

# Understanding ABVs for cows and heifers

## Technote 6

### HIGHLIGHTS

- Australian Breeding Values (ABVs) measure the genetic merit of heifers and cows.
- ABVs predict a heifer's value in the herd and her potential for breeding high genetic merit calves.
- Cows and heifers that are herd tested or genotyped (or both) can have an ABV.
- Cows that don't have sufficient data won't receive an ABV.

Australian Breeding Values are used to compare the genetic merit of females within a herd and between animals in different herds. Following are some examples of ways female ABVs can be used for decision making.

- Farmers use heifer genomic ABVs to select the best replacements to enter the herd and to avoid bringing the duds into the herd.
- Farmers use ABVs to select which females to breed replacement heifers from. High genetic merit heifers most often breed high genetic merit calves.
- Farmers use ABVs to decide which females should be bred using sexed semen or beef.
- Farmers determine the average genetic merit of their herd using ABVs and monitor genetic progress over time.
- Bull companies use ABVs to identify females from which the next generation of bulls will be bred.

### What do ABVs mean?

ABVs are the best estimate of a female's genetic merit. ABVs measure the characteristics (traits) she is likely to pass on to her offspring. ABVs are available for 50 different traits. The most economically important ABVs are incorporated into breeding indices: Balanced Performance Index, Health Weighted Index and Sustainability Index.

Balanced Performance Index (BPI)	Health Weighted Index (HWI)	Sustainability Index (SI)
		
Index units	Index units	Index units
<b>Eg. BPI of 300</b> On average this animal returns \$300 more income over feed/herd costs. The average is 0.	<b>Eg. HWI of 280</b> This animal is 280 units greater for health and fertility traits.	<b>Eg. Sustainability Index of 250</b> This animal is 250 units more efficient for emissions intensity than average. The average is 0.

ABVs are relative measures. They work best when comparing one animal to another or one animal to the average. To make sense of a relative measure, it is useful to understand the average of each ABV

and how the ABVs figures relate to each other. ABVs are expressed in units of measure, standard units or a percentage, depending on what's most appropriate for the trait.

Production Feed Saved	Type Traits	Management Traits
Kg % fat and protein L milk Kg feed saved	<b>100</b> SD5	<b>100</b>
<b>Eg. Protein ABV of 40 kg</b> This animal is 40kg greater for protein than average. The average is 0.	<b>Eg. Overall Type ABV of 105</b> This animal is 1 standard deviation above average for overall type. The average is 100.	<b>Eg. Daughter Fertility ABV of 103.</b> This animal is 3% greater than average for fertility. The average is 100.

Table 1 provides an example of the difference in genetic merit for protein and fertility that can be observed between two cows. 'Bossy' is superior for both protein and fertility and is expected to produce more profitable replacements that are superior for both protein and fertility.

To estimate the breeding value of offspring, half the breeding value from each parent is combined. This reflects the fact that offspring receive half their genetic merit from the dam and half from the sire.

### The average or base

ABVs and indices are relative measures, meaning they make more sense when compared to each other or an average. The 'average', also known as the 'base' is a clearly defined group of animals to which all others are compared.

Table 1: Comparing the ABVs of two cows

	Protein ABV (kg)	Fertility ABV (%)	BPI (\$)
<b>Bossy</b>	28	104	<b>300</b>
<b>Daisy</b>	22	96	<b>250</b>
<b>Difference</b>	6kg more protein	8% greater 6-week in calf rate	<b>\$100</b> more income over feed costs per year
Half passed on to her offspring			

The Australian genetic evaluation system defines the average as the purebred cows of the same breed that are born between the years 2009 - 2013. It was last updated in 2016. The average is set at 0 for production traits and 100 for non-production traits and provides a reference point for comparisons between ABVs for both cows and bulls.

## Reliability

The reliability of a cow's ABV depends on the quality and quantity of information provided by the herd recording and or the genomic service provider systems. In general, the more information used to calculate an ABV, the more accurate it is and the higher is its reliability. Genotyping animals provides a significant boost to the reliability of ABVs, as illustrated in Table 3.

**Table 3: Reliability of production ABVs for Holstein cows with different information sources (August 2020)**

Average reliability*	
Young heifer (parent average ABV)	40%
Genotyped heifer ABV(g)	78%
10 year old cow (no genomics but herd tested)	70%
* Reliability of individual animals will vary	

## Which cows get ABVs?

To receive an ABV, a cow must be herd recorded, genotyped (or both).

**Genotyped:** Increasing numbers of heifer calves are being genotyped. Genomic ABVs are available for Holstein, Jersey, Aussie Red, Ayrshire, Illawarra and their crosses.

To get an ABV(g) an animal must have:

- a valid genotype recorded at DataGene
- a unique national ID and
- a valid birth date and breed code

It is optional, but preferable, to also have sire, dam and maternal grand sire recorded.

**Herd recorded:** herd recording information is collected from herd improvement centres around Australia and supplied to DataGene for genetic evaluation. To get an ABV a cow must have:

- records of lactation production in an Australian herd recording system
- a unique national ID
- a valid birth date and breed code
- a known sire that has also been given an ABV

Some cow lactation information may not be used in calculating an ABV because of:

- abnormally high or low lactation performance
- lactations commencing for cows less than 18 months or more than 20 years of age at calving
- lactations that are too close to another or overlap another
- lactations beyond the third lactation

The following page provides some tips for females that are either missing on DataVat or have limited information.

