

Heat Tolerance ABV

Technote 18

HIGHLIGHTS

- The Heat Tolerance Australian Breeding Value (ABV) allows farmers to identify animals with greater ability to tolerate hot, humid conditions with less impact on milk production.
- It is expressed as a percentage, with a base of 100.
- To breed for improved heat tolerance, look for high BPI bulls with a Heat Tolerance ABV of greater than 100. Use a team of bulls to allow for the lower reliability of the Heat Tolerance ABV.
- High selection pressure for heat tolerance alone will improve fertility but compromise production.

Changing weather patterns have created a trend towards higher temperatures in some Australian dairying regions. In hot, humid conditions, cows expend more energy regulating their body temperature. This can affect their feed intake, milk production, milk composition and fertility.

Dairy farmers use a variety of tools to manage hot weather, such as providing shade, fans, water sprinklers, extra drinking water and changing the timing of milking and feeding. [Dairy Australia's website](#) provides tools and resources to help farmers with this, including sending alerts according to the weather forecast.

In addition to these management strategies, the Heat Tolerance ABV provides a genetic tool which allows dairy farmers to breed animals with improved tolerance to hot, humid conditions.

Cows and heat

Cows being ruminants, generate heat internally (metabolic heat) as a result of digesting feed. Like most mammals, the dairy cow needs to maintain its core body temperature within a narrow range around 39°C. Cows also take on heat from the environment around them. The cycle of gaining and losing heat absorbed from the environment is ongoing and always operates in the context of the metabolic heat a cow is carrying at any given time.

The level of environmental heat a cow gains or loses over time is influenced by:

- air temperature and relative humidity
- amount of solar radiation
- degree of night cooling
- ventilation and air flow
- the duration of the hot conditions.

Hot conditions can result in:

- reduced milk production, protein and fat
- reduced expression of oestrus and lower in-calf rates
- loss of body condition

- higher somatic cell counts and more cases of clinical mastitis
- other cow health problems.

Some of these effects last beyond the hot months. Higher production cows are more likely to be affected.

Benefits to cooling cows in the heat include:

- higher summer milk production
- improved animal health and welfare
- increased 6-week/100-day in-calf rates
- reduced loss of embryos
- increased calf birth weights.

(Source: [Dairy Australia Cool Cows booklet](#)).

Some cows respond differently

Within a herd, some cows demonstrate an increased tolerance for hot and humid conditions than others. Genomic technologies give us the opportunity to look for genetic markers for heat tolerance in these cows.

The Heat Tolerance ABV

The Heat Tolerance Australian Breeding Value (ABV) allows farmers to identify animals with greater ability to tolerate hot, humid conditions with less impact on milk production.

It is expressed as a percentage, with a base of 100. For example, an animal with a Heat Tolerance ABV of 105 is 5% more tolerant to hot, humid conditions than average. Its drop in production will be 5% less than average. An animal with a Heat Tolerance ABV of 95 is 5% less tolerant to hot, humid conditions than average. Its drop in production will be 5% more than average.

Breeds

DataGene publishes Heat Tolerance ABVs for Holsteins and Jerseys only. This is because it is a genomics-only ABV.

2024 update

An update in mid-2024 involved using an expanded reference population and increasing the number of SNP markers utilised in the evaluation. The model for the Heat Tolerance ABV has not changed.

The expanded reference population includes records from 9,020 herds in six states (see table).

Reference population for Heat Tolerance ABV (number of records)

	2017	2024
Holsteins	14,000	52,397
Jerseys	4,700	11,345

Improved reliability

The 2024 update resulted in an increase in reliability of the trait for both Holsteins and Jerseys. The reliability for Holsteins increased 10 percentage points while Jerseys had a modest 1% improvement. As a result, the reranking for Heat Tolerance ABV was greater for Holsteins than Jerseys.

Heat Tolerance ABV reliability

	2017	2024
Holsteins	38%	48%
Jerseys	38%	39%

The appendix provides details on the impact of the 2024 update on bull rankings.

