Development of an "Economic Cheese Index" for the Italian Holstein

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Introduction

Several countries have developed their selection indices taking into consideration specific production systems (Dekkers et al., 1998). This paper describes the development of a selection index for Italian Holsteins which will rank bulls based on the objective of transforming milk into hard cheeses. In Italy more than 70% of dairy milk is used for cheese production (Osservatorio del Latte, 2003) and 80% of that is used for typical Italian products (e.g., Parmigiano Reggiano and Grana Padano).

In order to develop an "Economic Cheese Index" for the Italian Holstein cattle breed, an economic analysis of the Italian dairy cattle sector has been undertaken. A general bio-economic model by Wolfovà et al. (2005) describing the diverse production, feeding, management and breeding strategies has been used. The aim is to use the economic weights of the different traits and their correlation structure to combine estimated breeding values (EBV) into a selection index, eventually taking into account its impact on the farm's profitability.

Material and methods

Economic analyses have been performed on production and reproduction data belonging to herd book farms located in the area of Parmigiano Reggiano cheese, and that bring the milk to the Parmigiano Reggiano consortium for cheese transformation. In order to develop an economic cheese index, two different milk payment systems have been compared 1) the one used for the direct consumption (CM) 2) the one used for the Parmigiano Reggiano hard cheese transformation (PR). The traits included in the analysis: milk, fat and protein yields (kg), fat and protein content (%) and somatic cell score (SCS), based on 305 d production, along with conception rate (CR) and functional longevity. Economic values of production traits were estimated using the ECOWEIGHT 2.0 package (Wolf et al. 2008).

The production milk system was defined as reported by Wolfovà et al. (2007). The collection of all economic values was based on interview to veterinaries and cheese consortia working in the investigated area.

After computing the 2 sets of economic values for the afore mentioned traits and paying systems, the "Economic Cheese Index" has been derived. Economic values for conformation traits are not considered by the program; therefore in order to obtain economic values literature review and visible gain approach based genetic selection response has been performed.

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Available genetic correlations between traits have been used; if missing, they have been estimated using the Calo et al. (1973) method. Phenotypic correlations have been calculated for all traits, with the exception of longevity traits where literature data have been used. Subsequently the selection response over a 10 years period for the developed aggregate index has been estimated. Two different scenarios were considered. In one scenario, type traits were not considered, resulting in of 56:0:44, for production, type and functional traits respectively; whereas in the second scenario, a relative importance of 10% was given to type traits reducing to functional traits, resulting in a ratio of 56:10:34 for production, type and functional traits respectively.

Results and discussion

Economic weights per unit of standard deviation of the considered traits are in Table 1. In the PR production system, Kg of protein has an economic value 10-fold higher than CM system.

Table 1: Economic values (€) per unit of standard deviation of the trait in the two payment systems considered, "Consumption Milk (CM)" and Parmigiano Reggiano (PR).

Tratis	Payment systems	
	CM	**PR**
Kg milk (305d)	426.21	420.04
Kg fat (305d)	-156.23	-335.32
Kg protein (305d)	145.70	1538.85
Fat (%)	-101.77	-185.75
Protein (%)	38.52	406.83
SCS	-15.15	-11.89
Conception rate (%)	1.67	3.26
Longevity	179.29	177.63

Based on those economic values, the relative importance of each trait has been estimated. Results are in Figure 1. It is evident that in the PR production system, protein, both as yield and/or content, is the most important criteria, whereas in the CM system kilograms of milk have a higher relative importance than milk content.

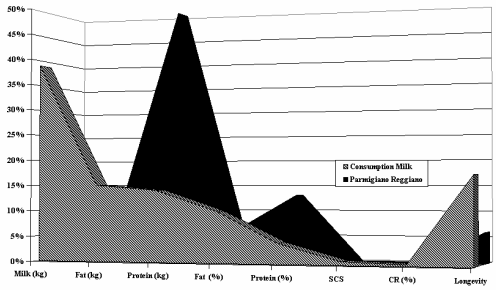

Figure 1: Relative weights of selection criteria in the two payment systems considered, "Consumption Milk"and Parmigiano Reggiano respectively.

Combining the 2 sets of economic weights, an Economic Cheese Index has been derived and the genetic response has been estimated.
Figure 2 shows the impact on genetic progress over 10 years for the Economic Cheese Index, with or without type traits. The expected response was estimated for the following EBVs: milk (kg), fat (kg), protein (kg), fat (%), protein (%), overall conformation score (OCS), feet and legs composite index (IAP), udder composite index (ICM), Somatic Cell Score (SCS), fertility (IAF), and functional longevity (herdlife). Including type traits in the selection criteria has a positive effect on all production traits, which increased by approximately 10%. On the contrary longevity and fertility experienced a slighter decrease, due to the reduction on weights for functional traits, and probably, also, because of the unfavorable genetic correlation with some type traits. The idea behind the Economic Cheese Index is to have a selection tool which might have solid commercial basis and might be accepted by the breeders. For these reasons, type traits, which have always been an important breeding objective for the Italian breeders, have been introduced in the selection index. However this aggregate index would be used together with the actual selection index the PFT.

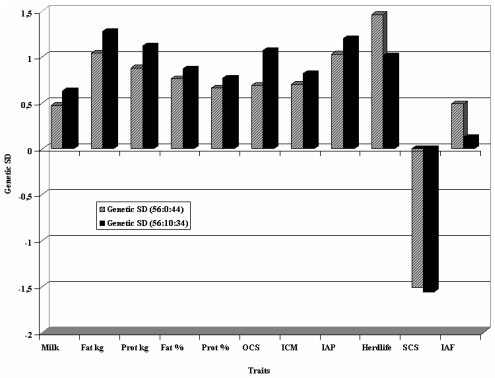

Figure 2: Standardized genetic progress in ten years in the two scenarios considered for the Economic Cheese Index, one including weights for type traits and one without weights for type traits.

Conclusion

Based on milk payment system of a particular production area, e.g. the area of Parmigiano Reggiano, it is possible to estimate the economic value of some selection criteria to be used in an aggregate selection index. In this study the objective of the selection index was the selection of the best bulls for cheese production. Two payment systems have been evaluated, namely Consumption Milk or Parmigiano Reggiano. The latter gives more emphasis to the protein level, as expected, while the former has a more balanced relative weight distribution. In order to develop a selection index which might be acceptable by the farmers, the 2 sets of economic weights can be combined and type traits could be added. Results in term of expected genetic response are worthwhile.

References

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