Conformation: what does it add to nowadays breeding?

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Introduction

Breed organizations for dairy cattle were founded 100 to 150 years ago by farmers. Goal was to define and improve the breed of which they are milking the cows. When defining the type of cows, of course, they were looking for the perfect cow. Actually a cow which fits the farmer best and which produces more milk and has a good longevity. At that time a lot was also based on what one could see from the outside: conformation, type. Another reason breed organizations were founded was that it facilitated trade between farmers and trade between countries.

To improve the trade breed organizations started to collect data. Of course pedigrees were registered, but describing registered animals was also important as base to decide which animals could improve the breed and which animal not. These description resulted at the end in giving scores for general characteristics like udder, feet and legs, frame, development and an overall or final score. Later, during the 80's of last century breed organizations started to score linear traits.

The advantages of using linear traits was that they were easier to score compared to general characteristics. Linear traits describe a trait just in one dimension. For a linear trait it holds that the whole scale of the trait is described with tall or short, wide or narrow, deep or shallow, etcetera. Further the linear traits were perfect to use in a mating program, to make in an easy way corrections for a cow. Linear traits made it also easier that score could be understood or interpreted across countries. This as the definitions are always simple. Further the linear traits are used in genetic evaluations and due to the usage of the same of similar traits in different countries it facilitated also the conversion of breeding values. But to improve the quality of the conversion of breeding values, the traits scored in all the countries should be as similar as possible. Therefore harmonization of traits across countries is important.

Harmonization

To facilitate the harmonization of conformation traits the ICAR working group on Conformation has established a list with traits which could be scored in dairy and dual purpose cattle. For all traits definitions are available and pictures show how a trait can look like in a breed. This is done in such a way that it can be applied in all different dairy and dual purpose breeds. The same has been done for beef cattle breeds and goats.

The Holstein breed organizations have worked on the harmonization of linear type traits since more than 25 years. The harmonization is also the base for the high correlations which are estimated by Interbull for most conformation traits. For traits like stature, rump angle, udder depth, teat placement, teat length, and rear teat placement estimated genetic correlation between countries are in general higher than correlation found for milk production traits. And looking over the years the

correlations have improved. Also for newly introduced traits like body condition score and locomotion. So in that sense harmonization works.

Relationship with other traits

Conformation traits are defined in such a way and are scored as they should help to improve the quality of the cow. By improving the quality of the cow we want to get a cow which functions better. This means actually for a farmer a cow which produces a lot of milk, fat and protein without having problems. The latter means, good fertility, no mastitis, good hoof health, no other diseases, resulting in a good longevity.

Using the scores for linear traits we also can make the relationship between low, medium or high score with longevity, somatic cell count or calving ease. It is possible to show which kind of cow, with which score for the different traits will have a higher chance to produce a fourth lactation. For example for chest width, as for other body traits, it is known that cows with medium scores stay longer in the herd. But it is also known that cows with more slope in their rump have less dystocia. And cows with stronger fore udder attachment have lower somatic cell count. So conformation traits help to look for a better cow by looking at the relationship between scores and the performances for functional traits.

Breeding goal

Conformation has always been used to get a better cow. But at the same time the breeding goal is broader than just conformation traits. Farmers have to deal with more breeding values than just breeding values for conformation traits. The breeding goal in general consists of production traits, longevity, fertility, udder health, calving traits and conformation traits. And conformation traits have predictive value for most of these traits.

Looking at a trait like protein yield, angularity has the highest genetic relationship: more angular, more protein (correlation of 0.29, see table 1). Followed by udder depth (deeper udder -> higher yield) and rear udder height (higher -> more yield). But when a breeding value for protein yield would be computed from angularity, we would end up with a maximum reliability of 9 percent!

For longevity moderate genetic relationship, correlation ranging from 0.20 to 0.25, is found with locomotion, udder depth and rear udder height, with better locomotion, more shallow udder and higher udder resulting in a longer herdlife. But at the same time animals with breeding values indicating deeper bodies and wider chests have genetically more risk to be culled than an average animal.

