Health Traits Data for Dairy Cattle in Norway - An Overview and New Opportunities

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Abstract

Health traits have been systematically recorded on dairy cattle in Norway over the past 20 years. The health card system, where all veterinary treatments are recorded on an individual animal basis, is central to its success. Health traits currently recorded in Norway are described here, in addition to other traits such as somatic cell counts, milking speed, leakage, conformation and culling reason that are of interest due to their relationship to health traits. The Norwegian recording system is briefly described and reasons for its success are discussed. Data from the Norwegian cattle recording service has now been organised into a research data base with phenotypic information on an individual cow basis from 1978, and will be of great value for genetic studies of dairy cattle health.

1. Introduction

The Nordic countries (Denmark, Finland, Norway and Sweden) have traditionally paid special attention to non-production traits in dairy cattle breeding. This has been facilitated by the recording, on a national basis, of traits of major economic importance, such as those affecting health and fertility, which have not normally been measured in other countries. This data is used for breeding evaluation but is also of value for research purposes. As a typical Nordic country, Norway selects for a broad breeding goal including, for example, dairy, beef, health and reproduction traits. As an illustration, the traits included in the total merit index for bull selection in 1996 are given in Table 1.

Table 1. Traits included in the total merit index for bull selection in 1996. The number of test daughters (actual, not effective) per bull is also given

Trait	No. Dgts.	Trait	No. Dgts.
Protein Yield	280	Carcass Value	190
Milking Speed	201	Leakage	201
Body Index	144	Feet/Leg Index	144
Udder Index	144	Temperament	144
Non-Return Rate	293	Stillbirths (sire of cow)	277
Stillbirths (sire of calf)	481	Calving Difficulties (sire of cow)	277
Mastitis	285	Ketosis	285

The number of test daughters per bull ranges from almost 500 for stillbirth (direct effects) to 144 for conformation traits. This data comes from a wide range of sources. Production data comes from the milk samples collected routinely by the farmer; milking speed, leakage, stillbirths and calving difficulties are recorded by the farmer; fertility (non-return rate) data is collected by the inseminator or vet; body, leg and udder traits and temperament are recorded by judges from the cattle recording service; carcass information comes from the slaughter houses and information on mastitis and ketosis is recorded by the veterinarians (Gravir, 1990).

Contribution of the farmers to the data recording scheme is substantial. Figures for 1996 show that 90% of all cows and 87% of all herds are registered in the cattle recording services (NML, 1996). Some of the reasons why it has been possible to record such a large number of traits in Norway with the involvement of so many farmers, are as follows:

i) Following the agricultural crisis in the 1930's, the farmers organised themselves into dairy co-operatives, based on the principal that, regardless of geographical location or how the milk was to be used, they were to receive the same milk price (Furre, 1996). This means that today, it is still the farmers themselves that own the dairy, in addition to the meat and AI organisations and so close co-operation between the different areas of animal production and with the veterinary and cattle recording services is possible.

ii) Costs of the local cattle recording service for a given dairy are covered by all the farmers that supply milk to the dairy. Thus, each individual farmer pays for the recording service, whether or not he avails of it.

iii) The farmers believe in the merits of the breeding work carried out and have seen that it works. This means that they are aware of the importance of reliable data recording and are, for example, willing to record new traits and to mate a large proportion (37%) of their herd to young bulls.

iv) Farm sizes are small, the average is 13 and over 90% of farms have less than 20 dairy cows (NML, 1996), so the farmers believe that they must co-operate to make progress.

v) There is no major market for sale of live animals. This means that farmers are not afraid to risk systematic recording of health or fertility traits of individual cows.

vi) Of relevance for health traits, there is strict regulation of drugs such that all antibiotic treatments are carried out by the veterinary and the farmer is not allowed to treat his own animals.

The purpose of our paper is to describe the health traits that have been recorded in Norway and to highlight the new research possibilities that are now available.

2. Veterinary treatments - the health card system

One of the key tools in health trait recording in the Nordic countries is the health card system, where each cow has an individual health card which is updated each time the veterinarian treats the animal. This system was first applied on a national basis in Norway in 1975 and later adopted in Finland (1982) and Denmark (1986) (Heringstad et al., 1996). In Sweden, although health cards are not used, treatments on an individual animal basis are recorded nation-wide since 1984 under the veterinary disease recording scheme (Eriksson and Wretler, 1987).

