfall region the relative risk is different, due to different periods of rainfall and warmer temperatures (Figure 1.4).

It is important that you know the seasonal times when flystrike is most likely for your region. Better planning enables you to better manage the risk of flystrike through strategic timing of events such as shearing and crutching.



Figure 1.3: Typical risk of all types of flystrike in a summer rainfall area. Source: FlyBoss



Figure 1.4: Typical risk of all types of flystrike in a winter rainfall area. Source: FlyBoss

Predisposing sheep traits

Evaluating your flock is the next step in determining your sheep's susceptibility to flystrike. The number of strikes in your flock is not a useful measure of your flock's susceptibility because you are actively managing to reduce flystrike. Any animal that is struck should be culled as it is both likely to be struck again and will pass on its susceptibility to any offspring. An additional benefit in removing this animal from the flock is that it reduces the entire flock's susceptibility to flystrike.

Key indicator traits can be used to evaluate the fly risk and determine the overall susceptibility of body and breech strike in the flock. Research has shown that susceptibility to flystrike is dependent on a number of indicator traits. The importance of each individual trait in determining the risk of flystrike depends on your region.

In summer rainfall areas the following traits (in order) are most important in determining flystrike:

1. wrinkles
2. dags
3. breech cover.

In winter rainfall areas with low wrinkle sheep, the following traits are most important in determining flystrike:

1. dags
2. breech cover
3. wrinkles.

Wrinkle score can be the most important factor in determining breech strike in moderate to high wrinkle-score sheep in a winter rainfall environment (Source: AWI funded study in south-east Australia), highlighting the interaction between the environment and the genotype of the sheep in determining the importance of each indicator trait.

Breech strike

Factors that are important in breech strike are dags, breech wrinkle, breech cover and urine stain. There are significant interactions between them.

In areas where scouring and dags are prevalent, dags can be the most important factor in determining breech strike. A dag score 4 animal (Figure 1.5) can be up to seven times more susceptible to breech strike than a dag score 1 animal in the same mob. Breech cover is also an important determinant of breech strike in winter rainfall areas and its importance increases with increasing dag and wrinkle score.

Don't use number of strikes to assess susceptibility—use key indicator traits instead.

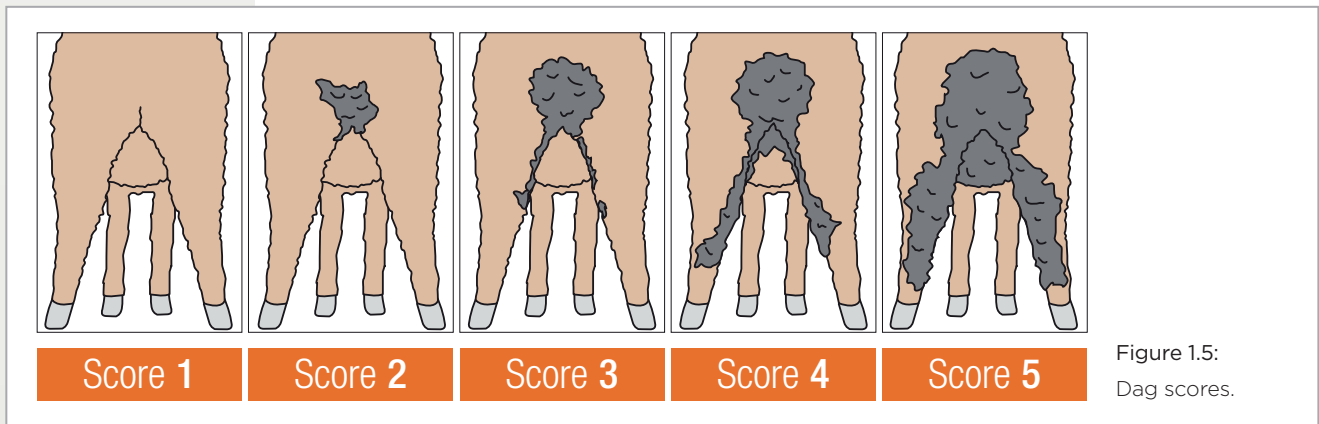


Figure 1.5:
Dag scores.

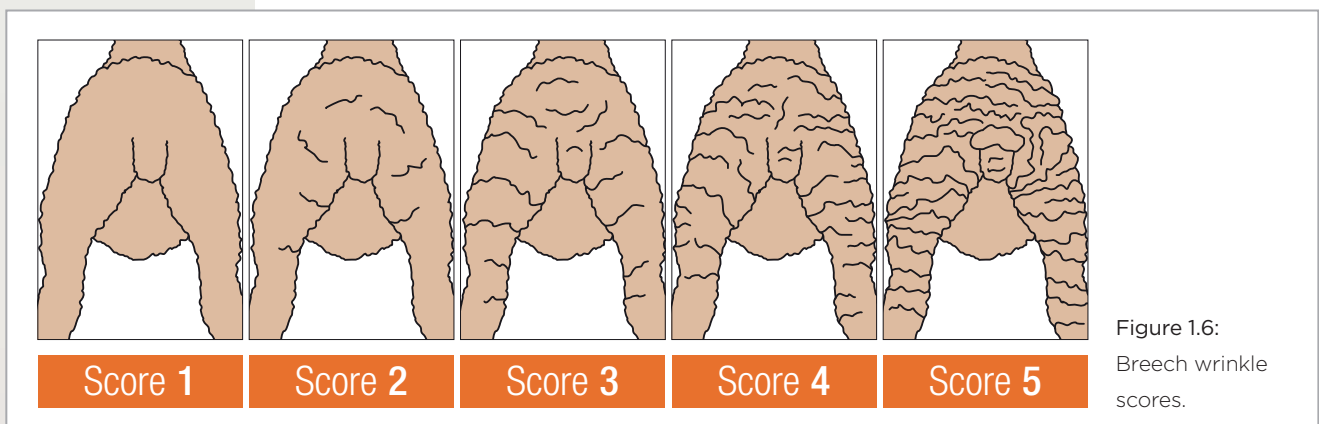


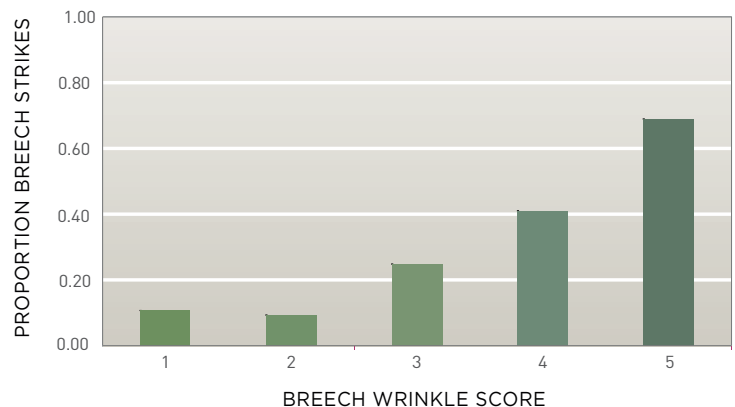
Figure 1.6:
Breech wrinkle scores.

Having daggy sheep will increase your risk of flystrike.

Susceptibility to breech strike also depends on the breech wrinkle score of lambs (Figure 1.6), although its importance varies between existing wrinkle score and between regions. In areas of summer rainfall, which are areas where there tend to be lower dags, breech wrinkle is more important as a determinant of flystrike than in winter rainfall areas.

Wrinkles around the breech area can increase the amount of urine and dags retained and therefore increase the susceptibility of flystrike. Reducing your flock's average breech wrinkle score will decrease your flock's susceptibility to breech strike (Figure 1.7).

Figure 1.7: Proportion of breech struck animals from a summer rainfall area post weaning and their corresponding breech wrinkle score. Source: CSIRO and AWI Breeding for Breech Strike Resistance Project



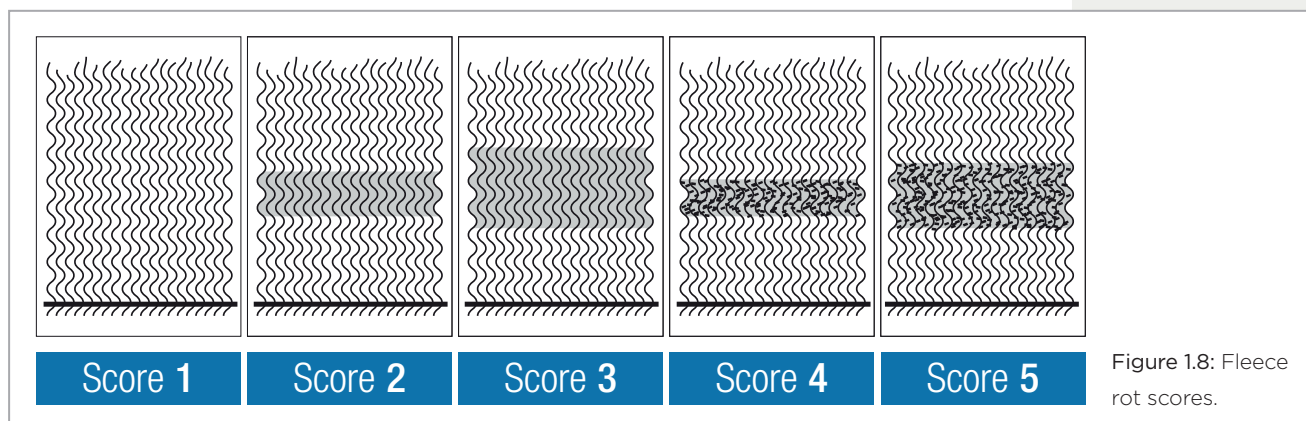


Figure 1.8: Fleece rot scores.

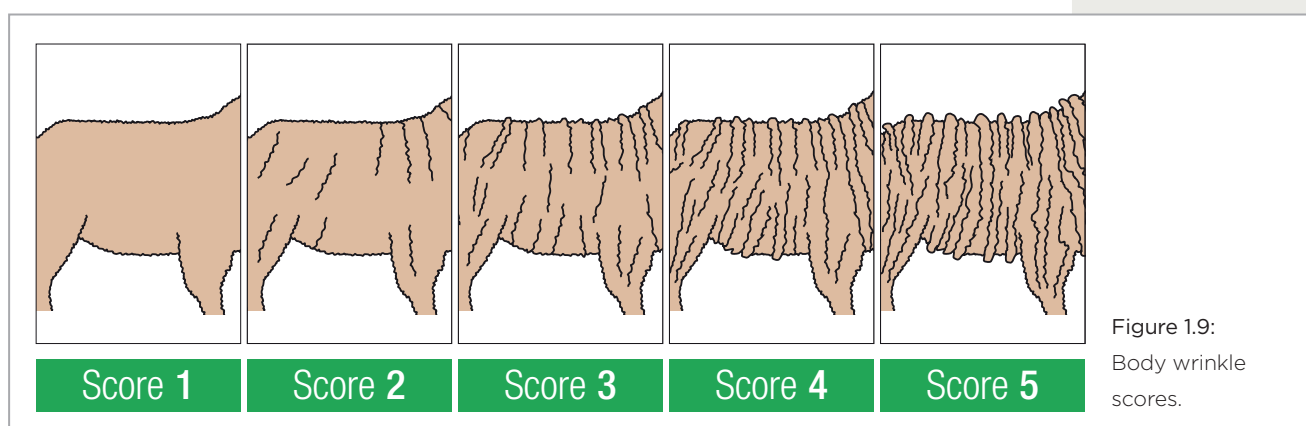


Figure 1.9: Body wrinkle scores.

