

The Frame index describes the size of cows

From 12th of August 2014 Body index is changing name to Frame for all dairy breeds evaluated in the Nordic cattle genetic evaluation (NAV). The index is identical to the previous Body for RDC (Nordic red breeds) and Jersey, but for Holstein the composition of the index is changed so that Frame for all breeds now gives a description of the expected size of the cow. Higher breeding values are associated with an increased size (height, depth, width) of the cows. Frame is not included in the joint Nordic breeding goal for increased profit of cows (NTM – Nordic Total Merit). The same was true for Body and the reason is that there is no economic benefit of larger cows.

What is Frame and how is it composed?

The information used to calculate Frame index is the same as for former Body index, thus the single breeding values for linear body conformation traits scored by classifiers.

For RDC and Jersey the only difference is the new name since the composition of Frame will be identical to the previous Body index.

For Holstein Frame will have a different composition than Body. The reason for the change was a suggestion from Nordic Holstein breeders who wanted an index describing size of the cows rather than reflecting the breeding goal for the linear body traits. There was a wish to be able to better predict which results to get in body conformation on daughters after a certain bull. This change for Holstein also makes the interpretation of the index more similar across breeds.

There are many factors affecting the combined conformation indices (Frame, Feet & Legs, Udder) of a bull or a cow. Besides the individual breeding values for linear traits, the value for e.g. Frame is decided by the breed's set-up for the following factors:

- Relative weights (see table 1 – changed for Frame in Holstein)
- Optimum values (see table 2 – changed for Frame in Holstein where breeding goal optimums for linear body traits are no longer used in calculation of Frame index. Instead the traits are allowed to vary without restriction so that higher scores increases the value of index)
- Breed averages (reflects where the breed is today) – with the changes in optimum for Holstein these will no longer influence
- The variation of breeding values in and the genetic correlations between traits included in the index affect the individual breeding values

Since Frame is affected by above factors, the absolutely best way to see what effect breeding for Frame will have on linear body traits is to study the correlations between Frame and the included body traits (Figure 1).

The effect on NTM and other traits of economic importance if breeding for increased value for Frame is described in another paper.

Effect on linear body traits when breeding for Frame

The effect you get in other traits when breeding for a certain trait (index or breeding value) can be seen by looking at the correlations between different breeding values for a group of animals. A positive value of the correlation implies that a high breeding value for one trait is associated with a

high breeding value in the other trait and vice versa (low value associated with low value). A negative correlation imply that a high breeding value for one trait is associated with a low breeding value in the other trait and vice versa (low value associated with high value). These correlations can also be interpreted as how much of the maximum genetic progress can be obtained for a trait (i.e. stature) by breeding for another trait (Frame) compared to breeding only for the first trait (stature).

In figure 1 you can see the correlations between bulls breeding values for Frame index for RDC, Jersey and Holstein with linear body traits. For a comparison the corresponding correlations for the former Body index for Holstein bulls are shown. By breeding for increased values for Frame the effect in all breeds will be increased values for primarily stature, rump width, body depth, chest width and dairy form (topline in Jersey will also be increased). The highest correlation for all breeds is between Frame and stature.

With the changes in Frame for Holstein, the interpretation of this index is much more similar between the breeds than it was before (compare bars for Frame and Body in Holstein with the other breeds). By breeding for Frame in Holstein very minor changes are to be expected for top line and rump angle.

The effects you get by breeding for Frame differs quite a lot from the effects by breeding for Body, which has strongest positive correlations to dairy form, stature and top line.