Heritability

The heritability of heat tolerance is moderate at 12% for Holsteins and 15% for Jerseys. This is similar to workability traits and higher than health and fertility traits.

Despite the low heritability, genetic selection has achieved significant progress in these traits in the Australian dairy herd.

This low heritability means that environmental conditions and management practices have a big impact on the cow's response to hot, humid conditions and genetics plays a smaller role. However, there is significant variation within Holstein and Jersey breeds which creates the opportunity to identify and breed from animals with better heat tolerance.

Breeding for heat tolerance

To breed for improved heat tolerance, look for animals with both high BPI and a Heat Tolerance ABV of greater than 100; use a team of bulls to allow for the lower reliability.

Heat tolerance is favourably correlated with fertility and unfavourably with production. This means high selection pressure for heat tolerance may improve

fertility but compromise production. It is important to check breeding values across the range of traits that are important to you.

Summary

The Heat Tolerance ABV allows farmers to breed cows that are more tolerant of hot and humid conditions with less impact on milk production. With every joining, farmers have the opportunity to make genetic gain. Farmers are now able to breed a herd that responds better to Australia's hotter environments. This is an additional tool to complement management practices to keep cows cool during hot, humid weather.

World first

The Heat Tolerance ABV(g) was a world-leading trait. Like the Feed Saved ABV, it is one of a new generation of breeding values for traits that are difficult to measure, made possible due to advances in genomic technologies.

Acknowledgement

The Heat Tolerance ABV was developed and updated by DairyBio, a joint initiative between the Victorian Government, Dairy Australia and the Gardiner Foundation, with funding from the Australian Department of Agriculture and Water Resources.

Scientific papers

Nguyen et al 2016. Genomic selection for tolerance to heat stress in Australian dairy cattle. *J. Dairy Sci.* 99:2849-2862

Nguyen et al 2017. A practical future-scenarios selection tool to breed for heat tolerance in Australia. *Animal Production Science*, 57:1488-1493

Nguyen et al 2017. Short communication: Implementation of a breeding value for heat tolerance in Australian dairy cattle. *J. Dairy Sci.* 100:7362-7367

Nguyen et al 2017. Breeding value for heat tolerance in Australian dairy cattle; a technical platform for implementation. *Herd 17 conference proceedings pp 35-39.*

More information

Ph 1800 841 848

E: enquiries@datagene.com.au

www.datagene.com.au

July 2024

More information on managing dairy herds in hot. Humid weather is available [on the Dairy Australia website](#).