Body strike

Fleece rot and fleece colour are predisposing factors for body strike. Animals susceptible to fleece rot are more likely to be affected by body strike.

Fleece rot is most common in areas where warm temperatures occur during periods of rainfall. The moisture and bacterial growth often associated with fleece rot provides an ideal environment for blowflies to lay eggs.

The scoring system in Figure 1.8 should be used to determine your flock's fleece rot susceptibility, with higher scores being more susceptible.

Body wrinkle can also be used to determine your flock's susceptibility to breech strike. Body wrinkle (Figure 1.9) is highly correlated with breech wrinkle and by reducing body wrinkle you will also be reducing breech wrinkle.

At Avondale, a Department of Agriculture and Food, Western Australia research station, dag scores and breech strike incidences were recorded in a high fly-pressure year. Using this information, the relative risk of breech strike was determined for dag score 2, 3 and 4 lambs. Compared to dag score 1 (no dags) lambs, score 2 lambs were twice as likely to be struck whilst score 3 and 4 lambs were, four and seven-times more likely to get breech strike. This highlights the importance of controlling dags and worms in non-mulesed sheep in this region.

Chapter 2

Management



Recommendations:

- Planning ahead is essential if any major changes are made to flock management for flystrike, for example, review the timing of other farming practices.
- Use effective chemicals in conjunction with sound management practice.
- Observe length of protection, wool withholding periods and export slaughter intervals.
- Understand that chemical efficacy may be reduced due to wet weather and dags.
- Use time of shearing and crutching to reduce your risk of flystrike.
- Use the National Wool Declaration.
- Consider the timing and length of lambing periods to increase flexibility in flystrike treatment.

Management options including strategic chemical use; timing of shearing and crutching; timing and spread of lambing will significantly reduce your flock's susceptibility to flystrike.

Strategic use of chemicals

Strategic chemical application can be very useful in reducing the risk of flystrike. Chemicals have different lengths of protection and withholding periods for meat and wool so it is important to know which ones work for how long. When considering a chemical treatment, check wool withholding periods, export slaughter intervals and the length of protection.

The wool withholding period (wool WHP) is the time (days or weeks) between application of the chemical and when wool is harvested from the animal. The meat withholding period is the time (days or weeks) between application of the chemical and the slaughter, collection or harvesting of meat products. The export slaughter interval (ESI) is the period that must lapse between chemical application to livestock and their slaughter for export (Source: Meat & Livestock Australia).

Table 2.1 shows the chemicals available to treat and/or prevent flystrike. Export slaughter intervals vary greatly and are updated regularly. To check a particular export slaughter interval visit www.apvma.gov.au.

Different chemicals are registered to be used as either a preventative treatment or to treat struck animals. Some chemicals only provide a protection period and will not kill maggots on already struck animals. For example, dicyclanil (e.g. Clik®) can give up to six months protection against flystrike but will not kill maggots and for this reason can not be used to treat struck animals. Other products, such as ivermectin (e.g. Coopers Fly and Lice®) can be used to prevent flystrike, as well as treating existing strikes, but only provide protection for up to 12 weeks. It is essential that you are using the correct chemical for preventing and treating struck animals.

Sale of stock for meat and export slaughter intervals will affect the type of chemical you choose and the time of application.

Strategic use of chemicals can decrease your risk of flystrike.

CONSIDER THIS:

A producer that lambs in early winter, has a high fly risk period over spring and plans to sell wethers for export at the end of the year. Previously a preventative chemical application at marking has been used, but has found that it wears off prior to selling stock but has very limited options to re-apply the chemical due to export slaughter intervals; as a result there are flystrike issues prior to the stock being sold.

ALTERNATIVE STRATEGY:

An option for this producer is to not apply a chemical at marking, and wait until weaning in late winter. The delay in application means that stock are covered over for the full high-risk period. Managing the ewes and wethers separately gives an additional option of applying two separate chemicals, a longer-acting one for the ewes, for which the export slaughter interval is not relevant, and a shorter-acting chemical for the wethers due to the export slaughter interval.

TIME OF APPLICATION	APPLICATION METHOD	CHEMICAL GROUP	EXAMPLES OF REGISTERED PRODUCTS	PROTECTIVE PERIOD	WOOL WITHHOLDING PERIOD/HARVEST INTERVAL	MEAT WITHHOLDING PERIOD	EXPORT SLAUGHTER INTERVAL (ESI)	
Off-shears	Spray-on	IGR	Clik	18–24 wks	3 mths	28 days	120 days	
			Clik Plus		6 mths	21 days	70 days	
Short wool	Spray-on	IGR	Clik	18–24 wks	3 mths	28 days	120 days	
Long wool (6 wks – 6 mths wool)	Spray-on	IGR	Cyrazin Vetrazin Venus Virbazine Clik	11 wks	2 mths	7 days	28 days	
				18–24 wks	3 mths	28 days	120 days	
	Jet	IGR	Vetrazin Venus Virbazine Cyro-fly	14 wks	2 mths	7 days	21 days	
	Jet	ML	Coopers Blowfly and Lice, Zinjet	12 wks	6 wks	7 days	7 days	
		Spinosyn	Extinosad Eliminator ¹	4–6 wks	Nil	Nil	Nil	
Long wool (6-9 mths)	Spray-on	IGR	Clik	18–24 wks	3 mths	28 days	120 days	
			Vetrazin, Virbazine	11 wks	2 mths	7 days	28 days	
Long wool (6-10 mths)	Jet	IGR	Vetrazin, Venus, Virbazine, Cyro-fly	14 wks	2 mths	7 days	21 days	
			Spinosyn	Extinosad Eliminator ¹	4–6 wks	Nil	Nil	Nil
			ML	Coopers Blowfly and Lice Jetting Fluid, Zinjet	12 wks	6 wks	7 days	7 days
Long wool (10-10 1/2mths)	Jet	Spinosyn	Extinosad Eliminator ¹	4–6 wks	Nil	Nil	Nil	
		ML	Coopers Blowfly and Lice, Zinjet	12 wks	6 wks	7 days	7 days	
Long wool (After 10 1/2 mths)		Spinosyn	Extinosad Eliminator ¹	4–6 wks	Nil	Nil	Nil	

It is essential that you observe wool WHP and ESI.

All chemicals should be applied according to label recommendations. Wet weather can reduce their efficacy.

Wool withholding periods also need to be considered and chemical options may be limited due to shearing time. It is important to plan for delays in shearing especially if shearing occurs when rainfall is possible (e.g. spring in a winter rainfall area) as chemical options will be limited.

Where fly prevention is needed at the time of mulesing, there are a limited number of registered chemical products available for application to the mulesing wound. Chapter 3 covers which chemicals can be used for mulesing wounds in more detail.

Wet weather will affect the protective period stated on product labels and labels should be viewed as a guide only. The protective period can be shortened if persistent rain reduces the chemical concentrations in the wool or if there is extreme fly pressure in the paddocks. Young lambs may also have a reduced protection period due to their wool having lower levels of lanolin, which reduces the binding and retention of the applied chemical.

It is essential the correct applications be used when applying chemicals to ensure effective results. The optimum pressure for hand jetting is 550 kpa (80 psi) for short wool and 700–900 kpa (100–130 psi) for long wool. If hand jetting, it is recommended that a Dutjet® wand or similar be used. For more information on the correct application methods when applying chemicals visit www.dpi.nsw.gov.au

Regardless of the jetting method, there must be sufficient quantity of chemical to penetrate the wool and wet the skin. In areas where the risk of body strike is low, it is likely that only a jet

Table 2.1: Current chemicals available to treat and/or prevent flystrike

COST/HD (50 KG SHEEP)*	RESISTANCE REPORTED
52¢-\$1.04	None
\$1.87	
\$1.04	None
30¢-\$1.04	None
33¢- 73¢	None
37 -41¢	None
54¢	
52¢-\$1.04	None
30-90¢	
31-90¢	None
72¢	None
37 -41¢	
37 -90¢	None
91¢	None

¹ Protective period reduced on lambs due to open fleece and less lanolin.

* Prices as of 13 January 2011 & are estimates only. Two prices indicate an application for breech & breech and body. IGR - Insect Growth Regulator ML - Macrocylic Lactone
Go to the FlyBoss products tools website for updates costs.

www.flyboss.org.au/tools/flystrike-decision-support-tools.php

A small trial at Mt. Barker, WA during 2008 showed that lambs that were treated with Clik® on the breech at marking were not struck between marking and weaning, yet six per cent of lambs in the untreated group were struck between marking and weaning. A similar trial in Victoria, conducted by the Mackinnon Project, found that no breech strikes occurred in animals with a chemical treatment whilst up to seven per cent of untreated animals in other mobs on the same property were struck. These results highlight the effect that strategically applying chemicals can have.

application on the breech of sheep is required. All jetting must be done according to label recommendations.

Although chemicals can be very effective, it is important that you use a mix of management strategies and don't rely on chemicals alone. This not only limits your exposure to occupational health and safety and environmental residue issues, but also reduces the risk of chemical residues and resistance issues. You need to be aware of the possible dangers and side effects of the chemical, not only for yourself but also for your staff and family.

By treating only the mobs at high risk of flystrike, you will not only save money but also decrease the possibility of creating resistance and residue issues on your property. The following practices are known to increase the risk of residues:

- premature shearing of pesticide treated sheep
- re-treatment after failed initial treatment
- use of combinations of dipping chemicals, outside label recommendations
- plunge or shower dipping sheep with more than 6 weeks wool, refer to label recommendations

Growers have a responsibility to follow the label directions judiciously and withhold any wool or stock that does not meet the relevant withholding period. Multiple applications of chemical in a given season will increase the risk of residues.