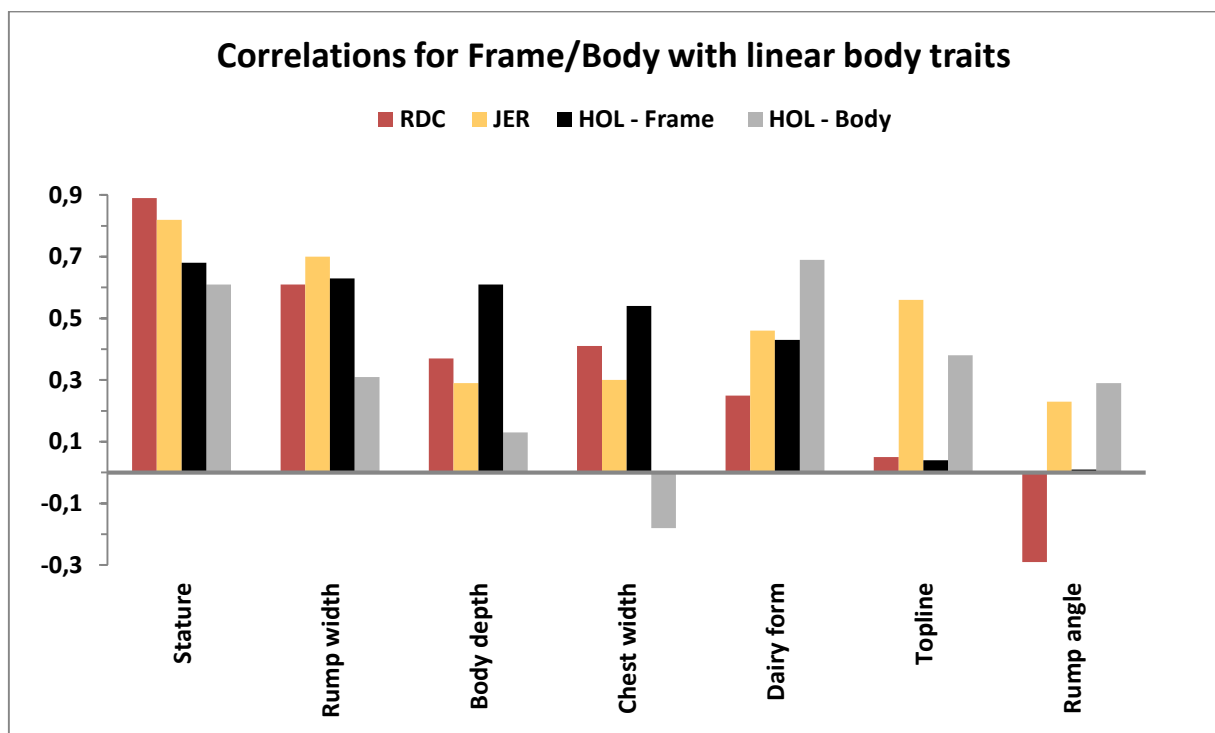


Figure 1. Correlations between bulls breeding values for the Frame index with linear body traits in RDC, Jersey and Holstein (red, yellow and black bars). For Holstein the corresponding correlations are also shown for the previous Body index (grey bars). The results are based on bulls born between 2004 and 2006/2007.

Relative weights and optimums

The results you get by breeding for Frame are affected by relative weights, optimum values and breed averages. In table 1 and 2 the relative weighting and optimum values of linear body traits are shown for all breeds in Frame and as a comparison also for the previous Body index in Holstein.

In Table 1 it can be seen that most weight in Frame in Holstein (75 % of total) is put on chest width, body depth and rump width. These are the three traits that describe the size of the cow and where the weight is now increased in Frame compared to Body. Stature of the cow is included as well with somewhat increased relative weight. The only trait not connected to size that is still included in Frame with the same relative weight as in Body (20 %) is dairy form, which describes the sharpness of the cow. Topline and rump angle are not included in Frame for Holstein.

The weights do not give the complete picture. As an example, although the weight on stature looks low, especially for Holstein, the largest effect is obtained for this trait when breeding for Frame (see Figure 1). This is due to the other factors affecting the value of Frame, such as the optimum values. These values are set to very high levels (above breed average), which in practice implies that no optimum is used and higher phenotypic values (score) in linear body traits give higher breeding values both for single breeding values and for Frame. The value for Frame will be highest for animals that inherit genes that give larger cows in the next generation.

Table 1. The relative weighting (in percent) of single breeding values for linear body traits included in the Frame index for RDC, Jersey and Holstein. Note that topline and rump angle have no weight in Frame for Holstein. In the column to the right the weight in the previous Body index is shown for Holstein.

Linear body trait	Frame			Body
	RDC	Jersey ¹	Holstein	Holstein
Stature	10	6	5	3
Body depth	15	14	25	15
Chest width	20	13	30	15
Dairy form	10	10	20	20
Topline	10	25	0	12
Rump width	15	11	20	15
Rump angle	20	11	0	20

¹ JER also has a weight of 10% of body remarks which is not listed in the table.

Table 2. The optimum values of single breeding values for linear body traits used to calculate Frame index for RDC, Jersey and Holstein. Note that all of them are not included in Frame for Holstein and that the optimum used for calculating Frame in Holstein differs from the breeding goal optimum for linear body traits (see column for Body). Optimum for stature is in cm, other traits are on a linear scale (1-9).

Linear body trait	Frame			Body
	RDC	Jersey	Holstein	Holstein
Stature	142	129	155	148
Body depth	6	6	9	6
Chest width	5,5	5	9	5
Dairy form	5,5	6	9	6
Topline	7	7	7	7
Rump width	5	6	9	5,5
Rump angle	5	5	5	5

In summary, the changes made in Holstein on both weights and optimum values to calculate Frame gives the result that Frame index describes size of cows also for Holstein but this does not reflect the breeding goal for body traits in this breed.

Publishing of breeding values for Frame

From 12 August and onwards breeding value for Frame on bulls with Nordic herdbook number will be published on NAV Bull Search. Here you can also find the single breeding values for linear body traits (both those included in Frame and those not included). On the graph with breeding values, the breeding goal optimums for the breed in question will be marked for the conformation traits so it is easy to see what effect (higher or lower than optimum) you will get by using a certain bull. Later this year a function on this page will demonstrate what the breeding values mean in phenotypic values.

The breeding values for Frame will also replace the values for Body at all other places where breeding values are published in Denmark, Finland and Sweden.

The background of changing the name Body to Frame in all breeds and the composition of Frame in Holstein is a workshop organized by NAV (Nordic cattle genetic evaluation) in January 2014 where participants from the owner organizations Videncentret for landbrug, Faba and Växa Sweden discussed NTM and related questions. Representatives for the Holstein breed suggested the new Frame index and after additional analyses by NAV the three countries agreed on the exact composition of Frame. The translation of Frame used nationally will differ somewhat. In Sweden and Finland the translation will be "Body size" whereas in Denmark it will be "Body capacity".