

SHEEP GENETICS



LAMBPLAN and MERINOSELECT

Things you need to know...



The Mission:

Genetic improvement for a sustainable and profitable Australian sheep industry facilitated by the world's best sheep genetic evaluation system

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Sheep Genetics

(i) The Foundations

Sheep Genetics is the national genetic information and evaluation service for the meat and wool sectors of the sheep industry.

Sheep Genetics will host records on around one million individual Merino sheep, and a similar number from the terminal and maternal sire breeds – reflecting the data from more than 1000 flocks around Australia.

The data has been drawn from the Merino Benchmark, LAMBPLAN, CSIRO Select Breeding Services, Merino Genetic Services, Australian Merino Sire evaluation Association (AMSEA) Central Test Sire evaluation databases and other independent providers. It is anticipated that the database will grow as more breeders participate.

Sheep Genetics's main purpose is to improve the quality, scope and utilisation of across-flock, and where appropriate across breed genetic information for the Australian sheep industry.

Sheep Genetics acts as a resource for sheep genetic information and improvement through which commercial producers, ram breeders and service providers can interact. It will supplement the skills of ram breeders and sheep classers by evaluating current measurements and providing further information, often on traits that cannot be assessed visually e.g. reproduction, carcass and internal parasite characteristics.

Sheep Genetics will interact with federal and state agencies, breed societies, livestock agents, sheep classers, agricultural advisors and veterinary consultants, fleece testing businesses and genetic service providers. It will function as Australia's sheep genetic information database for all stakeholders to use.

Sheep Genetics will be an evolving genetic evaluation system, that is able to be upgraded to accommodate new, proven technologies as they arrive, including DNA parentage, gene markers, new traits, and electronic identification.

(ii) Sheep Genetics Services

The core Sheep Genetics product is the provision and maintenance of a national database for the calculation of breeding values using a single standard for genetic information. These breeding values will be released in the form of trademarked Australian Sheep Breeding Values (ASBVs).

ASBVs are designed to be used by ram breeders and commercial producers to compare the genetic potential of rams and ewes for a range of industry agreed traits, across flocks, independent of the environment and location. ASBVs will be delivered via MERINOSELECT and LAMBPLAN, which have been designated for the wool and prime lamb sectors respectively.

MERINOSELECT is for Merino ram breeders and commercial wool producers. It is the new brand name for Merino genetic information combining data from the current Merino schemes into a national, consistent and quality assured service. LAMBPLAN continues as the brand name under which genetic information is delivered to Terminal, Maternal and dual Purpose ram breeders and commercial lamb and sheep producers.

Terminal, Maternal, Dual Purpose and Merino breed information will be stored, managed, utilised and reported as separate databases as will the information for specific breed groups.

Information evaluated by Sheep Genetics describes the genetic performance of sheep within their breed or industry group, for example, Merino or Terminal sire breeds. The majority of producers will have a minimum standard of pedigree links to other flocks within their breed or industry group to allow their sheep's genetic performance to be compared to other flocks and to their appropriate benchmarks.

Breeding values are typically expressed as the difference between an individual's merit and the average merit base of the year of the genetic pool to which the animal is compared. Sheep Genetics has developed new terminology to express this estimated breeding value.

(iii) New Terminology for Breeding Values

Australian Sheep Breeding Values (ASBVs) will become the primary sheep genetic evaluation language in both MERINOSELECT and LAMBPLAN.

ASBVs will be derived from measured or visually scored traits using agreed standard procedures. In many respects, ASBVs are similar to genetic evaluation estimates that are used in other sectors of the livestock industry. There will be a wide range of ASBVs. They will be available for the following core traits:

- wool
- carcass
- internal parasite resistance
- growth
- reproduction
- temperament

To ensure integrity, genetic data will only earn ASBV status if it meets accuracy, quality assurance and across flock linkage standards, determined after review by a technical committee of Sheep Genetics. Producers will be able to use ASBVs in selection programs to focus on specific traits such as fibre diameter, growth rate, reproductive rate or a combination of traits that suit their flocks' breeding objective.

In the future, other traits may be considered and included. These include structural soundness, bare breech, style, crimp definition, face cover, body wrinkle, wool colour and lambing ease. Those animals with the highest (or lowest for traits such as fibre diameter that breeders are aiming to reduce) ASBVs for different traits will be identified in trait leader and elite animal summaries. Flock Breeding Values (FBVs) will be a secondary term to allow breeders whose data do not meet ASBV standards at a particular point in time to receive breeding values that are comparable within their flock only.

LAMBPLAN and MERINOSELECT Basics

1: What are LAMBPLAN and MERINOSELECT?

LAMBPLAN and MERINOSELECT are the genetic information and improvement systems that compare animals on the basis of their value as parents, that is, their **breeding value**.

Sheep Genetics run this service with the office based at The University of New England, Armidale, NSW. The analysis of all LAMBPLAN and MERINOSELECT information is carried out using OVIS and is managed by the Animal Breeding and Genetics Unit (AGBU). There is a Sheep Genetics Advisory Committee comprising Industry Stakeholders from various areas as well as a Technical Committee and Executive Committee to ensure that the project continues in the right direction.

LAMBPLAN and MERINOSELECT are all about increasing accuracy of selection decisions, and when properly understood and used, can be a significant aid to a producer's decision making when selecting stock and can be used to estimate the relative performance of an animal or its progeny compared to the breed benchmark.

LAMBPLAN and MERINOSELECT are an industry-based service backed by some of the best expertise in the world.

Note: LAMBPLAN and MERINOSELECT use similar technology to that used by the pig, poultry, beef and dairy industries to make such dramatic production changes over the last few decades. It has worked wonderfully well for those industries, and works just as well for the genetic evaluation of sheep.

2: An overview of LAMBPLAN and MERINOSELECT

What you see in an animal is the effect of genes they inherit from their parents modified by the effect of non-genetic (environmental) factors such as feeding and parasite control, sex, age of dam etc.

To improve your flock by selection, you need to evaluate the genetic merit of sheep - that is the proportion of the animal's performance, which is controlled by its genes, and not its overall performance which has been influenced by environmental and other non-genetic effects.

LAMBPLAN and MERINOSELECT use three pieces of information to assess the value of an animal's genes.

- The animal's own performance
- Its performance for genetically related traits
- The performance of its relatives for those traits.

To allow comparison of animals between management groups or even different properties genetic links between contemporary groups are essential. A genetic link is

achieved where animals in one group/flock have a parent in common with an animal in another group/flock. For sires this cross linkage is usually achieved through AI but could also be through common dams.

LAMBPLAN and MERINOSELECT use "multiple traits" evaluation which further increases the accuracy of the ASBVs.

Because there is usually a genetic association between different traits (which may be positive or negative and vary from low to high) this information can be used enhance measurements of recorded traits or estimate an animal's breeding value for traits that have not been directly measured.

The multiple trait analysis also helps to reduce the "bias" which can be introduced by a previous selection decision, say selective joining or dis-proportional culling based on single traits. For example, culling of lighter lambs at weaning will give higher group average. The fact that the remaining animals have a higher group average as a result of previous culling is accounted for as long as the records of the previously culled animals are included in the evaluation.

ASBVs are expressed in the same units as they were measured (eg, kg) and are calculated relative to the breed benchmark set so that the mean of the 1990 drop of animals from all breeds is zero.

3: What does LAMBPLAN and MERINOSELECT do?

LAMBPLAN and MERINOSELECT adjust on-farm measurements (raw data) submitted by the breeder to calculate an **estimate** of the animals **breeding value** (ASBV). It uses information from the performance of the individual animal as well as its relatives, and allows for differences in environment and chance that animals have been exposed to and that would otherwise bias selection decisions.

