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Producer Research Support

Sheep Physical Traits

Combined Sheep Producers

The Combined Sheep Producers group set about developing and implementing an objective system for describing physical traits for all sheep breeds.

The result of this project is that Australian sheep breeders will soon have a physical traits genetic analysis similar to LAMBPLAN Estimated Breeding Values (EBVs) for growth, muscling and leanness.

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The project

Australian sheep breeders will soon have a physical traits genetic analysis similar to LAMBPLAN Estimated Breeding Values (EBVs) for growth, muscling and leanness.

In fact, the analysis has already been built into the LAMBPLAN software. All that is needed to trigger widespread adoption is demand and the resolution of a few minor issues, such as who will score the sheep and what level of importance to attach to each trait.

The scoring system is tipped to revolutionise sheep breeding with an objective analysis and description of animals for heritable structural traits such as feet, mouth, pasterns and hocks.

The development follows a multi-breed structural traits Producer Research Support project conducted by Victorian Poll Dorset breeder and consultant Simon Beattie.

Three years of research underpins the scoring system. A sub-committee of Poll Dorset and White Suffolk Breeders and the Heywood Advanced Breeders Group has been involved, with structural traits assessed in flocks across Australia.

According to LAMBPLAN Manager, Dr Alex Ball, the prevalence of ram breakdown has resulted in many requests for the development of the scoring system.

Dr Ball says a structural traits scoring system will also be invaluable for breeders using outside rams by AI, where an independent and uniformly measured genetic analysis of structure would allow faster gain.

Structure and physical traits are considered important in every sheep breeding program, but are generally assessed visually. A combined production and structural genetic analysis would add a new dimension to breeding sheep.

Objectives

1. Determine breeders' perceptions of important physical traits in the major sheep breeds that have an impact on the Australian sheep industry (ie terminal sires, dual purpose breeds and Merinos);
2. Develop a single-page diagrammatic representation of selected physical traits as a reference source for all breeders;
3. Develop and deliver a training program for accredited LAMBPLAN assessors and representatives of leading stock agencies;
4. Develop and deliver a training program for approximately 200 seedstock producers;
5. Obtain and process data to identify linkages of physical traits with production and possible development of physical Estimated Breeding Values (EBVs);
6. Determine usage rates and obtain feedback to assist with further improvements; and
7. Deliver the system to meat sheep breeders across Australia through accredited LAMBPLAN assessors.

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Key points

Following are findings related to the correlation between muscling and structural traits.

- Wider shoulders result in a higher incidence of turned out front feet.
- Sheep with wider shoulders are often more heavily muscled.
- Heavily muscled sheep are often looser in the pasterns.
- Animals with straighter hocks tended to be tighter in the pasterns, and faster growing.

These genetic relationships confirm the value to industry of having an objective structural trait scoring system and EBVs because without them, many breeders will struggle to find a balance between use of EBVs for production traits and their legitimate concerns about structural soundness and functionality.

What was done

The project was conducted in lamb breeding flocks throughout Victoria, NSW, SA and WA – areas reflecting different production environments and agricultural systems. This limited environmental bias on the variations existing for the assessed structural traits.

Classification of 24 flocks was conducted, providing structural trait scores for 3,850 animals. In addition to the structural scores, production data was compiled on all of the scored population. This data was combined with full pedigree information. The complete data file contained 43,246 records.

The key criterion for the selection of the flocks was that they had to be LAMBPLAN members with accurate data, and be involved in the production of terminal sires.

A 1–5 point scoring system was designed to identify the variations existing within each trait.

The survey determined breeder perceptions of the most important structural traits and this formed the basis for the entire project.

A total of 120 responses were received, which identified 18 traits important in the breeding of terminal sires.

Scores for all structural traits were recorded on each individual animal. The animals descended from 247 sires and 2,807 dams. Thirteen of the sires, and 129 of the dams had structural trait scores recorded for them. After including the background pedigree the total file for analysis was composed of 10,620 animals from 1,294 sires and 5,597 dams.

