

## Difficulties with the Temperament trait in Holstein cows

When porting the BV estimation for temperament to a Single-Step model, we found a worryingly low Legarra-Reverter score. By moving the cut-off point of the Legarra-Reverter Analysis, we got the following scores for Holstein:

Cut-off	Legarra-Reverter score (SD full BV)	Sire contribution (SD)	Dame contribution (SD)	r <sup>2</sup>	n
2015-01	0.717 (13.31)	0.452 (13.74)	0.202 (9.45)	0.185	121
2015-08	0.736 (13.60)	0.466 (12.93)	0.217 (9.56)	0.191	117
2016-01	0.694 (13.30)	0.396 (13.79)	0.227 (9.43)	0.174	109
2016-08	0.821 (13.33)	0.462 (11.89)	0.332 (8.67)	0.180	109
2017-01	0.875 (12.73)	0.482 (12.02)	0.351 (8.54)	0.224	97
2017-08	0.967 (13.40)	0.507 (11.96)	0.407 (8.29)	0.247	90

Table 1. Legarra-Reverter analyses w/ normal heritability (10%)

As can be seen, the breeding value of both the sire and the dame is weighed too highly when we estimate the breeding value of the offspring. This led us to look at the heritability of this trait. Traditionally, the heritability of this trait has been 10%. We estimated it to be 4%.

Running the BV estimation again with this heritability gave these results:

Cut-off	Legarra-Reverter score (SD full BV)	Sire contribution (SD)	Dame contribution (SD)	r <sup>2</sup>	n
2015-01	0.840 (14.05)	0.496 (14.56)	0.271 (10.31)	0.249	121
2015-08	0.823 (14.41)	0.503 (13.62)	0.251 (10.33)	0.231	117
2016-01	0.771 (13.99)	0.435 (14.50)	0.252 (10.27)	0.211	109
2016-08	0.936 (13.92)	0.511 (12.73)	0.376 (9.38)	0.240	109
2017-01	0.935 (13.29)	0.501 (13.21)	0.394 (9.35)	0.278	97

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<b>2017-08</b>	0.996 (13.97)	0.523 (13.30)	0.416 (9.11)	0.291	90
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Table 2. Legarra-Reverter analyses w/ lower heritability (4%)

Which leads to a much more well-behaved sire contribution, while the contribution from the dame is better, but still not good. Perhaps more importantly, the  $r^2$  value is improved. The correlation coefficient between these two runs is ~98%, indicating that the lower heritability doesn't change the ranking of bulls much, simply makes their EBVs less extreme.

A greater problem with these numbers is the lack of statistical significance. When computing 95% confidence intervals for these numbers, the expected number (1 for Legarra-Reverter, 0.5 for sire and dame contribution) is within the confidence intervals for all runs.

## What we have done

- Removed mothers of bulls, as these may be HIP
- Tried to filter data to remove low-quality scorings

None of these measures improved the result by much, in some cases data filtering led to worse results. But that may also be a fluke.

## Questions

- Would you support lowering the heritability, since it leads to more accurate EBVs?
  - Perhaps we should monitor the Legarra-Reverter every year, to spot changes
- Do you know of other tests we can use to supplement Legarra-Reverter?