Swedish Sire Evaluation of Hoof Diseases Based on Hoof Trimming Records

Jan-Åke Eriksson, Swedish Dairy Association

Abstract

This paper describes hoof diseases (dermatitis, heel horn erosion, sole haemorrhage and sole ulcer) recorded in the field by hoof trimmers and the possibilities to use the recorded data for genetic evaluation of AI sires.

Introduction

Leg and hoof disorders causing lameness are common reasons for culling of Swedish dairy cows; 5.5 % of culled SRB (Swedish Red) cows and 6.8 % of culled Holstein cows are culled for this reason (Swedish Dairy Association, 2005). Lameness problems seem to be more common with the change from tie stalls to cubicles. Lameness and culling are not only causing increased treatment and recruitment costs for the farmers, but also increased suffering for the cows. Thus it is important to find measures to decrease the rate of leg and hoof disorders. The most immediate tools are maintenance hoof trimming, metabolic balance and environmental improvements, but on a long term perspective genetic improvement is also a possibility. Several studies, summarized by Ral et al, 2001, have been performed in Sweden in order to find methods to improve the health status of hoofs by breeding.

The problem with genetic improvement is to find traits that could be used as early predictors of improved leg and hoof health. One possibility is to use hoof trimming records as shown by Ral et al, 2001. They recommended using the diagnosis sole ulcer, which is relatively easy to diagnose (Manske, 2003) and has been shown to have a relatively good heritability, 0.08, Ral et al, 2000. Based on this recommendation and an earlier recording scheme, an enhanced recording scheme for hoof trimmers' findings of hoof diseases was launched in late 2003.

The goal of the present study was to evaluate if the hoof trimming records were suitable for the genetic evaluation of sires for hoof diseases. As recordings are made on a voluntary basis, it is assumed important to show as soon as possible that the records are used for breeding purposes, in order keep the recording rate at a high level.

Data

Hoof trimming data have been recorded and used in Sweden for several years. All lesions, locomotion and conformation can be recorded, but emphasis is made on the most common lesions which are also scored as slight or severe lesions; dermatitis (digital or interdigital), heel horn erosion, sole haemorrhage (sole or white line hemorrhage) and sole ulcer (ulceration of sole or white line area), Bergsten C, 2006. In total, 89 hoof trimmers made 98.5 % of all recordings. All diagnoses are made per cow except for ulcers which are made per foot, because these lesions are of more interest for an individual follow-up by the farmer. The frequency of hoof lesions per year, table 1, shows that sole haemorrhage has the highest frequency, 25 to 30 %, and sole ulcer has the lowest frequency, 4 to 5 %.

In this study, only first lactation SRB and Holstein cows with a known sire and dam were included. The traits were defined as 0 = no lesions or 1 = slight or severe lesions within first lactation.

Methods

EBVs (Estimated Breeding Values) were estimated using a single trait linear sire model including fixed effects of herd*year of calving, age at calving and month of calving. Heritability used was 0.08 for all traits.

All cows with known sire were included in the analyses in order to utilize the data as efficiently as possible. This explains the great number of sires with daughters included in the analysis, table 2. It was decided that the number of daughters should be more than 49 for an official/accurate EBV. Due to the short time period covered, more than 80% of the sires with more than 49 daughters are already progeny tested, either in Sweden or abroad.

In order to check the quality of the data and evaluation procedure, the data were split into two datasets and two separate EBVs were calculated for each sire. The splitting of the data was done at herd level. The first herd was assigned to dataset one, the second herd to dataset two, the third herd to data set one, and so on. The separate EBVs for individual sires with at least 25 daughters in each dataset were correlated in order to estimate the repeatability of EBVs.

Result

The standard deviation of EBVs from the full dataset, table 3, indicates that the genetic variation is large for those traits. The standard deviation is of course dependent of the heritability used, number of daughters and the phenotypic variation, which is quite large for some of the traits. The reason for the difference in std. between breeds is that the average number of daughters per sire is higher for SRB, 430, compared to Holstein, 250.

The correlations between EBVs for different diagnoses indicate a strong positive relationship between dermatitis and heel horn erosion in both breeds, as well as between sole haemorrhage and sole ulcer, table 4. Weaker but positive relationships are indicated between the other diagnoses. Do these traits have some relationships to other traits in the breeding goal? One could expect or hope for a relationship to other feet and leg traits. This was tested by calculating the correlation between EBVs for hoof diagnosis and six conformation traits for feet and legs. The result showed correlations quite close to zero and no clear pattern across breeds. The correlation between the total breeding value for feet and legs and the hoof diagnosis varied from 0.19 to -0.25. Not even for the only specific foot trait, foot angle, was the correlation significantly different from zero.

The correlation between repeated EBVs from the divided dataset, table 5, shows that the correlations are higher for SRB than for Holstein. One reason is larger daughter groups for SRB sires. The average theoretical repeatability was 0.60 for SRB and 0.55 for Holstein.