It provides the **best estimate** of an animal's breeding value from the **information available**.

LAMBPLAN and MERINOSELECT are a useful aid to selection, not because breeders are a poor judge of the physical attributes of sheep but because when it comes to long term memory recall or making simultaneous adjustments for known environmental effects (eg birth type and rearing type) over a number of traits, human brain power is no match for a computer.

4: Why use LAMBPLAN or MERINOSELECT to analyse performance records?

What we see or measure in an animal is influenced by both environmental and genetic factors.

The effect of non-genetic, or **environmental** factors on the expression of an animals' genes, mean that using a simple measure of performance alone, will not give an accurate guide to the animals' genetic merit. To make the guide as accurate as possible we need to account for these environmental factors.

Environmental effects that need to be taken into account in a breeding program are birth date, age of dam, birth type and rearing type, weaning group, management groups post weaning etc. Other often forgotten effects include disease problems and feeding differences.

Observed differences of performance between animals resulting from differences in environment can be large, but are not inherited by their progeny, and as such can lead our selection decision astray and often in the wrong direction. As an example selecting on weight alone will more than likely lead to selection of large mature size animals that are early born singles from adult ewes. It is likely that you are not selecting for increased growth rate at a constant age or improvements in fertility which are important to lamb and sheep producers.

Genetic factors are the result of genes inherited from the parents and are the blueprint for future performance, both of the individual and its progeny.

You buy a ram not for what he looks like but how his progeny will perform. It is only when environmental factors are either standardised or adjusted that real genetic differences become apparent.

LAMBPLAN and MERINOSELECT uses sophisticated computing technology to adjust for known environmental effects over a number of selection traits. This technology is called BLUP (Best Linear Unbiased Prediction).

Even after taking into account the environmental effects, not all the differences identified are passed on to progeny. The degree to which differences are passed on – or inherited – is known as heritability. Typical heritability of performance traits are about 30% for weight and growth, about 33-35% for fat depth, about 30-40% for eye-muscle depth and about 10% for reproductive traits.

5: What are the key features of the LAMBPLAN and MERINOSELECT analysis?

Key features of LAMBPLAN and MERINOSELECT include:

- Calculating breeding values for all animals and all traits simultaneously, hence its description as a "Multiple Trait Animal Model".
- Using performance information from relatives and progeny, as well as the individual animal.
- Using the known correlation between traits to increase the accuracy of measured traits and to calculate ASBVs for non-measured traits such as birth weight or weight at later ages.
- Adjusting for the effects of differences of nutrition, age of dam, age of lamb and management group treatments. These are non-genetic differences that will affect the observed performance of the individual but are not passed onto its progeny.
- Adjusting for the effects of preferential mating of a sire to selected ewes, unequal and selective culling, and competition between comparison groups.

Removing these biases and taking into account the performance of other animals makes LAMBPLAN and MERINOSELECT predictions more accurate than predictions on visual assessment.

As well as giving you ASBVs for your animals, LAMBPLAN and/or MERINOSELECT also plots the genetic trend for your flock. This trend shows the genetic direction of your flock for individual traits from year to year, and also lets you see the effect of environmental changes such as pasture improvement on your overall flock production.

6: What traits are analysed in LAMBPLAN and MERINOSELECT?

The basic measurements analysed by LAMBPLAN and/or MERINOSELECT are growth, fat, muscle and reproduction. Optional traits include birth weight, lambing ease, disease resistance, and wool traits.

These traits have a direct influence on important aspects of flock performance such as weaning percent, maternal ability, carcass yield, growth, fibre diameter, fleece weight, resistance to parasites and fertility.

Additional traits will be added as we learn to accurately measure and analyse them, and if the industry says they are important. More detail on this topic is given in section 12 of this bulletin.

7: How LAMBPLAN and MERINOSELECT ASBVs are used to compare animals?

LAMBPLAN and/or MERINOSELECT ASBVs for an animal can be compared to...

- A breed benchmark (Base) for each trait. This benchmark is set at Zero (0) for the 1990 drop and is “fixed” at that point in time.
- “Head to head” with other animals for a particular trait. Rams with positive eye muscle depth figure produce lambs that have more muscle in their carcass independent of weight. For example, a ram that is +1 for eye muscle depth will produce lambs that on average will have a 0.5mm deeper eye muscle depth.

8: How do ASBVs help in the selection of rams?

- They take into account the performance of the ram’s relatives as well as the animal’s own performance.
- It uses an industry standard language that means the same wherever you are.
- They allow you to compare rams on the basis of how they will breed (breeding value) rather than how well they have been fed (environmental influence).
- They can be used to accurately estimate progeny performance for specific traits and to predict the outcome of breeding programs.

- They identify genetic differences for “hard to see” traits such as maternal ability.
- They report differences in units of commercial value, eg. carcase yield, fleece weight.

Australian Sheep Breeding Values (ASBV)

9: What is an ASBV (Australian Sheep Breeding Value)?

An **ASBV** is an **estimate** of the animal's true **breeding value**. As ASBVs are benchmarked they allow the animal to be fairly and directly compared to the benchmark, the current breed average, or with other animals from the same LAMBPLAN or MERINOSELECT analysis.

ASBVs do not necessarily reflect the animal's observed performance, which is a combination of both genetic and environmental influences; rather they are an estimate of the genetic component of that performance.

The ASBV is a value (number) which expresses the difference (+ or -) between an individual animal and the benchmark to which the animal is being compared. Thus an ASBV of +6 for post weaning weight means that the animal is genetically better by 6kg at post-weaning age than the base it is being compared to.

ASBVs are reported in terms of actual product, for example, kg of weight or mm of fat depth.

ASBVs adjust for known environmental differences such as age of lamb, age of dam and nutrition. This allows comparison of animals born in different seasons and years, and adjusts for known genetic differences such as preferential joining of ewes, and unequal competition between contemporary groups.

ASBVs consider all the available information from relatives as well as from the individual animal, and take account of the relationship (correlation) between traits, for example the relationship between birth weight and mature weight.

Development of an ASBV is an ongoing process, for example;

(i) At birth the ASBV is calculated from the known performance of the lamb's parents and close relatives. This is a preliminary estimate, useful but subject to change as siblings do not completely mirror the performance of their parents. At this stage, the ASBV is the sum of half each of the parents ASBV.

(ii) At weaning, and at several later ages, the performance of the lamb and its half-sibs is used to fine tune the original estimate.

(iii) Finally the performance of the animal's progeny is used to further fine tune the predictive power of the ASBV.

As each step progresses the ASBV becomes a better estimate, as more information is available to calculate the ASBV. Thus, the ASBV becomes a more accurate estimate of the animal's breeding value – for more information on accuracy, see Appendix A.

10: How are ASBVs calculated?

ASBVs are calculated by:

- (a) Firstly, adjusting recorded measurements for age differences between lambs and for age differences between dams rearing those lambs.
- (b) Adjusted measurements are then compared to the average of a contemporary group of animals of the same sex, of the same seasonal age group and having had the same management and nutritional treatment.
- (c) Groups are then compared, using genetic linkage, to correct for the effects of non-genetic differences between groups. This allows comparisons of animals between different management groups and flocks.
- (d) Finally, the adjusted value is multiplied by heritability and correlation factors to derive the heritable component of adjusted differences between animals, that is, the ASBV.

11: What's so special about ASBVs?

There is no magic about ASBVs - they are simply a method of comparing animals for what they really are (rather than what they may appear to be), and for what their progeny are expected to be.

By accounting for a range of environmental (non-genetic) influences that cloud the genetic difference between individuals they increase the accuracy of selection decisions.