Time of shearing and crutching

The time of shearing can be based on turn-off of cull for age/sale stock, staple strength management, lambing, grass seed and vegetable matter management as well as shearer availability and other major events on the property.

Don't rely 100 per cent on chemicals. Treat only animals that need treating.

Appropriate timing of shearing and crutching can dramatically reduce the risk of flystrike.

Each region will have different flystrike risk periods.

Shearing and crutching are key management tools for controlling flystrike. Shearing and crutching can give up to six weeks protection from breech strike. If sheep are scouring, this protection can be reduced to three weeks. Scouring issues are covered in more detail in Chapter 5.

In a non-mulesed flock the timing of crutching or shearing becomes even more important. Shearing or crutching time should be planned to coincide with the start, or just before the usual start, of the fly season, keeping in mind withholding periods and protection periods of chemical preventatives.

Environmental differences and combinations of rain and warm temperatures at different times during the year mean that different regions will have different flystrike patterns and subsequent times of high risk. The graphs below (Figures 2.1 to 2.5) have been developed using the FlyBoss tool (www.flyboss.org.au). The graphs indicate an overall risk of flystrike, which includes all types of strike. You can visit the FlyBoss website to obtain a relative-risk graph for your location.

Figure 2.1 shows the relative risk for a typical winter rainfall environment. The risk period starts to increase in early spring and peaks in mid spring. Over the spring and early summer months there is an increase fly pressure due to the warmer temperatures and spring rainfall, making it an optimum time for flystrike. The risk levels out over the summer and autumn months due to high daily temperatures and little rainfall.

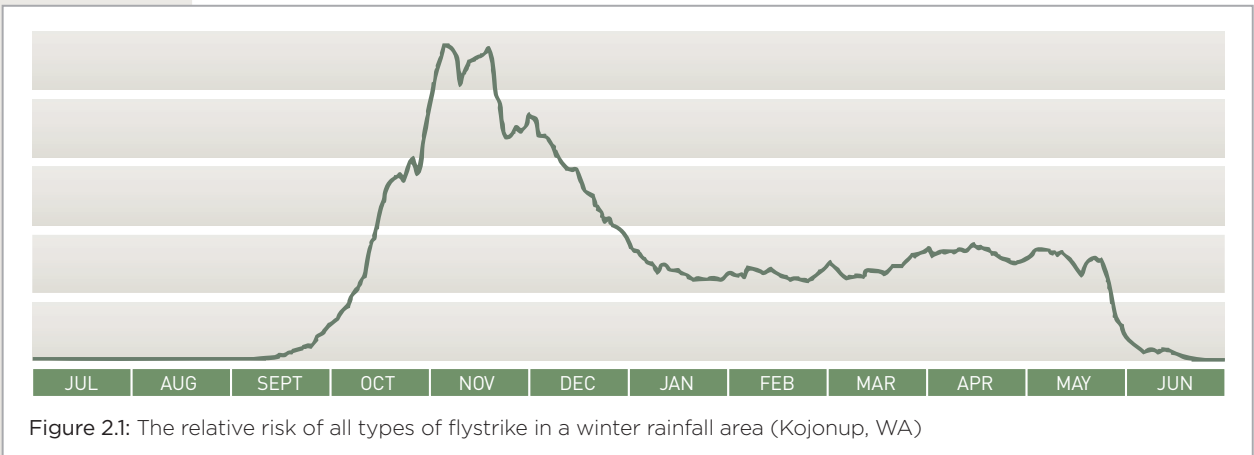


Figure 2.1: The relative risk of all types of flystrike in a winter rainfall area (Kojonup, WA)

Appropriate timing of crutching can significantly decrease your risk of flystrike (Figure 2.2). The high peaks in October and November seen in Figure 2.1 have been decreased to a manageable level.

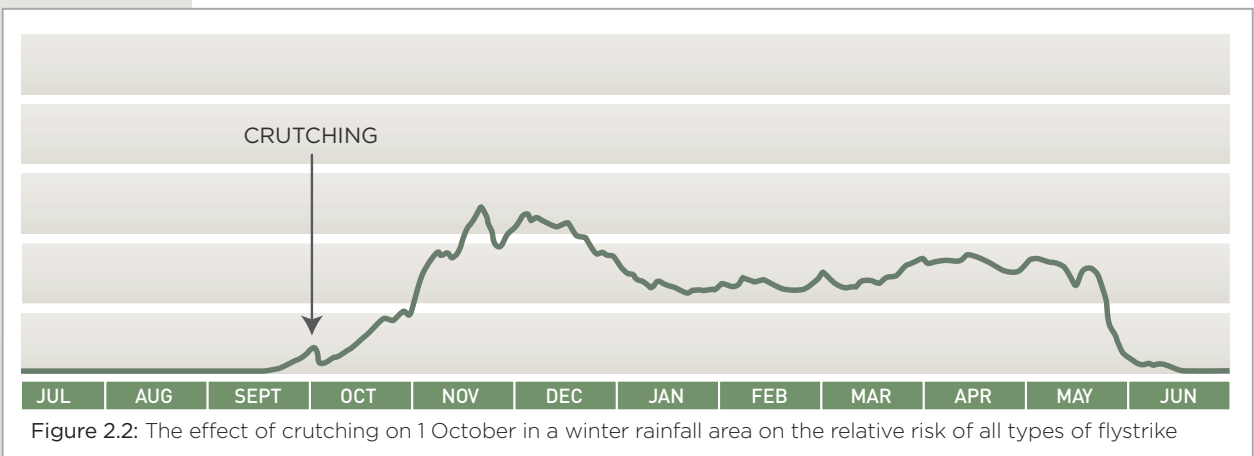


Figure 2.2: The effect of crutching on 1 October in a winter rainfall area on the relative risk of all types of flystrike

Shearing on 15 March will further reduce your risk of flystrike (Figure 2.3). The risk period over the autumn months has now been significantly reduced.

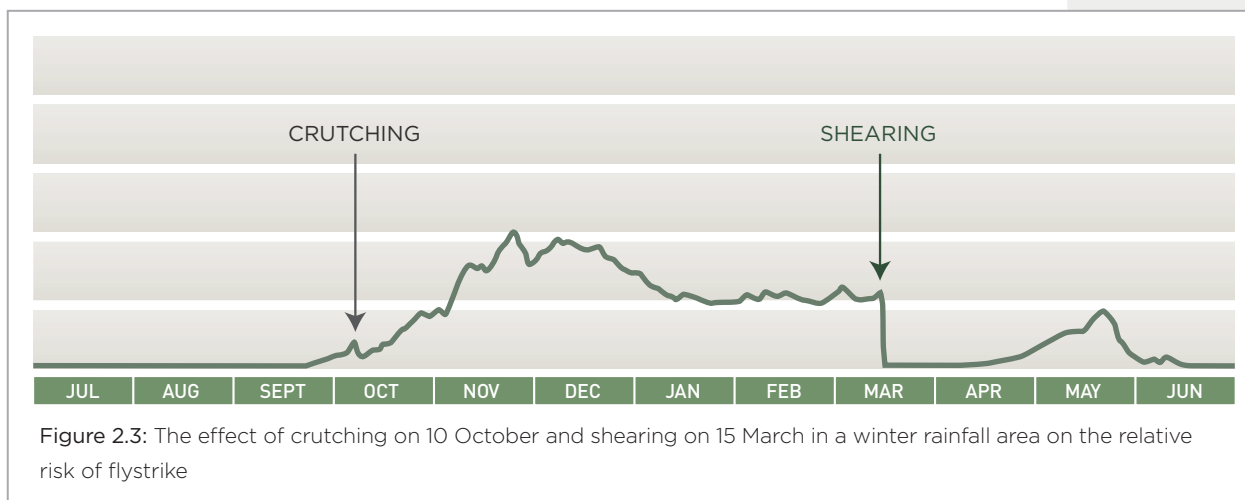


Figure 2.3: The effect of crutching on 10 October and shearing on 15 March in a winter rainfall area on the relative risk of flystrike

There is still a large relative risk of flystrike over the later spring and summer months. This risk can be further reduced with a preventative chemical application (Figure 2.4) at the time of crutching. No extra yarding is required if the chemical is applied at crutching and the flystrike risk has significantly decreased over the summer months.

Shearing and crutching can give six weeks protection from breech strike.