In Norway, the health card system was developed as a response to the large increase in the number of veterinary treatments observed in the 1950's and 1960's (Solbu, 1983). To counter this growing problem, the Society of Veterinarians in Norway, the Norwegian Cattle Organisation (NRF) and the cattle recording service decided to implement the health card system so that the health status of each individual cow could be monitored and that all diagnoses and veterinary treatments

of milk-recorded cows would be recorded (Gravir, 1990). The system was first tested in 1970 and was introduced on a national basis five years later (Solbu, 1983). It helps both the veterinarians, since they can use records from previous visits to aid diagnosis when on farm and the geneticists, since it allows selection for disease resistance. The data can also be used to monitor trends in the most important dairy cattle diseases and to estimate the genetic and non-genetic factors affecting them (Østerås and Landsverk, 1996). Since drugs and antibiotics can only be prescribed by veterinarians in Norway, health recording is very reliable and health card data has been used as official Government figures since 1989. Details on the health card are filled out by the veterinary on the farm and are later sent to the data recording centre by the farmer or by an advisor from the cattle recording service.

The first health card system included 10 traits and was later extended to 46 traits in 1978. In 1989, the data registration system was re-organised and health cards were also introduced for female calves and heifers. At the same time, the number of health traits recorded was extended to 63. (In addition, codes for preventative treatment of the traits are available, but such treatments are rare). Participation in the health card system is very high, including 98% of all milk-recorded cows (NML, 1996).

Table 2 shows the disease traits currently recorded, as well as the number of cows treated for each in 1996 (NML, 1996). From the 411,433 cows that were in the health card system for at least part of 1996, 238,673 treatments were recorded in the 63 disease classes. The traits are divided into 10 different major groups and the most frequent veterinary treatments were due to the mammary system (52.8%), non-organ related disorders (20.1%) or reproduction-related problems (17.7%). Specific disorders had high frequencies, with acute and chronic clinical mastitis, ketosis and milk fever occupying the top four places respectively and accounting for 25.1, 18.4, 11.9 and 6.7% of all treatments.

Because veterinarians may vary in the way they define acute or chronic clinical mastitis, the separation of clinical mastitis into these 2 traits is not very informative and both are used for breeding evaluation. For a cow to be recorded as having sub-clinical mastitis, it is necessary that the veterinarian takes a milk sample for analysis and that, after the lab results are available, he writes it on the health card when later visiting the farm. It is thus not used for breeding evaluation because of under-reporting, since not all veterinarians may recommend lab analysis and, of those carried out, the veterinary may later neglect to record it.

3. Other health related traits

Mastitis is the most costly disease in dairy cattle (Heringstad et al., 1996) and, since so few countries directly record the trait, much research has been devoted to finding other traits that may be used to indirectly select for reduced mastitis frequency. In Norway these traits are recorded as follows:

Somatic Cell Counts (SCC): SCC have been recorded for all lactating cows (in units of 1,000) every second month since 1978. The farmer collects the samples and sends them to the local laboratory for analysis. They have not been used for any genetic evaluation purposes.

Milking Speed and Leakage: These two traits are recorded by the farmer and sent to the cattle recording service on the same form. Since 1955, milk yield in the first 2 minutes of milking as well as total milking time have been recorded as measures of milking speed (Gravir, 1990). This was obviously time-demanding and, following a trial study (Steine, 1988), it was decided that from 1989 the farmer would simply rank the cows as fast, average or slow milkers. Leakage has been recorded since 1978 in 3 classes - no, little or much leakage. Up until 1988, both traits were recorded on a sample (70-80) of daughters of bulls being progeny tested. From 1989, it was extended to include all first lactation cows bred by AI. Farmers are requested to send in data on both traits within 120 days of the first lactation. Table 1 suggests that over 70% of them do so.

Table 2. Health traits recorded in Norway on an individual cow basis in the health card system. Veterinary treatments are classified under 10 different groups, depending on the animal's ailment, with % of the total treatments in brackets. The number of cows treated from 1/1/96 - 31/12/96 for each trait is also given. A total of 238,673 treatments were recorded (NML, 1996).