Special things about ASBVs are;

- They use industry standard language that means the same thing to all people.
- They estimate the amount of difference between animals that is heritable, i.e., transferable to the next generation. We need to know this if we are to plan the marketing and production strategy of our flock in the future.
- They allow us to compare the performance potential of individual animals with other individual animals, and with the average of the breed.
- They estimate differences between animals for traits that can't be detected by eye, eg. Resistance to worms.

- They express genetic differences between animals in terms of commercial product that can be assigned a value when calculating the comparative net worth of breeding animals.
- They reduce the risk of selection decisions. ASBVs have an accuracy rating that allows you to assign an objective risk factor to selection decisions made about animals.

They answer the question that every ram buyer needs to know - which is the best ram rather than which is the best fed ram?

12: For what traits are ASBVs available, and what do they mean?

LAMBPLAN/MERINOSELECT can produce ASBVs for a wide range of production traits of sheep:

Birth Weight ASBV is based on measured birth weight of lambs adjusted for age of dam. Where birth weights are not available it is estimated as a correlated trait from weight measurements taken as the lamb matures. The lower the ASBV the lighter is the estimated progeny birth weight potential.

Weight ASBVs describe the animals' genetic merit for growth rate. A positive ASBV means the animal is genetically faster growing. Weight ASBVs are available for weaning (100 days), post-weaning (200 days), and yearling, hogget and adult ages.

Fat Depth ASBVs describe the value of an animal's genes for fat depth at a constant weight – a negative ASBV means a genetically leaner animal.

Eye Muscle Depth ASBVs describe the value of animals' genes for eye muscle depth at a constant weight – a positive ASBV means a genetically thicker-muscled animal, and one that will have slightly more of its lean tissue in the higher-priced cuts.

Wool Weight ASBVs describe the value of animals' genes for wool weight – a positive ASBV means a genetically heavier-cutting animal.

Fibre Diameter ASBVs describe the value of an animals' genes for finer or coarser wool – a negative ASBV means a genetically finer animal. In addition fibre quality measurements such as staple length, staple strength, CV and curvature can be converted into ASBVs

Reproductive ASBVs describe the value of animals' genes for lambing and/or marking rate.

Worm Egg Count (WEC) ASBVs describe the value of animals' genes for carrying worm burdens – a combination of being genetically less likely to pick up worms and being better at getting rid of them.

13: What is the commercial difference between sires with ASBVs for growth of +2 and +10?

As well as using ASBVs to compare individual animals to the average, they can be used to compare animals based on estimated difference in progeny performance.

As a sire (and dam) contribute half the genes of the progeny, differences in progeny performance of sires, can be estimated by halving the difference between the sires ASBVs.

For example, compare 2 sires, sire **A** and Sire **B**

ASBV of sire A	+ 10 kg
ASBV of sire B	+ 2 kg

Bred to similar ewes, LAMBPLAN and MERINOSELECT estimate that the progeny of ram **A** to be an average of 4 kg heavier than the progeny of ram **B**. (10 minus 2 = 8, divided by 2 = 4)

14: How Accurate (reliable) are ASBVs – What does Accuracy mean?

ASBVs are an **estimate** of the real breeding value of an animal. The estimate is made from analysis of all information that is currently available on the animal. Naturally, the more information that is available the more accurate the estimate will be and the less likely it will change as additional information becomes available.

The accuracy of an ASBV reflects the amount of information used to estimate the animal's breeding value, as a percentage of the amount of information needed to calculate its true breeding value with 100% certainty.

For example, if the only information available is the ram's own measured performance for growth (a trait with a heritability of 30%, or 0.3), the accuracy of his ASBV will be 55%. If 10 progeny records are added to the analysis the accuracy will increase to 74%.

Accuracy ratings are quoted in percentage terms from 0-99 for ASBVs. The accuracy is printed underneath the ASBV.

An accuracy of **less than 35%** indicates that not much direct information is available about the animal - it may be from relatives rather than direct observation, it may be from a correlated trait, and/or the trait has a low heritability. This ASBV should be considered a preliminary estimate only and could change considerably as more substantial information becomes available.

ASBVs for **yearling rams** without progeny recorded are calculated from the record of the ram and/or its relatives - the accuracy of these ASBVs will be in the range of **45 to 75%**, with the higher accuracy ASBVs reflecting a greater depth of information from relatives.

The ASBVs of **sires** with recorded progeny are more accurate and more stable than the ASBVs of young rams - progeny information is a better estimate of a ram's

breeding value than own performance. These ASBVs will range in accuracy from **75% to 99%**, the higher accuracy ASBVs reflecting a greater number of progeny and/or daughters progeny records being available.

For more information about Accuracy, see *Appendix A*

15: Why do ASBVs change?

Remember, an ASBV is the best estimate made from the available information - as the information gets better (more plentiful), so does the estimate. Therefore it is only logical that the ASBV of an animal will change with the addition of more information.

This additional information could come from weights taken as the animal grows, performance records of progeny, or from performance records of daughters' lambs. Alternatively, the additional information could come from close relatives.

In general the ASBV of a sire or dam with many progeny will not change very much with the addition of new information; however the ASBVs of a young sire can change quite markedly once its progeny start being evaluated.

These changes should be reassuring in that Sheep Genetics are continuously refining the estimates as more information comes to hand, just as breeders do by eye as an animal grows and has progeny.

For more information about Accuracy, see *Appendix A*.

16: What happens to the ASBV if incorrect data is submitted for analysis?

The ASBVs will be incorrect. As for the pedigree, the integrity of an ASBV is dependent upon the integrity of the information submitted. Accuracy of measurement is important, as is correct management group coding to allow for known environmental differences.

There are a number of checks and balances in the system that identifies and questions performance information that falls outside expected boundaries. In addition for traits such as fat depth and eye muscle depth, accredited operators must be used to ensure that there is a national consistency for this information.

17: Can a person cheat the system?

Concern is often expressed about the possibility of a person "loading" the weight of an animal to increase its ASBV. This could happen, but it would be an unwise thing to do.

There are checks and balances within the system that queries animals that are too far ahead of the group with which it is to be compared, and secondly, as progeny are analysed its failure to perform to expectations will be noticeable not only to the

breeder, but to others that have used genetics from that animal.

18: How do ASBVs enhance the traditional pedigree?

The pedigree was the first method of performance recording, based on the premise that "like begets like".

Somewhere along the way the performance profile alluded to in the pedigree has become clouded. There are now so many people breeding so many sheep in so many places that it is beyond comprehension for any person to compare individual animals. Where they rely on "word of mouth" to describe animals there has not been a common industry language to do so.

Also, the use of show ring success as a de-facto measure of performance (with its associated intensive feeding) somewhat neutralise the original theory of "like begets like" - unless you buy the feed bucket as well.

The pedigree is still, and always will be the basis of performance recording but is more meaningful if the level of performance that we attach to it is free of environmental biases.

The ASBV allows this to happen. It takes into account the known performance of relatives as well as the individual's performance, and it makes allowance for known environmental differences. As such, the ASBV compliments the traditional pedigree, rather than competing with it.

19: How much of the ASBV is transmitted to progeny?

An ASBV is an estimate of an animal's breeding value for a particular production trait. When the animal becomes a parent, half of its genes (breeding value) are passed on to the progeny. (The other half comes from the other parent).

Therefore, when rams with different ASBVs are joined to similar ewes, the difference that can be expected in their progeny's performance will be **half the difference** in the ASBVs of the rams being compared.

