



J. Dairy Sci. 99:1–10
<http://dx.doi.org/10.3168/jds.2016-11116>
 © American Dairy Science Association®, 2016.

Genetic correlations between type and test-day milk yield in small dual-purpose cattle populations: The Aosta Red Pied breed as a case study

Serena Mazza, Nadia Guzzo, Cristina Sartori,¹ and Roberto Mantovani

Department of Agronomy, Food, Natural Resources, Animals and Environment, University of Padova, Viale dell'Università 16, 35020 Legnaro (PD), Italy

ABSTRACT

This study aimed at estimating the relationships between linear type traits and milk production in the dual-purpose Aosta Red Pied (ARP) cattle breed, by expressing type traits as factor scores with the same biological meaning of the individual traits. Factor analysis was applied to individual type traits for muscularity and udder of 32,275 first-parity ARP cows, obtaining 3 factor scores for individual muscularity (F1), udder side (F2), and udder conformation (F3). Data from 169,008 test-day records of milk, fat, and protein yield (kg), belonging to the first 3 lactations of 16,605 cows, were also analyzed. After obtaining genetic parameters for both morphological factors and milk production traits through a series of AIREML single-trait models, bivariate analyses were performed on a data set accounting for 201,283 records of 35,530 cows, to assess the phenotypic and genetic correlations among all factor scores and milk yield traits. The heritability estimates obtained proved to be moderate for both groups of traits, ranging from 0.132 (fat) to 0.314 (F1). Muscularity factor showed moderate and negative genetic correlations (r_a) with udder size (-0.376) and udder conformation (0.214) factors. A low and negative r_a was found between udder factors. Strong and positive r_a were found among all the 3 milk production traits and F2 ($r_a \geq 0.597$). Negative r_a with milk traits were obtained for both F1 and F3, ranging from -0.417 to -0.221 . Phenotypic correlations were lower than the genetic ones, and sometimes close to zero. The antagonism between milk production and meat attitude traits suggests that great attention should be paid in assigning proper weight to the traits, comprising functional traits such as udder conformation, included in selection indices for the dual-purpose breed. The r_a obtained for factor scores are consistent with previous estimates for the corresponding individual type traits, and this con-

firms the possible use of factor analysis to improve type traits relevant to beef attitude.

Key words: dual-purpose cattle, genetic parameters, test-day milk, type traits, factor analysis

INTRODUCTION

Increased milk yield is a primary goal in dairy cattle breeding because of its preeminent importance in determining herd profitability (De Lorenzo and Everett, 1982). In dual-purpose cattle, equilibrium between selections for milk and meat is required, especially in local populations, in which the bond between the history, the products, and the specific environment of the breed is significant (Gandini and Villa, 2003). Selection for meat is based in some breeds on muscularity traits scored during routinely linear type evaluation (e.g., Italian Simmental, Frigo et al., 2013). Emphasis on linear type trait evaluation has been placed over time on dairy breeds, and genetic relationships between type traits and yield have been widely studied (e.g., Thompson et al., 1981; Vanraden et al., 1990; DeGroot et al., 2002). Linear type traits are visual characteristics of an animal expressed as a range of values within 2 biological extremes (Berry et al., 2004). These traits are described with numerical scores following the specific classification system of each breed and they usually approximate to a normal distribution (Norman et al., 1988). An advantage of this system is to quantify a trait using different degrees of expression rather than its desirability (Samoré et al., 1997). Conversely, the high number of traits scored and the high degree of correlation usually observed when they refer to the same body part can produce biased correlation estimates due to collinearity (Sieber et al., 1987). To overcome this problem, factor analysis has been proposed as a useful procedure to remove the redundancy from high correlated traits, deriving a new set of less correlated traits called factors (Vukasinovič et al., 1997). The main derived factors typically include correlated traits and may assume a biological meaning (Ali et al., 1998). Factor analysis has been widely studied as a tool for genetic evaluation

Received March 1, 2016.

Accepted June 17, 2016.

