Genetic evaluation for body condition score in Italian Brown Swiss cattle

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ABSTRACT: Body Condition Score (BCS) evaluates the body energy reserve in a cow using a numeric classification. It is possible to use the BCS as an indirect indicator of fertility. The genetic evaluation for BCS in Italian Brown Swiss is performed on 73125 BCS evaluations on the same number of primiparous, daughters of 507 sires. Effect of herd by year goes from -1,02 to +0,94 indicating large differences among herds. The primiparous cows show about 3.2 BCS points at calving, their BCS decreases slightly during first 90 milking days but, after this period, the BCS increases until 3.5 BCS points at the end of first lactation. Sires with larger 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 EBV sires. The pseudo-genetic correlations, correlations values estimated among EBV, confirmed the relationships between BCS and other important traits like milk yield (-0.20), final score, dairyness and udder. The correlations between BCS and functional traits, milking speed and functional longevity, is -0.14 and +0.17 respectively.

Key words: BCS, Dairy cattle, Brown Swiss, Fertility.

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 (Gonzalez-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) and 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 phenotypic relationships existing between BCS evaluated in specific life period (calving, postpartum, ecc.) and the ovarian activity (Dechow et al. 2002, Harris 2002). A preliminary study on Italian Brown Swiss Cattle reported a genetic correlation of -0.35 between calving interval and BCS, a h² of 0.15 for this latter trait and concluded that it is possible to use BCS data recorded in various periods of lactation on primiparous cows as a fertility indicator (Dal Zotto et al. 2006). Aim of this study is to set up a genetic evaluation system in the Italian Brown Swiss population for BCS as an indirect measure of fertility, analyzing BCS relationships 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 was used in this study with all. The model included the fixed effects of herd-3year (the same class for all BCS record scored in the same herd for 3 years) , days in milk (12 classes of 30 days), classifier-year interaction (16 classifier, 5 years), and the random factor of animal additive genetic effect. All Italian brown swiss pedigrees were used in analysis. Equation were solved using PEST software (Groeneveld 1990). In order to evaluate the different shape of BCS curve during lactation for sires with different EBV we analyse the interaction between EBV level for BCS (high and low) and days in milk. To do that, 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. Pseudo-
genetic correlations among traits were estimated through Pearson correlation of trait EBVs.

RESULTS AND CONCLUSIONS – The residual error analysis confirmed the normal distribution of residual error. The means of standard errors for days in milk and for age at calving is quite constant, around 0. Effect of herd by year goes from -1.02 to +0.94 indicating large differences among herds as like as 3 phenotypic standard deviation over and under the mean.

Figure 1. Least means square for BCS during the first lactation.

The Figure 1 shows the least means square of BCS plotted against days in milk. The primiparous cows show about 3.2 BCS points at calving, their BCS decreases slightly during first 90 days of milking but, after this period, the BCS increases until 3.5 BCS points at the end of first lactation. These results are quite different from those reported by Gallo et al. (1996) on the Italian Holstein where the means of BCS at calving was 3.55 and less than 3.4 at the end of first lactation. Probably these differences between breeds depend on different milk production level and on different herd management. The EBVs means of sires are -0.087 and standard deviation are 0.076. The genetic trend is practically flat indicating that from a genetic point of view fertility in the Brown population probably have not decreased dramatically in the last decade, even if days open phenotypically is increased of 21 days in the last 10 years (ANARB, unpublished). 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).

Table 1. Pseudo-genetic correlations between BCS and other traits (*=P<0.05 **=P<0.01).

| Traits  | EBV BCS | Traits   | EBV BCS | Traits   | EBV BCS |
|---------|---------|----------|---------|----------|---------|
| Milk kg | -0.20** | Longevity| 0.17**  | Dairyness| -0.48** |
| Fat kg  | -0.09*  | SCS      | 0.01    | Strengh  | 0.23    |
| Fat %   | 0.14**  | Milking speed | -0.14** | Rear leg | -0.26** |
| Protein kg | -0.07  | Final score | -0.19** | Rear udder height | -0.31* |
| Protein % | 0.25** | Udder    | -0.12** | Angolosity | -0.72** |

The pseudo-genetic correlations, correlation values estimated among EBVs, (Table 1) confirmed the relationships between BCS and other important traits found in previous studies. BCS is negatively correlated with milk yield (-0.20) and it is positive correlated with protein contents (+0.25). BCS has also negative correlations with final score, dairyness and udder. The correlations between BCS and functional traits as milking speed and functional longevity, are -0.14 and +0.17 respectively.

These correlations indicate that the introduction of BCS in the selection index would produce a reduction in the genetic gain for protein yield and for some type traits, and an increase of the genetic gain for protein content and
longevity. According to this study and others, ANARB discuss to deliver the genetic evaluation of sires for BCS.

Figure2. Least means square for interaction factor between sire and milking days of daughters.

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