Updating the base

Technote for industry discussion

HIGHLIGHTS

- A base is created to compare an animal's ABVs and indices with a set group of animals.
- The base is defined as a group of animals based on breed, sex and year of birth. It can be updated more or less frequently.
- Base changes alter absolute values of ABVs but not the difference in ABV or index between two or more individuals.
- This technote provides industry with the estimated impact of a base change for discussion.

Why use a base?

Breeding values that are output by the statistical machinery do not have an absolute value; they are only useful to compare animals.

To give breeding values some absolute value, they are expressed against a group of animals referred to as the base. The average of the base animals is set to a fixed value (typically 0 or 100) for each trait, so that all other animals can be compared to that base.

Indices, which are a combination of breeding values, do not have their own base. They are calculated from breeding values after adjustment to the base.

Updating the base

Updating the base, means changing the group of animals that is set to an average of 0 or 100.

Globally, most dairy genetic evaluation services have a policy of updating the base at a specified interval, such as every five years. The aim of updating the base is to ensure that it reflects the cows that are milking in today's herds.

The base can be updated annually (rolling base) or at longer intervals which is referred to as a stepwise or fixed update.

Australia's policy

Australia's policy is for a rolling update but the updates to the base were paused in 2013.

The decision about updating the base is based on industry feedback which is reviewed periodically by the Genetic Evaluation Standing Committee.

Australia is a member of ICAR – the International Committee for Animal Recording. ICAR provides guidelines on the definition of the genetic base at a national level and it is desirable to update Australia's base policy to reflect the guidelines.

Australia's base

Australian Breeding Values and indices are relative measures, meaning they make more sense when compared to each other, or a group of animals, to which all are compared.

- 0 The base is set at zero for production traits, Feed Saved, Gestation Length and the indices.
- 💯 The base is set at 100 for type, health and management traits.

In Australia, the current average is defined as the purebred cows of the same breed that were born between 2009 and 2013 that have phenotypic observations for production and conformation. For other traits the base is a group of NASIS bulls with Publishable ABVs for the trait and born 2002 to 2006.

ICAR recommendations

ICAR recommends that member countries define the genetic base at the national level for **production traits** based on cows born at the onset of specific 5-year periods.

Member countries are encouraged to change the base in the first evaluation in the years ending with 0 or 5.

It is recommended that they include in the base the average genetic merit (EBV) for all cows that entered national genetic evaluation system that were born five years before the onset of the new 5-year period.

For countries using a rolling base, ICAR recommends using information from cows born seven years before the current evaluation.

For traits other than production, bulls may be used instead of cows.

Base update policies around the world

Country	Update approach
Australia	Rolling (paused, 2013)
USA	Fixed/step
NZ	Rolling
Canada	Rolling
Germany	Rolling
Denmark, Finland, Sweden	Rolling
UK	Rolling
Netherlands	Rolling
Italy	Rolling

Potential effects of base change

In August 2024 DataGene analysed the potential effect of a base change on ABVs, as part of its review of the National Breeding Objective.

The analysis looked at the impact of creating a new base in 2025 based on cows born in 2020 and using the ICAR recommendation of including all cows that enter the genetic evaluation system. This is different to the current base that includes cows with phenotypic observations to calculate the base.

Pros of updating the base

- Bulls and cows are compared to a modern group of animals.
- Broadening the base (adopting the ICAR recommendation) provides lifts in some traits and better alignment of breeding values some other countries (eg: type with USA).
- Estimates of profit achievable by using the BPI become more realistic.

Cons of updating the base

- Some traits of interest might see a greater proportion of ABVs with negative values.
- General downward proof movements require explanations. Either small steps every year, or bigger ones every 5 years.
- Perception that no progress is made as mean ABVs and indices in the population stay the same.

Effect of base change on production ABVs

Tables 1-3 summarise the impact of changing from Australia's current base to the ICAR recommendation, using the ABVs published in DataGene's August 2024 ABV release. The numbers are the effect on the ABVs.

For example:

- Holstein: all Milk ABVs would increase by 36L
- Jerseys: All milk ABVs would drop by 212.5L.

The difference between breeds is a consequence of the change in base definition and differences in genetic gain for milk volume in the two breeds.

In the major breeds, all fat and protein kg ABVs will fall. The change in fertility is negative for Holsteins and reflects the recent, accelerated rate of genetic gain. Both Holstein and Jersey will have lower SCC ABV of ~20-30 units, lower Mastitis ABV of ~2-3 units.

Table 1. Effect of base change in 2025 on yield ABVs (August 2024 ABV release data)

Breed	Fat (kg)	Milk (L)	Protein (kg)	ASI*
Ayrshire	-2.6	-11.7	-2.4	-20.5
Brown Swiss	-6.5	-156.2	-6.4	-44.2
Dairy Shorthorn	-9.9	-386.5	-8.2	-44.3
Holstein	-9.2	36.0	-3.6	-46.7
Guernsey	-5.8	-124.4	-4.3	-30.8
Illawarra	-0.3	24.2	0.5	0.6
Jersey	-9.2	-212.5	-8.6	-59.6
Aussie Red	-8.2	-135.6	-7.9	-59.4

*Note: ASI was calculated from the trait base changes using the current formula.