After merging the structural data with the LAMBPLAN production data, pedigree and flock information, the final data file represented a total of 276 different flocks.

What happened?

An objectively based scoring system for structural traits was successfully developed which provided LAMBPLAN EBVs for key structural traits. This process provided a new understanding of body length in particular.

Producers are now more aware of individual components of sheep structure and have identified consistent strengths or weaknesses in specific areas of their sheep, as a result of replacing value judgments with precise descriptions.

Breeders are confident with the accuracy and reliability of the classification process and the results obtained. They believe the benefits will flow through to the broader sheep industry.

Breeders have now developed a greater respect for structure as a component of their breeding enterprise. Subsequently the production of high performance animals of sound structure is more attainable than ever.

Table 1. Measured traits

Major traits	Minor traits*
Feet 83%	Wool Density 28%
Mouth 70%	Frame Size 23%
Body Length 68%	Muzzle Width 11%
Butt Shape 62% (hindquarter)	Bone Thickness 8%
Pasterns 50%	Pigmentation 5%
Hocks 50%	Scur 5%
Barrel 30%	Length hip to tail 3%
Front Legs 49%	Length shoulder to pin 2%
Face Cover 46%	
Shoulder Width 40%	

* Minor traits were not measured.

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Producer Research Support

MLA Producer Research Support offers support funding of up to $15,000 over three years for groups of producers keen to be active in on-farm research and demonstration trials.

These activities include:

- Producer Initiated Research and Development
- More Beef from Pastures demonstration trials
- Prime Time Wean More Lambs demonstration trials
- Sustainable and productive grazing grants.

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Table 2. Scoring system

Major traits	1	2	3	4	5
	Low		Medium		High
Mouth	Undershot				Overshot
Face Cover	Open				Covered
Shoulder	Narrow				Broad
Front Feet	In-turned				Out-turned
Hocks	Sickled				Straight
Pasterns	Loose				Tight
Body Length in (cm)					

A level of response of 40% and above was deemed to be of significance.

Some data was collected for butt shape, however due to the complexity of scoring this trait, it was discarded subject to further research. Some data was also collected for last rib–pin as a proportion of the total body length.

Other significant survey results include:

- 70% of the respondents stated a physical classification system would be beneficial when making seen/unseen sire selections, particularly for AI programs;
- 66% of respondents endorsed the use of an accredited structural trait assessor, as opposed to individual classification of structural traits; and
- 80% of respondents requested that the classification system result in the development of EBVs within LAMBPLAN.

Discussion

According to the final report for this project, seedstock producers using the structural classification system have benefited by replacing value judgments with precise descriptions.

This reduces subjective bias, and enables more accurate progeny evaluations and, ultimately, sires proofs.

"This project has provided a universal language for structural description that assists when making breeding decisions, particularly unseen sire selections for AI or ET programs," the final report stated.

As a result of conducting this research, terminal sire seedstock producers learned that:

- a quick and accurate system for scoring significant structural traits can be utilised for productive sheep breeding;
- a 1–5 scoring system is adequate for describing the variation that exists within each trait;
- most traits show similar variability (phenotypic variance) to weight, fat and eye muscle depth (EMD) etc (excluding mouth and body length). However, reference must be given to the degree of culling pressure on each trait, particularly prior to classification;
- in many traits these variations can be influenced by factors such as, age, sex, breed, birth type, dam age and management group. Importantly these adjustments are not usually made when breeders make subjective decisions on structural traits;
- genetic accuracy (heritability) for several of the traits is quite high (h2=0.45 to 0.50), but for others, such as hocks, mouth and body length, it is low;
- some significant correlations do exist between/within structural traits and productive traits. These relationships should be subject to further analysis as part of any future research;
- producers feel the system will create a more comprehensive LAMBPLAN program.

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Including EBVs and perhaps modified indexes;

- breeders can replace valued judgments with precise descriptions; and
- a descriptive structural language will be beneficial when making unseen breeding decisions.

