Collecting functional traits in dairy herds: overview of a program currently running in Italy

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Abstract

The national scheme of milk recording in Italy is currently based mainly on the collection of records on milk yield and composition. Recently, increasing attention has been paid also to other traits that are helpful for improving management of dairy herds and for increasing efficiency of breeding schemes. Given this concern, a project for extending the recording procedure to some functional traits has been started in April 1998, enrolling some milk recording agencies of Veneto region. Operators of milk recording agencies collect data, and visits to registered herds occur at 4-wk interval. The scheme planned the collection of traits ordinarily recorded in the national scheme (milk yield, fat and protein content, pedigree information, animal identification, calving date, insemination and culling date) and "new" traits: i) BCS, mastitis and lameness, recorded on periparturient heifers (since about two months before the expected calving date), lactating and dry cows every 4 weeks; ii) retained placenta and mammary oedema, recorded on heifers and cows at calving; iii) leakage, milkability and temperament while milking, recorded on lactating cows every 4 weeks; iv) reasons for culling, recorded on all culled animals. Training of recording personnel at the start of the project and procedures aimed to improve the standardisation of BCS will be discussed. Moreover, with the aim of encouraging the true participation of farmers, the development of tools for supporting herd management decisions based on analysis and interpretation of BCS data are in progress and will be described. Currently, 88 dairy herds have been enrolled on this project, and 35 operators have been involved in the recording of functional traits. This produced a database, currently containing nearly 77,600 records from nearly 9,300 Holsteins females that will be of a value for studying the relations of body reserves status and change during lactation with milk yield, health and fertility.

1. Introduction

In most European countries milk production traits have traditionally held a predominant position in the selection goal of dairy breeds under the assumption that profit would have increased at increasing output per cow. National milk recording programs have largely supported this objective, yielding accurate database on milk production traits needed for both genetic improvement and herd management.

In recent years, the opportunity for farmers of increasing revenues by increasing milk yield was constrained by imposing of quota system. The new market situation led to a decrease of the economic value of milk production (Strandberg *et al*., 1996; Pieters *et al*., 1997). Breeding for production with little concern for other traits caused an increase of costs for milk production by increasing feed intake capacity and the nutritional value of feedstuff, and by negatively affecting reproduction and health characteristics of dairy cows (Østergaard *et al.,* 1990; Hageman *et al*., 1991; Simianer *et al*., 1991). Current dairy cattle production systems rely largely on high levels of product output per animal with possible decrease of animal health and reproductive performance, increased metabolic stress and involuntary culling rate, reduced economic performance and animal welfare.

Suffering of animals because of diseases and metabolic disorders, the use of antibiotics and their effects on animals, pathogens and humans are factors which affect the acceptability of the production system by the consumer. In the next years, more attention will be paid to balance improvements of production and functional traits in order to support the consumer acceptance of animal products and to avoid decreases of economic performance. Technological development and integration of "new" traits in national recording schemes should aim to improve genetic gain and management of herds (Strandberg *et al.*, 1996, Bratt, 1997).

Only the Nordic countries have traditionally paid attention to non-production traits in dairy cattle breeding (Ruane *et al.*, 1997). In Italy, the national recording scheme is based mainly on the collection on milk yield and composition records, pedigree information, animal identification, calving date, insemination date and culling date. Operators of the milk recording agencies that visit herds at 4-wk intervals collect data. Recording data on functional traits is currently viewed as a major change for the national recording scheme in Italy.

The aim of this paper is to describe a project currently running in Italy for recording functional traits in dairy herds and to discuss some choices related to the project.

2. Procedures

In April 1998, in the Veneto region (north-east of Italy), a project aimed to provide research, culture and extension service on animal health and dairy cattle management was discussed involving researchers, farmers and technicians. The main purpose of the project was defined to be the recording of data on traits of dairy cows and peri-parturient heifers which were "More Than Production" (MTP project).

2.1. People involved in the project

The MTP project is a joint project involving the Department of Animal Science of the University of Padova, some milk recording agencies working in the Veneto region and a national A.I. stud. The project is addressed to create a data base with accurate information on production, functional, health and management-related traits and to provide farmers with reports useful for comparing performance and occurrence of management and health problems in their own herds with averages of all herds in the same province. One additional goal is to provide information on traits that can be very helpful to prevent management and health problems at the farm level.

