Industry perspective on breeding goal and selection strategy

Henk Geertsema

CR Delta, Holland Genetics division
P.O.Box 454, 6800 AL Arnhem, The Netherlands
Phone 026-3898537, Fax 026-3898555, Geertsema.H@CR-Delta.nl

Abstract

The selection and mating of elite animals to breed the next generation of young bulls is an important part of commercial breeding programmes. This needs to be done with the right breeding goal to maximise the output of marketable proven bulls. A breeding goal is usually derived from different economic factors. In an industry perspective however not only economic factors are important. Sale of semen is also influenced by non-economic and possibly non-rational factors. Therefore the use of semen by farmers was analysed to sort out which extra factors are important. A breeding goal was defined based on both economic and non-economic factors. Selection of parents is performed using a linear combination of production traits, conformation traits and functional traits according to the breeding goal. Sires and dams are selected maximising this linear combination across age groups while restricting the rate of inbreeding. Mating of the selected parents will be done by using a non-linear combination of traits to avoid weaknesses in the inheritance of future progeny.

1. Introduction

The selection and mating of elite animals to breed the next generation of young bulls is an important part of commercial breeding programmes. Sires and dams should be selected and mated in such a way that output of marketable proven bulls is maximised. A breeding goal is usually derived from different economic factors. In an industry perspective however not only economic factors are important. Sale of semen is also influenced by non-economic and possibly non-rational factors.

2. Definition of breeding goal

2.1 Economic factors

Because we want to maximise the output of marketable sires, the breeding goal should be based on the sale of semen in six to ten years. It is hard to predict the situation at that time, but it can be expected that sale of semen then will be based on mainly economic factors. Since august this year in the Netherlands we have the DPS (Durable Performance Sum). This is the economic sum of production and durability. After two months farmers already very well accept the DPS. So we can expect that the DPS will be important in semen sales in the future.

Durability is based on culling data and predictors of culling. In an average situation the predicting information is based on rump angle 15%, front teat placement 5%, udder depth 30%, feet & legs 20%, somatic cell count 20% and interval calving insemination 10% (NRS, 1999).

2.2 Non-economic factors

Although economic factors will be important, other (non-economic and possibly non-rational) factors will influence semen sales in the future as well. To sort out which other factors are important we analysed the sale of semen during the last years. We tried to predict

semen sales from breeding values. The first approach was to do a linear regression using Inet, size, frame, udder and feet & legs as main traits. The levels of significance are in table 1.

Table 1. **Analysis of trait importance in determining semen sales - level of significance for Net merit production index (Inet) and overall conformation.**

	Level of Significance[i]
Inet	1
Calving ease	1
Size	1
Frame	2
Udder	1
Feet & Legs	1

[i] 1: lower than 0.05; 2: between 0.05 and 0.20

The results show a significant role for almost all traits. So, farmers select on Inet and the main conformation traits.

Secondly we did the same analysis using linear traits (Table 2).

Table 2. **Analysis of trait importance in determining semen sales - level of significance for linear conformation scores.**

	Level of significance[i]
Inet	1
Calving ease	1
Feet & legs	1
Stature	1
Chest width	-[ii]
Body capacity	3
Rump angle	2
Rump width	1[iii]
Angularity	3
Rear leg set	3
Foot diagonal	3
Fore udder attachment	2
Front teat placement	3
Teat length	1
Udder depth	3
Rear udder height	2
Suspensory ligament	3

[i] 1: lower than 0.05, 2: between 0.05 and 0.20, 3: higher than 0.20
[ii] not enough data
[ii] negative relation

Only stature, rump width and teat length had a high significance. It proved hard to do predict semen sales from linear traits. It seemed there were to many other factors, like marketing and availability, that influenced semen sales. But most important, the number of proven bulls with data (about 20 bulls per year) was too small.

Using the DPS and the analysis of semen sales we defined a breeding goal with Inet, durability, feet & legs, stature, rump angle, udder depth, somatic cell count and interval calving insemination as the main traits.

3. Selection

Selection of parents is performed using a linear combination of traits. The method of Meuwissen (1997) was implemented in the breeding program to select parents. Sires and dams are selected maximising the linear combination of traits while restricting the rate of inbreeding. Doing this the average relationship between our tested bulls is restricted. This decreases the risk of the breeding program. Furthermore, when the young bulls receive their test results, proven bulls can be selected which are less related to the population and to each other.

4. Mating

Mating must be done in such a way that the output of marketable proven bulls is maximised. An important aspect is to avoid weaknesses in a bull's inheritance. Most heavily used bulls are all-round bulls in a sense that they have no major weaknesses on important traits. To decrease the chance on a major weakness already in mating weaknesses should be avoided. This can be reached by using non-linear functions as shown in Figure 1.

A non-linear (quadratic) function like this penalises low breeding values for a certain trait more heavily. Using this quadratic function for all traits, the index for all possible matings is computed. The optimal mating scheme is obtained by maximising the average non-linear index of all matings. Doing this, mating of sires and dams with the same weaknesses in their inheritance will be avoided. The method of simulated annealing (Press *et al*., 1989) is used to do this maximisation.

References

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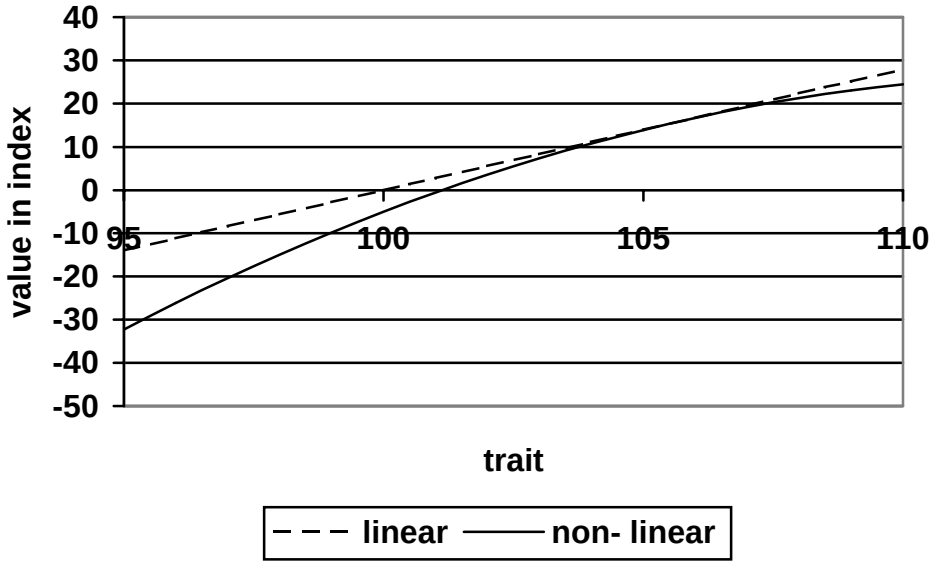

Figure 1. Linear and non-linear functions relating trait level PBV and considered value in overall index.