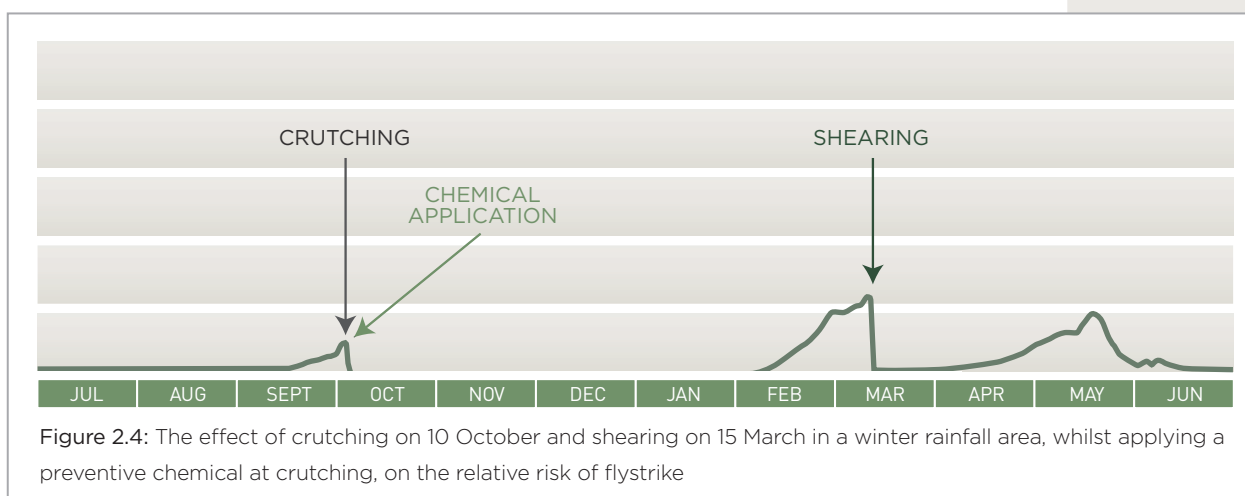


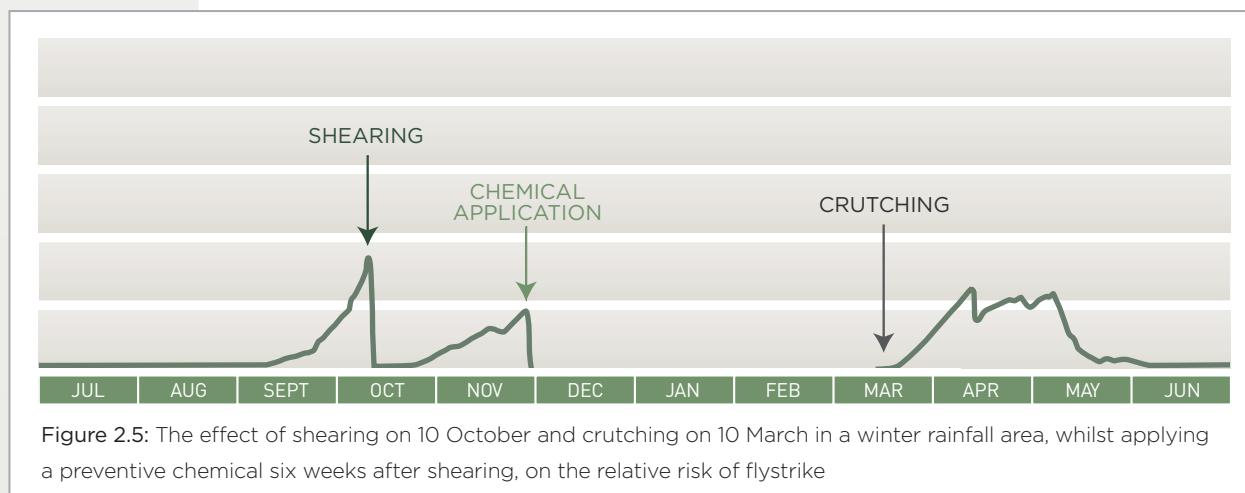
Figure 2.4: The effect of crutching on 10 October and shearing on 15 March in a winter rainfall area, whilst applying a preventative chemical at crutching, on the relative risk of flystrike

If applying a preventative chemical after shearing it is best to wait six weeks after shearing before application to gain the maximum benefit from shearing. However this may not be practical in all farming systems, in which case applying a preventative chemical straight off shears, is recommended.

Shearing on 15 October, applying a three month preventative chemical six weeks post shearing and crutching prior to lambing on 20 April decreases the length of time at risk over the late summer and early autumn months (Figure 2.5). However, there are now two peak-risk periods in spring, unlike the previous example.

Time of shearing and crutching obviously needs to fit with other major events on the property such as seeding and harvest, but the likely impact of wool value should also be considered if possible. Staple strength and vegetable matter management should also be considered when changing shearing and crutching dates to lower the risk of flystrike. In summer rainfall areas, shearing during spring and summer may place the position of the break in the middle of the

Wool quality should be considered prior to changing shearing/ crutching dates.



staple which can increase the chances of incurring a price discount for low staple strength. It is important to plan when you can deal with higher risks of flystrike; each producer will have their own optimum time to shear and crutch.

Timing lambing so that it doesn't coincide with high fly pressure can be a useful strategy. If lambing during a known high-risk fly period, it is advisable to use a chemical preventative on the ewes prior to lambing as amniotic fluid from lambing can be an attractant to flies. Some producers minimise their risk by having a shorter lambing period which allows earlier access to the ewe flock after lambing in the event of high fly pressure. This strategy has additional benefits as it means less late-dropped lambs which have a higher mortality rate and are less likely to achieve target weight at weaning. Others are finding that a shorter lambing period gives them options to shear every eight months.

Tony and Richard Gee of Fingal Valley, Tasmania, run non-mulesed Saxon Merinos and encounter minimal incidences of breech strike.

They began breeding for plain-bodied sheep in the 1960s with an emphasis on reducing excessive skin wrinkle. Their management system is based on careful timing of shearing and crutching. The risk of flystrike is primarily managed through the timing of these operations. This includes a late spring or early summer shearing, which removes wool from sheep during the worst period of flystrike. Ewes may get crutched twice a year, once prior-to-lambing to reduce stain and then another, if needed, in later summer or early autumn. Richard reports that the quality of their wool has not been compromised by their management decisions as bright soft fine white wool has always been their first priority, but the key to their success is that they have been able to balance that priority with reducing wrinkle.

Chapter 3

Customer Requirements

Recommendations:

- Fill out a National Wool Declaration—it's easy!

Changes in customer requirements

There has been growing international concern, regarding the flystrike prevention procedure of mulesing. There are clear messages along the supply chain indicating retailers and brands are increasingly seeking more choice in the wool they source from the range of categories defined within the NWD. These requirements are subsequently passed onto processors along the supply chain. The Australian wool industry has recognised this and as part of responding to changing global customer requirements and attitudes, the Australian Wool Exchange (AWEX) have expanded the National Wool Declaration to include declarations for flystrike management to assist buyers in identifying the type of wool they want.

Through the NWD wool can be categorised as:

- (a) from non-mulesed sheep,
- (b) from sheep mulesed with pain relief,
- (c) from sheep on a property where mulesing has ceased, or
- (d) from mulesed sheep.

Declaring your wool at sale

The National Wool Declaration (NWD) allows buyers to identify the type of wool that meets their client's specifications. This form, which is filled in at the same time as your wool specification sheet, gives you an opportunity to record practices such as chemical and pain relief usage, crutching and mulesing status. The form, which is reviewed annually, gives the supply chain transparency about flystrike control strategies and contact with shedding breeds. Remember to inform the classer of the different status of each mob so that it can be filled out in the shed.

Figure 3.1 shows a completed current version of the NWD. In this example, there are three different mobs of different ages and sex. The first mob is a mixed sex merino mob at their first shearing. This mob has not been mulesed. Mobs two and three have been mulesed, with mob two having pain relief applied at the time of mulesing.

It is important to use the latest version of the NWD which can be found on the AWEX website at www.awex.com.au. Version 4.0, March 2011, defines 'ceased mulesing' as 'any sheep born on this property in the last 12 months must not be mulesed at the time of this shearing and there must be no intention to mules in the future.'

NWDs are filled out when your wool is sold.

Chapter 4

Breec Modification

Recommendations:

- Tail dock to the correct length (third joint).
- Use an accredited contractor and pain relief if mulesing.
- Only mules animals that require it where there is not a viable alternative.
- Use a chemical treatment at marking if mulesing in a high fly pressure time.
- Consider alternatives such as clips.
- Consider the effect mulesing has on live weight gain and mortality rates.

Breech modification is a tool for decreasing the susceptibility to breech strike. There are two physical breech modification methods currently available. These include breech clips and mulesing. Intradermal injections are currently being researched and remains in the R&D phase. Tail docking is a recommended practice, whatever the method of breech modification.

Tail docking

Tail docking decreases dag formation, urine staining and tail strike. The current recommendation is that lambs should be docked at the third palpable joint (Figure 4.1), or to the tip of the vulva in ewes and to the same length in wethers. When tail docking, it is important to make sure that the tail covers the vulva to reduce incidences of cancer. Docking at the correct tail length has a significant benefit in reducing stain around the breech area, as well as other advantages, particularly in lambing ewes. Docking at the correct length diverts excretion flow from the breech area and thus can reduce dag formation. The rate of rectal prolapses increases when sheep are docked very short or 'butt tailed'. This is thought to be because of the impact tailing has on the surrounding muscles. Some studies have demonstrated that tail docking at shorter lengths reduces the ability of sheep to 'twitch' their tails which may in turn reduce the effectiveness of deterring flies.

It is recommended that tailing is done by a cold knife, gas knife or by using elastic rubber rings. There is conflicting and inconclusive evidence that one method is better than the others in terms of reduction of flystrike and welfare outcomes. Whichever method you use, the key is docking at the correct tail length to reduce susceptibility to flystrike.

There are two versions of a gas knife; the standard gas knife and the Te Pari Patesco knife (Figure 4.2). The Te Pari Patesco knife is a relatively new gas knife that sears and removes the tail and stretches the woolly skin producing a bare area on the top of the tail. It works in a similar fashion to normal gas knives, except for a rotating anvil system that extends the skin on the woolly side of the tail before cutting, which results in more bare skin on the dorsal tail surface and tip of the tail. This leaves a greater bare area, where wool would normally grow and may possibly reduce urine stain and dags, and thus flystrike.

Docking at the incorrect length make your sheep more susceptible to dags, flystrike and other health issues.



Figure 4.1 (Far left): Tail docking is recommended at the third palpable joint, or to the tip of the vulva in ewes and at a similar length in wethers.

Figure 4.2 (left): The Te Pari Patesco knife with a rotating anvil.

Breech clips

Breech clips are plastic clips that are applied to the breech of lambs at marking time or after weaning. These have been developed by AWI and became commercially available in 2009 from Leader Products (www.leaderproducts.com.au).

When compared to mulesing, clips offer a reduction in pain (based on both behavioural and physiological parameters) and higher growth rates from marking to early post weaning. Growth rates of clipped lambs are similar to growth rates of non-mulesed lambs. Clips can provide a reduction in breech wrinkle score and decrease urine stain and dags when compared to non-mulesed lambs, but not compared to mulesed animals. Table 4.1 shows some results from an AWI clip field study using 1300 lambs over four sites in South Australia, NSW and Victoria.

	AVERAGE DAG SCORE	AVERAGE BREECH WRINKLE SCORE	AVERAGE URINE SCORE*
Mulesed	1.2	1.3	1.2
Clipped	1.5	1.8	1.7
Non-mulesed	1.6	2.1	2.2

*Female lambs only.

Table 4.1: Average dag, breech wrinkle and urine scores for mulesed, clipped and non-mulesed lambs over four sites in Australia

Clips also reduce breech wool cover of the breech and tail, when compared to non-mulesed sheep but not compared to mulesed animals. Thus Clips are not considered suitable for lambs with high natural breech wrinkle scores of four or greater.

There are two styles of clips required per lamb, one type for the tail and another type for the breech area (Figure 4.3) with a total of four clips (two tail clips and two breech clips) required per lamb (Figure 4.4). Clips should only be applied by trained contractors. Once the clips are applied, keep lambs close to the yard where possible as the clips can be removed seven days after application. It is possible to re-use the clips several times.

Lambs that are clipped show a reduction in pain responses when compared to mulesed lambs.

Clips increase bare area and reduce urine and dag scores when compared to unmulesed lambs.



Figure 4.4: Clips applied to a lamb's tail and breech area. *Source: AWI*



Figure 4.3: Breech clip (top) and a tail clip (bottom). *Source: AWI*

Mulesing with pain relief

Where mulesing is still to be conducted, it is recommended that producers use a registered pain relief treatment and the procedure performed by an accredited operator. Preferably lambs should be between two and twelve weeks of age when mulesed and mulesing should be conducted at lamb marking to reduce additional handling and stress. It is essential to maintain a high standard of hygiene and use sharp, clean equipment.