2.2. Interest of participants

Prior to the start of the project, all milk-recording agencies were asked to join the discussion. For different reasons, three of the seven milk recording agencies decided not to join the project from the start and wait for at least one year. The milk recording agencies which actually joined the MTP project (Padova, Treviso, Venezia and Verona) were asked to select within the group of associated dairy farmers whom they would like to be involved. This selection was practised in order

- to have farmers truly interested in this kind of program, and
- to ensure that collection of data by the farmers was carried out by people who (a) would have used those data for managing their own animals, and (b) are motivated to feed the recording system with high-quality data (Bratt, 1997).

In this context, a total of 88 dairy herds and 35 technicians were involved in the project.

2.3. Expected advantages for participants

Expected advantages from the project are:

1) dairy farmers get more information helpful and specific for management purpose and in the middle-long term will be able to breed superior cows for health and management problems;
2) a major advantage for milk recording agencies is the chance to strengthen and to differentiate services offered to associated dairy farmers and to increase the level of technical skill;
3) for the A.I. stud it will be possible to propose genetic material with aspects related to robustness and functional traits known;
4) for the Department of Animal Science a useful data base will be available for research purposes and the connection with the industry, farmers and breeding organisations will be enforced.

2.4. Data collecting

Every farmer involved in the MTP project is to fill in a survey on farm characteristics regarding location, size, management and nutrition practices, stables, milking machine and destination of milk. This information is updated every year for monitoring changes in the farm production system.

The data collection scheme is based on recording at 4-week intervals "traditional traits and information" (milk yield, fat and protein content, somatic cell count, pedigree, animal identification, calving date, insemination date, and culling date) and, "new traits": i) body condition score (BCS) (Edmonson et al., 1989), mastitis and lameness, recorded on periparturient heifers (since two months prior to the expected calving date), lactating and dry cows every 4 weeks; ii) retained placenta and mammary oedema, recorded on heifers and cows at calving; iii) leakage, milkability and temperament while milking, recorded on lactating cows every 4 weeks; iv) reasons for culling, recorded on all culled cows. All traits are recorded by farmers, with the exception of BCS, leakage, temperament and milkability being recorded by technicians. The method of collecting data for farmers is based on a paper form. During the milk recording visit the technician load MTP-functional traits using a notebook.

2.5. Data flow

The current data flow is reported in Figure 1. The data recorded at the farm level are first downloaded to the database of the milk recording agencies, and after the laboratory response for milk composition and somatic cell count, everything is sent to the Department of Animal Science by electronic mail. At the Department, the data are automatically validated using a specific program (Figure 2). Inconsistent data are sent back to the agencies that provide, if possible, corrections. Within few hours, a report on BCS (see later), is sent by e-mail to the agencies that provide a BCS-based service at the farm level.