Table 2. Effect of base change in 2025 on ABVs for selected traits (August 2024 ABV release data)

Breed	Fertility	Survival Direct	SCC	Mastitis
Ayrshire	-2.9	-0.8	6.0	0.0
Brown Swiss	0.4	0.2	1.2	0.2
Dairy Shorthorn	7.7	-0.8	-13.0	-0.6
Holstein	-6.0	-5.4	-28.5	-2.8
Guernsey	-1.6	-4.2	-7.5	-1.1
Illawarra	-0.7	-1.5	-14.2	-2.6
Jersey	0.0	-5.8	-19.5	-2.1
Aussie Red	1.8	-1.1	-7.0	-1.1

……..more information over the page

Table 3. Effect of move to ICAR base recommendation in 2025 on ABVs for conformation composites and selected traits. (August 2024 ABV release data)

Breed	Overall Type	Mamm System	Dairy Strength	Feet & Legs	Rump	Pin Set	Stature	Teat Length	Udder Depth
Holstein	3.6	3.8	0.8	1.5	1.0	0.3	3.7	-0.9	1.7
Jersey	2.4	2.4	2.1	1.8	2.6	0.8	1.0	-0.6	0.3
Red Breeds	-1.0	-0.1	-0.2	-0.2	0.0	0.2	-0.3	0.1	-0.1
Guernsey	1.9	1.0	1.8	2.4	1.8	4.9	2.2	-2.7	1.0

Table 3 shows the impact on ABVs from shifting to the 2020 born cows base for composites and selected traits.

Overall Type and Mammary System ABVs will increase by ~2-4 units in Holstein and Jersey breeds with a smaller downward adjustment expected for Aussie Red. The changes will impact individual type traits differently. For example, teat length will go down by ~1 unit in both Holstein and Jersey whereas stature will increase by ~1 in Jersey and -4 units in Holstein.

The full list of conformation traits is in Appendix 1.

There would be the option to put Red breeds on separate bases, if numbers allow.

Effect of base change on other traits

Workability traits have a non-linear adjustment that makes these calculations more complex. The impact of a base change for these traits on BPI is expected to be small.

A few traits such as Calving Ease, Gestation Length and Heat Tolerance, will also be affected by a change in base, but this does not currently affect BPI.

Effect of base change on BPI

The base change will mean a lower BPI for all breeds, based on this analysis of selected traits (ASI, fertility, survival, somatic cell count, mastitis, overall type, mammary system, pin set and udder depth). Table 4 describes the effect for each breed.

Table 4. Effect of base change in 2025 on BPI as calculated from base changes for selected trait reported above. (August 2024 ABV release data)

Breed	BPI
Ayrshire	-44.0
Brown Swiss	-38.1
Dairy Shorthorn	-11.6
Holstein	-148.0
Guernsey	-74.5
Illawarra	-44.3
Jersey	-118.1
Aussie Red	-68.5

Implementation challenges

Implementation of a base update will involve considerable work by DataGene with a number of challenges to be addressed.

Small data sets: Guernsey and some Red breeds have a very small group of bulls that qualify, making the base unstable. Moving to cows provides more numbers and therefore stability.

Missing ABVs: Animals with missing ABVs tend to be favoured by base changes, as the zero contribution of the ABV to their BPI remain constant while it drops for other animals. This is not an issue for genomically tested animals.

Timelines

The decision to make a change to the base is expected to occur in line with the National Breeding Objective Review which is expected to be complete in the middle of 2025 for a release in the lead up to the December 2025 ABV release.

More information

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Appendix 1.

Effect of base change in 2025 on type traits

(August 2024 ABV release data)

Trait	Red Breeds	Holstein	Guernsey	Jersey
Angularity	-0.6	1.3	-0.2	2.3
Body Depth	-0.6	0.0	1.9	-0.3
Body Length				1.2
Bone	-0.7	1.7	-0.7	3.7
Composite Dairy Strength	-0.2	0.8	1.8	2.1
Centre Ligament	-1.2	3.6	-1.8	1.9
Composite Feet & Legs	-0.2	1.5	2.4	1.8
Chest Width	0.9	-0.9	2.4	-0.2
Composite Rump	0.0	1.0	1.8	2.6
Foot Angle	0.1	1.1	0.5	1.0
Fore Attachment	0.5	1.2	0.8	0.7
Heel Depth	-0.4	2.6	-1.5	-0.7
Loin	0.1	0.3	1.2	1.3
Mammary System	-0.1	3.8	1.0	2.4
Muzzle Width	1.0	-0.2	-0.6	0.7
Overall Type	-1.0	3.6	1.9	2.4
Pin Set	0.2	0.3	4.9	0.8
Pin Width	0.5	2.6	0.0	1.1
Rear Attachment Height	0.2	2.7	2.5	1.8
Rear Attachment Width	0.3	1.9	3.9	1.6
Rear Leg Rear View	-0.3	0.2	1.0	0.3
Rear Set	-0.3	-0.6	-3.7	0.0
Rump Length				0.3
Stature	-0.3	3.7	2.2	1.0
Teat Length	0.1	-0.9	-2.7	-0.6
Teat Placement Front	-0.3	2.3	-3.2	0.9
Teat Placement Rear	-1.4	2.5	-1.0	1.4
Udder Depth	-0.1	1.7	1.0	0.3
Udder Texture	-1.0	3.9	-2.1	3.1

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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