.... refer over page for appendix

Appendix: Impact of 2024 update on bulls

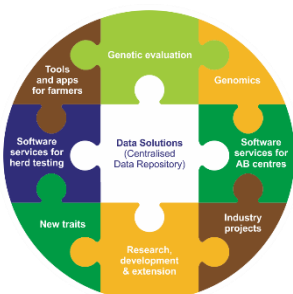
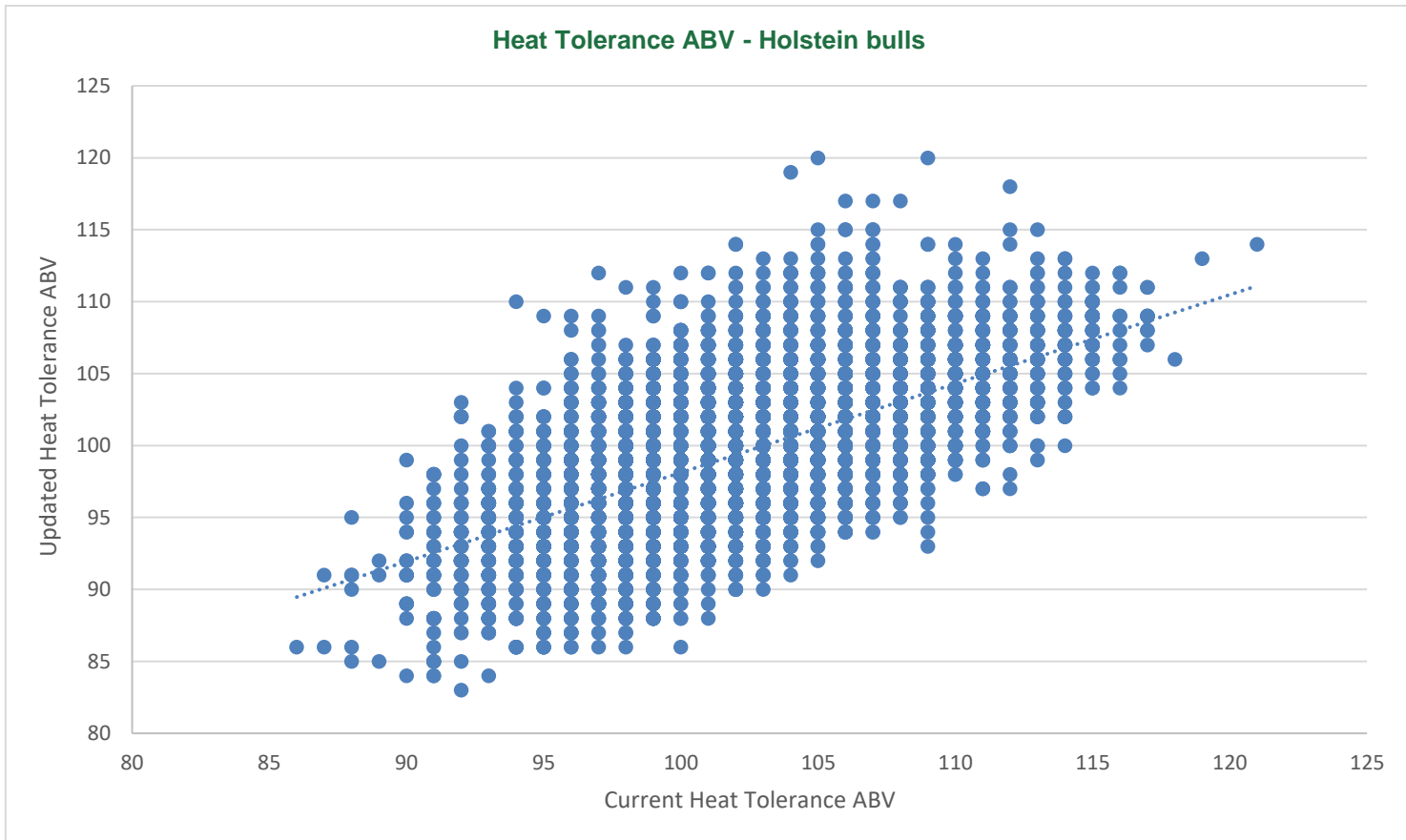
The 2024 update had a once off effect on bull ABVs for Heat Tolerance.

In Holsteins the standard deviation of the change in Holsteins is a little over 4 ABV points. This means that about two thirds of the bulls changed by plus or minus 4 ABV points, while the extreme changes were be plus or minus 12 points (about 1% of the population).

In Jerseys, the standard deviation of the change was a little less at about 3.5 ABV points resulting in a smaller amount of movement in Jerseys.

Bull rankings for BPI

Heat Tolerance is not included in the Balanced Performance Index or other Australian indices, so the 2024 update had no impact on bull rankings.



About DataGene

DataGene is an independent and industry-owned organisation responsible for driving genetic gain and herd improvement in the Australian dairy industry. Formed in July 2016, DataGene brought together many pre-competitive herd improvement functions such as genetic evaluation, herd testing and herd improvement software development, data systems and herd test standards. DataGene is a Dairy Australia and industry collaboration.

www.datagene.com.au Ph 1800 841 848 E: abv@datagene.com.au