Genetic Evaluation for Body Condition Score in Italian Brown Swiss Dairy Cattle

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Introduction

The considerable genetic improvement of milk yield traits has reduced reproductive efficiency of dairy cattle (Castillo-Juarez *et al.*, 2000) and has increased the susceptibility to some diseases and the risk of culling (Simianer *et al.*, 1991).

Fertility traits have a large economic value for breeders (Gonza´lez-Recio *et al.*, 2004) and several countries included reproductive traits in a breeding goals (Van Raden, 2004). Calving interval is the fertility indicator mostly used, particularly in dairy cattle (Rege and Famula, 1993), it is easy to collect but it's not available when culling occurs and it is not a measure of fertility early available during productive life.

Body Condition Score (BCS) evaluates, by a numerical scale, the body energy reserves in a cow. It is possible to use BCS like an indirect indicator of fertility. Several studies evidenced the genetic and phenotipic relationships existing between BCS evaluated in specific life period (calving, postpartum, ecc.) and the ovarian activity (Dechow *et al.*, 2002; Harris 2002).

Aims of this study are to estimate the genetic parameters for BCS in Italian Brown Swiss Cattle, to verify the impact of the introducion of the cow production level as factor in the model and to analyze the relationship of BCS with other traits under selection.

Material and methods

Since 2002 the Italian Brown Cattle Breeders' Association is recording BCS of primiparous cows together with morphological classification. BCS is scored with the Edmonson methodology (1989) that scored the animal from 1 (emaciated condition) to 5 (obese condition) using 0.25 unit increments based on evaluation of 8 body areas.

BCS scores recorded from classifier with less than 50 evaluation per year and in herds with less than 3 cows in three years were excluded, while only records of cows calving between 18 and 36 months and scored between 5 to 365 days of milking were kept in the data set. A total of 73125 BCS scores on the same number of primiparous cows, daughters of 507 sires, was used in this study.

The model included the fixed effects of herd-3years, days in milk (12 classes of 30 days), classifier-year interaction (16 classifier, 5 years), and the random factor of animal additive genetic effect.

In additional 3 different covariates were separately tested in order to verify the impact of cow production level on BCS: i) the cow mature equivalent milk production; ii) the cow production at BCS scoring; iii) the total cow milk production from calving to BCS scoring. All covariates are as in interaction with days in milk.

The VCE package has been used for the estimation of variance components (Kovae'*et al.*, 2002).

To test interaction between EBV level (high and low) and days in milk a data set was created using the BCS scores of the daughters of 4 sires (2 with low EBV and 2 with high EBV) with at least 900 daughters. Relationship was tested with GLM SAS with a fixed factor model including sire*days in milk interaction.

Table 1. Genetic parameters estimated with different models for BCS. Standard error inside parentheses

Model	h^2	Correlation of BCS with	
		CI	Milk production
Without production level	0.19 *(0.01)*	-0.67 *(0.04)*	-0.48 *(0.02)*
Mature Equivalent 305 Milk yield	0.20 *(0.01)*	-0.54 *(0.03)*	-0.52 *(0.02)*
Milk production at BCS scoring	0.21 *(0.01)*	-0.69 *(0.04)*	-0.59 *(0.02)*
Milk production from calving to BCS scoring	0.19 *(0.01)*	-0.52 *(0.03)*	-0.47 *(0.02)*

Results and conclusions

The genetic parameters estimated with a different model are reported in Table 1. The BCS heritabilities vary from 0.19 to 0.21 according to the estimation model used.

The correlation between BCS and Calving Interval from 0.69 to 0.52 indicate a very strong connection between this two traits. The cow with a higher BCS EBV has less fertility problem compare to emaciated cows.

Dal Zotto *et al.* (2006) reported similar results indicating a genetic correlation of -0.35 between CI and BCS and a h^2 of 0.15 for BCS. The negative correlation (-0.59 to -0.47) between BCS and milk production indicated that obese cows produce less milk compared to individuals in good condition.

A practical problem is that breeders don't like to use BCS to increase a fertility because this is linked to reduction in genetic gain for milk.

To surpass this practical aspect the impact on correlations of production level was tested including this factor in the model. All the three models tested did not show significant impact of production level on the BCS-production relationship. The smallest genetic correlation (-0.47) between this two traits is estimated with a model considering total milk production from calving to BCS scoring. But with this model also the genetic correlation between BCS and CI is the smallest one (0.52).

The pseudo genetic correlation between BCS and Italian Brown Swiss selection index (ITE) is 0.04. This indicate that the breeders could use BCS EBV without compromising their current genetic selection strategy.

Interaction between EBV level and days in milk was significant. The graph in Figure 2 shows that sires with larger BCS EBVs guarantee a slower decrease of BCS during the first part of lactation, which is preferred to the strong decrease exhibited by the daughter of low BCS EBV sires. This behavior is particular interesting because the critical period for the fertility is the beginning of lactation: cow losing a large amount of body fat in this period show a delay in the restart of the luteal activity (Royal *et al.*, 2002).

After approval from the technical committee the Italian Brown Breeders' Association, deliver the genetic evaluation of sires for BCS since Aug 2007.

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Figure1. Least square means for BCS for days in milk class, in a sample of 4 sires.