2.6. Training of recording operators

The precision and accuracy of recording data by technicians is constantly evaluated with training both at the start of the project and with joint evaluations every 4 months conducted by an expert trainer, in particular for BCS. This training procedure is important not only for scoring of BCS but also to maintain a high level of interest for the recording quality of data. Observations on BCS are corrected using adjustment coefficients that take into account individual differences on mean and variability of technicians in comparison to the overall average and variation assessed during the training. Corrected data for differences on evaluations of BCS among technicians are currently available to allow for comparison among herds.
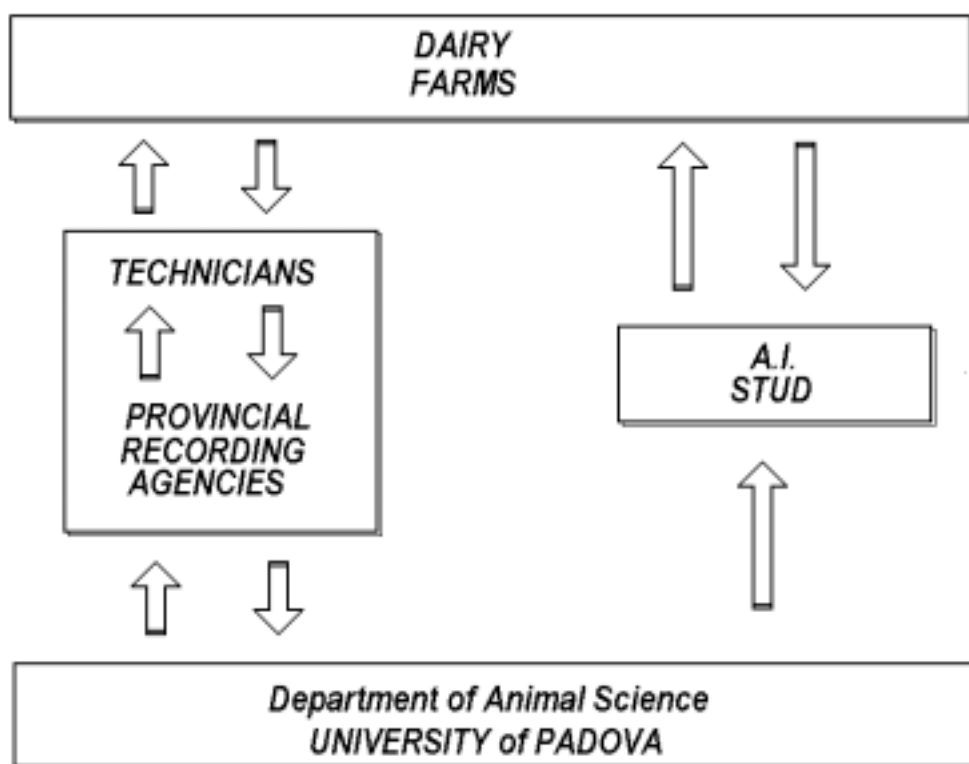
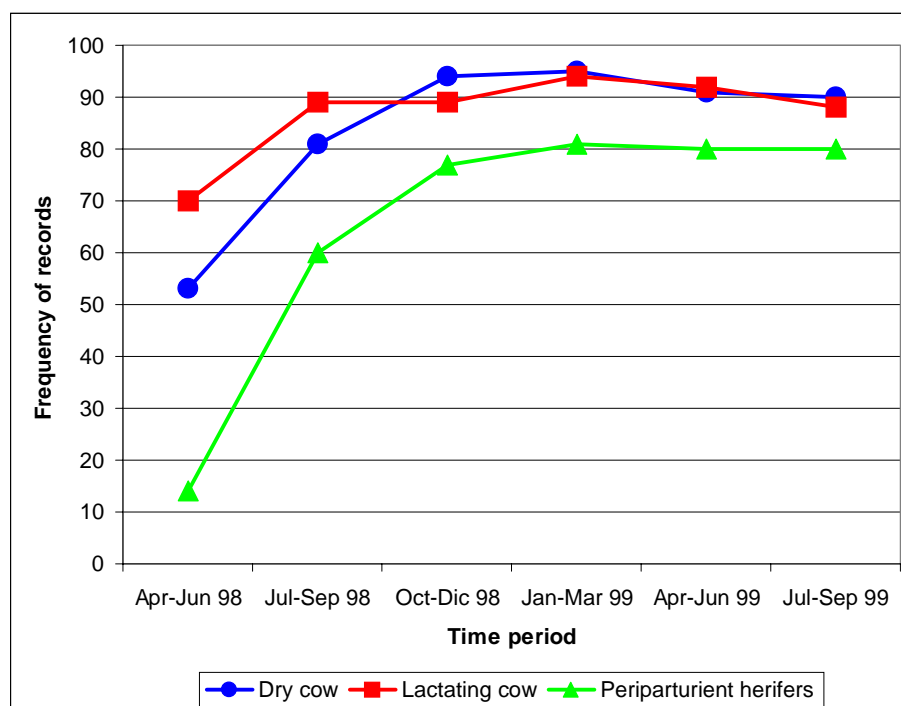Figure 1. **Data flow of functional traits among the participants**

Figure 2. **Trend of frequency of validated records on input, in the database**

Table 1. **Description of recorded functional traits**

Trait	Description of classes
HEALTH	
Mastitis	0 - No mammary infection
	1 - Mammary infection, without antibiotic treatment or other medicament
	2 - Mammary infection with antibiotic treatment or other medicament
Lameness	0 - No disease.
	1 - Lameness without medical treatment or other medicament
	2 - Lameness with antibiotic treatment or other medicament
Retained placenta	1 - No retained placenta
	2 - Forced expulsion of placenta, using medical treatment and/or vet.
Other problems	Note of diseases: ketosis, metritis, milk fever, teat trauma, etc.
MANAGEMENT	
Temperament	1 - Easy to handle during milking time
	2 - Difficult to handle during milking time
Leakage	1 - No leakage before milking time
	2 - Irregular leakage before milking time
	3 - Continuos leakage before milking time
Milkability	1 - Slow milking relative to other cows in the herd
	2 - Average milking time
	3 - Fast milking time among lactating cows in the herd
Mammary oedema	1 - No evidence of mammary oedema
	2 - Mammary oedema until to cover half udder and navel
	3 -Oedema covered all udder, navel, sternum, thigh, and vulva
Culling reasons	1 - Farmer wanted to cull the cow for low production level
	2 - Farmer must to cull the cow for other problems than production

3. Discussion and perspectives

The MTP-data base is an open archive with continuous updating of records, animals and herds. The future interest for recording management (BCS, temperament, leakage, mammary oedema, milkability and culling reasons) and health (mastitis, lameness and retained placenta) traits (Table 1) is mainly due to define better selection indexes and management practices for Italian dairy cattle.