Discussion

The result shows that it is possible to use hoof trimming records for genetic evaluation of sires. This is a very important finding, because the recording is carried out in the field by people with no previous experience in this kind of work. It indicates that the data are of good quality. Even for diseases which are difficult to diagnose, such as dermatitis, heel horn erosion and sole haemorrhage, the recordings seem to work very well. These last mentioned findings are encouraging, as these have not been shown in Swedish field data before. It indicates heritabilities in line with the findings by Koenig et al, 2005 & Waaij et al, 2005.

The low correlation between EBVs for hoof diagnoses and leg and hoof conformation traits was not expected, but might be true. It shows the importance of including more traits in order to be able to improve hoof and leg qualities, which has also been presented by Ral et al, 2001. Improved hoof and leg qualities are important both for the economy and for animal welfare. Animal welfare seems to become an increasingly important issue when it comes to consumer acceptance of dairy products and, thus, even for the economy of the dairy farmers. The economic value of the different hoof diagnoses has so far not been assessed, but needs to be before it can be used in a selection process.

The main part of the data has been recorded during a very short time period, and this is a problem for the genetic evaluation of young sires and also because it prohibits more comprehensive genetic analyses. The main part of sires with relatively large daughter groups have their second batch of daughters and are a selected sample group of sires. The short recording period also creates a problem when studying the correlations between first lactation traits and later or life time traits. Only a small part of the cows have records on second and third lactation hoof diagnoses or survival records.

It is important to continue the recording of hoof diagnoses to the same or higher extent as in 2005. The percentage of approved first lactations compared to the total number of records in the data was 23 %, which is less than expected as the recruitment was 38.3 % during this time period, Swedish Dairy Association, 2005. The reason for this is that it is a quite common practice that cows are trimmed twice per year; incomplete pedigrees and that also heifers are trimmed. If an official EBV requires at least 50 first lactation daughters, that 180 bulls are progeny tested per year and that the percentage of young bulls' semen is 30, then at least 130,000 hoof trimming records have to be collected per year. With some marginal for variation in daughter group size, 160,000 is not too much.

Hopefully, the recording system will be a basis for improvement of management for hoof and leg diseases, and that good examples will increase the recordings to involve even more of the herds and hoof trimmers. In such a situation, genetic evaluation of young sires should not be a problem. Naturally, even second and later lactations will be utilized in sire evaluation in the future in order to increase repeatability, but that would not help the selection of young sires very much.

Literature

Ral, G., Philipsson, J., Berglund, B., Manske, T., & Hultgren,J. 2001. Selektionsindex för klövhälsa. Publication No. 137. Swedish University of Agricultural Sciences Department of Animal Breeding and Genetics.

Ral, G., Manske, T., Bergsten,C., Berglund, B.& Philipsson, J.2000.

Genetic studies of conformation and foot health in Swedish Dairy Cattle.
Bergsten C. 2006. Personal Communication.
Swedish Dairy Association. 2005. Livestock statistics 2005.
Koenig, S., Sharifi, A. R., Wentrot, H., Landmann, D., Eise M. & Simianer, H. 2005. Genetic Parameters of Claw and Foot Disorders Estimated with Logistic Models. J. Dairy Sci. 88:3316-3325.
Manske, T., 2003, Om klövvårdares klövhälsoregistreringar. (About claw trimmers recording of claw diseases) Svensk Vet.tidn. 55, 11-18.

van der Waaij, E.H.,Holzhauer, M., Ellen, E., Kamphuis, C. and de Jong, G. 2005. Genetic Parameters for Claw Disorders in Dutch Dairy Cattle and Correlations with Conformation Traits. J. Dairy Sci. 88:3672-3678

Table 1. Frequency of hoof lesions recorded by Swedish hoof trimmers

Year	Number of records	Dermatitis	Heel horn erosion	Sole haemorrhage	Sole ulcer
2003	42700	0.071	0.205	0.269	0.044
2004	64964	0.078	0.217	0.300	0.048
2005	162334	0.070	0.198	0.244	0.045
2006	37545	0.083	0.263	0.253	0.038

Table 2. Number of 1st lactation cows and sires included in the analysis

	SRB	Holstein
Number of sires, total	1,103	1,852
With > 49 daughters	52	92
Number of cows	33,004	37,541

Table 3. Standard deviation of breeding values for sires with > 49 daughters

Diagnosis	SRB	Holstein
Dermatitis	5.4	5.0
Heel horn erosion	6.8	5.8
Sole haemorrhage	7.0	6.0
Sole ulcer	4.0	3.9

Table 4. Correlation between EBVs, SRB above and Holstein below the diagonal

	Dermatitis	Heel horn erosion	Sole haemorrhage	Sole ulcer
Dermatitis		0.65	0.13	0.01
Heel horn erosion	0.51		0.13	0.17
Sole haemorrhage	0.09	0.18		0.48
Sole ulcer	0.09	0.29	0.41	

Table 5. Correlation between EBVs between divided daughter groups

Diagnosis	SRB	Holstein
Number of sires	45	75
Dermatitis	0.66	0.48
Heel horn erosion	0.75	0.46
Sole haemorrhage	0.43	0.39
Sole ulcer	0.76	0.51