Flystrike resistance in breeding programs for commercial flocks

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Summary

Commercial producers need to be able to understand and set specific breeding objectives that include flystrike resistance. Wider access is needed to advisers with the skills to assist commercial producers in setting breeding objectives.

Information is needed on comparative bloodline performance in fleece rot resistance to allow commercial producers to meet their objectives. Wether comparisons should be encouraged and assisted to routinely record information on fleece rot. Statistical methods need to be developed that allow the inclusion of fleece rot information into the combined wether comparison analyses.

Improved availability and quality of information on breeding objectives and rates of progress in fleece rot and flystrike resistance from ram breeders; commercial producers need to be able to interpret and assess this information. Increased ability of advisory services to assist producers to identify suitable bloodline options for the selection of flock rams to breed for fleece rot and flystrike resistance.

Keywords

Flystrike, body strike, fleece rot, resistance, commercial flock

Introduction

To achieve genetic improvement in flystrike and fleece rot resistance as well as other traits in the commercial flock through an appropriate choice of bloodline, the breeding program of the commercial producer needs to (Atkins, 1997):

- set a flock breeding objective that includes flystrike resistance;
- benchmark current performance to identify and evaluate potential alternative bloodlines; and,
- evaluate the breeding programs of the alternative ram sources.

This review will describe briefly each of these steps and the information available currently to implement each of these steps in a commercial breeding program. Issues affecting the inclusion of flystrike resistance in commercial breeding programs will then be identified.

Body strike, as well as its precursor fleece rot, is the only form of flystrike considered in this review, as information on the genetics of other forms of flystrike is limited. If the use of surgical methods to control breech strike is restricted by animal welfare concerns, the genetics of breech strike will need revisiting to allow breeding for breech strike resistance to be included in breeding programs.

Rationale

Genetic improvement of flystrike resistance in the commercial flock will largely be determined by the improvement made by that flock's ram source. The choice of ram source by a commercial producer is then critical and will affect both short- and long-term performance in the flock.

In the short-term, the flystrike resistance of many flocks may be limited by the performance of their current ram sources. In the long-term, genetic gain in commercial flocks will be governed by the current levels of flystrike resistance of their ram sources, the emphasis given to flystrike resistance in the breeding objectives of the ram sources and the efficiencies of the breeding programs used by the ram sources in achieving their objectives for flystrike resistance. The commercial producer must then identify a ram source whose breeding objective matches that of the commercial flock and which can show that acceptable rates of genetic change are occurring in the ram breeding flock.

Setting a breeding objective

To include body strike resistance in a production-based breeding objective for a commercial flock, the relevant part of the objective is best defined by a target level for improvement (Atkins and Mortimer, 1990). The objective then includes a statement on what levels of body strike resistance a commercial producer may wish to achieve in a flock. For example, valid breeding objectives for commercial flocks might include, together with economic values or target performance levels for the production traits, improvements in body strike resistance ranging from no change in resistance (to maintain the flock's resistance levels) to setting a target of having the flock resistant to body strike (to eliminate the need to apply chemical treatments).

In a survey of commercial wool producers, 92% of respondents were able to state their general breeding objective for the following 10 years but only 5% had a quantified objective (Pope *et al.*, 1996). An interpretation of this finding is that many commercial producers need the skills to be able to define specific breeding objectives for their flocks. The definition of breeding objectives for a commercial flock is among the issues addressed by the workshop, "Merino Breeding and Selection - a Commercial Focus", developed by the Merino Breeding Group of NSW Agriculture (Hatcher and Bayley, 1999). At present, commercial producers can be assisted in setting a breeding objective by a number of breeding services around Australia e.g. *Advanced Breeding Services*. Other breeding advisers (consultants, sheep classers, extension officers) should be assisted and encouraged to provide a similar service more widely.