For Example:

	Birth Weight ASBV
Ram A	+ 0.6 kg
Ram B	<u>- 0.2 kg</u>
Difference	0.8 kg

Assuming they are joined to the similar ewes, LAMBPLAN/MERINOSELECT estimates that the progeny of Ram A will average 0.4 kg heavier at birth than the progeny of Ram B.

20: Can ASBVs from different flocks be compared?

Yes! The first step in producing LAMBPLAN/MERINOSELECT ASBVs is to determine the difference between the performance of an animal and the average of

the group that animal has been part of until the particular measurement is taken.

This information is then corrected for environmental factors, and then combined with the information from other traits and from relatives of the animal. These relatives don't have to have been in the same group ~ all that is needed is that each relative has a performance record, we know the average of the group the record was made in, and we can adjust for environmental factors appropriate to the group and each animal in it.

This means that LAMBPLAN and MERINOSELECT ASBVs use information from all relatives of each animal in all management groups. Using all the information means that the ASBVs will be as accurate as possible: it also means that animals in different groups can be compared provided that there are genetic links between the groups. Knowing that animals have relatives in other groups means that we know about the genetic links between groups.

What groups can be compared:

- Different groups within the same year ~ stud and flock ram groups, ram and ewe lambs.
- Different years within a stud.
- Different studs.

This feature of LAMBPLAN and MERINOSELECT means **that all recorded, genetically linked animals can be directly compared for their genetic value.**

This means that:

- The best animals within the flock, or within the breed, or for terminal sires between breeds, for any trait or set of traits, can be selected.
- It becomes straightforward to determine whether the flock is making any genetic change ~ if the average genetic merit of animals born in different years is not changing, then the flock is not making genetic progress.

Joining LAMBPLAN or MERINOSELECT

21: What extra work will be required if I join LAMBPLAN/MERINOSELECT:

LAMBPLAN and MERINOSELECT users pay an annual subscription fee as well as a database charge as new animals enter the system. The annual membership fee that is paid is \$330.00 and \$99.00 for each additional stud or waived for small studs that pay a higher database charge. The database charges are \$1.65 per animal or \$8.25 per animal for small studs. The total fees paid annually are capped at \$2750. All these prices include GST.

To participate in LAMBPLAN or MERINOSELECT you will need to;

- Have the ewes, sires and lambs you wish to record individually and uniquely identified.

- Record the birth date, sire and dam of each lamb.
- Mother up and tag or tattoo lambs soon after birth.
- Weigh lambs at least once. Weighing and scanning at other ages is optional, but highly desirable.

The first 3 steps are required for normal breed society records so the only extra work for stud breeders is weighing lambs on one or more occasions.

There will be some extra office work involved, particularly in the first year, if back records are processed. Those with personal computers are able to transfer records disk or e-mail if compatible software is used.

22: The LAMBPLAN and MERINOSELECT ID System

To obtain maximum benefit from LAMBPLAN or MERINOSELECT it is desirable to use information from relatives. Clearly, this means having a uniform ID system that allows each animal to be identified accurately, and linked to all its recorded relatives.

The ID system ensures a unique ID for every animal in any breed of sheep anywhere in the world. This system identifies the breed, the flock of birth, the year of birth, and the animals own tag number.

For example, for the animal:

16005620006060137

16	0056	2006	060137
Breed Code	Flock Number	Year of Birth	Animal Tag Number
Poll Dorset	Flock 56	2006	06/137

In general, Sheep Genetics recommends avoiding mixing letters with numbers in the ID, and also strongly advises against giving the same numbers to ram and ewe lambs within a year.

23: Small flocks

Small flocks can join LAMBPLAN or MERINOSELECT and benefit greatly by doing so by being linked to the breed base. This allows them to see how their animals compare with the breed average and other flocks, identify sires that will progress their breeding program, and compete on a level playing field with larger studs when marketing their animals.

Flocks with as few as 10 ewes can get meaningful ASBVs however they need a tight management program to ensure that all of their animals are included as well as genetic links to other studs.

The basic mechanism by which LAMBPLAN and MERINOSELECT works is to compare the performance of animals to other animals in the same group. Where there is only one animal in a group there is nothing that it can be compared with and therefore its performance cannot be used. Lambs are only analysed in the same

group if they:

- were bred in the same flock,
- are of the same sex,
- were born within 35 days of each other,
- have been run under the same conditions,
- and have been weighed on the same day.

An analysis group must therefore have a minimum of two animals that meet these criteria in order to be used in the LAMBPLAN or MERINOSELECT analysis. There are a number of strategies that breeders can use to ensure that the performance of lambs will be included in effective analysis groups.

1. *Restricted lambing periods:* as lambs are only included in the same analysis group if they are born within 35 days of one another, it is essential that small flocks have as shorter lambing period that is practical.
2. *Run all lambs under the same management conditions:* where possible all lambs should be run under the same conditions and weighed on the same day. If lambs are to be split into different groups it is useful to weigh the whole group before it is split
3. *Inclusion of commercial animals:* Many breeders have a small stud flock run in conjunction with commercial animals which can be recorded alongside the pedigree animals. This allows a greater number of animals to be included in the same analysis group and there is no charge for commercial animals as long as they are identified as such (please refer to the QA Manual). This can also be achieved by analysing together the performance of animals from two stud flocks that are run on the same property.
4. *Use more than one sire:* Another important factor to consider is that a flock should use more than one sire in any joining program. LAMBPLAN and MERINOSELECT require at least 2 sires to be represented in an analysis group if the performance of the progeny is going to contribute to the calculation of ASBVs for their sire. Where AI programs are used they should be timed so that AI sired lambs are born at the same time as lambs sired by natural joining.
5. *Supply recipient dam details:* Flocks that use embryo transfer need to identify the breed and age of the recipient dams of ET lambs. If the identity of recipient dams is not supplied ET lambs are split into single animal analysis groups and therefore their own performance cannot be used. If possible recipient dams should be of the same breed.

24: What do I get back from LAMBPLAN or MERINOSELECT?

The annual subscription fee entitles the member to receive the following services:

- ASBV report per calendar year at the time of scanning.
- National Breed Summary – including ram marketing report for individual flocks in August each year plus an Elite Animal Summary and a Genetic Trend

- Report.
- Reliable advice on request.
 - Extra ASBV reports ~ Birth Weight, Weaning Weight, later weights and additional traits.
 - Mate Checker Report.
 - Extra Genetic Trend reports.
 - Inbreeding Analysis.
 - Accuracy Analysis.
 - Breeder's Directory Updates.
 - Listing in Flock Genetic Merit Listing.

25: Can I record lambs that have been fed or managed differently?

Yes. Lambs that have been treated differently, for example run in different paddocks, or have received a feed supplement, can be compared as long as you record them as having been managed differently from their peers. There is a column on the recording form for different management groups and within the Pedigree Wizard software there are also options for identifying different management groups.

26: Identifying Management Groups

The basic step in producing ASBVs is to compare animals with others that have received the same treatment. For this reason it is important to accurately identify groups of animals that have been run together ~ that have been in the same management group.

LAMBPLAN and MERINOSELECT splits management groups at weaning to 35 day intervals. So, if a group of lambs comes in that range in age by, for example 65 days, they would automatically be split into two groups. However, it is good management to separate later born lambs into a different management group if the environment has changed significantly during lambing.

Lambs that have been orphaned need to be identified as being in a separate management group to remove the risk of biasing their information. These lambs should be assigned a rearing type 1.

Subgroups should be used to identify lambs raised in different paddocks or with different feed availability. The proper use of management groups and subgroups ensures the most accurate ASBVs are available to the breeder.

27: How long does it take before my ASBVs are meaningful?