3.1. Why these new traits?

With respect to management traits, the BCS is interesting to identify robust cows that put fewer constraints on economic farming systems. Indeed, BCS suggest precise indications on the level of the diet, and can be related to reproduction performance, metabolic diseases, calving difficulty and retained placenta. The temperament, in milking-room, is interesting for the development of automatic milking and for the capacity of animal to avoid environmental stress. Leakage before milking is useful for improving udder health index because of a positive correlation with milkability (Luttinen and Juga, 1997) and for association with teat shape and diameter of teat sphincter. The mammary oedema is relevant to study the relationship with mastitis, and reduced milk yield due to the liquids accumulated in the interstitial spaces. Milkability is useful for identify biological extremes (slow and fast) because it acts as an optimum trait. Selection for faster milking cows increases leakage and somatic cell counts, whereas, selection for slower milking cows increases clinical mastitis (Luttinen and Juga, 1997). This trait is also important to

standardise milking time within groups of animals for reducing milking costs. Involuntary culling frequency is an important trait because it is able to give a measure of vitality, health status and reproductive performance (Ducrocq, 1987; Dekkers, 1993). Involuntary culling is associated with the functional longevity of dairy cows that affects profitability of dairy herds by reducing replacement costs and by increasing the proportion of cows yielding at mature level (White, 1973, Burnside *et al*., 1984; Van Arendonk, 1985).

Concerning health traits, mastitis is extremely important because it causes economic losses mainly from reduced milk production, lower milk quality premium and increased cost of replacement, labor and veterinary fees (Luttinen and Juga, 1997). Lameness can be useful for definition of locomotion score and for better prediction of longevity of dairy cows (McDaniel, 1997). Placenta retention is related with fertility, diet and BCS problems.

3.2. Description of the data base

In the MTP project 35 technicians for recording of production and functional traits are involved. Currently, the data base contains 77,600 records from nearly 9,300 Holsteins females which 81% lactating cows, 15% of dry cows and 4% of pregnant heifers, reared in 88 dairy herds with an average farm size of 68 lactating dairy cows, 7 dry cows and 4 pregnant heifers. Average (standard deviation) of milk yield production is 29.3 ($\pm$9.1) kg/d, with 3.64 ($\pm$0.8) and 3.26 ($\pm$0.4) % of fat and protein, respectively. Average lactation number is currently 2.3 with an average stage of lactation of 197 days in milk for lactating cows.

The management traits show an average BCS of 3.11 ($\pm$0.6) scores for all animals. With respect to lactating cows, 4.9% of cows are registered with a nervous temperament, 3% show a

continuos or irregular leakage before milking, 9% (on total recorded calving) reported a wide mammary oedema and 11.5% and 16.2% of cows are defined slow an fast in milking speed, respectively. The percentage of involuntary culling rate is 52% of the total culled cows.

The health traits show an average of somatic cell count, weighted for milk yield, of 312,000 cells/ml, with 18.4% records with more than 400,000 cells/ml; retained placenta occurred in 12.5% of calvings, mastitis and lameness incidence are 2.9% and 1.8%, respectively, on all registered records.

3.3. Use of data base

To encourage the participation of farmers, the development of tools for supporting herd management decisions based on analysis and interpretation of BCS data are available and based on a monthly report that compare expected BCS in function of parity, stage of lactation and production level (Gallo *et al*., 1996). Cows with extreme absolute difference between observed and expected BCS are marked on report to allow farmers and technicians for a timely and effective management intervention. For other functional traits a tri-monthly report is available using a comparison between frequency observed in the herds and frequency observed in the provincial area.

From the scientific perspective, the data collecting on MTP-project will allow to investigate, for the first time in Italy, genetic aspects for several functional traits, to study the relationships between them and production traits. Prediction of breeding values and definition of breeding objectives based on overall economic efficiency will be practicable. Particular emphasis will be reserved to BCS for studying the relations of body reserves status and change during lactation with milk yield, health, management and fertility traits.

4. Conclusion

The MTP project is a co-ordinate activity of data collection created to provide research, culture and extension service on animal health and management in Italy. These data will allow to study balanced selection indexes between production and functional traits in dairy cattle and will provided useful tools for modern management practices for dairy herds. Although several researches have been conducted for a long time, integration of functional traits in dairy cattle breeding goals and management practices is still a major challenge for dairy farmers around the world. Further studies and actions should be done in Italy for better use of functional traits in animal breeding and management and to increase number of dairy herds involved in similar programs.

Acknowledgements

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