Breeding for Breech Strike Resistance Project

WA Issue 5

This project is a collaborative effort with research performed by the Department of Agriculture and Food Western Australia and CSIRO with funding provided by AWI

EDITORIAL

The original WA breech strike project started off in 2005 by sourcing representative ewe lambs at marking time from 10 different industry flocks, as well as ewes from WA research flocks for the 2006 mating. In addition, rams that showed indicator traits that could contribute to make them more or less resistant to breech strike, were also sourced from research and industry flocks. During the past 5 years, a large body of production and visual classing and scoring information has been collected from the sheep in this experiment. This information has been used to help identify dags, wrinkle and breech cover as key indicator traits for breech strike in a Mediterranean environment. This lead to the development of a standardised scoring system and assisted the introduction of Australian Sheep Breeding Values (ASBVs) for these traits. This information has also allowed us to show that for WA type sheep breeding plainer animals with open faces will not reduce overall production but rather will result in increases in reproduction rates as well as other 'easy care' benefits. The benefits are expressed as more lambs weaned, increasing the profitability of such sheep over the original more wrinkly sheep with only a small trade-off in fleece weight.

This newsletter summarises the main outcomes of this trial to date.

AWI APPROVED NEXT PHASE

We are pleased to announce that Australian Wool Innovations Ltd has approved funding of the next phase of this research to find additional indicator traits for breech strike resistance. This will be a three year project and this phase will focus on the role of odour secreted by resistant and susceptible sheep in attracting blowflies. The work has already started, and a young bright Ph. D. student has started working on this topic. Initial results look very promising. See the section on **Next research phase focuses on odour** in this newsletter for more information.

GENETIC DIFFERENCES BETWEEN SIRE PROGENY GROUPS FOR BREECH STRIKE RESISTANCE

The breech strike project in WA has progeny tested 49 different sires from industry and research flocks, from 2006 to 2009 for breech strike resistance from birth to hogget shearing. No preventative management treatments such as mulesing, crutching or jetting were applied in order to allow the animals to be challenged by flies. The incidence of breech strike in the unmulesed progeny of these 49 sires are shown in Figure 1. The many medium coloured blue bars in the graph below shows the results of individual sires that were used only once, while the other coloured bars shows the results of 10 sires that were used in different years to generate genetic links between years. For example the red bars in 2006 and in 2009 shows that this sire had progeny in these two years. Similarly for the purple bars in 2008 and 2009, etc.

The average incidence of breech strike over the four years was approximately 27% where no preventative management treatments were applied. The incidence of breech strike per sire progeny group ranged from 2.5% to 103%. Three sires that were used in different years, changed ranking while others continued to be ranked similarly. With relatively small progeny groups, especially for categorical traits such as breech strike, re-ranking of sires is always a possibility as had happened in this flock.

The results clearly show that large differences exist between sires within each year for breech strike. This implies that there are sires that are resistant to breech strike in all flocks. Thus it is important to develop methods to identify these sires accurately without the need to challenge the animals with flies. This was the purpose of this experiment and the results to date are given below.