ASBVs are a useful estimate of genetic merit from the time you analyse your first records, however their usefulness increases as your databank build up - remember, the ASBV is the **best possible estimate** from the **available** information, so the better (more) the information the better the estimate.

It takes about 2 to 3 years to build up a really useful bank of records. LAMBPLAN/MERINOSELECT speeds up the process by increasing the pool of progeny being analysed.

The real benefit comes when you have a complete generation of records, that is, when animals first recorded as lambs become parents themselves. Then the ASBVs increase in accuracy and predictive power considerably.

Note with LAMBPLAN/MERINOSELECT you can add previous year's pedigree and performance information at no cost. This option allows you to build up more data and hence receive more reliable ASBVs within a shorter time period.

28: Should I record lambs from only my better ewes?

No. The value and accuracy of LAMBPLAN/MERINOSELECT relies on building up a complete profile of flock performance.

Selectively recording animals will deny you a true picture of what is happening in your flock. It will give you a distorted base set unreasonably high or it may undervalue your better sires whilst overvaluing the lesser sires, and may make your genetic trend appear lower than it actually might be.

For example if you have 30 ram lambs each from 2 sires and you cull 20 lambs from one sire because of unsatisfactory performance, but do not record them, then the only information that LAMBPLAN/MERINOSELECT has for that sire is from the 10 good lambs. When the records are analysed, the average performance of these 10 lambs will probably be higher than the average performance of the 20 lambs from the better sire. You will say that LAMBPLAN/MERINOSELECT has got it wrong when in fact LAMBPLAN/MERINOSELECT got it right - from the information that was submitted.

LAMBPLAN/MERINOSELECT makes the **best** estimate from the **available** information, and if the submitted information is biased then so will the resultant estimate be biased.

Therefore it is important to record at least a first weight for castrated and cull lambs as well as those lambs that you keep on. Record the outcome of all matings, even if the lamb was born dead or did not make it through to weaning. There is no charge for recording dead lambs.

29: Can records from past lamb drops be included?

Yes, past records can be included and will build up the performance profile of your flock, and establish your flock base, more quickly.

In general, if you were starting to record with the current lamb drop, it would be advisable to add records from the parents and grandparents of these lambs, if available.

30: What help is available if I join LAMBPLAN/MERINOSELECT?

The LAMBPLAN/MERINOSELECT staff are always available to provide technical support. Your preferred scanners are also able to help with any problem that may

come up... Please ring the LAMBPLAN/MERINOSELECT Office on (02) 6773 2948 with any questions that you may have. In addition within each state there are state department lamb extension officers that can help you.

31: When I buy an animal with ASBVs, do the ASBVs go with the animal?

Provided the correct ID is used, the system will pick up the pedigree and past information on that animal.

General Questions

32: What are the environmental effects that LAMBPLAN/MERINOSELECT refers to?

These are the range of things that influence the way sheep look and perform, but which are not inherited by their progeny. They are the man-made or chance events that influence our judgement when we compare sheep, but have no bearing on the value of the animal as a future parent. These factors include...

- differences in birth type – singles and twins
- differences in age between lambs

- differences in age of the lamb's dam - this effect can influence the weaning and post-weaning weight of a lamb

- differences in feeding, whether they be paddock differences or supplements

- differences in seasonal conditions between years and between properties

- differences in the feed quality between different properties

- preferential parasite control and trace mineral supplementation

- health problems

If we are to make valid and fair comparisons about the differences we observe between animals, environmental differences that affect those differences need to be recorded and accounted for. LAMBPLAN/MERINOSELECT makes adjustments for these effects.

33: How does LAMBPLAN/MERINOSELECT allow for variation between seasons/years?

The comparison of ASBVs for animals born in different seasons and different years is achieved by comparing the performance of similarly bred lambs in those other seasons or years. This is termed *linkage*.

Each animal is initially compared only with animals of the same sex born within a

limited lambing spread and reared under the same conditions. It is then compared to other linked groups.

34: Can I record ET lambs reared on recipient ewes?

Yes, but if the performance of the ET lamb's natural dam has not been previously recorded LAMBPLAN/MERINOSELECT will make a very conservative estimate of the ASBV. If you want accurate information on ET lambs you should use recipient dams that have already had several lambs recorded on LAMBPLAN/MERINOSELECT. Preferably, use recipient dams of the same breed as the donor ewe.

35: Does LAMBPLAN/MERINOSELECT make allowance for structural soundness & conformation?

It doesn't! LAMBPLAN/MERINOSELECT can only calculate traits that can be accurately and repeatedly measured.

Important traits such as structural soundness need to be subjectively evaluated independently of LAMBPLAN/MERINOSELECT ASBVs and adjudged accordingly. It is possible to have an animal that has very high ASBVs and yet be unsound - such an animal is not useful to your breeding program regardless of its ASBVs and should be avoided. Remember you breed the sheep; LAMBPLAN/MERINOSELECT only provides objective information that can assist you to determine the value of that animal's genes. Using an animal that has poor structure but has good performance will ultimately be very costly to your breeding program.

36: Can LAMBPLAN/MERINOSELECT evaluate "doing ability"?

Yes, indirectly. High performing animals are those that can best handle the environment in which they produce. As long as they are maintaining a regular reproductive pattern, the animals with the higher ASBVs will be the better "doers" under your environment.

37: On which trait should I place most emphasis?

The trait on which breeders place most emphasis depends on their production goals and the current strengths and weaknesses of their flocks. Ram breeders' production goals should largely be determined by the production goals of their clients.

38: Should I select for the highest ASBVs?

Not necessarily, your selection pressure will depend upon your environment, your flock improvement goals, and the market you are aiming for. Different traits will assume different importance under different circumstances, but improving growth, as long as it is not at the expense of fertility is sound economic sense.

Successful breeding results from applying selection for a balance of economically important traits therefore it is usually better to select animals that fall within an acceptable range for a number of traits rather than select the best for only a single trait.

39: How much emphasis should I place on ASBVs when selecting rams?

A logical procedure for selecting ram is;

Select those rams that fall within your minimum/maximum ASBV range for your target traits, then disregard any that don't meet minimum requirements for functional and/or market traits, for example,

- Those rams that have unacceptable structure, conformation and temperament,
- those rams that are too early or too late maturing for the type of market that you are aiming for.

40: LAMBPLAN/MERINOSELECT selection Indexes – a simple solution to a complex problem

Selection Indexes take the hard work out of knowing how much emphasis you should give to each of the available ASBVs when selecting breeding animals – an index gives you a **single ASBV, for the whole animal**, that reflect the value of an animal, in relation to your breeding objective.

Indexes allow **balanced** selection - they apportion the amount of selection pressure that needs to be applied for growth, maternal, carcass, wool and fertility traits to give you the most profitable flock over the long term – high index animals will rarely have the highest ASBV for any single trait.

Typical production parameters, prices and production costs underlie each index.

The process of balanced (index) selection involves a couple of logical steps that combines economics with genetic selection. Economic values for performance measures are calculated for each flock's production and market situation.

Using some tried and tested genetic theory these economic values are then used to calculate appropriate weightings for the ASBVs currently available.

Weightings are calculated to account for correlated responses between traits, and for the long term effects of selecting for "cost traits" such as growth and leanness, which may eventually lead to decreased ewe fertility or increased ewe maintenance.

These weightings apply selection pressure to the right ASBVs to achieve the greatest long term flock profit.

Customised indexes can be calculated for individual flocks using flock-specific production information and marketing goals. The flock owner needs to answer some questions about the on-farm production and the requirements of the market being targeted. Providing indexes for clients is a valuable marketing tool for stud breeders.

41: Can LAMBPLAN analyse performance records from crossbred animals?