The complete genetic picture

The report said that in addition to the production of heritabilities and correlations, the development of LAMBPLAN EBVs for structural traits created a more complete genetic picture.

LAMBPLAN can now provide information on all aspects of sheep breeding – performance, health, reproduction, wool and carcase attributes and structure.

The report said the system should be particularly beneficial for programs such as Total Genetic Resource Management (TGRM), as it would allow mating combinations to be selected on purely objective production and structural data.

The outcome offers a structural traits system applicable to all sectors of the seedstock production chain, but especially to those breeds conducting young sire programs.

The only remaining issue, according to LAMBPLAN manager Alex Ball, is how to ensure the information on structural traits is accurate and repeatable. He says this can only be achieved through a system of accreditation.

"Breeders have yet to decide whether they should become accredited through a training process of whether there is a need for independent assessors, as with LAMBPLAN," said Dr Ball.

The other major issue to be determined is the lifetime commercial value of the structural traits.

Dr Ball sad that "for certain traits, such as jaw setting, this is relatively straightforward, but for traits such as pasterns and shoulder angle, the difference in monetary terms to a commercial lamb breeder of rams that have scores of 3 and 4 has yet to be determined.

"This is needed to establish the economic value that ram breeders should place on these traits."

Dr Ball said the issue of carcase length was also to be resolved.

"It is clear that there is significant variation in the proportion of carcase in the hindquarter, loin and forequarter. As we link this genetic information to feedback systems, such as VIAscan®, that measure this information on commercial carcases, we will again have the basis to determine the real economic commercial impact of carcase length, rather than breeders' perceptions of its commercial value."

MLA also recommends

Sheep Genetics Australia

Sheep Genetics Australia (SGA) is the national genetic evaluation service for the Australian sheep industry. It is built around the world's most comprehensive sheep genetics database, and will deliver genetic information on a fee-for-service basis.

Tel (02) 6773 2493 or
www.sheepgentics.org.au

EDGEnetwork

EDGEnetwork offers practical field-based workshops to improve productivity and profitability for the long-term.

Workshops cover breeding, nutrition, grazing management, marketing and selling.

Call MLA on 1800 993 343 or
www.edgenetwork.com.au

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Body length – real but small genetic differences

Body length is widely considered to be an important trait in terminal sire breeding. This project showed that while body length is highly heritable (50%), it has very low variation (4.4%) after all fixed effects are accounted for. This means:

- most of the observed variation in length within a breed is actually variation in age, dam age and birth type;
- breeds differ significantly in average body length; and
- after accounting for these effects there are real genetic differences (50% heritability) but only small scope to make change, because the variability is small).

Great care is needed when making comparisons of observed body length.

For example, assuming the average animal within a breed group, at constant weight and age is eight months old, 65kg and 60cm long, we can expect other animals at this constant to vary about (+/-) 2.6cm from the mean for length.

The small variation in body length is an important message for breeders, and suggests that much of the observed variation results from not accounting for fixed effects, and what the report's authors suggest is an optical illusion – thicker, heavier muscled animals look shorter.

An additional important point is that breeders must be aware of the environmental and non-genetic effects that can influence the physical appearance of an animal but are not transferred to progeny.

The genetic correlations of important production traits – growth and leanness – are favourable. However, the genetic correlation with eye muscle depth at constant weight (muscling) is negative. This means that selecting fast-growing, lean animals will automatically produce genetically longer animals.

Improving muscling at the same time will slightly reduce the tendency for animals to become longer as selection proceeds. Longer animals are also significantly more open in the face, straighter in the hocks and tighter in the pasterns.

There is a slight positive correlation between the 60:20:20 LAMBPLAN index and body length. However, when including the body length EBV with the index there is a more significant positive response from the majority of traits.

Therefore, if selecting purely on a 60:20:20 + body length index as opposed to any one index or trait, it should be genetically possible to:

- maintain birth weight;
- increase growth;
- decrease fat;
- maintain or increase eye muscle depth;
- have a slightly positive effect on all structural traits; and
- increase body length.

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