Benchmarking of current performance

Genetic benchmarking seeks to identify the performance of the current ram source relative to alternative ram sources and the direction in which the breeding objective will lead. The combined wether comparison results of Coelli *et al.* (1996) make this a simple process for fleece weight and fibre diameter. Information on bloodline differences in fleece rot and body strike resistance has been largely limited to experimental studies. Differences in fleece rot and/or body strike resistance between Merino strains, highlighting the relative tolerance of the fine-wool strain and the relative susceptibility of the strong-wool strain, have been reported by Dunlop and Hayman (1958), Atkins and McGuirk (1979) and Atkins and Mortimer (1988). Raadsma *et al.* (1989) showed that similar strain differences were observed for both conditions when observed following experimental induction of fleece rot.

Between-bloodline correlations between natural and induced expressions of fleece rot (0.57) and body strike (0.70) showed that the different environments for expression produced slightly different traits (Atkins and Mortimer, 1988), so that differences between relatively susceptible bloodlines were reduced under the induction system than when expressed under natural environmental conditions. Atkins and Mortimer (1988) found that differences between the bloodlines were highly dependent on the incidence of the conditions. Differences increased as the incidence increased and bloodline ranking did not change greatly in different years, so that changes in bloodline performance between different environments (or years) were largely due to the scale of observation rather than differing susceptibility of bloodlines under different environmental conditions. In addition, similar amounts of variation between bloodlines within the medium-wool Peppin strain to the variation between strain were observed by Atkins and Mortimer (1988) for fleece rot and body strike. Relative to the within-bloodline genetic variation, the range in the medium-wool Peppin strain was equivalent to at least 4 generations of single-trait selection or, with variable incidence, much longer. Bloodline within strain differences in fleece rot and body strike resistance for medium-wool sheep had been reported earlier by Atkins and McGuirk (1979) and for fine-wool sheep, more recently, by Li *et al.* (1999). The ability to describe the variation in fleece rot resistance has been facilitated by the development of a standardised system of fleece rot scoring (Raadsma *et al.*, 1988). Murray and Mortimer (2001) give an illustrated description of the scoring of sheep for fleece rot.

A recent preliminary study has shown that it is possible to use wether comparison data to estimate bloodline differences in fleece rot severity (Mortimer and Atkins, 2001). From data derived from four wether comparisons, significant differences between bloodlines in fleece rot severity were found for 22 bloodlines (Figure 1), but these differences were estimated with limited precision. Differences in fleece rot incidence between the bloodlines were not significant. Much more data is needed to provide useful and reliable information for commercial producers on bloodline differences in fleece rot resistance. Organisers of future wether comparisons should be encouraged to score fleece rot on each animal. Better reporting of bloodline differences in fleece rot resistance from wether comparison data needs statistical methods to be developed that better account for the discontinuous distribution of the data and to avoid the possibility of apparent bloodline interaction that may be due only to scale effects (Mortimer and Atkins, 2001).

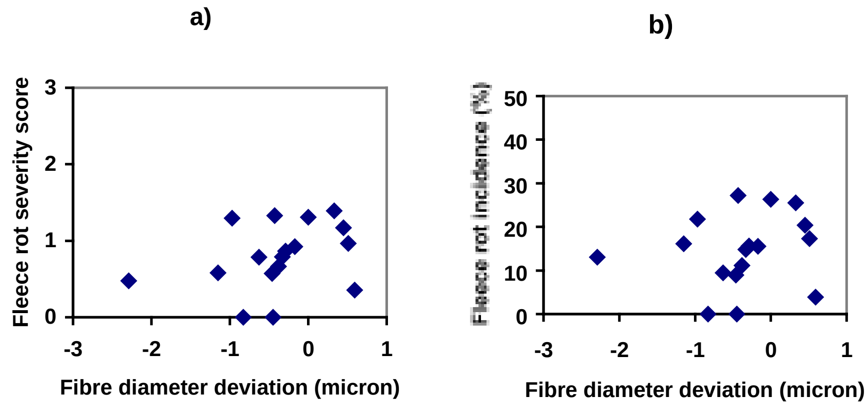

Figure 1. Bloodline trend for fleece rot severity (a) and incidence (b) versus fibre diameter deviation.

