

# Genetic Evaluation of Beef Cattle in Sweden

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## Abstract

This paper describes the beef cattle recording scheme, genetic evaluation and genetic trends for growth traits in Swedish beef breeds.

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## Introduction

Genetic evaluation of beef cattle in Sweden is based on the beef recording scheme run by the Swedish Dairy Association in cooperation with the different breed associations. In total seven breeds; Charolais, Hereford, Aberdeen Angus, Limousine, Simmental, Highland Cattle and Blonde d'Aquitaine, take part in the recording and evaluation scheme. The total number of purebred calves born per year with a calving performance record is around 16,000, of which 83% has a birth weight record, 63 % a weaning weight record and 52 % a yearling weight record (Swedish Dairy Association, 2006).

In addition to the beef recording scheme, records are also collected on direct calving performance of dairy cows with calves sired by beef bulls, on a performance test station for beef bulls and carcass traits from the abattoir.

The small number of animals per breed has forced the breeders to import semen, embryos and animals in order to be efficient even after the foundation of the breed in the country. None of the beef breeds in Sweden is native to the country.

The breeding programs are heavily relying on purebred pedigree herds and on natural service bulls. Artificial insemination is used only on a small part of the purebred beef cows. Totally 4,121 AIs were performed in order to produce purebred beef calves (Swedish Dairy Association, 2006). A special AI breeding program including one or two of the best performance tested beef bulls per year and

breed has been running for many years. In this program the bulls are tested for calving traits on dairy cows.

The purebred bulls are used for cross-breeding in the commercial herds, which heavily relies on crosses between different beef breeds, and between beef and dairy breeds. The total number of suckler cows in Sweden was around 167,000 in December 2006 (Swedish Board of Agriculture, 2007) and the number is constantly increasing.

## Beef Cow Database

The beef cow database at the Swedish Dairy Association includes all information necessary for genetic evaluation including pedigree and performance records from the beef recording scheme and the abattoirs. It is partly integrated with the dairy cow database when it comes to AI records and carcass data.

## Pedigree Data

Pedigree data are available from 1975 and onwards. A large number of animals have been imported and this is well documented. The question is whether foreign identifications have been correctly recorded. A standardization of identification systems has been of great help. The number of imported bulls with offspring born in Sweden is shown in figures 1 and 2. Figure 3 shows the minimum number of purebred calves with pedigree records per year.

## Calving Traits

Calving traits are recorded by the farmers and the recording is compulsory. The traits recorded are survival of the calf as dead or alive 24 hours after birth and the calving performance is recorded in seven classes from easy calving to caesarean section.

## Weights

Weighing is made by the farmers themselves and/or by technicians from the beef recording scheme. Birth weight is usually recorded by the farmer and compulsory in order to get the animal genetically evaluated. It has to be recorded within four days after birth. Weaning weight is recorded in the interval between 150 and 250 days of age. Yearling weight is recorded in the interval between 325 and 425 days of age and sometimes even a 550-day weight is recorded on heifers.

## Carcass Traits

Carcass weight, fleshiness and fatness grades are recorded at commercial abattoirs in the ordinary slaughter routine and transferred to the beef cow database. Carcass fleshiness and fatness grade are subjectively judged by trained graders in accordance with the EU system (Swedish Board of Agriculture, 1998). The number of slaughter records on young, fattening animals is limited, particularly for females, due to the fact that the best animals are kept for breeding.

## Genetic Evaluation

Linear animal models have been used for genetic evaluation of growth traits in Swedish beef cattle since 2000 (Larsson, 2000). Carcass and calving traits have been added to the evaluation more recently (Eriksson, 2005)

## Calving Traits

The only calving trait evaluated is calving performance for first calvers. Eriksson *et al* (2004) showed that this was the only trait with

a high enough heritability, just over 0.10 for direct effects and slightly below 0.10 for maternal effects, taken into account the breeding structure in the beef breeds with mostly natural service sires with a limited number of offspring. The model used is a multiple trait model including birth weight and calving performance of first calvers as well as of older cows treated as different traits, as well as direct and maternal effects. Fixed effects are herd\*year, sex of calf, age at calving and for birth weight also season of calving, multiple birth and age of weighing. Multiple births are excluded for the calving performance trait.

## Growth Traits

Growth traits are evaluated with a multiple trait model including direct and maternal effects of the pre-weaning traits birth weight, gain between birth and weaning and the direct effect of post weaning gain. The model is based on the study by Stålhammar *et al* 1997, and includes the fixed effect of herd\*year, sex of calf, age at calving, season of calving, multiple birth and for birth weight also age of weighing (Larsson, 2000).