The National Mulesing Training and Accreditation Programme, run by the Kondinin Group (www.kondinin.com.au), provides training on up-to-date mulesing techniques to achieve highest possible animal health and welfare standards. The minimal amount of wool bearing skin adjacent to bare skin is removed, depending on your environment and sheep type.

Growth rates of lambs for several months post mulesing can be lower than their non-mulesed counterparts, an effect which is more likely in tougher seasons. As this affects weaning weights, prime lamb producers and producers who wish to sell stock for slaughter soon after weaning should reconsider the need to mules.

Current Codes of Practice for sheep state that mulesing must not be done on sheep that are older than 12 months of age and anesthetic must be used when mulesing sheep older than six months of age.

If mulesing in spring or when conditions are ideal for flies, consider a preventative chemical application at the same time. Where fly prevention is needed at the time of mulesing, there are a limited number of chemical products available (Table 4.2) that are registered for application to the mulesing wound.

	CHEMICAL GROUP	ACTIVE INGREDIENT	MULES WOUND	STRIKE WOUND	VOLUME PER TREATMENT BAND	MEAT WITH HOLD PERIOD	WOOL WITH HOLD PERIOD	RESISTANCE REPORTED
Clik	IGR	Dicyclanil 50 g/L	✓	✗	4 ml	28 days	3 mths	No
Extinosad & Extinosad Aerosol	SPN	Spinosad 25 g/L	✓	✓	Spray on – until area is blue & wet	Nil	Nil	No
Mules 'N Mark II Blowfly Dressing	OP	OP - Propetamphos 500 mg/L (no dilution)	✓	✓	30 ml	14 days	2 mths	Yes
Defiance S* & Defiance S Aerosol*	OP	Chlorfenvinphos 2.5 g/L & cresylic asc 25g/L + oils + naphthalene	✓	✓	5-8mL/kg but no less than 55ml per head	3 days	14 days	Yes

Table 4.2: Preventative flystrike treatment options for mulesing wounds at marking

Flystrike prevention chemicals with low volume treatments should be used in preference to those of larger volumes to prevent excess run off and dilution of the pain relief product. You should note that most blowflies are at least partially resistant to the organophosphates (OP).

It is important to ensure that your lambs are not disturbed, handled or mustered for at least four weeks after mulesing to allow the wound to heal. For further information on the use of pain relief at mulesing, visit www.betterchoices.com.au. For information on accreditation of mulesing operators contact www.kondinin.com.au

Apply a preventative chemical if mulesing during high fly pressure.

Intradermal treatment increases the breech and tail bare areas and removes wrinkles.

Intradermal injections

Intradermal applications could prove to be another way to modify the breech of sheep. Currently, Cobbett Technologies in conjunction with AWI are conducting field trials to develop an intradermal alternative system using sodium lauryl sulphate as the active ingredient. The solution is delivered intradermally to the breech and tail skin using a needle free applicator (Figure 4.5).

The applicator uses pressure from an air compressor to deliver the solution into the skin. Once in the skin layer, the solution denatures protein in the surrounding areas, which results in tissue necrosis (death of the tissue) including pain sensing cells and blood vessels. A dry scab (or eschar) forms, which eventually lifts off, leading to a tightening of the newly formed skin underneath. This enables the wrinkles to be removed and reduces wool cover i.e. increases the natural bare area (Figure 4.6).

More than 90 per cent of any unreacted solution is metabolised by the liver quickly, within eight hours of treatment, and excreted from the animal. In terms of welfare, lambs exhibit similar behavioural responses to untreated lambs, however there are some differences in physiological parameters. Temperature and blood markers may stay at higher than normal levels for several days after treatment, indicating a healing process.

For more information on this technology contact Cobbett Technologies at www.cobbett.com.au.



Figure 4.5: Needle free applicator being used on a lamb at marking. Source: Cobbett Technologies



Figure 4.6: A lamb on the day of treatment (day 0) and the result 53 days after effective application of an intradermal injection to its breech during an early trial. *Source: Cobbett Technologies*

Clayton South, a producer of Wagin WA, decided in 2008 to reduce mulesing and 2010 was his first year of having a 100 per cent non-mulesed lamb drop.

Clayton made the decision to cease, based on weaning weights and production differences between mulesed and unmulesed sheep. Clayton used a conventional docking iron in 2008 on 1500 non-mulesed lambs. He found as the tails healed, wool would heal back over the tip of the tail leaving them more prone to flystrike and making them more difficult and timely to crutch. In 2009 Clayton used a Te Pari knife when marking 2500 non-mulesed lambs with the aim of reducing the amount of wool on the tip of the tail. He has been pleased with the amount of bare skin the knife left and will continue using the Te Pari knife in future years as a tool assisting him with the transition from mulesing. However, it is important that when using this docking iron that it is used correctly, following the manufacturer's directions, to ensure effective results.

Chapter 5

Scouring and worm control



Recommendations:

- Know the different types and causes of scouring specific to your region.
- Monitor and use faecal worm egg counts to determine if worm burdens are present.
- Use fully effective drenches.
- Plan to minimise re-infection of sheep with worms by providing 'low risk' paddocks for susceptible sheep after treatment.
- Use genetics, such as buying rams with negative Australian Sheep Breeding Values (ASBVs) for Worm Egg Count (WEC) and Dags and grazing management strategies to reduce the likelihood of scouring.

Since the 1970s scouring and dags have been recognised as one of the most significant risk factors associated with breech strike in mulesed sheep and severe scouring can significantly decrease the productivity of your enterprise. High production grazing systems with improved pastures and higher stocking rates has undoubtedly contributed to the prevalence of scouring and its importance in breech strike risk.

Scouring can be the most important factor associated with breech strike.

There are generally five main types of scouring and their prevalence varies by region and farm (Table 5.1).

Table 5.1: Type of scouring, risk and class of sheep most susceptible

TYPE OF SCOURING	RISK	CLASS OF SHEEP
High worm burden	Winter rainfall areas — moderate to high, depending on rainfall	Immature sheep and lambing ewes are most susceptible. Sheep in poor condition are also susceptible.
	Summer rainfall areas — low to moderate, depending on rainfall	Immature sheep, lambing ewes and sheep in poor condition are more susceptible.
Larval challenge (hypersensitivity)	Summer rainfall areas — nil to low	Susceptible from about 12 months of age, mostly in mature sheep.
	Winter rainfall areas — moderate to high (occurs in winter)	
Pastures/feed changes	Very specific to some pasture types	All
Coccidiosis	Occasional*	Very young lambs, occasionally older sheep in stress situations.
Bacterial infections	Sporadic	Mainly seen in young sheep and lambing ewes.

*Coccidial infection occurs in almost all sheep but visible problems are not common

High worm burdens

High worm burdens are the most common cause of scouring in sheep, especially in winter rainfall areas. Adult 'scour worms' (black scour worm, the brown stomach worm) damage the gut and reduce feed intake, which can eventually result in the visible signs of wasting and diarrhoea.

Lambs and weaners are at the highest risk as they have less immunity. Ewes suffer a temporary drop in immunity around the time of lambing and early lactation and thus impacted more by worm burdens at these times. Adult wethers usually don't have significant worm burdens due to higher immunity but can if they graze heavily contaminated pasture, or are in poor body condition.

High worm burdens are the most common causes of scouring and lambs are most at risk.

Larval challenge

Larval 'hypersensitivity' is another worm-related condition that is more common in high winter rainfall environments. The problem is not the physical damage from the larvae developing to adult worms but rather an inappropriate immune response when worm larvae reach the gut. This

Larval hypersensitivity is commonly found in winter rainfall areas in sheep older than 12 months and isn't predictable.

is seen as an inflammatory reaction that damages the gut and leads to scouring. This form of immune response is repeatable from year to year, i.e. a sheep that scours in one year is likely to scour the next.

Larval hypersensitivity is most commonly seen in adult sheep that have already developed a reasonable immunity. In Mediterranean climates, scouring can occur when sheep start eating larvae on feed after a period of low exposure, such as over a hot, dry summer, and is typically seen from winter to early spring. It then progresses through a mob, with a portion of the sheep actively scouring at any one time, and can last up to a month. Individuals will cease scouring after a week or two, after which a new batch of sheep will start to show signs. Sheep suffering from this condition are usually not visibly ill.

As the immune reaction prevents worm larvae from becoming adult worms, worm egg counts are usually very low, and drenches have little effect. It has a strong genetic basis but not easy to select for, often affecting only 1-2 per cent of a flock, while at times a much larger proportion (50 per cent or more) may be affected.

Nutritional causes of scouring

Nutritional factors, including rapid feed changes and some pasture species, have been reported anecdotally as causes of scouring. Grazing green oats and other species with high moisture and digestibility may also cause scouring. Cape weed is also often implicated in scouring but research has shown that whilst it may increase the severity of scouring, other factors need to be present to incite the scouring.

Digestive upsets such as acidosis from grain overload or highly mineralised bore water can also cause scouring, but these events are sporadic rather than regular seasonal events. Occasionally, severe mineral or trace element deficiencies, such as selenium or salt toxicity, can cause sheep to scour.

Bacterial/coccidial infection

There are several other infectious or toxic agents that can be associated with scouring in sheep.

Bacterial, viral and protozoal agents, such as *Yersinia*, *Salmonella*, *Giardia*, *Campylobacter* and *Cryptosporidium*, are often found in the environment and can affect susceptible sheep quite severely. Signs include fetid or blood stained scouring, fever, weakness and even deaths as the disease outbreak progresses. These situations are not common, but can be extremely significant primarily in younger and/or immuno-compromised and stressed animals.

Diagnosis of scouring

The correct diagnosis of the cause of scouring is an essential step in effective treatment and future management and prevention.

Diagnosis of scouring due to large burdens of adult worms is generally relatively simple. A faecal worm egg count can help to determine whether there is a large burden of adult worms.

Diagnosis and prediction of larval hypersensitivity scouring remains a challenge and is often made using the history of the problem and ruling out other likely causes. As there are often few adult worms involved in this syndrome, typically sheep will have very low faecal worm egg counts. No drench would be recommended in that case, but a worm egg count is useful to detect cases

Use worm egg counts to determine if worms are causing your sheep to scour.

where there are unexpectedly heavy burdens.

Diagnosis of other suspected infectious or toxin-related syndromes is best carried out in conjunction with your local veterinarian.