## Publishing cow ABVs

**DataVat:** Female ABVs are accessible to herd owners through DataVat, under secure login. They are updated weekly (on Tuesday afternoons) incorporating the latest available genomic and herd test results.

ABVs are summarised in herd reports like the Genetic Progress Report and Genetic Futures Report. These are also available on DataVat and updated in April, August and December with each public ABV release.

DataGene also publishes a list of the top females with each public ABV release. Anyone can access this [on DataGene.com.au](https://www.datagene.com.au).

**Third parties:** When you send samples to genomic service providers, they will supply you with results, including ABVs for tested females. Some services provide custom reports, tools and apps.

DataGene also supplies ABVs for eligible females to herd improvement centres and breed associations.

## More information

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## Data update cycles

DataVat	Centre/Mistro
<ul style="list-style-type: none"> <li>Female ABVs: updated weekly (Tuesdays) based on latest genomic and herd test results.</li> <li>Genetic Progress Reports &amp; Genetic Futures Reports: updated in April, August and December with public ABV releases.</li> <li>Bull ABVs: updated in April, August and December with public ABV releases.</li> </ul>	<ul style="list-style-type: none"> <li>Herd Test results: updated as soon as herd test centre supplies.</li> <li>Female ABVs: updated to the Centre software in April, August and December with each public ABV release.</li> <li>Parent average ABVs: updated with each herd test (no ABV reliability is estimated and left blank.)</li> </ul>

## Trouble shooting missing female information on DataVat

DataVat delivers information that reaches its database. If you notice gaps in your data, speak with your data supplier who might be a herd recording organisation, genomic testing service, breed organisation or farm management software package. DataVat cannot fix incomplete or inaccurate records but can highlight where gaps exist.

### The cow was genotyped but genomics are not included in her ABVs

Possible causes	Possible actions to resolve
The genotype has not yet reached DataGene or could not be linked to the animal	Check with your Genomic Service Provider
The sample failed quality measures	Check with your Genomic Service Provider. Generally, an animal will need to be resampled.
The animal's genotype is inconsistent with its sex or a parent	Check with your Genomic Service Provider for details. The system may propose alternative parents.

### Cows or the entire herd are not displayed

Possible causes	Possible actions to resolve
Users must be logged into DataVat and be authorised by the herd owner to access their data.	If you haven't already done so, Sign Up on DataVat to register as a user and connect with your herd records If you are an advisor, you need to sign up and request authorisation from the herd owner. (click on Report & Tools then Authorisations) If you have previously signed up, make sure you have logged in.
An animal and its pedigree must be entered on the central data repository (CDR) either via genotyping or herd test centre.	Contact your herd test centre or genomic service provider to check that this animal's ID and pedigree are recorded.
Calves haven't been entered on the CDR.	Synch your on-farm calf data with your herd test centre or genomically test your calves.

### Cow appears on DataVat but without ABVs

Possible causes	Possible actions to resolve
Cow must have unique National ID	Advise your data supplier if a cow doesn't have a National ID.
Cow must have known sire which has also been given an ABV	Record the sire of the animal with your data supplier. Cows with unknown sires won't receive ABVs.
Cow must have valid date of birth relative to sire and dam.	Record the birth date with your data supplier. Check that the birth date is correct. Check that the sire and dam are correctly recorded.
Cow's breed must be consistent with sire breed.	Check the breed of the animal and record it if known. Make sure the breed is consistent with the breed of the sire and dam.
If a cow is by an AI sire, then semen for that sire must have been available at the time of conception	This is a safety check to make sure the sire is correctly recorded. Double check the sire to make sure it's the right one.
ABVs must have a reliability of at least 10%	If very limited information is available for an animal, the reliability may be less than 10% which means that any ABVs are not published.

## Animal appears on DataVat but without lactation information

Possible causes	Possible actions to resolve
Animal was genomically tested but not officially herd tested or has been sold to an un-tested herd or for export	The only way to resolve this is to herd test if the animal is still in a herd recorded herd.
Lactation has been excluded because it did not meet the following criteria <ul style="list-style-type: none"> <li>Cow age at calving must be between 18 months and 20 years</li> <li>Lactation cannot overlap or be too close to another</li> </ul>	Check with your on-farm software or herd test centre that the recorded date of birth and calving dates are accurate.
The herd recording data for this animal and its genotype are not linked to the same National ID.	Check National IDs and contact your genotype service provider about updating the National ID on their records.

## Animal appears on DataVat but without latest herd test information or culling data

Possible causes	Possible actions to resolve
Herd test results were rejected because they failed to meet one of these criteria: <ul style="list-style-type: none"> <li>test date must be valid</li> <li>raw milk test must be greater than 1L but less than 80L</li> <li>Raw test fat must be greater than zero and less than 9%</li> <li>Raw test milk protein must be greater than zero and less than 8%</li> <li>Test day exclusion code must not be set</li> <li>First test day must be conducted within the first 100 days of lactation</li> <li>Interval between consecutive test days must be 2-120 days</li> <li>Test days must be between 5 and 305 days of lactation to be included in ABV</li> </ul>	Speak with your herd recording centre.

## About DataGene

DataGene is an independent and industry-owned organisation responsible for driving genetic gain and herd improvement in the Australian dairy industry. DataGene performs pre-competitive herd improvement functions such as genetic evaluation, herd testing and herd improvement software development and data systems. DataGene is a Dairy Australia and industry collaboration.

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