## Carcass Traits

Evaluation for the carcass traits, carcass weight, fleshiness and fatness are based on bulls and evaluated together with birth weight and weaning weight as correlated traits in order to take into account selection of breeding animals based on birth and weaning gain, according to the suggestions by Eriksson *et al* 2003. The fixed effects for growth traits are as described earlier and for carcass traits the fixed effects are herd\*year, age of dam, multiple birth, season of slaughter and category of bull.

## Genetic Gain

Growth traits have been a basis for selection ever since beef recording started. The genetic change of these traits can be seen in figures 4 and 5 for Charolais and Hereford. The main goal has been to improve direct pre-weaning and post-weaning growth rate for both Charolais and Hereford, and at the same time keep birth weight constant in order to decrease

calving problems. This aim seems to have been achieved. Hereford has also increased milk production, as can be seen by a slight increase in maternal pre-weaning gain.

## Future Development

A project is now going on with the aim to present a basis for construction of a total merit index for the Swedish beef breeds. Within this project economic weights for direct and maternal effects on calving traits, maternal effects on pre-weaning gain, and direct effects on net gain from birth to slaughter, carcass fatness grade, and carcass fleshiness are developed. The total merit index is suggested to consist of three subindexes (a maternal index, an index for production, and an index for direct effects on calving ease).

In the Swedish beef recording scheme, about 40 % of the cows are crosses and the plans are to study the possibilities to use information from crossbreds (both crosses between various beef breeds and between beef and dairy breeds) in the genetic evaluations of calving and carcass traits. An evaluation with a mixture of breeds can make it possible to compare bulls of different breeds and to evaluate potential crossbred breeding cows. Use of information on crossbred calves in the dairy herds increases the amount of data and the genetic evaluations of beef bulls for carcass traits can be improved.

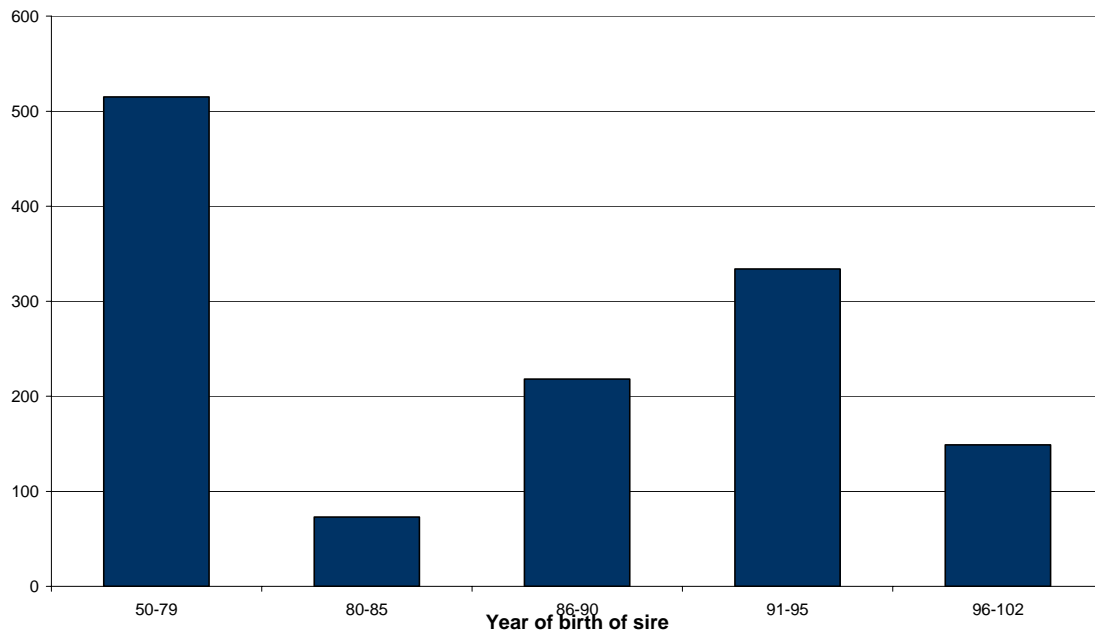
In Sweden we are right now about to start a PhD project with focus on the effects of marker/candidate genes on meat quality, carcass traits and growth in beef cattle. Female fertility is another trait that so far is not included in the genetic evaluation of beef cattle. The plans are therefore to study the genetic variation in calving interval, age at first

calving and calving date, and also the genetic relationships between these fertility traits and growth and carcass traits. It is also of interest to study the economic importance of and the possibilities to include female fertility in the total merit index.