Because of their associations with fleece rot resistance at the bloodline level, research has identified a number of fleece traits which could be used as resistance indicators for fleece rot (Raadsma and Wilkinson, 1990; Raadsma, 1993). The most promising of these indicator traits include greasy wool colour (greater resistance with whiter fleeces), average fibre diameter (greater resistance with finer fibres), fibre diameter variability (greater resistance with more uniform fibre diameters), crimp frequency (greater resistance with higher crimp frequency) and staple length, thickness and uniformity (greater resistance with shorter, thinner and more uniform staples). The analyses of wether comparison data by Mortimer and Atkins (2001) also reported that bloodlines of greater fleece rot resistance had finer fibre diameter, better style and colour and shorter staple length.

Greasy wool colour is one trait which is recorded routinely in wether comparisons and could be used cautiously as an indicator of a bloodline’s susceptibility to fleece rot and flystrike. The more resistant bloodlines will tend to have lower levels of discolouration in the fleece and so better colour. The combined wether comparison results show that there is substantial variation between bloodlines in colour scores (Figure 2). Incidences of greasy colour in fleeces between the bloodlines ranged from 0% to 20% or more of fleeces showing colour. Another indicator of a bloodline’s susceptibility to fleece rot and flystrike recorded routinely in wether comparisons is of course average fibre diameter. Again, the combined wether comparison results could be used to identify bloodlines with reduced fibre diameter and desired production to achieve potentially an associated increase in fleece rot and body strike resistance. As for greasy wool colour, bloodline differences in staple length are provided by the combined wether trial results and could be used as a gauge of a bloodline’s comparative resistance. This information is unavailable currently for fibre diameter variability (although some individual wether trials do record these data), crimp frequency and staple thickness and uniformity. It must be stressed that these fleece traits (and other fleece, body and skin traits examined to date) are relatively inefficient indicators of a bloodline’s fleece rot resistance and so should be used carefully.

Nevertheless, the indicator traits highlighted here will be of benefit in predicting resistance of bloodlines when environmental and/or management conditions provide insufficient or no risk of fleece rot and body strike occurring. Alternatively, induced fleece rot resistance could be used to identify fleece rot resistant bloodlines under these conditions. Screening animals on induced fleece rot resistance following fleece rot induction based on the application of a standardised wetting, overcomes the environmental/management constraints to the natural expression of fleece rot resistance. Animal welfare issues would need to be addressed before screening using this procedure could be implemented.