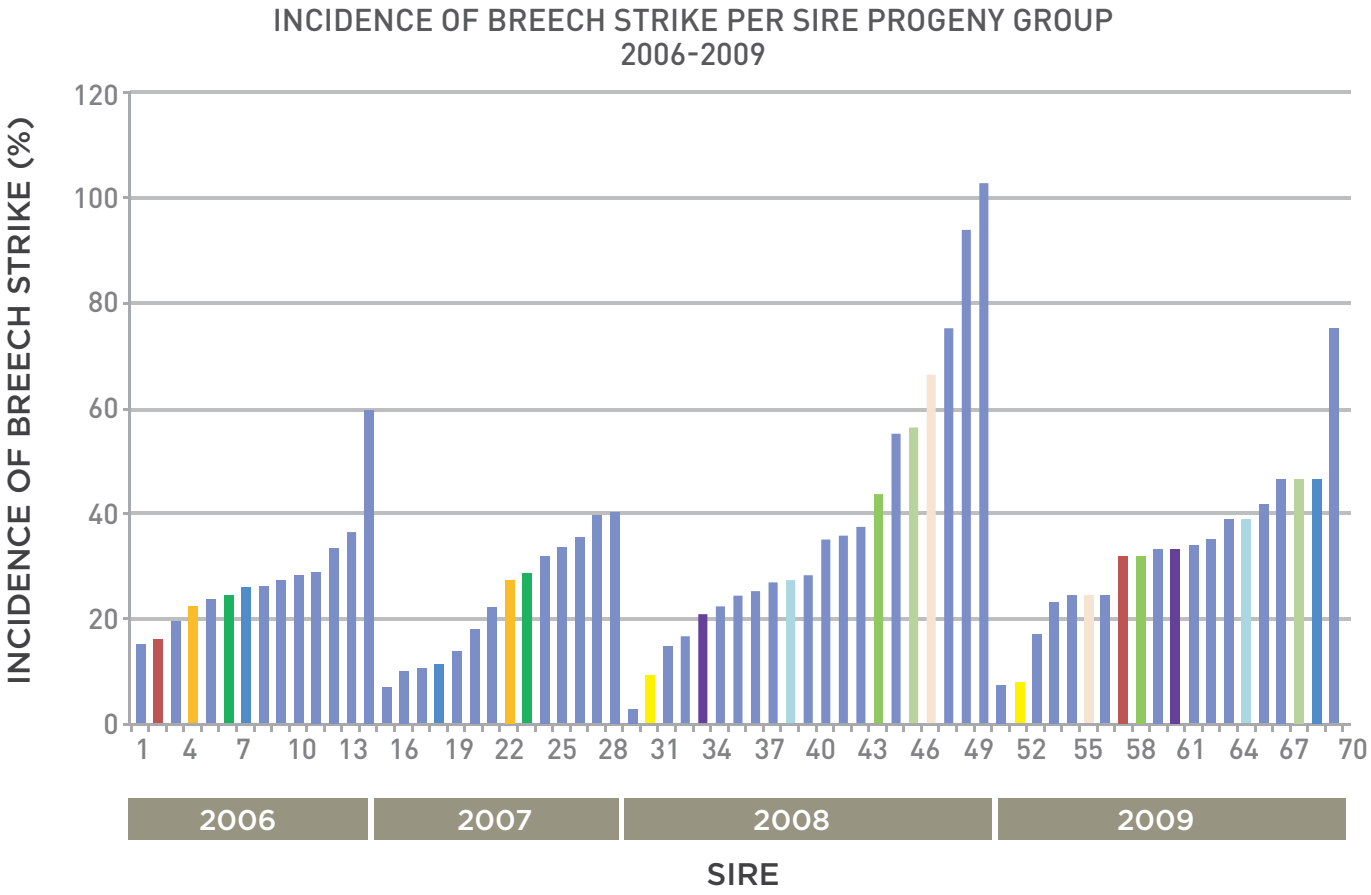

Figure 1. Incidence of breech strike from birth to hogget age per sire progeny group from 2006 to 2009.

Finding effective indicator traits for breech strike resistance/susceptibility in Merino sheep in Mediterranean regions

The Mt Barker flock of the Department of Agriculture and Food WA (DAFWA), and its "sister" breech strike flock at CSIRO Chiswick research station in NSW, were established to identify traits that could be used as effective indicators to breed indirectly for breech strike resistance. In the Mt Barker flock 77 skin, body conformation, wool, disease and production traits were identified that may contribute to breech strike, and these were scored on all progeny. Specific traits that were recorded include wrinkles and wool cover on different parts of the body, dags, urine stain, wool colour, and all the normal growth and production traits. Individuals were scored at birth, weaning, post-weaning, yearling, winter, spring and at pre- and post-hogget age at approximately 18 months of age in the DAFWA flock. Thus a large number of traits were measured and scored from birth to after hogget shearing on 2,833 unmulesed sheep. No preventative treatments such as drenching, jetting or crutching prior to the fly season were applied to these progeny. The traits that were subjectively scored or objectively measured are listed in Tables 1 and 2, respectively.