Yes. LAMBPLAN now provide a composite breed code and flock number for members joining as such. Provided the lambs that they are producing have pedigree

links to other LAMBPLAN recorded animals, breeding values can be estimated.

42: I'm a commercial breeder, should I be in LAMBPLAN/MERINOSELECT?

The benefit of LAMBPLAN and MERINOSELECT to commercial breeders is less clear than it is for seed stock breeders, as some of the recording procedures that are an integral part of a stud operation would require additional work and commitment for commercial breeders.

Extensive commercial operations and flocks in difficult terrain would have problems in meeting the animal identification and birth date recording requirements of LAMBPLAN/MERINOSELECT. These flocks can still directly benefit from LAMBPLAN/MERINOSELECT, by using ASBVs as a method of comparing the genetic merit of sire replacements.

More intensively run commercial flocks may well benefit by direct involvement in LAMBPLAN or MERINOSELECT, and in fact many flocks are, if not for the entire flock then for a nucleus flock from which they breed their replacement stock. If these flocks can handle at least one AI program to provide links to LAMBPLAN/MERINOSELECT flocks, then they can clearly identify the relative genetic merit of their flock to the breed benchmark, and identify sires that will give the desired rate of improvement.

43: How does LAMBPLAN/MERINOSELECT make allowance for the wide differences in nutrition between flocks?

Difference in nutritional levels between properties is accounted for by the use of link or marker sires, which have progeny in at least two flocks. The link sires in each flock are used as the reference point for that flock and all animals are ranked in relation to these link sires.

44: Do sires rank differently in different areas?

In most cases the ranking of sires is not affected.

Reproductive Traits

45: What are Maternal Weaning Weight ASBVs?

The performance of the lamb is affected by the value of its own genes for growth and how much milk the mother provides and how good a mother she is. So, there are two sets of genes affecting the growth of the lamb:

- The genes of the lamb itself for taking food and converting that food to body tissues ~ the **direct** genes for growth.
- The genes of the dam for providing milk and generally assisting the lamb to grow ~ the **maternal** genes for growth.

Where records are available for weaning weights and the sire and dam pedigree, the growth of the lamb to weaning can be split into its Direct and Maternal components.

46: How does LAMBPLAN/MERINOSELECT perform the split between Direct and Maternal effects for Weaning Weight?

A simple example shows how LAMBPLAN/MERINOSELECT separates the effect of the lamb's genes from those of its dam.

Assume that a ewe has twin lambs – 1 ram, 1 ewe, that both weigh 5 kilograms heavier than their respective sex averages. We can use information from the progeny of these two lambs to find out the proportion of that extra 5 kgs of merit was due to their direct or maternal genes. Assume that 10-20 progeny are produced from the ram lamb and 4 lambs over two joinings from the ewe.

If we observe that her male-line grand progeny are average for weaning weight, but that her female-line grand progeny averaged 2.5kg heavier than average, this would be clear evidence that:

- The DIRECT growth genes of the original ewe are average – her son passed on genes for only average growth to his progeny.
- The MATERNAL growth genes of the original ewe are better than average – her daughter has produced lambs that are heavier than average – by 2.5kg.

47: How to use DIRECT and MATERNAL Weaning Weight ASBVs.

This separation between direct and maternal genes for growth means that breeders can:

- Identify animals with the best genes for early growth – those with superior direct weaning weight ASBVs. Especially in terminal sire breeds, these will be the best animals for siring early season lambs.
- Identify dams that will give their lambs the better start – higher milk and better mothering or maternal performance - those with superior maternal weaning weight ASBVs.

48: Number of Lambs Born (nlb) and Number of Lambs Weaned (nlw) ASBVs

The number of lambs weaned in a ewe's reproductive life is influenced by several components including:

- Ovulation rate
- Litter size
- Pre – and post-natal survival, and the interval between lambings.

OVIS, the analytical software for LAMBPLAN/MERINOSELECT genetic evaluation, has two traits that describe reproductive performance. They are the number of lambs born (nlb) and the number of lambs weaned (nlw), expressed as the ratios to the number of the ewe's lambing opportunities.

The nlb and nlw per lambing opportunity are female fertility traits; however, information from male animals can contribute to ASBVs. Male animals receive ASBVs for these traits, because they have genes for female fertility traits, which they pass on to their daughters.

The starting point in calculating ASBVs is to know the heritabilities and the averages

for each breed. The second step is to identify contemporary groups. Contemporary groups are defined by factors including breed, flock, management group and different levels of variability across groups. ASBVs are then calculated from the measured differences of the animals from the mean of their contemporary group.

OVIS adds to the accuracy of the ASBV, by adding extra information. This includes:

- The differences recorded for each ewe's female relatives,
- Any records of scrotal circumference for male relatives of each ewe. Genetically, male scrotal circumference is positively related to female fertility, as well as to litter size, age at puberty and possibly pelvic size.

49: Most young rams have low accuracy for Maternal ASBVs - are these ASBVs likely to change?

As most sale rams do not yet have daughters in production, their maternal ASBV can only be estimated from their parents and relatives ASBVs. Because of this, and the fact that reproductive traits are lowly heritable, the accuracy of the ASBVs for young rams will usually be between 30 and 50%. As such they will be subject to fluctuation, either up or down, as half-sib and daughters progeny information becomes available.

Even with low accuracy ratings, ASBVs are still the best estimate with which to compare young rams to the breed base for reproductive traits, and will be more accurate than visual selection. *See Appendix A*

50: Why is Missing Data Important?

As data for some of the reproduction traits is generated from the pedigree, missing information in the pedigree makes accurate calculation difficult. Any missing information may result in the actual reproductive record of a dam being different to that recorded in the pedigree. This may also lead to lower values for nlb and nlw than was actually achieved. For example, a ewe that has had seven lambs in five years would have a value of 1.4 but if a pair of twins was not recorded in an intermediate year than this value would only be 1.0. Therefore it is important to record all lambings.

51: ASBVs to describe lambing ease

1. Gestation Length ~ There is some relationship between gestation length and lambing ease. For this reason breeders using AI or who have accurate records of serving date are encouraged to supply this information to the LAMBPLAN/MERINOSELECT database.
2. Lambing Ease ~ As with BREEDPLAN, LAMBPLAN/MERINOSELECT will be able to provide ASBVs for lambing ease. These will be in two forms, LE_{DIR} , an ASBV that describes a ewe's ability to lamb unassisted and LE_{MDRTS} , an ASBV to describe the lambing ease of a sire's maiden daughters.

Optimising your LAMBPLAN/MERINOSELECT result

52: Flock management tips to get the most from LAMBPLAN/MERINOSELECT, & to increase the accuracy of your ASBVs.

It is important to ensure that your recording procedures optimise the accuracy of the ASBVs calculated for your flock. Most problems encountered for some animals can be explained by biases brought about by incorrect data recording or flock structure.