¹Corresponding author: cristina.sartori@unipd.it

of type traits in some Italian cattle, both in specialized beef breeds (Chianina, Marchigiana, and Romagnola; Forabosco et al., 2005), and in local dual-purpose cattle as Rendena and Aosta Red Pied (Mantovani et al., 2005; Mazza et al., 2016). Dwelling on the milk yield, current genetic evaluation largely uses single test day (**TD**) records to enable earlier selection decisions (Bilal and Khan, 2009) and to improve selection accuracy respect to the traditional 305-d lactation yields (Schaeffer et al., 2000). In Italy, a multi trait-random regression TD model (Kirkpatrick et al., 1994) is used for the Italian Holstein (Muir et al., 2007), whereas repeatability TD models (Meyer, 1995) are applied for the Italian Brown (Dal Zotto, 2000), Italian Simmental (Degano et al., 2003), and local dual-purpose Rendena breed (Guzzo et al., 2009). A repeatability TD model, considering consecutive test-day samples from the same lactation as repeated observations (Bilal and Khan, 2009), is particularly adaptable to dual-purpose local breeds showing fewer cows with evaluation and records per cow than specialized cosmopolitan breeds. In addition, dual-purpose local breeds are often characterized by mountain grazing activity during the summer, and the absence of TD in the final part of lactation leads to poor genetic evaluations at extremes when random regression models are used (Misztal, 2008).

For dual-purpose breeds, the understanding of the relationship between milk yields and traits related to meat attitude is of particular interest to allow the proper combination of traits when selection is simultaneous for antagonistic aspects. Selection indexes in dual-purpose cattle typically provide a greater emphasis to milk yield (Aass, 1996), often expressed as fat or protein yield, or combination of both, and also include some beef traits such as the muscularity score measured on cattle or (sometimes and) in vivo or postmortem carcass evaluations performed on young bulls [e.g., in Austrian Simmental (Sölkner et al., 2000) and in Rendena (our unpublished data)]. Some selection indexes for dual-purpose attitude have also recently included functional traits such as longevity or somatic cells (Krupová et al., 2016). Negative genetic correlations have been found between milk yield and postmortem carcass traits (Pirchner, 1986; Liinamo et al., 2001), and between milk and type traits related to muscularity (e.g., de Haas et al., 2007; Frigo et al., 2013). Only few studies have been already focused on the genetic aspects of the dual-purpose attitude, despite the evidence that a stronger selection for one attitude may cause a genetic detriment in the other (e.g., Sölkner et al., 2000). This issue is particularly relevant in local dual-purpose breeds, in which the maintenance of a nonspecialized beef or dairy conformation may help to preserve some

valuable functional characteristics (e.g., health, longevity, fertility, and robustness; Krupová et al., 2016).

The Aosta Red Pied (**ARP**) is a local dual-purpose breed mainly raised in the Aosta Valley region (northwest of Italy), and originated from short headed animals that lived in Central-Western Europe (Feliuss et al., 2011). Those animals, presenting a red and white coat, with white head and light muzzles, were brought from Burgundy to north Italy at the end of the 5th century (Del Bo et al., 2001). The ARP is one of the most diffused breeds of the Western Alps because of its high adaptability to living and producing in the harsh conditions of the Alpine areas. In 2014 the total number of ARP animals registered in the Herd Book, cows and bulls, was 23,721, 12,868, and 228, respectively (FAO, 2015). The ARP cows are usually characterized by strong shoulders, well covered by muscles, and an udder that is sufficiently developed to identify an animal with a prevalent milk aptitude but also good meat characteristics (ANABoRaVa, 2015a). The milk yield of ARP is mainly used to produce the Fontina cheese, labeled PDO (Protected Designation of Origin). In 2014, the average milk yield per lactation was 3,921 kg, with milk fat and protein percentages of 3.48 and 3.25, respectively (ANABoRaVa, personal communication). In 2015 the traditional lactation model used for the genetic evaluation of milk traits in Valdostana breed was replaced by a repeatability TD model developed by AIA (Cappelloni, 2013; ANABoRaVa, 2015b). The beef attitude is selected instead by using the muscularity traits of the linear type evaluation.

Considering the ARP as a case study for other small, local dual-purpose breeds, this study has aimed at estimating genetic parameters between linear type traits expressed as morphological factor scores and TD milk yields evaluated through a repeatability TD model. Traits retained for the factor analysis were those mostly related to the dual-purpose attitude, which are muscularity and udder traits. The attempt of estimating heritability and genetic correlations with TD milk yield traits by using the factorization of some linear type traits scored on primiparous cows is a novelty of this study.

MATERIALS AND METHODS

Data Editing

Data were provided by the National Association of Breeders of Valdostana cattle (**ANABoRaVa**) and included conformation and productive information. Linear type traits for the ARP breed have been referred as morphological traits (**MORPH**) in the study.

Download English Version:

<https://daneshyari.com/en/article/5541846>

Download Persian Version:

<https://daneshyari.com/article/5541846>

[Daneshyari.com](https://daneshyari.com)