DEFINITION OF TRAIT	DEFINITION OF TRAIT
Number of breech strikes from birth to hogget shearing	Urine stain at marking
Number of breech strikes from weaning to hogget shearing	Urine stain at yearling
Birth coat	Urine stain pre-hogget shearing
Breech cover at marking	Wool colour at weaning
Breech cover at pre-weaner shearing	Wool colour in spring
Breech cover at post-weaner shearing	White shoulder pre-hogget shearing
Breech cover at yearling	Wrinkle of breech at marking
Breech cover post-hogget shearing	Wrinkle of breech at yearling
Crutch cover at weaning	Wrinkle of breech post-hogget shearing
Crutch cover at hogget shearing	Wrinkle of neck post-weaner shearing
Dag moisture score in spring	Wrinkle of rump at yearling
Dag moisture prior to hogget shearing	Wrinkle of rump post-hogget shearing
Dagscore at marking	Wrinkle of body at birth
Dagscore at weaning	Wrinkle of body at yearling
Dagscore post-weaner classing	Wrinkle of body post-hogget shearing
Dagscore at yearling	Wrinkle of tail wrinkle at marking
Dagscore in spring	Wrinkle of tail pre-lamb shearing
Dagscore prior to hogget shearing	Wrinkle of tail post-weaner shearing
Facecover at weaning	Wrinkle of tail post-hogget shearing
Facecover at yearling	Tail size at marking
Facecover at pre-hogget shearing	Tail width at marking
Belly cover yearling	Faecal consistency score at weaning
Belly cover pre_hogget shearing	Faecal consistency score in spring
Belly cover post-hogget shearing	
Belly pluckscore	

Table 1. List of breech strike traits and subjectively classed traits scored in the breech strike flock at Mt Barker WA.

DEFINITION	DEFINITION
Greasy fleece weight	Bare area width across anus at marking
Clean fleece weight	Bare area depth from base of tail down to the groin across the anus at marking
Fibre diameter	Tail length at marking
Standard deviation of FD	Tail bare length at marking
CV of fibre diameter	Tail width at marking
Fibres below 15 micron	Tail bare width at marking
Fibres above 30 micron	Worm egg count at weaning
Coarse edge	Worm egg count in spring
Comfort factor	Worm egg count at weaning
Staple strength	Worm egg count in spring
Staple length	
Yield	
Fibre curvature	
Standard deviation of Curvature	

Table 2. List of objectively measured traits conducted on the progeny in the breech strike flocks at Mt Barker WA.

Traits that have the greatest potential to be used as indicator traits are those traits that are genetically correlated to breech strike. Traits may be correlated phenotypically with breech strike but if traits are not genetically correlated, they will not result in correlated responses in the progeny and thus will not be useful in breeding programs for breech strike resistance.

Table 3 shows the indicator traits that have the highest genetic correlation with breech strike and their heritability estimates. The table also shows the correlated response (CR) in breech strike by selecting on the indicator trait, compared to the predicted response (R) by selecting directly for breech strike resistance. It was assumed that the selection intensity for both traits is the same.