1) Infectious (0.2 %)	
Bovine cysticerosis	8
Malignant catarrhal fever	34
Other	306
2) Skin and hoof (2.2 %)	
De-horning after injury	51
Laminitis	3,227
Hoof problems	1,189
Lice infection	22
Tumours	32
Cuts/injuries caused by fittings	315
Cuts/injuries - other causes	367
Non-specific skin problems	35
Other	0
3) Blood/respiratory system (10.5%)	
Cardiovascular diseases	112
Respiratory tract infections	893
Lungworms	7
Other	119
4) Digestive tract/liver/pancreas/endocrine glands (5.4%)	
Indigestion	7,109
Colic	957
Traumatic gastritis	2,829
Gastritis/enteritis	992
Parasite diseases	50
Dental problems	125
Bloat	150
Other	585
5) Mammary system (52.8%)	
Agalacti (no milk)	75
Agalacti (no milk letdown)	297
Removal of extra teats	34
Acute clinical mastitis	60,073
Chronic clinical mastitis	43,935
Subclinical mastitis	6,693
Teat injuries	13,411
Other	1,416
6) Sexual organs: obstretics (8.0%)	
Uterine prolapse	617
Torsion of the uterus	810
Prolonged gestation	687
Dystocia	4,531
Malformations	65
Vaginal prolapse	560
Retained placenta	11,335
Other	446
7) Sexual organs: reproduction/urinary tract (9.7%)	
Abortion	804
Silent heat	11,273
Synchronisation of heat	1,747
Metritis, vaginitis and salpingitis	4,109
Cystic ovaries	4,460
Inflammation of urinary tract	51
Other	758
8) Disease in nerve/sense organs (0.0%)	105
9) Non-organ related (20.1%)	
Abscesses/phlegmons	804
Abnormal behaviour	53
Poisoning	89
Hypomagnesaemia/grass tetany	527
Ketosis	28,520
Milk fever	16,070
Paresis	742
Vitamin/mineral deficiency	362
Other	713
10) Musculo-skeletal system (1.2%)	
Tendinitis and bursitis	593
Fractures	83
Arthritis	1,401
Muscular dystrophies	77
Paresis due to pelvic/muscular injury	308
Other	517

Culling Reason: This can be used as an additional source of information for health traits, such as mastitis (Heringstad et al., 1996). From 1978, culling reason was recorded in Norway with few classes, e.g. culled due to disease, but was developed from 1989 onwards to give more information i.e. culled due to high SCC or mastitis, due to injured teats or due to other diseases.

Udder Traits: These traits are not recorded on all cows but only on a sample (roughly 50% in 1996, see Table 1) of daughters of young bulls being progeny tested. They are recorded by judges from the cattle recording service and, with few exceptions, the same traits have been recorded from 1980 until today. In 1986, the evaluation form was changed to include diagrams and the scoring system was altered for some traits. Minor modifications, involving teat size, were carried out in 1996. Fifteen udder traits are recorded.

Although not as important as mastitis or infertility, hoof and leg diseases are a major problem in dairy cattle, and are recorded in all the Nordic countries (Ral et al., 1995). In Norway, five traits involving feet and legs are recorded on the same animals and on the same form as udder traits described above.

4. Recent developments in Norwegian data

Two sources of phenotypic data are available in Norway. The first, which is an NRF data base, is of minor importance since it involves the more unimportant traits recorded on only a sample of females. This extended heifer test data base (EHTDB) includes data for the udder and feet/leg traits described previously as well as temperament and body conformation traits on a sample of first lactation daughters bred by test bulls. Data is thought to be stored from at least 1985 (T. Steine, pers. comm.). The EHTDB also includes calving difficulties, leakage and milking speed data up to 1989.

The second, of far greater importance, is the cattle recording services data base (CRSDB) which contains information on all other traits (in addition to leakage, milking speed and calving difficulties from 1989 onwards). Data from a whole range of sources - including the health card, slaughter houses, laboratory milk analyses and insemination reports - is recorded in the CRSDB on an individual animal basis. Running of the data base used to be the responsibility of the Government (Department of Agriculture) until the national dairy co-operative (NML) took over from 1978 and re-organised the data recording system. It was later modified in 1989 and this system has been in use since then.