Treatment of scouring

Where worm burdens are the problem, treating your animals with a fully effective broad-spectrum anthelmintic will remove the worm, stop the scouring and allow the gut to begin to regenerate. Importantly, if the sheep are simply returned to a paddock reasonably contaminated with worms then larval pick-up will commence again soon after a short acting oral drench and hence the syndrome may re-appear. Some judgement is needed of the likely worm levels in a paddock, to avoid the need for frequent re-treatment. Treatment to reduce larval hypersensitivity scouring is even less clear-cut and more research is required to provide practical solutions to reduce the impact. In the long term, genetic selection offers a solution, however apart from treating sheep with a long-acting drench capsule, little can be done to prevent it. It is important that sheep are not drenched unnecessarily in order to reduce the development of drench resistance in worms. An extra crutch may be useful to reduce dag build up if hypersensitivity is a significant problem.

Long-acting worm treatments are often used successfully by producers to control worms and scouring. However, there is a significantly greater potential to increase levels of anthelmintic resistance compared to short-acting drenches if these products are used routinely and on a widespread basis. Long-acting products should only be used according to a worm control plan that aims to reduce this risk. Treatment of other infectious or toxic scouring disease can include antibiotics and other supportive therapies if warranted.

Work with your local animal health expert to determine your drench resistance status and the most effective treatment for your sheep.

GRAZING MANAGEMENT

Planning grazing management after drench treatment is necessary to minimise re-infection of sheep with worms. Paddocks need to be spelled for at least three months in winter and four or more weeks after pasture dries-off to minimise re-infection.

Prepare low-worm-risk paddocks for high risk mobs. Low-risk paddocks can be recently cropped, spelled for more than three months, grazed by cattle for greater than three months or have been grazed by low-risk sheep such as adult sheep in good condition.

LONGER-TERM MANAGEMENT OF SCOURING

A small number of adult sheep scouring while the majority of the flock are clean, usually indicates a genetic basis, and these sheep should be culled. Genetic selection of sheep, typically at the hogget age, that are less susceptible to larval hypersensitivity scouring is another long-term strategy to assist with dag management.

A planned, effective worm control program will assist you in reducing the risk of scouring outbreaks. Conducting regular worm egg counts to identify significant worm burdens before clinical signs become obvious will assist you in preventing problems before they have an adverse impact.

General sheep worm control information for Australia is available at www.wormboss.com.au



Long acting treatments have greater potential to increase levels of anthelmintic resistance.

Use an effective drench, grazing management strategies and genetic selection to reduce your flock's susceptibility to scouring.

Major problems with breech strike occur when worms begin to take hold in winter rainfall areas.

On one property near Beverly, WA, pregnant ewes began to show signs of scouring in July and faecal worm egg counts revealed moderate worm burdens (an average of about 500 eggs per gram). Ewes were drenched in mid-August, when checking of the lamb worm egg counts also commenced, (and averaged over 500 epg). Lambs were drenched with an effective drench and jetted in mid-September but intensive fly problems persisted up to and beyond shearing in mid-October. About 10 per cent of the weaners showed fresh dags during the weeks after shearing and so another drench was required. The weaners were then put into clean paddock with good stubbles and the levels of strikes and scouring declined. Worm monitoring and closer control earlier in the season may have reduced the worm contamination of the paddocks by the ewes and hence reduced the impacts of worms, scouring and subsequent flystrike in ewes and lambs.



Chapter 6

Breeding for breech strike resistance

Recommendations for selecting sheep resistant to breech strike:

- Use indicator traits to select flystrike-resistant breeding animals; dags breech cover and breech wrinkle are the most important traits to reduce, but wool colour is related to flystrike.
- Increase the importance of resistance to flystrike in your breeding objective.
- Use a two-stage selection (independent culling levels) for your ewe flock.

Breeding for resistance to breech strike offers the best long-term solution and has the additional benefit of being “permanent”. Selecting the best animals for your breeding flock requires selection of both superior rams and ewes using traits that are easily and accurately measured, and that are heritable.

Large variation exists between sires.

Inheritance of breech strike

Large differences between animals in the incidence of breech strike have been reported and results from a trial at Mt Barker in WA show the variation in the incidence of breech strike in the progeny of 69 sires across four years. In year three, the most resistant sire only had one of its non-mulesed progeny struck, while the non-mulesed progeny of the second most resistant sire in year three was still better than mulesed animals. In the same year, the most susceptible sire had 100 per cent of his progeny struck (Figure 6.1).

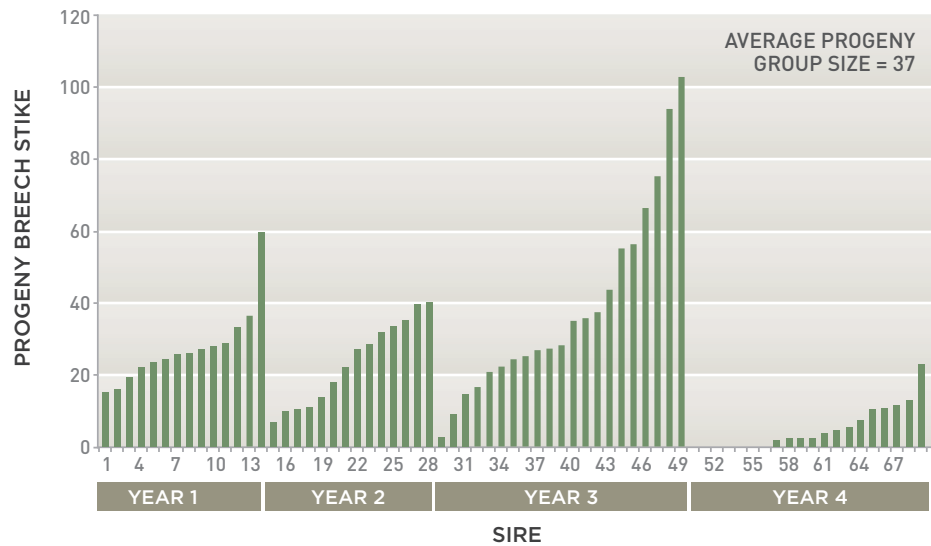


Figure 6.1: The incidence of breech strike in progeny from 69 sires tested over four years. Source: unpublished results from a WA breech strike trial

Make use of indicator traits to reduce your flock’s susceptibility to flystrike.

The large differences that exist between sire progeny groups indicate that some sires are genetically more resistant or susceptible than other sires. This trait has a heritability of about 38 per cent, which implies that it would be possible to breed directly for breech strike resistance. However, it would require that the animals are allowed to become struck, which would be unethical and undesirable to do under normal farm conditions. A solution is to use indirect selection by using ‘indicator’ traits.

Different sires have varying levels of resistance to breech strike that they pass onto their progeny. For example, at one site, one sire’s progeny had only three per cent of breech strike, whilst another sire’s progeny had more than 100 per cent breech strike (some progeny were struck twice), when progeny were run under the same conditions.

Indicator traits

Research shows that certain traits are associated with breech strike and these can be used to successfully breed for breech strike resistance. These are called indicator traits.

The traits that have been shown to be related to breech strike in winter rainfall environments are:

- scouring and dags
- breech wrinkle
- breech cover (or alternatively bare area).

The traits that have been shown to be genetically related to breech strike in summer rainfall environments are:

- breech wrinkle
- scouring and dags
- breech cover (or alternatively bare area)
- wool colour.

Low wrinkle, dags and breech cover are important as individual traits by themselves but are increasingly valuable where two or more of these attributes are present on the same animal. The interaction between traits can impact on the susceptibility of sheep to flystrike.

There is a positive and strong relationship between the indicator traits of dags, breech wrinkle, breech cover and wool colour at hogget age and the incidence of breech strike (Figure 6.2).

The graphs show that dags, breech cover and wool colour traits contribute to breech strike susceptibility and understanding their inheritance is important in order to breed flystrike resistant sheep.

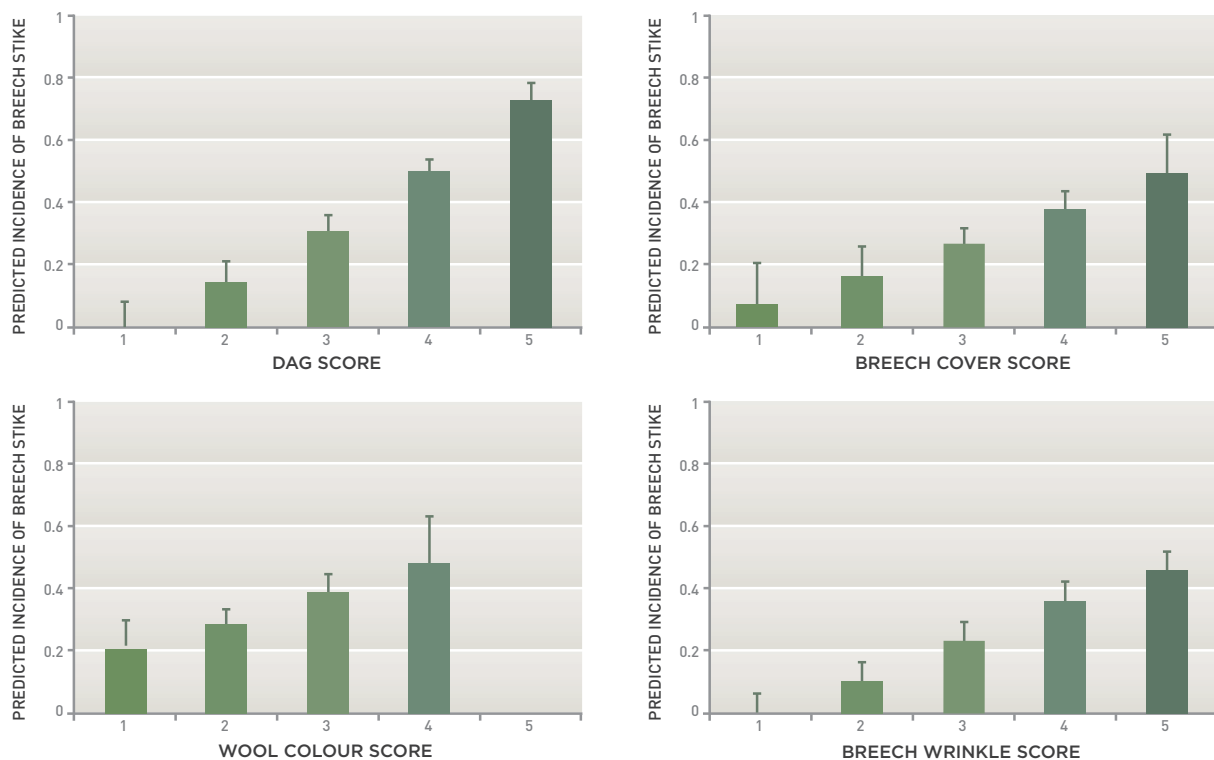


Figure 6.2: Relationships between incidence of breech strike and dags, breech cover and wool colour scores (Mt. Barker, WA) and breech wrinkle (Armidale, NSW)

Inheritance of indicator traits and breech strike

The indicator traits are all either slightly or moderately heritable (Table 6.1) and selecting for these in a breeding program will result in genetic change. The table shows the heritability of the important indicator traits, measured at hogget age.