INDICATOR TRAIT	HERITABILITY	se	r_g	se	CR/R
Dags pre-hogget shearing	0.37	0.05	0.81	0.15	0.60
Urine stain at weaning	0.55	0.09	0.54	0.13	0.59
Dags in spring pre-shearing	0.37	0.05	0.77	0.13	0.57
Neck wrinkles at marking	0.62	0.09	0.38	0.13	0.47
Neck wrinkles at post-hogget shearing	0.50	0.08	0.46	0.13	0.47
Body wrinkle post hogget shearing	0.68	0.06	0.34	0.11	0.45
Dags post weaning	0.36	0.06	0.62	0.13	0.45
Dag moisture at yearling age	0.63	0.08	0.34	0.13	0.44
Dags at yearling age	0.63	0.08	0.34	0.13	0.44
Face cover at weaning	0.79	0.08	0.28	0.10	0.44
Dag moisture pre hogget shearing	0.24	0.10	0.85	0.21	0.41
Face cover at yearling age	0.73	0.05	0.27	0.10	0.39
Breech wrinkle at yearling age	0.73	0.05	0.27	0.10	0.39
Dag moisture in spring	0.25	0.09	0.73	0.20	0.37
Dags at weaning	0.28	0.06	0.64	0.14	0.36
Dags at marking	0.34	0.06	0.50	0.13	0.34
Neck wrinkles post weaner shearing	0.64	0.09	0.26	0.15	0.34

Table 3. Heritability estimates with standard errors (se) of the most important indicator traits for breech strike their genetic correlation (r_g) and standard errors (se) with breech strike and the predicted correlated response by selecting on the indicator traits relative to selecting directly for breech strike resistance (CR/R).

Table 3 shows that at Mt Barker, dags and dag moisture content scored at different ages, urine stain at weaning, neck wrinkle at marking, post weaning and post hogget shearing and facecover at weaning and yearling, are the most effective indicator traits. The expected rate of gain by selecting on dags at pre hogget shearing will be 60% of that of selecting directly on breech strike.

It is interesting to note that facecover is a better indicator trait than breech cover. Although breech cover is a moderately heritable trait (about 40%), the results show that it is less strongly correlated with breech strike than face cover, and therefore it is of less value as an indirect indicator trait for breech strike.

The fact that neck wrinkle is a better indicator trait than breech wrinkle may be related to the plainness of the DAFWA research flock as it is more difficult to score breech wrinkles on low breech wrinkle sheep. This is probably because wrinkles on the neck have greater variability than on other sites on the body, giving a better indication as to what the skin is like under the breech wool. As the wrinkle traits across the body are very highly correlated and thus genetically the same trait, reducing any wrinkle trait will reduce wrinkle across the body and therefore will have a beneficial effect on breech and body strike.

Productive rams are also resistant to breech strike

There is a perception that sheep that are genetically resistance to breech strike have a lower wool production. Growers make this assumption as there is a positive genetic relationship between breech cover and wool production and between body wrinkle and wool production. This has lead to the belief that selection for plain sheep (low wrinkle and low breech cover) to reduce breech strike will lead to reduced overall production. However, the following graphs in Figure 2 show the genetic relationship between the ASBV of the incidence of breech strike of each sire's progeny group against yearling body weight, fleece weight and fibre diameter, and against late dags, breech cover and breech wrinkle as supplied by Sheep Genetics.