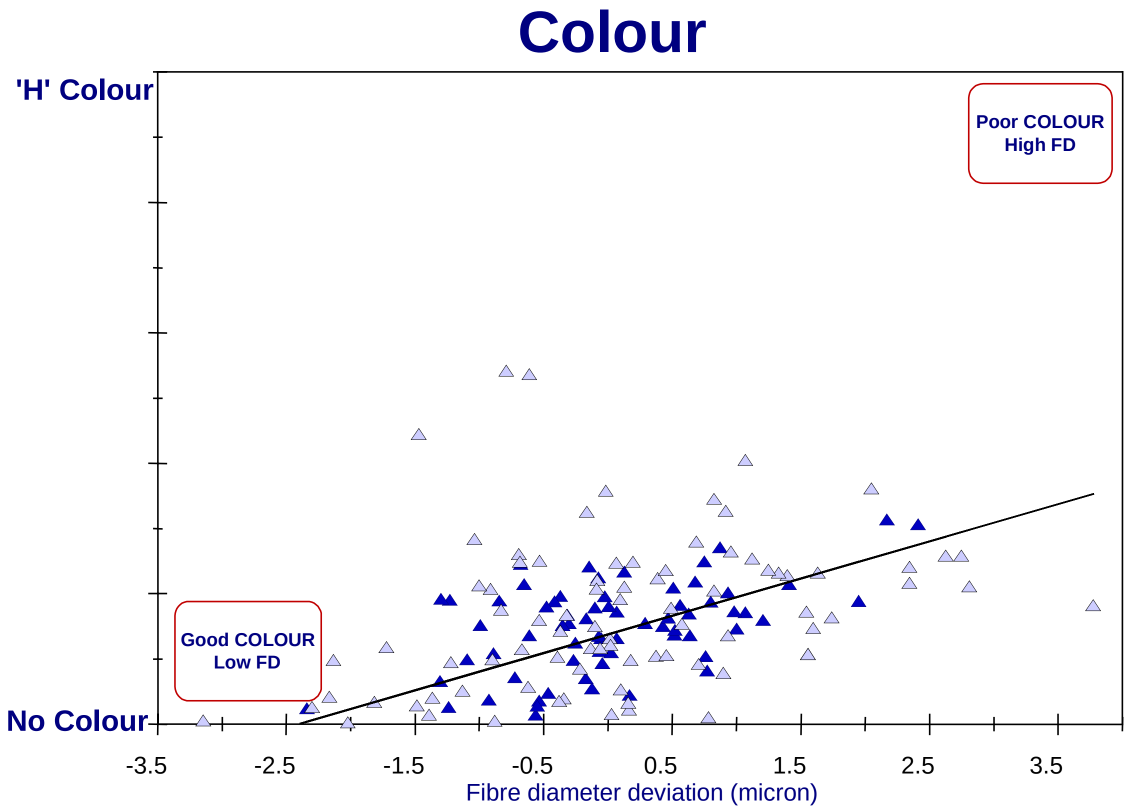

Figure 2. Bloodline trend for colour versus fibre diameter from wether comparisons (1984-1995). (Source: Coelli *et al*., 1996).

Evaluating progress in ram sources

Ideally, the commercial producer needs to know the breeding objective of his/her ram source and to have proof of progress towards that objective to be able to evaluate the rate of genetic improvement that will be achieved. Ram breeders, irrespective of whether body strike resistance is in their breeding objective, should be monitoring the sire selection process, by comparing the breeding values of selected sires with the potential breeding values of the top-ranked animals on all selection criteria. Commercial producers should be able to get this information from their ram breeder and use it to judge the ability of the ram breeder to provide the expected genetic improvements.

Where rams are bred in low incidence environments and then purchased for use in high incidence environments, the commercial producer has to judge as well if the rates of genetic gain in the ram breeding flock in body strike resistance will be sufficient to provide acceptable genetic changes in resistance in their own environment. In this situation, commercial producers will need both information and to be able to interpret this information. These issues are addressed by the workshop, "Merino Breeding and Selection - a Commercial Focus" (Hatcher and Bayley, 1999).

Opportunities for commercial producers

The appropriateness of a strategy to change the body strike resistance level of a flock will vary depending on the breeding objective set by the commercial producer i.e the amount of required change, if any, in body strike resistance for that flock. Substantial and significant changes in resistance levels will favour one strategy over another.

If large changes in body strike and fleece rot resistance are part of the commercial flock's breeding objective, then a change of bloodline is likely to be the best strategy. For this strategy to be useful, commercial producers then will need to try to obtain information on bloodline differences in fleece rot resistance. Currently, such information is of limited availability. To assist commercial producers to identify and access superior bloodlines in fleece rot resistance, methods need to be developed to report better bloodline differences in fleece rot resistance. In situations where flystrike resistance is an important feature of the objective, commercial producers may need encouragement to undertake an on-farm comparison of alternative sources that will include an assessment of relative resistance. Having identified a more resistant bloodline, then changing bloodline source is a highly predictable process given that heterosis is relatively unimportant. Results from the Merino crossing project have shown that both natural (Raadsma, 1988; Mortimer *unpublished*) and induced (Raadsma, 1988) expressions of fleece rot resistance are not influenced significantly by heterosis.

If the breeding objective of the current bloodline matches the commercial flock's breeding objective and it is expected that this objective will be achieved, then the commercial producer is likely to obtain greater overall benefits from continuing to purchase rams from the current bloodline source. The commercial producer can then influence further the flystrike resistance of the flock through judicious ram and ewe selection policies within the current bloodline. Careful inspection of rams at purchase, on the basis of firstly fleece rot and then indicator traits, and direct selection of replacement hogget ewes on fleece rot resistance can give useful genetic gains. On the other hand, if there is little likelihood of the current bloodline achieving its objective for body strike resistance, then a change of bloodline is needed. Breeding advisers (consultants, sheep classers, extension officers) need to be assisted and encouraged to provide appropriate services covering breeding objectives and breeding strategies for commercial producers.

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