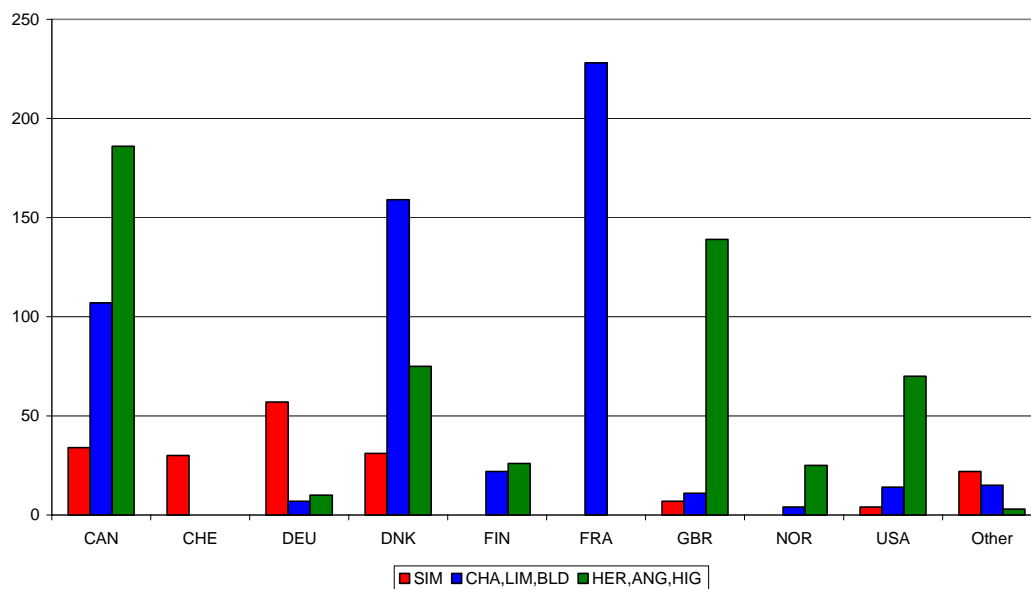
## Literature

- Eriksson, J.-Å. 2005. Avelsvärdering för slaktkropps- och kalvningsegenskaper. *Stencil*. Swedish Dairy Association, Eskilstuna, Sweden.
- Eriksson, S., Näsholm, A., Johansson, K. & Philipsson, J. 2004. Genetic parameters for calving difficulty, stillbirth and birth weight for Hereford and Charolais at first and later parities. *J. Anim. Sci.* 82, 375-383.
- Eriksson, S., Näsholm, A., Johansson, K. & Philipsson, J. 2003b. Genetic analyses of field-recorded growth and carcass traits for Swedish beef cattle. *Livest. Prod. Sci.* 84, 53-62.
- Larsson, N.-E. 2000. Lägesrapport 2000, lägesrapport. *Stencil*, Swedish Dairy Association, Eskilstuna, Sweden.
- Stålhammar, H. 1997. Genetic studies of beef characteristics in Swedish cattle breeds. *Acta Universitatis Agriculturae Sueciae: Agraria. Sweden. No 55*.
- Swedish Board of Agriculture. 2007. Antal nötkreatur i Sverige december 2006. *JO23 SM 0701*, Jönköping, Sweden.
- Swedish Dairy Association. 2006. *Annual Statistics 2006*. Swedish Dairy Association, Eskilstuna, Sweden.
- Swedish Board of Agriculture. 1998. *Klassificering av slaktkroppar från nötkreatur och får*. Jönköping, Sweden.