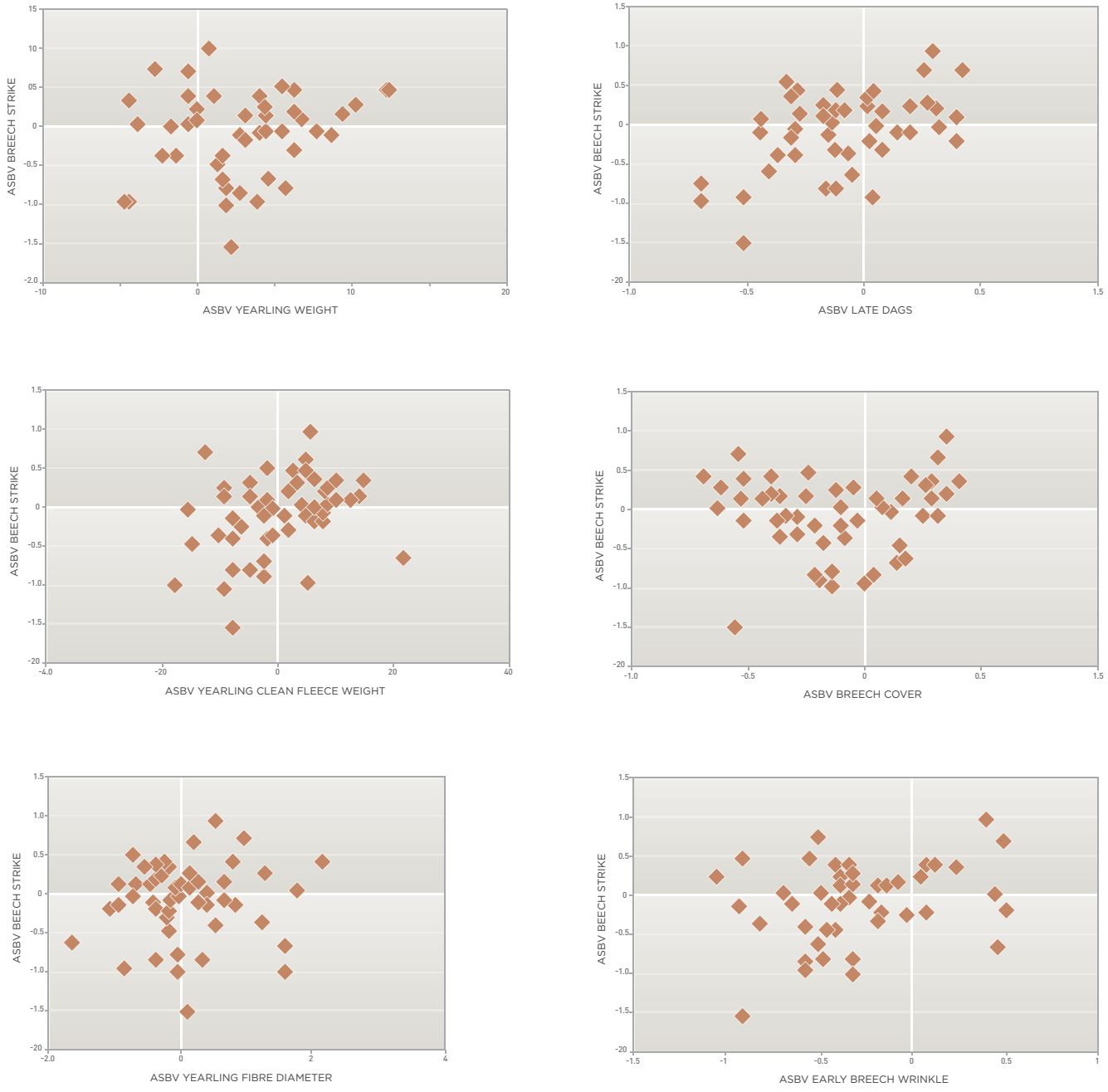

Figure 2. Sire Breeding values for breech strike against yearling, dags, yearling late breech cover, fibre diameter and indicator breech wrinkle.

Figure 2 shows that yearling body weight and fibre diameter are not related to ASBV for breech strike. Only clean fleece weight shows a slight positive relationship. However, two rams in the right bottom quadrant of the clean fleece weight graph clearly shows that there are rams that are more resistant to breech strike and also above average wool producers. This relationship is not as tight as between fleece weight and fibre diameter, which clearly indicates that breeders will be able to select simultaneously for high wool producers that are also more resistant to breech strike.

Figure 2 also shows that the indicator traits dags and breech wrinkle, have a positive relationship with breech strike which indicates that selecting for low dags and low wrinkles will reduce breech strike. Breech cover appears to have a U-shape relationship with a significant increase in breech strike when breech cover has a positive ASBV. More data is needed to confirm this pattern but again this indicates that reducing high breech cover scores will reduce susceptibility of breech strike.