The recipe for increasing the accuracy of your ASBVs is to keep management groups as large as possible and to ensure linkage between groups of lambs, therefore,

- Weigh lambs before they are separated into different management groups, for example before some of the males are castrated, or before some will be preferentially fed. Where you have to split a group before weighing, make the split on the basis of sex of lamb (sex groups are analysed separately anyway), and then on lamb age if a further split is required.
- Record as separate management groups, any animals (or group of animals) that have been managed differently to the extent that their performance could have been influenced. For example feeding a group of rams for sale whilst the remainder of the drop are pasture reared, mixed sex lambs from a group of ewes run on improved pasture versus a group on unimproved pasture.
- Time AI programs to coincide with natural mating, or include a sire from the natural mating in the AI program, to avoid the AI group being genetically isolated from any comparison.
- Ensure more than one sire is represented in each management group by ewes and lambs after mating and reforming mating groups at weaning each year.
- Don't change all your sires in the same year; rather have a carry-over of sires from year to year.
- Have a compact lambing. This increases the number of lambs in each group and reduces the number of groups based on lamb age.
- If you use back-up sires ensure that these sires have progeny in the main group or have had progeny in previous years. Using ram lambs for back-up requires careful consideration of management groups.
- Don't join the same sire to the same group of ewes each year, such as can happen when ewes are set stocked in year-of-drop groups. It is better to re-allocate ewes and sires to joining groups each year, and where this is not possible then ensure that more than one sire is joined to each "isolated" ewe group, and that sires are rotated amongst groups from year to year.
- Ensure that rams are allocated evenly across ewe age groups. Don't join one

sire to all the ewe lambs or maidens.

- Don't only record the better lambs as this will cause considerable bias in the ASBVs. Weigh and record all lambs at weaning before culling.
- Weigh and record castrated lambs. You won't be breeding from them but they do get their genes from the same parents as their brothers and sisters. Their record does contribute to the individual record of their sire and dam and to the genetic profile of the flock or breed in general.
- Record the pedigree, lambing ease and, if possible, the birth weight of dead lambs (including those that die within 48 hours of birth).
- Ewes that have had an opportunity to lamb but don't lamb should be recorded by using dummy lamb Ids with DRY001 DRY002 in the Id as the last six digits please refer to the QA manual).

53: Keeping LAMBPLAN/MERINOSELECT going during a drought or poor feed availability situation.

Owners of LAMBPLAN/MERINOSELECT flocks in drought affected areas have more pressing worries than the finer points of LAMBPLAN/MERINOSELECT, and it will be tempting to drop recording for awhile.

However, with a little effort it is often possible to keep the essentials going and thus avoid a major gap in the recording history of your flock. It also helps protect the investment you have made in your performance recording program. A few things to consider are;

- (i) Don't avoid submitting low drought affected weights in the fear that they will lower your ASBVs. Sheep are only compared in like treatment groups, so the drought affected lambs should not be disadvantaged.
- (ii) There will be situations where it is not be possible, or worth while, collecting weights, for example no facilities at the agistment site, sheep on the road, or hand feeding with uneven distribution.

Where possible keep the pedigree records for these animals and submit a later weight when the job is back to normal, for example, miss the weaning weight but submit a yearling weight.

- (iii) Where groups of sheep are away on agistment or receive different levels of feeding, note groups treated differently by giving them separate management group codes.

Dispelling a few myths

54: LAMBPLAN/MERINOSELECT costs too much

The perceived cost-benefit of LAMBPLAN/MERINOSELECT is a commercial decision for each individual to consider, but the cost of LAMBPLAN/MERINOSELECT needs to be considered relative to other costs of producing seedstock, for example;

The annual cost of LAMBPLAN/MERINOSELECT, for a flock of 100 ewes is around \$495. .

Assuming that such a flock sells 40 rams a year, and the total flock LAMBPLAN/MERINOSELECT cost is assigned as a cost of production to those rams, then the cost per ram is around \$12.37.

Assuming an average sale price of \$400, this cost represents **3%** of the sale price of each ram sold. Clearly, if LAMBPLAN/MERINOSELECT value-adds the sale price of your rams, either now or in the future, by more than \$12.37 then you are ahead. This is over and above increased value of female seedstock or any genetic improvement that you achieve in your sheep flock for growth, reproductive, carcass or wool traits through improved selection decisions.

- If scanning for carcass traits is included (40 rams and 40 ewes), the cost per head is increased by a further \$350 or another \$8.75 per ram sold. This combined total LAMBPLAN/MERINOSELECT cost of \$21.12 then represents **5.28%** of the sale price of each ram sold.
- The above LAMBPLAN/MERINOSELECT costs do not include labour for weighing, mothering up etc. However, most if not all these procedures are a routine part of seedstock production.
- The above LAMBPLAN/MERINOSELECT percentage cost may vary. Likewise, other production costs will vary between individual breeders as a result of differences in marketing strategies and management systems.

55: I couldn't compete with people who might cheat the system

LAMBPLAN or MERINOSELECT subscribers are dedicated to improving their flocks by accurate recording of their sheep. It is impossible to hide the genetic characteristics of an animal when inspecting their progeny. When another breeder uses an outside sire the breeder will discover what that sire is really like, genetically. The system is self-regulating.

However, some people are concerned that a few unscrupulous breeders may record incorrect information to gain advantage for their flock or particular animals.

Experience has shown however that the perception of cheating often stems from a

lack of understanding about how LAMBPLAN and MERINOSELECT work, with people drawing incorrect conclusions about what they see or hear.

The system is not easy to cheat, and doing so could well be counterproductive for the instigator.

- As records are received they are checked by an experienced operator for discrepancies and their fit to expected normal statistical pattern. It is surprising how conspicuous incorrect data can be.
- When calculating ASBVs, LAMBPLAN and MERINOSELECT take into account the genetic correlation that occurs between associated traits. Overstate the weight of a ram and you will increase his birth weight ASBV to his disadvantage, and give his contemporaries lower birth weight ASBVs to their advantage.
- ASBVs are calculated from information recorded from close relatives of the animals, as well as the animal's own performance. This means that an inflated weight record will be somewhat diluted in the pool of records from relatives, particularly if the sire in question has been used in other flocks.

In addition, the animal will appear as an "outlier", that is, one that is too far ahead of the pack, and will be singled out for attention when the data enters the national database.

Furthermore, should an animal's weight records be misstated and the animal's ASBV be biased as a result, that animal will have a lot to live up to when he is used in other flocks. In this instance, LAMBPLAN/MERINOSELECT is a great equaliser.

56: LAMBPLAN/MERINOSELECT doesn't work, Fred Smith told me so

Most confusion seems to occur from one or more of the following factors;

- People expect that the ASBV describes the performance of the animal they see in front of them. It doesn't. It describes the genetic component of what you see in the animal's progeny. Remember, much of what you see has been influenced by environmental happenings such as differences in feed availability.
- ASBVs are a prediction about breeding potential of animals, which is a prediction of what you will see in the next generation, not what you see in front of you.
- People sometimes express disappointment when a favoured animal's ASBVs are not as good as they had hoped.

Perhaps incorrect or insufficient data has been entered, for example the wrong management group codes have been recorded, so the ASBV is calculated incorrectly.

In other instances, the ASBVs are right and the animal is not as good as expected - this may be difficult to accept, particularly if people are observing environmental

differences, not genetic differences.

* A person's conclusion may have to be drawn from a single observation of only one or two progeny of a sire. These observations may not be representative of the sires breeding value and may be influenced by selective joining to top ewes or heavy culling of lesser performing progeny. LAMBPLAN and MERINOSELECT adjusts for these factors, people rarely do.

Where you perceive a problem, have the matter investigated yourself, don't rely on other people's judgement.

57: LAMBPLAN/MERINOSELECT selects the wrong type of sheep

LAMBPLAN/MERINOSELECT does not select any sheep, people do. LAMBPLAN/MERINOSELECT often gets blamed for making sheep too short, or for taking away fat etc. - it does not, and cannot, do such things.

Where LAMBPLAN/MERINOSELECT can become implicated in such perceptions is that it does allow attention to be focused on differences between animals for single traits - then entrepreneurial spirit takes over.

LAMBPLAN/MERINOSELECT describes the expected performance of a ram, just as a set of automobile specifications describes the expected performance of a vehicle. You don't go and buy the biggest car or fridge just because it is the biggest; you buy the one that best meets your needs. Nor should you buy the biggest ram just because it is bigger than the rest. Again you buy the one that best meets your needs.