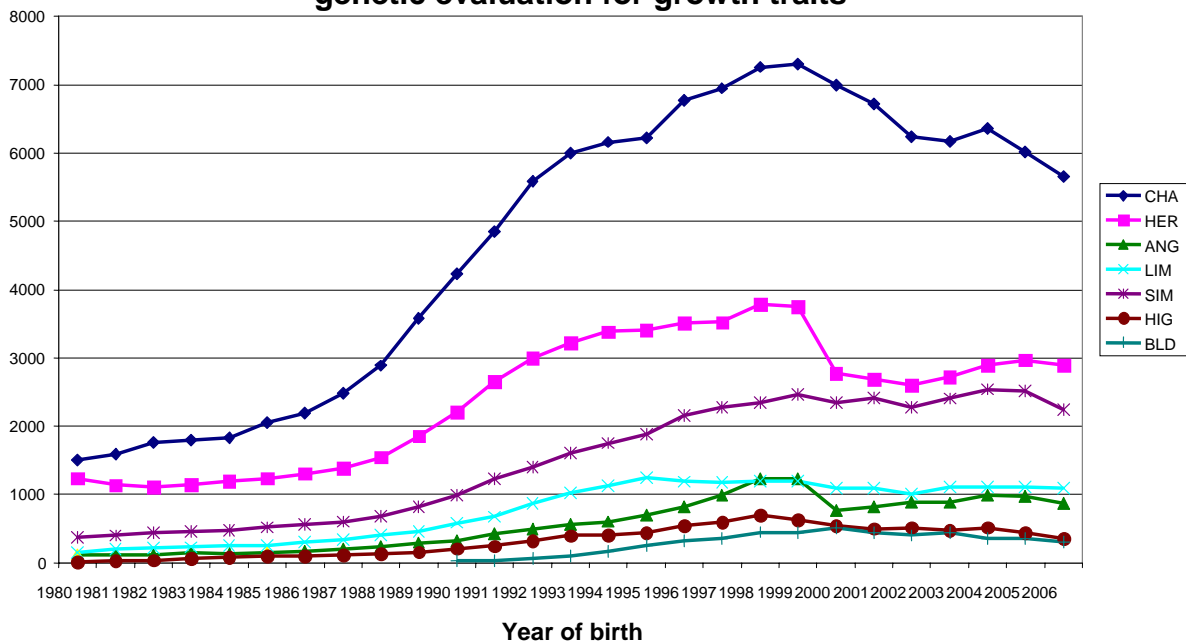
**Figure 1. Number of imported sires with offsprings i Sweden**



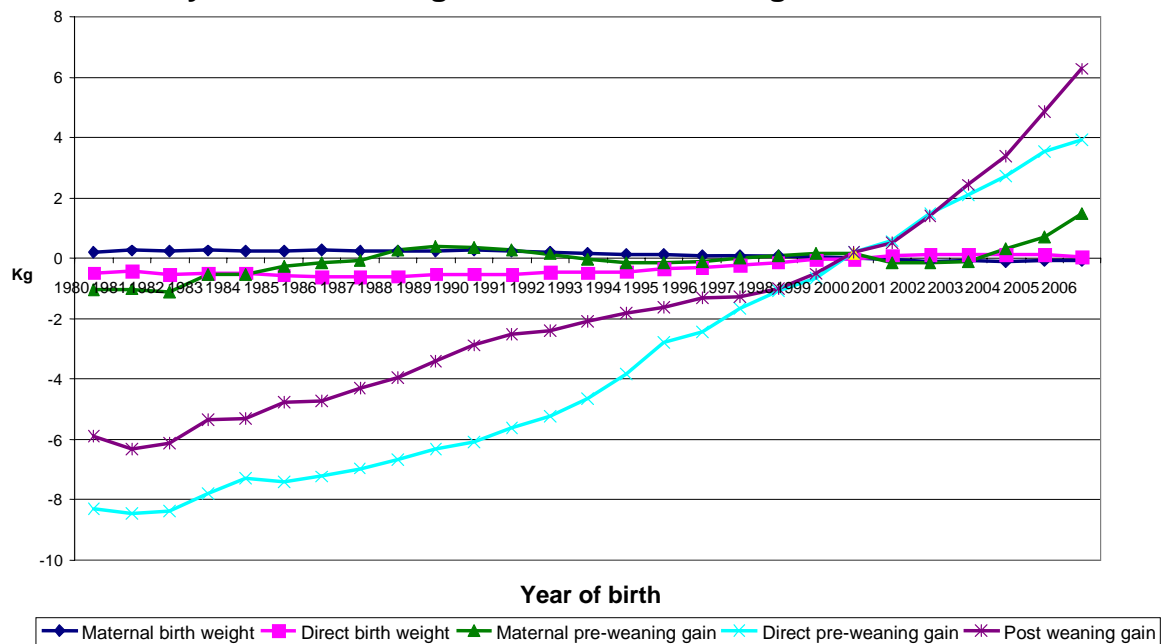
**Figure 2. Number of imported sires with offsprings in Sweden in different breed groups**



**Figure 3. Number of calves of beef breeds included in the genetic evaluation for growth traits**



**Figure 4. Average EBV:s for Charolais calves borne different years based on genetic evalaution for growth traits**



**Figure 5. Average EBV:s for Hereford calves borne diffrent years based on genetic evalauton for growth traits**