Figure 3 shows the relationship between ASBV of breech strike and the 7% Micron Premium (MP) dual purpose index and the 10% MP index that includes staple strength. The 7%DP index places about an equal amount of selection pressure on meat and wool production traits, while the 10% MP index aims to reduce fibre diameter, improve staple strength while fleece weight increases slowly.

The important conclusion from these two graphs is that there is no relationship between breech strike and the genetic level of overall production as expressed by these two different indexes. Progeny of rams with index values of 150 and higher were amongst the most resistant progeny groups. This clearly indicates that resistant sheep can also be highly productive and profitable sheep.

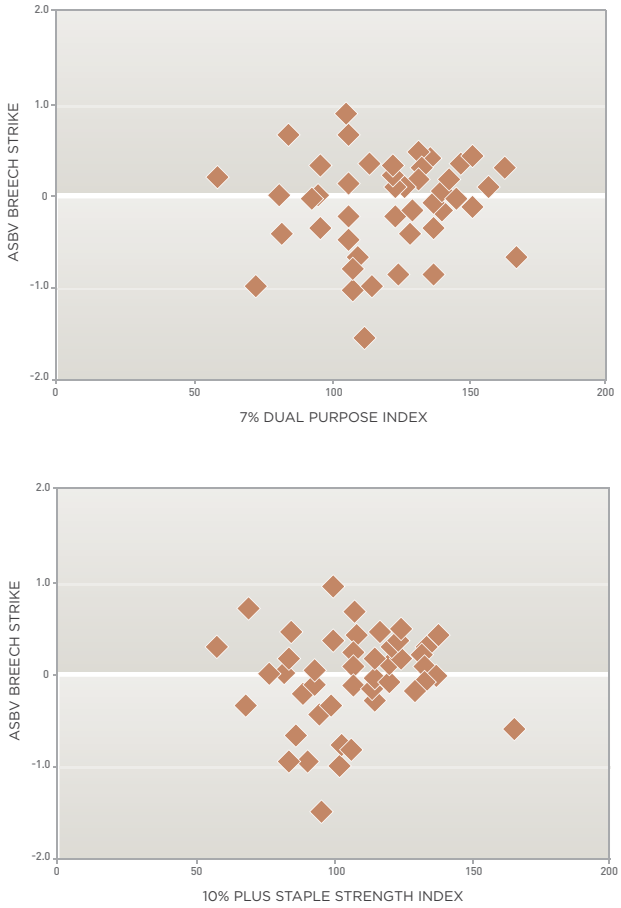

Figure 3. Relationship between ASBV of breech strike and the 7% DP and the 10% plus selection indexes from Sheep Genetics.

Additional benefits of selecting on indicator traits for breech strike

The known indicator traits of breech strike at Mt Barker, i.e. dags, wrinkle, breech cover and urine stain, are not only strongly associated with breech strike resistance but are also closely linked to the concept of easy care or low input sheep. Low input sheep require less intervention such as mulesing, less chemical usage from jetting, and less labour for crutching and general handling. Our results are summarised in the following graphs. Figure 4 shows that wrinkly ewes wean less lambs even for relatively low wrinkle scored ewes.

Figure 5 shows that ewes with high breech cover are less fertile than bare breech ewes and wean more lambs.

Similarly as for breech cover, ewes with higher face cover scores also weaned less lambs than clean faced ewes (See Figure 6). These results in Figures 4, 5 and 6 are consistent with research carried out 60 years ago by Bob Dunn in New South Wales. He showed that plain bodied ewes with open faces, have higher reproduction and better survival rates than wrinkled ewes with muffled faces. It is the first time, however, that we showed that breech cover shows the same pattern as face cover, which is due to the fact that these two traits are strongly correlated. Skin folds and muffled faces are proven faults and animals with scores higher than 3 for these traits should be considered to be culled.

The higher reproduction rate of plain bodied, bare-faced and bare breech ewes as shown in Figures 4, 5, and 6 also resulted in an increased profitability. The predicted gross income from using the actual wool and meat production records of our selection line which consist of more plain bodied, bare-faced ewes than our unselected control line, is shown in Figure 7 for different wool to meat price ratios.