One of the factors that has limited dairy cattle research in Norway is the fact that to get data, it has been necessary to send the data specifications to the data recording centre and to pay them for downloading the requested data set. For this reason, the Department of Animal Science at Ås has now built up its own data base, on an individual animal level, based on the CRSDB (Heringstad et al., 1997). This has been a long, tough job and more problems than expected were encountered on the way. The work was done using annual copies of CRSDB tapes, going back to 1978, containing lifetime data on cows culled each year, in addition to the most recent tape containing animals still alive. For each cow, the entire life history can thus be re-created as all information on birthdates, culling dates, pedigree, veterinary treatments, inseminations, production, calvings etc. etc. are stored.

The situation today is that the relationship file contains over 3 million females, the first of which are born in 1958, and roughly 4,000 bulls. From 1978 onwards the following phenotypic data are available: a) 305-day milk performance - milk, fat and protein yields, fat % and protein %, b) test-day records of milk yield, fat %, protein % and SCC, c) health card information, d) insemination and mating information, e) multiple births, f) survival and g) stillbirths. From 1989 onwards, the data base includes a) to g) as well as h) carcass traits i) leakage j) milking speed k) calving difficulties l) abortion and m) presence of horns.

If we consider the traits mentioned earlier in the paper, most of the health card traits recorded from 1978 were recorded in the same way after the new data recording system was introduced in 1989. This means that there are now almost 20 years data on the main disease traits, such as clinical mastitis (there are almost 1.5 million records), and less than 10 years data on some others. SCC data is available in test-day form from 1978. Culling reason is

recorded from 1978. For milking speed and leakage, these records are available from 1989. Records stored on the EHTDB could eventually be included in the data base at Ås as the same animal ID system was used as in the CRSDB, but this has not been done.

The data base that is now available at the Department is a valuable research tool for improving our understanding of health traits in dairy cattle. In the immediate future, it is planned to use it first in a study for detecting QTLs for traits such as disease resistance using a grand-daughter design with individual cow records rather than deregressing the sire's proof (Gomez-Raya et al., 1996) and in a study of the genetic components and genetic trend for mastitis (Heringstad et al., 1996). The data base is also to be used in other research areas. For example, to investigate genetic aspects of twinning and fertility and to evaluate the feasibility of running an animal model with data from the Nordic countries.

5. Acknowledgements

Henrik Solbu and Torstein Steine from the NRF are thanked for helpful discussions.

References

Eriksson, J-Å. and Wretler, E. 1987. Sire evaluation for diseases in Sweden. *38th Annu. Meeting EAAP,* Lisbon, Portugal, 9 pp.

Furre, B. 1996. Meieria: Skal Finden få vesle fingeren ? *Aftenposten*, January 27th. p.3.

Gomez-Raya, L., Våge, D.I., Olsaker, I., Klungland, H., Klemetsdal, G., Heringstad, B. Lie, Ø., Rønningen, K., Ruane, J. and Lien, S. 1996. Mapping QTL affecting traits of economical importance in Norwegian cattle. *47th Annu. Meeting EAAP,* Lillehammer, Norway. 10 pp.

Gravir, K. 1990. Breeding of NRF-Norwegian Cattle. *2nd edition. NRF-Norwegian Cattle,* Hamar. 69 pp.

Heringstad, B., Klemetsdal, G. and Ruane, J. 1996. Selection for mastitis resistance in dairy cattle - a review with special consideration of the situation in the Nordic countries. *47th Annu. Meeting EAAP,* Lillehammer, Norway. 10 pp.

Heringstad, B., Ranberg, I.M.A., Ruane, J. and Klemetsdal, G. 1997. Utplukk av kukontroll-data til slektskapsfil. Internal document. 30 pp.

NML Annual Report. 1996. Årsrapport organisasjonsavdelingen NML/Norske Meierier. 127 pp.

Ral, G., Berglund, B., Bergsten, C. and Darvelid, U. 1995. Genetic aspects of leg and hoof traits in cattle. *46th Annu. Meeting EAAP, Prague,* Czech Republic. 10 pp.

Solbu, H. 1983. Disease recording in Norwegian dairy cattle. I. Disease incidences and non-genetic effects on ketosis and milk fever. *Z. Tierzüchtg. Züchtgsbiol. 100,* 139-157.

Steine, T. 1988. Utmjølkingseigenskapar. *Buskap og avdrått, 2,* 88-89.

Østerås, O. and Landsverk, K. 1996. Herd health programmes for small dairy herds in Nordic countries. *47th Annu. Meeting EAAP,* Lillehammer, Norway. 7 pp.