Looking at health traits, body condition scores has a rather good correlation (0.39) with fertility when looking at genetic level. It is by far the best conformation trait which gives an indication about fertility. And locomotion is a good predictor for the genetic potential for an animal for claw health (correlation of 0.79). Both traits are rather new in the list of linear traits, but were added as they give rather good information on health traits.

Data

Conformation helps to breed a better cow. But at the same time it holds that selection on the trait itself is even more effective. And we know that for example in the Holstein breed a trait like fertility and udder health needs attention. Those traits can only be improved when breeding values for these trait are available and are used in the selection process. In many countries these traits have been

added to the breeding goal and total merit index and the genetic trends in the population have improved.

One has to keep in mind that for getting the perfect cow for the farmer not conformation counts, but those traits that generate income for the farmer. Traits like production, health, fertility, longevity and efficiency are important traits to form the base for a good income generated with cows easy to manage. To facilitate selection on all these traits breed organization should cooperate with AI-organizations and other organizations which help farmers to get better cows. Cooperation is not only needed in defining the breeding goal but also in data collection. More data is generated by milk robots, from NIR/MIR spectra, feed intake, methane measurements, sensors, etcetera. These new data will lead to possibilities to select even more efficient for health and efficiency.

In conclusion

Scoring cows on conformation has been successful in defining the right type of cow. The development of linear traits also made it possible to use mating programs and has given knowledge on the relationship between conformation and functional traits. International harmonization of traits has helped to improve exchange of data and genetic material. It also has improved the quality of conversion of breeding values. Therefore it is easier for the farmer to make a better selection from the international offer of bulls.

Conformation always should be used in relation with production traits and functional traits. Conformation should support these traits and for commercial farmers conformation is not a goal on itself. Body condition score and locomotion are good examples of rather new traits which fulfilled a need to support the breeding of a more functional cow.

For the near future focus should be for breed organizations on cooperation between all organizations involved in breeding on determining the breeding goal and collection of new data.

Table 1. Estimated genetic correlations between linear conformation traits and protein yield and functional traits in the Netherlands and Flanders. Bold figures are correlation which are 0.25 of higher or -0.25 of lower

trait	protein yield	longevity	fertility index	SCC	udder health	claw health	maternal calving ease
stature	0,07	-0,18	-0,05	-0,03	-0,05	-0,20	0,11
chest width	-0,03	**-0,29**	0,09	0,01	0,03	-0,04	-0,04
body depth	0,15	**-0,36**	**-0,27**	-0,20	-0,24	**-0,25**	-0,14
angularity	**0,29**	**-0,32**	**-0,36**	-0,22	**-0,28**	-0,21	-0,09
body condition score	-0,24	-0,03	**0,39**	0,21	**0,27**	**0,29**	0,03
rump angle	0,05	0,06	0,07	-0,02	-0,02	0,21	**0,29**
rump width	0,11	-0,19	-0,08	-0,07	-0,10	-0,21	0,20
rear legs set rear view	0,00	0,12	0,03	0,06	0,06	**0,47**	0,11
real legs set side view	0,05	-0,11	-0,09	-0,09	-0,10	-0,29	-0,02
foot angle	-0,06	0,05	0,08	0,08	0,09	0,17	-0,08
locomotion	0,07	**0,25**	0,06	0,08	0,08	**0,78**	0,17
fore udder attachment	-0,22	0,15	0,16	**0,26**	**0,31**	0,16	0,05
front teat placement	-0,05	0,02	-0,01	0,08	0,10	0,05	0,09
teat length	0,06	-0,12	-0,05	-0,03	-0,06	-0,09	-0,05
udder depth	**-0,28**	0,22	0,21	**0,32**	**0,38**	0,10	0,13
rear udder heigth	0,20	0,22	-0,17	0,04	-0,01	0,16	0,06
udder support	0,03	0,09	-0,08	0,03	0,03	0,00	0,09
rear teat placement	-0,01	-0,03	-0,05	-0,01	-0,01	0,00	0,07