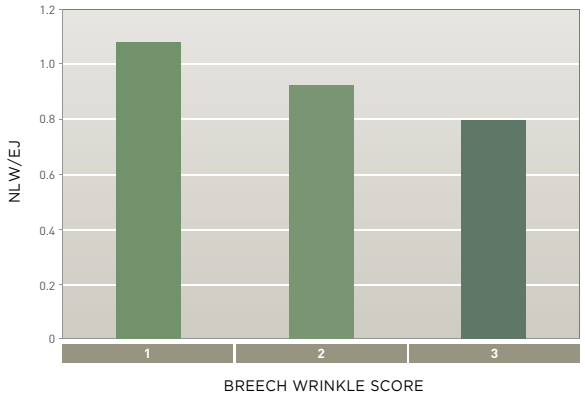

Figure 4. Relationship between wrinkle and lambs weaned per ewe joined (NLW/EJ)

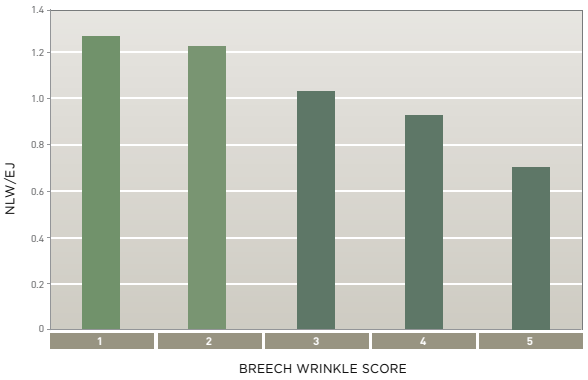

Figure 5. Relationship between breech cover and lambs weaned per ewe joined (NLW/EJ).

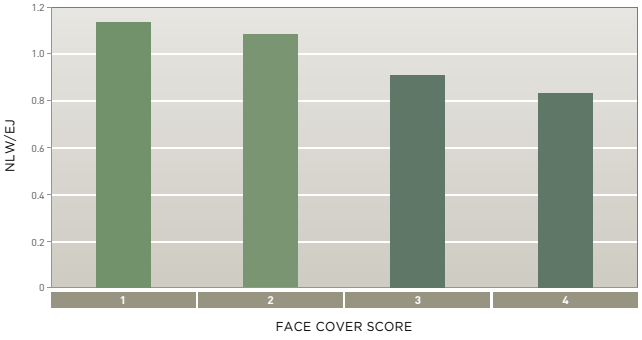

Figure 6. Relationship between face cover and lambs weaned per ewe joined (NLW/EJ).

Previous results have shown that the selection line produced about 100 grams less clean wool per sheep but their larger number of lambs weaned per ewe joined completely compensated for this small loss in wool production. It is clear that the resistant line is significantly more profitable than the control line and the difference in profitability increased with higher meat and wool prices. These results were achieved without considering the amount of labour and the time necessary to crutch and jet animals from these two lines.

