

A new Poll Testing option for Hereford Australia clients.

Key Points:

- The new Poll test will determine the likelihood of an animal carrying one (PH), two (PP) or no (HH) copies of the Poll gene based on SNP mutations.
- To date the scientific community's understanding of scurs is limited
- A SNP-based test for Herefords is now possible

Current status for the Hereford breed

The microsatellite based haplotype test for Poll (POLL) (MLA project B.AWW.0222) developed by researchers at CSIRO, University of New England and The University of Queensland has been a major improvement on tests previously available. It was designed to be suitable for *Bos taurus* breeds, *Bos indicus* breeds and composite cattle as is the requirement in the Australian Livestock sector. The haplotype test is set apart from other Poll tests by its ability to 'learn and adapt' as new data is entered into the system; each time a new set of data is entered into the system the entire dataset is reanalysed according to the updated information. Since its introduction in October 2013, over 18000 cattle across a diverse range of breeds have been tested with this version of the Poll test.

To date, 3220 Hereford samples have been tested at UQ's Animal Genetics Laboratory (UQ-AGL). The results are shown below in Figure 1. This test shows predicted confidence of up to 98% for homozygous carriers of Poll (PP) in Hereford, and the undesirable Not Determined outcome is occurring in 7% of animals tested.

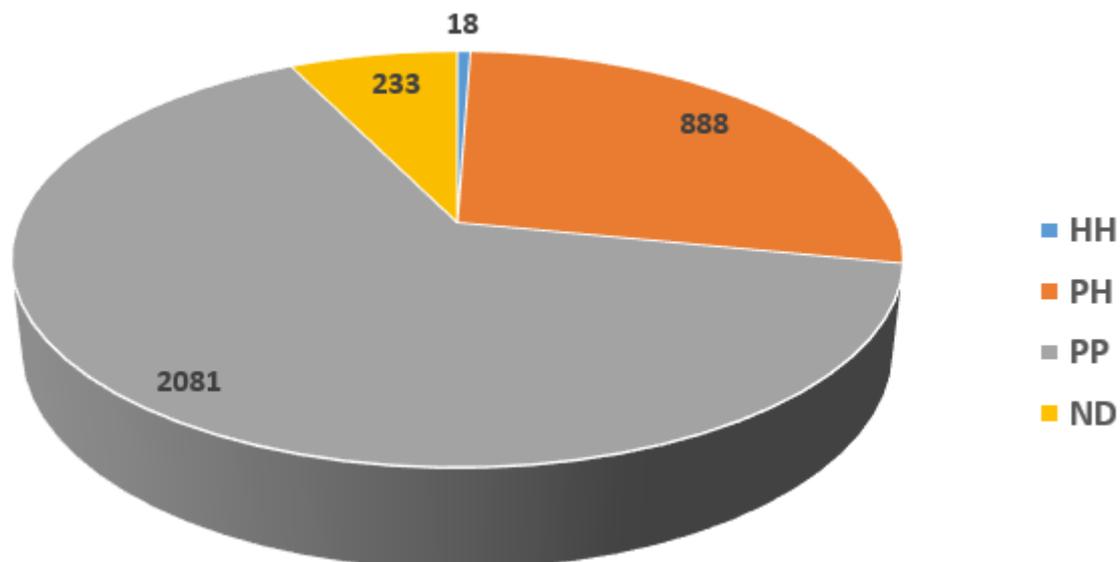


Figure 1: proportion of Hereford tested in each of the 4 categories Homozygous Polled (PP), Heterozygous (PH), homozygous Horned (HH) and Not Determined (ND).

Recent Developments.

Genomic research has recently identified new mutations that are associated with Polledness in Celtic and dairy breeds of *Bos taurus* cattle, including one mutation in breeds originating from Scandinavia, Great Britain,

France and South-Germany, figuratively called polledness of Celtic origin, P_c (1). These markers have been added to the most recent SNP chips including GGPLD and GGPUHD chips used by HAL.

GGP_POLL

In collaborations with Herefords Australia Ltd, UQ-AGL have assessed the accuracies of Poll predictions based upon genomic data (GGP_POLL) relative to the current industry standard Poll test. Results are based upon 150 animals. Predictions by each test were identical in most cases. Furthermore, 15 samples that had previously returned a NOT DETERMINED" result via the microsatellite haplotype test generated a GGP_Poll result that was in line with the phenotypes of the animals. Taken together, these results give confidence that implementation of POLL testing based upon the P_c mutation is appropriate.

