

Heat Tolerance ABV

Technote 20

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 Cool Cows website provides tools and resources to help farmers with this, including sending alerts according to the weather forecast.

The latest tool is the Heat Tolerance ABV which allows dairy farmers to breed animals with improved tolerance to hot, humid conditions.

Cows and heat

Cows generate heat internally (metabolic heat) as a result of eating and 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 on-going 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; and
- length of the hot conditions.

Hot conditions can result in reduced milk production, protein and fat tests, in-calf rates, liveweight and higher somatic cell counts, more clinical mastitis cases and 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; and
- increased calf birth weights.

(Source: Dairy Australia Cool Cows).

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. 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.

Reliability

The reliability of the Heat Tolerance ABV is 38% which is lower than conventional production traits but in line with the newer generation of genomic-only traits. Like all new ABVs, reliability is expected to improve with time, as more data becomes available. If placing a high priority on selecting for heat tolerance, allow for its lower reliability, by using a team of bulls.

Heritability

The heritability of heat tolerance is moderate at 12%. 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.

Bull rankings

Heat Tolerance is not included in the Balanced Performance Index or other Australian indices so there will be no impact on bull rankings. Heat Tolerance will be considered for inclusion in indices in the next National Breeding Objective review.

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) is 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 by DairyBio, a joint initiative between the Victorian Government and Dairy Australia, with funding from the Australian Department of Agriculture and Water Resources.

More information

Heat Tolerance ABVs for bulls at www.datagene.com.au.

More information on heat tolerance in the Australian dairy industry is available at www.coolcows.com.au

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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.

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Case Study



Breeding for heat tolerance

Dairy farmers: Parrish family

Region: New South Wales

Topic: Heat Tolerance ABV

When bull-buying clients started asking Holstein breeder Trevor Parrish about the new Heat Tolerance ABV, he knew he had to make sure he was breeding what his customers wanted.

Trevor runs Illawambra Holsteins in the Kangaroo Valley, NSW, selling about 30 bulls and 100 females a year to other dairy farmers, with these sales making up a sizeable share of the farm business.

The Illawambra herd ranked number one in Australian Holstein herds for profit (Balanced Performance I – BPI), health (Health Weighted Index – HWI) and type (Type Weighted Index – TWI) in DataGene’s August 2017 release of Australian Breeding Values (ABVs).

While leading the breed indices, Trevor is now also considering the Heat Tolerance ABVs in his breeding decisions.

“If bull clients are asking about an ABV then I need to make sure we can provide bulls that meet their requirements and the new heat tolerance ABV is no different,” Trevor said.

Illawambra genetics have sold to Queensland and the north Coast of NSW as well as locally, making heat tolerance an important consideration for some buyers.

“We have bull clients coming to us looking for BPI combined with calving ease, polledness and now heat tolerance, so we need to make sure we are breeding cattle which meet the demands of our buyers now and into the future.”

The new Heat Tolerance ABV allows farmers to breed animals with improved tolerance to hot, humid conditions.



Leading Holstein breeder, Trevor Parrish, from Kangaroo Valley, NSW, intends to add breeding for heat tolerance to his tool box for managing his herd in hot, humid weather.



In hot, humid weather cows eat less and spend more energy trying to regulate their body temperature. This can lead to a drop in milk production, lower milk protein and fat tests and reduced in-calf rates.

The Heat Tolerance ABV is a world first, and one of the new generation of breeding values for traits made possible due to advances in genomic technologies and Ginfo, Australia's national genetic reference herd.

On-farm experience

The Parrish dairy business involves Trevor, his wife Leah, their daughter Toni who has taken over the book work and son-in-law Nathan helps when not doing his electrical job.

The family milks between 160 and 240 cows year round and have had first-hand experience with the impact of high temperatures on herd production.

Trevor said that while the farm had plenty of shade in the paddocks and at the dairy, production and fertility were affected by hot, humid conditions over summer.

"We experience hot summer weather in Kangaroo Valley where we don't get a breeze, unlike dairy areas near the coast," he said.

"We also get humidity, which decreases the cows' ability to deal with heat.

"If we get a run of hot weather we will change our milking times around so we can get the herd back in the paddock and on the pasture before the temperatures get up.

"Irrespective of what we do on farm, there are cows that don't eat as much when it gets hot and humid and milk production drops."

Trevor said making changes on farm were one part of managing heat stress, but identifying cows with a superior genetic ability to cope with hot conditions was a significant step in dealing with heat issues in the future.

Breeding program

The Heat Tolerance ABV, is expressed as a percentage with a base of 100.

An animal with a Heat Tolerance ABV of 105 is 5% more tolerant of hot, humid conditions than average. Its drop in production will be 5% less than the average.

The Heat Tolerance ABV is favourably correlated with fertility and unfavourably with production, but natural genetic variation means there will be some high production animals with greater heat tolerance. Its reliability is 38%, which is lower than conventional production traits but in line with the newer generation of genomic-only traits. This is expected to improve with time as heat tolerance is added into breeding programs.

Trevor has been genomically testing all Illawambra heifers for two to three generations, allowing him to cull on BPI.

"With our females, we focus on the whole herd rather than individual cows and draw a line in the sand for BPI at 150 – if a female is below the required level then they don't stay," he said.

"We just need to make sure we identify animals with heat tolerance that don't sacrifice production. Those animals are out there.

"I'm very passionate about breeding bulls and do a lot of research and I'm always looking for bulls that will make our herd easier to manage.

"Now when I get a list of bulls I'm going to be looking for bulls which combine increased production and increased heat tolerance – they are going to be the ones who buck the trend."

Trevor's experience has shown that cows that have positive Heat Tolerance ABVs are not necessarily light coloured or have a lot of white.

Some of the females with the highest Heat Tolerance ABVs in the Illawambra herd have predominantly black coats.

"You wouldn't pick their ability to handle hot weather by just looking at them, which makes an ABV for Heat Tolerance all the more important if you want to make progress," he said.

To breed for improved heat tolerance, look for bulls that combine a high Balanced Performance Index (BPI) with a Heat Tolerance ABV of greater than 100.

The Heat Tolerance ABV was developed by Dairy Bio, a Joint Initiative between the Victorian Government and Dairy Australia, with funding from the Australian Department of Agriculture and Water Resources.

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