	WINTER RAINFALL (WA)	SUMMER RAINFALL (NSW)
Breech strike	★★	★★
Breech cover	★★★★	★★
Breech wrinkle	★★★★★	★★
Wool colour	★★★★★	★★
Dags	★★	★
Urine stain	★★	★

Table 6.1: Heritability estimates of breech strike, breech cover, breech wrinkle, wool colour, dags and urine stain. Amount of stars represent how heritable each trait is in a winter and summer rainfall environment. Source: AWI Breeding for Breech Strike Resistance Project at Mt Barker, WA and Armidale NSW

Breech wrinkle score has an important positive relationship with body wrinkle and neck wrinkle score. This means that reducing breech wrinkle score will also reduce body wrinkle.

Emerging research results from WA show that the reproduction rate is higher for plainer sheep (Figure 6.3). This confirms previous research that the number of lambs weaned per ewe joined decreases as the breech wrinkle score of the ewe increases.

Select against dags, wrinkles and other key traits for your area.

Using the indicator traits to breed for breech strike resistance

DAG SCORE

In a winter rainfall environment where dags can be a sizable problem, dag score is an important indicator trait for breech strike. However, breeding directly for reduced dags could be difficult from a management perspective as the flock has to be allowed to develop dags, whilst at the same time not becoming fly struck. Therefore ram breeders may be reluctant to allow their animals to become daggy but there is no need to allow this to develop to the maximum. You can decide

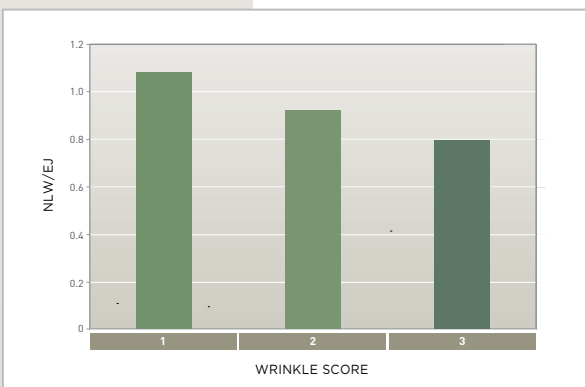


Figure 6.3 (left): Number of lambs weaned per ewe joined in a winter rainfall environment at Mt Barker, WA, for ewes with different breech wrinkle scores at hogget age

ANIMAL ID	YWT	AWT	YEMD	YCFW	YFD
LEAHCIM POLL-050154 CRC	7.0 98%	6.5 96%	-0.7 98%	13.6 97%	-1.9 98%
GLENDEMAR-071641 MSS	6.5 97%	6.2 89%	1.6 94%	16.5 83%	-0.3 88%
LEAHCIM POLL-060120 CRC	11.1 96%	10.8 89%	-0.3 94%	15.0 90%	-0.7 97%
AVERAGE INDEX	2.1	1.6	0.3	5.9	-1.1

Figure 6.4 (above): The current ASBV trait leaders for breech wrinkle score. Current for June 2011. Source: www.sheepgenetics.org.au

what is an acceptable level of dagginess in your flock. For example you could decide to allow 25 per cent of the flock to develop dags up to a dag score of three. When this level is reached, you can score the individuals in the mob and then crutch and drench the whole mob. The same logic applies to Worm Egg Count (WEC).

Having the dag score information will allow breeders to:

- Cull rams that scour so that they are not bred from.
- Select replacement ewes on dag score. However the proportion of score one and two ewes may vary from year to year, making it hard to apply consistent selection pressure.

BREECH WRINKLE SCORE

Selecting sheep on breech wrinkle score is best done after crutching or shearing or at marking. Where animals to be purchased are in full wool, assessment of neck wrinkle can be a guide as it is strongly correlated to breech wrinkle, but where possible obtain a bare shorn score.

Wrinkle score through a sheep’s life is reasonably consistent and although it may change over time, an animal’s rank on wrinkle score will be fairly consistent within a flock. Remember that flocks in good condition will average up to 0.5 of a breech wrinkle score higher than those in normal condition. Single lambs will be at least 0.2 of a score higher than a twin born lamb due to nutritional effects. These effects are not genetic and will not be passed onto their progeny so it is important to recognise these differences and select within groups that have had a similar nutritional history.

Use AWI/MLA Visual Score Guide to ensure a standardised scoring system.

Use a selection index that incorporates all traits that are important to your enterprise.

Selecting a sire

Selection of resistant sires is the most effective method for a commercial sheep producer to reduce the susceptibility of the flock to flystrike. Many studs have clear selection practices to breed superior sires by selecting rams based on the important indicator traits for their environment. To gain the most rapid genetic change in your flock, choose a ram source that has the same objectives and select replacement animals on indicator traits that are important in your environment. Before purchasing rams or selecting a sire source:

- Ask the breeder for their breeding objectives and whether they measure any trait to select for resistance against flystrike.
- Choose rams with accurate assessments of these traits.

YDCV	YSL	YSS	YWEC	NLW	EBWR	EBCOV	LDAG	7%DP	7%	10%ss	14%ss	3.5%DP
-1.8 98%	16.5 98%	0.7 96%	-31 89%	3% 61%	-1.3 96%	-0.5 89%	-0.3 80%	154 74%	160 75%	163 81%	154 82%	145 74%
-2.3 86%	14.6 79%	2.0 78%	-	0% 49%	-1.2 90%	-0.7 87%	0.0 82%	157 64%	141 61%	137 66%	131 67%	158 65%
-0.9 96%	8.4 96%	-2.9 85%	-20 66%	5% 42%	-1.2 92%	-0.1 84%	0.3 70%	161 61%	152 61%	146 68%	135 71%	162 62%
-0.7	3.3	0.1	-4	1%	-0.1	0.0	0.0	130	130	133	127	126

- Make a decision using all available data such as a breeding index and individual trait measurements to ensure other traits also meet your objectives i.e. fleece weight.

Sheep Genetics have a number of studs and sires that have ASBVs for important indicator traits for breech strike such as breech wrinkle and worm egg counts, dags and breech cover. Figure 6.4 shows the trait leaders for breech wrinkle score ASBVs. Sires with a negative figure for early breech wrinkle (EBWR) will produce progeny that are plainer than those with positive figures.

For a list of the current top low-breech-wrinkle sires please visit the Merinoselect website on www.sheepgenetics.org.au

Selecting ewes

To identify the best ewes for resistance to breech strike, score the flock for the indicator traits that are most important in your environment. These are likely to be a combination of:

- breech wrinkle
- dag
- breech cover
- wool colour.

Multiple trait Breeding Values should be used to select for resistance to flystrike and at the same time other important production traits. However, a number of the indicator traits have to be measured at different times during the year, which means that it becomes a multiple stage assessment process. For example, dag score in full wool and breech wrinkle in bare shorn animals.

For independent culling in a two-stage process:

1. Cull the lowest ranking animals on your selection system (visual plus production measurements such as growth rate, clean fleece weight and fibre diameter), preferably using a selection index and leave some capacity for further culling on this.
2. Cull for breech strike susceptibility by culling those animals with extremely high values (scores four and five) for the indicator traits appropriate for your environment until the required number of animals has been identified.

Some producers choose to cull susceptible animals as weaners and hoggets as early as possible due to their susceptibility and the risk in the flock. This requires that a proportion of the worst animals are culled in each trait, making sure that enough animals remain for selection on production traits as hoggets.

1. If 10 per cent are available for culling on breech strike traits and breech wrinkle is the most important trait in your environment, cull the highest 10 per cent scoring ewe lambs at marking. Continue to cull any animal that gets struck over its lifetime, as the animal is likely to become struck again and pass on its susceptibility to its offspring.
2. Those animals remaining at ewe selection time can be selected using the usual selection for production traits.

Whilst breeding for these traits will not prevent all strikes, it will immediately decrease your flock's susceptibility to flystrike but many years of selection is required to make large scale improvement.

Impact on other productivity traits

The more traits that are used in selecting superior animals, the slower the genetic gain in a particular trait. This is due to having to choose animals that have the highest combination of scores of all traits, which may eliminate some animals with high scores in just one individual trait. The advantage is that sheep enterprises usually require sheep with multiple traits such as low fibre diameter, high weaning weight and high clean fleece weight.

Choosing to breed for plainer sheep through selecting on breech wrinkle score with no selection on fleece weight will decrease fleece weight, just as selecting on clean fleece weight will increase micron.

Analysis of sires across Australia has shown there are always individuals within a mob with low breech wrinkle scores and higher than average fleece weights. Figure 6.5 demonstrates not only the variation amongst different rams, but also that sheep with high fleece weight and low wrinkle score (animals within the left top quadrant have both high greasy fleece weight (GFW) and low wrinkle score) do exist in the national flock. Thus, selecting for reduced wrinkle score should not necessarily result in a decrease in fleece weight.

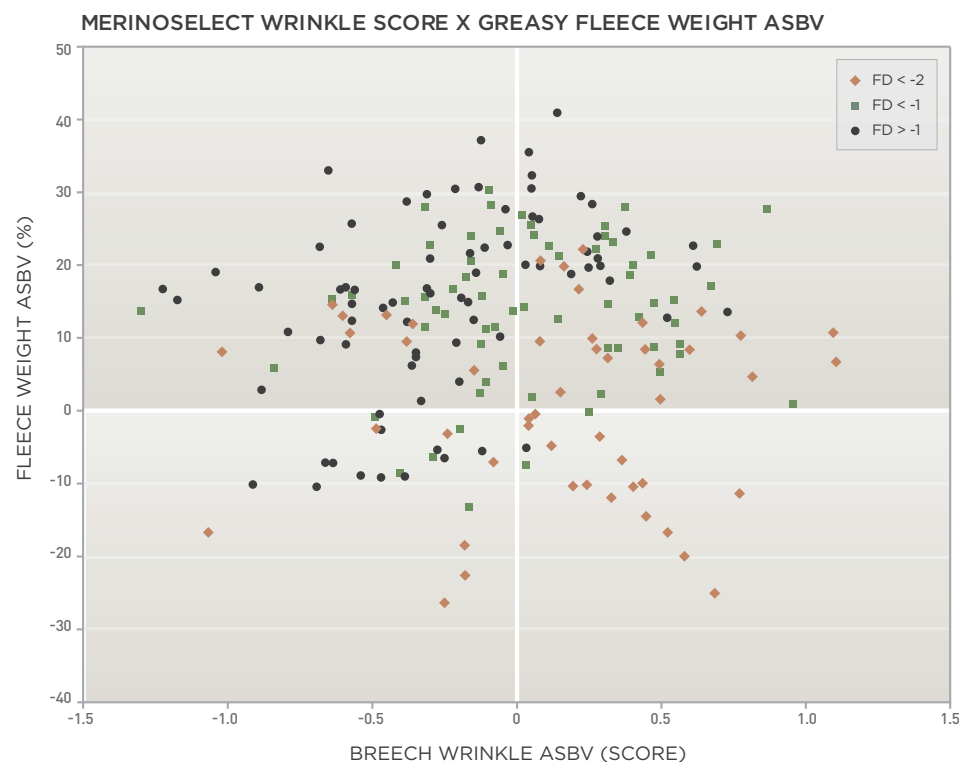


Figure 6.5: The variation in progeny greasy fleece weight compared to the breech wrinkle score from 560 sires involved in sire evaluation trials across Australia. *Source: www.sheepgenetics.org.au & www.merinosuperiorsires.com.au*

The latest research shows that there are additional traits as yet unknown factors that make animals more or less resistant than others. Research is currently underway to identify other indicator traits that attract flies. In the future these traits could be included in selection for breech strike resistance in conjunction with the current indicator traits.