Advantages of the GGP_POLL test are as follows:

- Reduced incidence of "Not Determined" Results
- Options for bundling with other SNP test applications (e.g. GGPLD), and associated cost savings.
- Direct test means no longer requiring a percentage accuracy.

NOTE: While UQ-AGL aim for as short a turnaround time as possible, please note that GGPLD or similar technologies require more complex processing, and therefore associated Add-on tests (e.g. GGP_POLL) can take 3-4 weeks, so plan ahead where possible.

SEQ_POLL:

Alternatively, we have also developed a stand-alone SNP assay for the SNP mutations (SEQ_POLL) , so members are not required to use genomic chips. Turnaround time on this is 10 working days, and for urgent results this would be the recommended method.

Fees for HAL members for each test type are listed below:

GGP_POLL (Add-on to GGPLD or GPPHD)	\$18.70 inc GST
SEQ_POLL (stand-alone SNP assay)	\$27.50 inc GST

Disputed Results:

UQ-AGL and HAL have decided to run a further validation phase to the roll-out of the new Poll test. This process will allow us to identify animals that are not presenting phenotypically as expected by genetic testing e.g. tested PP but has Horns or Scurs , OR Polled but tested HH. We will then attempt to resolve if possible, and in the process pull together resources for further optimisation if required.

If such concerns arise, please contact your breed society for relevant documents and procedures. We will require photographs and confirmation of pedigree, and will make all efforts to identify the issues. If animals cannot be resolved, these will become important samples for future study of the Polled gene in Hereford cattle.

Understanding GGP_Poll and SEQ_Poll Test Results

Animals will be returned with one of the following genotypes

- HH:** No copies of Polled molecular marker are present.
- HPc:** One copy of the Polled-Celtic molecular marker is present. 50% of the offspring inherit the Polled molecular marker.
- PcPc:** Two copies of the Polled-Celtic molecular marker are present. All offspring inherit the Polled molecular marker.

Animals that return a P_cP_c result can be bred with horned (HH) animals to produce only P_cH offspring, with these usually appearing Polled, reducing the need for dehorning. P_cH animals when bred with horned (HH) animals can produce either P_cH or HH offspring with a 50% chance it will be P_cH and a 50% chance it will be HH. Progeny from a P_cH x HH mating may appear Polled, scurred or horned. The progeny of a horned (HH) x horned (HH) mating will be horned.

Scurs

To date the scientific community's understanding of scurs is limited. Recent data indicated that the gene controlling scurs is likely on a different chromosome to the gene controlling horns, but further research is needed to determine which chromosome. While there appears to be a strong influence of the animal's sex, with males more likely to present with scurs than females, there is no hard and fast rule that can be applied, especially in the *indicus*-influenced breeds. Scurs is most commonly observed in heterozygous (P_cH) animals, although there are exceptions to that rule also.

*Any animals that are reported as P_cP_c but are scurred in appearance are of great interest to the scientific community. Please collect tail hair, pedigree and photographic evidence and contact UQ-AGL (agl@uq.edu.au).

The Future of Poll Testing

While the microsatellite based haplotype test has proven to be an excellent addition to the genetic testing toolkit, and will remain an important test especially in Northern Australia, there are widely accepted limitations to the test in its current form. Firstly, as mentioned previously there is no means of identification or accurate prediction of carriers of the scur gene. Also, the microsatellite-based Poll test is a stand-alone test that is incompatible with the Single Nucleotide polymorphism (SNP) genotyping platforms increasingly used for parentage testing, diagnostics and genomic prediction of breeding values. While it now appears we have an accurate SNP-based test that will work across many taurine breeds including Hereford, a similar SNP-based test for Indicine cattle is not yet possible. To that end, researchers at CSIRO, the University of Queensland and Queensland Department of Agriculture and Fisheries have received funding to make this a reality.

For further information about Poll testing please contact Dr Russell Lyons or Sarah Buttsworth at UQ Animal Genetics Lab on (07) 5460 1960 or agl@uq.edu.au

References:

Medugorac, Ivica, et al. "Bovine polledness—an autosomal dominant trait with allelic heterogeneity." PloS one 7.6 (2012): e39477.