# Breeding Value Accuracies

SIL Technical Note

Relates to: Precision of estimates of genetic merit and risk in using them
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**Summary**

- Accuracies reflect the amount and value of information used to calculate the estimated Breeding Value (eBV).
- Accuracy values are expressed as a percentage from 0% (low) to 100% (high).
- Accuracies are built into eBVs. Animals are assumed to be 'average' until information indicates otherwise. When limited information is available, eBVs are shrunk back toward the population average. As more information is added eBVs become more accurate and the range of eBVs spreads out.
- Low accuracy eBVs, usually based on only limited data, are more likely to change as further information becomes available. You can reduce risk due to low accuracy eBVs by using several such animals.
- Rams with high accuracy eBVs (usually with lots of progeny data) are low risk. Their eBVs will not change much as more data is added - their eBVs are expected to be close to "true" genetic merit. They are ideal for breeding sale rams and use as link sires.
- Accuracy values are a useful tool for assessing risk.
- DNA breeding values (mBV) and standard breeding values (eBV) can be combined, proportionally on the basis of their respective accuracies, to produce a single genomic breeding value (gBV) for a trait.

## Background

When an animal is born there is background information from its Sire and Dam as well as more distant relatives. A breeding value (eBV) can be estimated from this information but it will have low accuracy. As the animal grows it may accumulate its own records for traits such as weaning weight, autumn weight and fleece weight. This information will increase the accuracy of estimated breeding values for those traits. If the animal is a twin or triplet there may be some information on one or two full sibs and usually there are half siblings ("half-sibs" have the same sire but different dams) which add to the accuracy of prediction.

For traits such as growth and fleece weight, which are measured early in life and have moderate heritabilities ($h^2$ =0.30), eBVs can have good accuracies (close to 70%) by one year of age (see Table 1). For sex limited traits, such as number of lambs born, or traits with low heritabilities, such as survival and number of lambs born ($h^2$ =0.10), we are usually working with lower accuracies eBVs, unless they have large numbers of progeny with information (see Table1) but this takes time. Usually only a few older sires have many progeny.

Large numbers of half sibs increase accuracy up to a point. Accuracy hits a ceiling at about 500 half-sibs and will not increase above that value until progeny information becomes available (see Table 1). Since each individual receives a unique mix of the genes on offer from their parents, we can't get the most accurate eBVs until we get this "proof" through progeny performance. Only then do eBV accuracies approach 100%.

Progeny information is the best type - relatively little gives significant gains in accuracy.

**Table 1**. The effect of the number of records, type of records and trait heritability on eBV accuracy.

| | | Number of Records | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of record | Own | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Dam | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Sire | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Full Sib | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Half Sib | | | | 25 | 50 | 500 | 25 | 25 | 25 | 25 | 25 |
| | Progeny | | | | | | | 10 | 25 | 50 | 100 | 500 |
| Heritabilities | 0.30 | **38** | **61** | **63** | **67** | **68** | **69** | **79** | **86** | **91** | **95** | **99** |
| | 0.20 | **31** | **51** | **54** | **59** | **61** | **64** | **72** | **81** | **87** | **93** | **98** |
| | 0.10 | **22** | **37** | **40** | **47** | **50** | **56** | **59** | **69** | **78** | **86** | **96** |
| | | **Accuracy of breeding value** | | | | | | | | | | |

**NB**: These accuracy figures are approximations. In practice, the complicated web of relationships in real animal pedigrees means derived accuracies will differ to some degree. Also the effect of small contemporary group size acts to reduce accuracy.

## Points to Note

- Accuracy values are usually less than 60- 70% until progeny information is available.
- A small number of progeny (as few as 10 with records) increase accuracy markedly. So test mating ram lambs can be an effective tool to refine estimates of genetic merit.
- Accuracies are significantly lower for low heritability traits unless there is a large amount of progeny information.
- There is a tradeoff between generation interval and high accuracy. Waiting years for highly accurate eBVs before making selection decisions will increase the generation interval and decrease the annual rate of genetic gain.

## Accuracy and risk

Sires with higher accuracies are likely to breed consistently. This makes them ideal for breeding sale rams or for use as link sires because there is low risk. However some lower accuracy rams lambs or hoggets offer the next step in flock improvement but with more risk for any one individual animal. You can reduce this risk by test mating a small "team" of ram lambs. Relatively few measured progeny add useful accuracy to a sire's eBVs. The eBVs will increase for some of these rams while decreasing for others as progeny information is added - that is why using a team is best.

SIL eBVs have the effect of accuracy built in, so you should not select on both eBVs and accuracy. When looking at one age group of young stock, such as 2-tooth rams as replacement sires, most have similar accuracy values (depending on depth of pedigree), so it is best to simply choose individuals with the best eBV package to suit your breeding objective.

## Combining different types of breeding values

New DNA technology allows us to produce "molecular" BVs (**mBV**) based on DNA tests. SIL can combine **mBV**s with conventional **eBV**s to produce genomic BVs (**gBV**), where the relative emphasis placed on each **BV** is based on their respective accuracies. With little conventional performance information a **gBV** will be dominated by the **mBV,** whereas without a DNA based **mBV**, the **gBV** simply equals the **eBV**.

## Need more information?

Contact your SIL bureau, telephone 0800-745-435 (**0800-SIL-HELP**) or send an email to silhelp@sil.co.nz.