When making selection decisions you need to ensure that the ram has a balance of the traits that are important to your production situation.

You, the person buying the ram have the responsibility to ensure that its performance profile meets your requirements. If you don't then it is unfair to blame LAMBPLAN/MERINOSELECT for mis-directed selection goals.

58: It can't be any good, Freddie Flintstone is in LAMBPLAN/MERINOSELECT yet his rams sell for less than Joe Blogg's rams, and Joe isn't in LAMBPLAN/MERINOSELECT

LAMBPLAN/MERINOSELECT only describes a small number of the total factors (albeit very economically important ones) that contribute to the perceived value of a ram.

Structure, conformation, muscling, maturity type, breed type and temperament are but a few other important factors that also set the market price.

Marketing expertise and energy, and presentation also play a big role in selling rams and setting prices. These are in fact environmental differences, not genetic, and will not necessarily influence the value of the ram's progeny.

Also, just because a ram has LAMBPLAN/MERINOSELECT figures doesn't mean he is an attractive sale proposition. He may be unsound or outside of the acceptable range for performance and/or maturity patterns or of poor temperament.

Maybe Freddie's rams have problems being marketed, but it is unfair to blame LAMBPLAN/MERINOSELECT for non-LAMBPLAN/MERINOSELECT problems. Maybe Freddie doesn't present his sheep very well, in which case they are probably undervalued and Freddie needs to attend marketing school.

59: You can't compare ASBVs from animals run under different environments

This is a question that exercises many minds, for example how can lambs in Victoria be compared with lambs in Western Australia. In other words, how can LAMBPLAN/MERINOSELECT differentiate between the amount of a lamb's growth that is due to the effects of environment, and that which is due to genetics?

Whilst it is difficult for people to accurately compare the performance of animals reared in different paddocks or on different properties, LAMBPLAN/MERINOSELECT can and does just that with relative ease.

LAMBPLAN/MERINOSELECT separates genetics from environment in two ways;

Firstly, by breeders noting on their data input forms or in the software any individuals or groups of sheep that have been treated differently, for example feed or management groups. LAMBPLAN/MERINOSELECT comparisons are initially done within these groups, and then compared to other groups after adjustments have been calculated.

Secondly, by having link animals in the different flocks, for example a sire on one property with progeny in 3 flocks, or an AI link sire with progeny in 3 flocks, LAMBPLAN/MERINOSELECT is able to create groups of animals across groups or flocks that are in effect...

- the same age
- out of the same age dam
- by the same sire
- out of similar performance dams

With a little fine-tuning it can be assumed that difference in performance across these linked groups is the effect of environmental (group or property) difference. LAMBPLAN/MERINOSELECT can easily adjust for this.

Appendix A

More on Accuracy

Each animal has a true breeding value ~ but it is effectively impossible to determine that. In practical breeding programs we use pedigree and performance information to get the best estimate of the true breeding value ~ to get an estimated breeding value (ASBV).

The accuracy of an ASBV depends on how much information we have on that animal ~ including information on all its relatives, and on how good a picture of the genes we get using whatever measure is involved (weight, fat depth, wool weight, or whatever).

Information about the animal's performance with regards to the trait of interest, information on correlated traits and information from its relatives all contribute to the estimate of breeding values. The more information there is the closer the ASBV will be to the true breeding value (TBV).

Accuracy for ASBVs can be expressed as:

- A percentage, with higher percentages meaning greater accuracy and hence the ASBV is closer to the TBV.
- A standard error, which indicates the range in which the true breeding value is likely to be, and for this a smaller standard error means the ASBV is closer to the true breeding value.

For example, an animal may have the following ASBV for yearling weight, accuracy and standard error:

ASBV = +10 kg

Accuracy = 71%

Standard Error = ±2.1 kg

The **ASBV** means that the estimated value of this animal's genes is +10 kg for growth. The **Accuracy** is 71%. The **standard error** means that the true breeding value of this animal is likely to be between +7.9 kg and 12.1 kg.

The following table illustrates how accuracy will improve as more information is added.

Stage of life	ASBV	accuracy	likely range for tbv
Birth	+5	25%	1.94 to 8.06
Own Record	+5	50%	3.27 to 6.73
Own Record + half-sibs	+5	57%	3.36 to 6.64
1 st progeny crop	+5	85%	3.95 to 6.05
2 nd progeny crop	+5	91%	4.13 to 5.87

From this table we can see:

- As accuracy increases, the standard error of the ASBV or index value decreases – we can be more confident that we are close to the true breeding value.
- Adding progeny improves accuracy more quickly than adding half-sibs – adding 5 progeny increases accuracy by more than does adding 5 half-sibs.
- Accuracy initially rises quickly as number of relative's increases but then increases more slowly – accuracy goes from 66% to 85% for sires as the number of progeny increases from 5 to 25, but then only to 91% as the progeny number grows to 50.
- Animals ASBVs do not necessarily change through their life ~ very early ASBVs on animals are a good guide to animals' true breeding value, where a breeder has good pedigree records, previous year's data already collected and collects good performance records.

Factors that improve accuracy and factors that reduce accuracy

increased accuracy	reduced accuracy
Accurate management groups	Poor identification of management groups
Even mating group sizes	Some sires get many progeny, others few progeny
Animals get similar amounts of performance information	Some animals get many progeny, others get few progeny
Accurate pedigree records	Poor pedigree data

LAMBPLAN/MERINOSELECT reports will contain accuracy information on the key production groups.

- Growth accuracy (the average accuracy of weaning, post-weaning and yearling weight ASBVs)
- Carcase accuracy (the average accuracy of fat depth and eye muscle depth ASBVs)
- Reproduction accuracy (the accuracy for NLW ASBV)
- Wool accuracy (the accuracy for GFW ASBV)

It is likely that the accuracies for these key areas will differ due to the fact that not all animals will get the same measurements taken, for example breeders may weigh all animals, but only scan 75% resulting in lower accuracy figures for carcase traits when compared to growth traits. It is important that when selecting animals for breeding that you look at the accuracies of all the ASBVs that are critical to your breeding objective.

So what ~ how does accuracy impact on genetic progress?

It is important to keep accuracy in perspective: accuracy and genetic merit are not the same. It is possible to have animals that have very low ASBVs, but for those ASBVs to be very accurate.

Running practical, profitable breeding programs that maximise genetic merit depends on two things:

- Having accurate information about animals' genetic merit,
- Finding plenty of animals with very high genetic merit.

From this foundation, the main challenge is then to identify better and better animals each year.

Typically, for flocks with LAMBPLAN/MERINOSELECT information and that are making genetic progress, this will mean using 7-8 young sires for every 2-3 older sires. This might seem risky ~ after all; the older sires have higher accuracy. But, remember that the ASBVs and index values have used all available information, and taken account of how much information is available on each animal, young or old. So, the animals with the best ASBVs and Index Values will be the best bets for breeding.

Summary

- ASBVs estimate animals' *True Breeding Value* ~ the real value of their genes
- ASBVs use all available information on the animal and its relatives
- ASBVs are more accurate when management groups are accurately identified, when mating group's sizes are even, when similar classes of animals have similar amounts of information, and when pedigree records are available and are accurate.
- Typically in flocks using LAMBPLAN/MERINOSELECT, young animals will have accuracy values of 55-60%, and sire will have accuracies of 85-90%.
- Groups of animals breed more closely to their average ASBV or index value than individuals ~ the breeding performance of a team of rams will be almost identical to their average ASBV, and the average ASBV of a whole year drop will be exactly the average of their parents ASBVs.