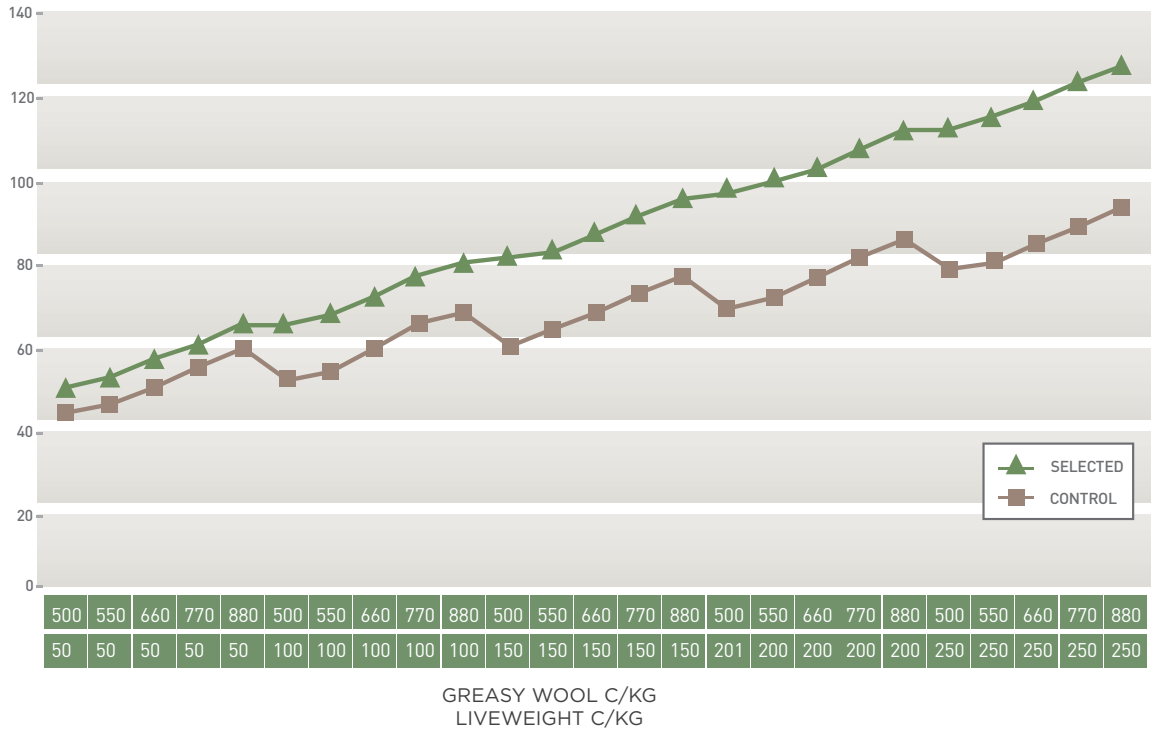

Figure 7. Gross return of the selection line that consist of more plain, open faced ewes compared to ewes in the unselected control line from Mt Barker research flock, using different wool and live weight prices.

ESTABLISHING A RESISTANT AND A CONTROL LINE FOR FURTHER GENETIC STUDIES ON BREECH STRIKE

A mixture of highly resistant and susceptible sheep from the AWI breech strike flock at Mt Barker.

The Breech strike flocks at Mt Barker and at CSIRO in New South Wales are today the best characterised research flocks for breech strike in Australia. This has enabled us to identify animals that are genetically more and less resistant to breech strike. This year we have identified 300 of the most resistant ewes for the selection line, and 300 of the remaining ewes as control ewes for future studies on breech strike. They have been selected so that there are minimal differences in any of the fleece production traits between these two lines. The average 7%MP index of both these two lines is 135%, which is slightly above the average for industry flocks that contributed production data to Sheep Genetics. The following picture shows some of the extreme ewes from the selection and control line.

No obvious visual differences exist between the very resistant and very susceptible mature ewes in these two lines in short wool before the dag season. They are therefore ideal to investigate the other unknown underlying biological factors that make animals more or less resistant to breech strike.

Geoff Lindon (AWI) inspects the AWI breech strike flock at Mt Barker with Nicky Stanwyck.

NEXT RESEARCH PHASE FOCUSES ON ODOUR

The focus of the next phase of this research program is to determine whether odour plays a significant role in attracting and/or repelling blowflies to sheep. We have done preliminary studies by training two dogs to differentiate between resistant and susceptible sheep. This was done by Hanrob Dog Academy and preliminary results are very encouraging. Research with hornflies in cattle has shown that some animals that are resistant actually secrete chemical odours that repel hornflies while other cattle secrete chemicals that attract hornflies. If this is also found in sheep then exciting breeding opportunities as well as novel clean and green options will become available on how to control blowfly strike in sheep.

ACKNOWLEDGEMENTS

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