Selecting against wrinkle does not mean you will lose GFW.



Conclusion

Reducing your flocks susceptibility to flystrike is essential for increasing the productivity of your sheep enterprise.

Both mulesed and non-mulesed sheep have the potential to become fly struck, so breeding sheep that are resistant, regardless of whether you still mules, will give you benefits.

The National Wool Declaration is now an integral part of the Australian wool supply chain and by filling out a National Wool Declaration when selling your wool, it shows that you are responding to the requests of the supply chain.

Whilst breeding genetically flystrike resistant sheep is the long-term aim, there is a need for interim management solutions. Good planning for these interim solutions is essential! By having clear breeding objectives, and by following management practices outlined in this publication, we believe you will be able to reduce your flock's susceptibility to flystrike.

Further information and contacts



AUSTRALIAN WOOL INNOVATION (AWI)

www.wool.com

- Latest news and information on managing flystrike
- Visual Sheep Score guide
- Link to Flystrike pages www.wool.com/flystrike



FLYBOSS

www.flyboss.org.au

- Tools and further information on managing flystrike



DEPARTMENT OF AGRICULTURE AND FOOD, WESTERN AUSTRALIA

www.agric.wa.gov.au/mulesing

- Non Mulesing Network Newsletter



DEPARTMENT OF EMPLOYMENT, ECONOMIC DEVELOPMENT AND INNOVATION QLD

www.deedi.qld.gov.au



NSW DEPARTMENT OF PRIMARY INDUSTRIES

www.dpi.nsw.gov.au



DEPARTMENT OF PRIMARY INDUSTRIES VICTORIA

www.dpi.vic.gov.au

Other Contacts:



SHEEP CRC

The Sheep CRC (CRC for Sheep Industry Innovation) is a partnership of Australia's leading sheep industry organisations and provides information on new products, services and technologies.

www.sheepcrc.org.au



SHEEP GENETICS

Provides national genetic information, e.g ASBV'S for breech wrinkle score, and evaluation services for the meat and wool sectors of the sheep industry.

www.sheepgenetics.org.au



WORMBOSS

Provides the most comprehensive and effective information on managing worms.

www.WormBoss.com.au

Appendix 1

AWI RESEARCH, DEVELOPMENT & COMMUNICATIONS STRATEGY: BREECH FLYSTRIKE PREVENTION

Updated September 2010

Australian Wool Innovation (AWI) is the research, development and marketing organisation for the Australian wool industry. Flystrike prevention - a highly complex issue - is AWI's number one research priority. Since 2005, AWI has invested \$A25 million on breech flystrike prevention Research and Development. Considerable progress has been made and AWI remains committed to a fast-tracked research, development and extension (RD&E) program to reduce the reliance on surgical flystrike prevention and improve the lifetime welfare outcome for sheep.

Australian farmers have been and continue to be committed to the highest standards of animal welfare. Caring for the welfare and protection of their sheep is a daily concern for woolgrowers.

AREAS OF INVESTIGATION	OBJECTIVE	CURRENT STATUS/ PROGRESS MADE	OUTCOMES	PARTNERS WITH AWI
IMPROVEMENTS TO CURRENT MANAGEMENT PRACTICES TO REDUCE FLYSTRIKE	Reduce the reliance on surgical procedure and to improve animal welfare	Majority of studies completed and incorporated into the 2005-2010 R&D Strategy.	Identification of specific areas requiring further R&D.	State DPI agencies, Sheep CRC, CSIRO, Universities of Melbourne, Adelaide and Sydney
BREEDING & SELECTION	Identify the incidence of flystrike resistance in current population	Incidence in population identified completed June 2010	10% of Merino flock estimated to be highly resistant to breech flystrike.	CSIRO & Department of Agriculture and Food Western Australia (DAFWA)
	Determine the relative importance of the four main breech traits (breech wrinkle, dags, breech cover and wool colour) and their association with flystrike	Completed June 2010	Relative importance varies between environments and sheep types but results indicate all four breech traits warrant the creation of Australian Sheep Breeding Values (ASBVs) breeding tools	
	Identification of breech trait heritability and correlations with production traits	Release of trait heritabilities and genetic correlations with other important traits published June 2010	Improved heritabilities and correlations to be utilised in the creation of ASBVs	CSIRO & DAFWA
		Update of trait heritabilities and genetic correlations with greater accuracy due to increasing number of records June 2012		
	Conduct R&D to produce ASBVs for main breech traits	ASBVs for wrinkles and dags completed	Development of prototype R&D ASBVs and then commercial release	Sheep Genetics, Meat and Livestock Australia (MLA) & Animal Genetics and Breeding Unit (AGBU)
		ASBVs for wool colour and breech cover ongoing		
	Launch and extend ASBVs to industry	ASBVs for wrinkles launched in September 2009	ASBVs released enabling growers to achieve improved welfare and production outcomes, through selection of sheep with natural resistance	Sheep Genetics
		ASBVs for dags to be launched September 2010 ASBVs for wool colour and breech to be launched in 2011		
Identify as yet unknown causes of flystrike	Interim report of investigations of continuing unknown flystrike causes due June 2012	Creation of further breeding tools or selection criteria if warranted	CSIRO & DAFWA	
Identify DNA associations & gene markers with flystrike resistant traits	Interim report identifying associations due 2011 with final reports due 2014.	Genomic enhanced, more accurate early-in-life breeding and selection tools	Sheep Genomics & Sheep CRC	
BREECH MODIFICATION DEVELOPMENTS	Develop non-surgical breech flystrike prevention alternatives	Commercial launch of anti-flystrike clip in 2009 following clip R&D	Alternative cost-effective options for flystrike prevention.	Leader Products, Joan Llyod Consulting, Strategic Bovine Services, et al
		Continuing R&D into an intradermal compound - SkinTraction™ - and registration through the Australian Pesticides and Veterinary Medicines Authority (APVMA).		Cobbett Technologies Pty Ltd
		Commercialisation of SkinTraction™ commencing 2011 conditional on the successful completion of the R&D phase.		
		Continue to investigate any novel potential alternatives		Variety of organisations

AREAS OF INVESTIGATION	OBJECTIVE	CURRENT STATUS/ PROGRESS MADE	OUTCOMES	PARTNERS WITH AWI
BREACH MODIFICATION DEVELOPMENTS	Develop a welfare-improved surgical procedure	National Mulesing Accreditation Program (NMAP) training delivered nationwide to contractirs and growers	Welfare improved surgical procedure	Kondinin Group
		Commercial of release of pain relief product in 2006		Bayer Australia
		Identification of optimal product and subsequent development of pre-analgesia treatment		Various pharmaceutical companies
IMPROVED MANAGEMENT PRACTICES	Investigate and monitor the impact on welfare and productivity of farms using alternative options	Development of a national program to collate existing data and case studies from research trials and on-farm data	Providing examples, details and outcomes to growers.	Sheep CRC & State departments of primary industry (DPIs)
GROWER, INDUSTRY & DOMESTIC STAKEHOLDER EXTENSION, TRAINING & COMMUNICATIONS	Provide woolgrowers, the domestic wool industry and relevant stakeholders updates of the RD&E outcomes and welfare advances	Current R&D progress published on website	To ensure the information is available and accessible to stakeholders to manage breech flystrike prevention, improve animal welfare and to provide stakeholder feedback to AWI.	Variety of wool RD&E partners
		Case studies published quarterly in 'Beyond the Bale', distributed to 29,000 woolgrowers nationwide since 2005		State DPI agencies (eg DAFWA non-mulesing network), Sheep CRC, Australian Wool Exchange (AWEX), Ram Breeders
		Monthly emails to AWI nationwide grower networks for a number of years		AWI Nationwide Grower Extension Networks
		Nationwide grower workshops		Sheep CRC, AWI Grower Networks, State DPIs, AWEX, various Woolbrokers
		Roadshows, field days, ram sales, sheep shows, grower conferences, broker client meetings		In association with a range of grower service providers and consultants
		Woolgrower Forum held every six months		In association with leading Australian Growers
		AWI Industry Consultative Committee (ICC) meets three times a year		In association with grower organisations, WoolProducers Australia, Australian Wool Growers Association, Australian Superfine Wool Growers Assoc., Australian Assoc. of Stud Merino Breeders
		Animal Welfare Forum held bi-annually		Australian Welfare Groups, RSPCA, Animals Australia, Animal Liberation, Compassion in World Farming, Australian Veterinarian Assoc. (AVA)
		Engagement of woolbrokers on regular basis		Various brokers
		Quarterly meetings with DAFF		Department of Agriculture Fisheries and Forestry (DAFF)
INTERNATIONAL SUPPLY CHAIN EXTENSION, TRAINING & COMMUNICATIONS	Develop and maintain efficient two-way communication along supply chain between grower and retailer	National Retail Federation (NRF) & British Retail Consortium (BRC) Quarterly Updates & annual visits	To ensure international stakeholders are provided with R&D developments and progress, production status, and demonstration of ongoing commitment to animal welfare. To ensure feedback from international stakeholders to growers	AVA, AWEX, Retail Associations and supply chain partners
		Ongoing support to individual retailers, brands and processors as required		
		Monitoring and reporting of NWD declared volumes; provision of information to identify appropriate direct supply chains;	Buyers and processors source Australian wool consistent with their requirements.	

www.wool.com



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