Livestock Science 158 (2013) 157–168

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Dairy systems in mountainous areas: Farm animal biodiversity, milk production and destination, and land use

E. Sturaro *, E. Marchiori, G. Cocca, M. Penasa, M. Ramanzin, G. Bittante

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

ARTICLE INFO

Article history:
Received 15 March 2013
Received in revised form
3 September 2013
Accepted 18 September 2013

Keywords:
Dairy cow
Farming system
Mountain
Sustainability

ABSTRACT

This paper aims to classify the dairy systems of an Alpine area (Trento Province, Italy) and compare them in terms of productivity, milk destination, maintenance of livestock biodiversity, land management, and landscape conservation. A sample of 610 dairy farms was surveyed, and data on their structural and management features were collected. Four different farming systems were identified through a non-hierarchical cluster approach: "Original Traditional" (lactating cows that are moved to highland pastures during summer), "Traditional without summer pastures", "Traditional with silages", and "Modern". "Modern" farms accounted for about one fifth of the total and were characterized by the presence of recent buildings with free animals and milking parlors, large herd sizes and high levels of milk production. The feeding strategy on modern farms consisted of total mixed rations based on silage, and Holstein Friesian was the main breed, whereas local and dual-purpose breeds were rare. "Original Traditional" farms were characterized by the presence of old buildings containing tied animals. These farms were small to medium and consisted of Brown Swiss and local breeds such as Rendena and Alpine Grey, which used mainly local forages and summer Alpine pastures. The GIS analyses of the utilized agricultural areas of each farm also showed that only traditional, low-input systems are able to maintain the steepest meadows and highland pastures. These systems guarantee a high sustainability in terms of livestock biodiversity, environmental impact (stocking and manure densities), and landscape protection (contrasting re-afforestation and managing Alpine pasture). The main concerns for economic and technical sustainability of traditional dairy farms are low productivity, land fragmentation and agricultural mechanization. The data analyzed also showed the strong link between these systems and the production of high value, Protected Designation of Origin cheeses is fundamental for reducing their economic handicap when compared with intensive farming systems.

1. Introduction

The sustainability of livestock farming systems plays a central role in addressing the policies aimed at sustaining and planning rural development. The World Commission on Environment and Development (WCED, 1987) defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In livestock science, the concept of sustainability includes environmental protection, animal welfare, biodiversity, food safety and quality, social issues and economic competitiveness (Gamborg and Sandøe, 2005). All these issues should be addressed when considering the diversification of livestock farming systems (e.g., use of resources, degree of intensification, species and orientation of production) at different scales (Bernués et al., 2011; Gibon et al., 1999).

* Corresponding author. Tel.: +39 049 827 2641; fax: +39 049 827 2633.
E-mail addresses: enrico.sturaro@unipd.it (E. Sturaro), elisa.marchiori.2@studenti.unipd.it (E. Marchiori), giampaolo.cocca@gmail.com (G. Cocca), mauro.penasa@unipd.it (M. Penasa), maurizio.ramanzin@unipd.it (M. Ramanzin), giovanni.bittante@unipd.it (G. Bittante).

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http://dx.doi.org/10.1016/j.livsci.2013.09.011

In mountainous regions, where livestock farming has traditionally been of great importance for the vitality of rural economies (Baldock et al., 1996), mutually dependent social, economic, technical and cultural changes are leading to the abandonment of agriculture in marginal areas and to the intensification of farming in the most favorable valleys (MacDonald et al., 2000; Strijker, 2005). In the Alps, the number of agricultural farms and Livestock Units (LU) decreased, on average, by 40% and 17%, respectively, between 1980 and 2000, although in most decentralized regions farming abandonment reached 70% (Streifeneder et al., 2005; Tasser et al., 2007).

Both abandonment of traditional, low-input farms or their conversion into intensive holdings lead to a loss of open areas and forest re-growth (Cocca et al., 2012), a loss of biodiversity (Giupponi et al., 2006; Marini et al., 2011), and are accompanied by radical socio-economic changes (Bernués et al., 2005). In mountainous areas, traditional dairy farms provide multifunctional services. In the Italian Alps, several Protected Designation of Origin (PDO) cheeses are produced (Bovolenta et al., 2011) with an added-value chain that helps to maintain a satisfactory income for farmers. These farms use local forages and highland pastures, preserving the landscape from reforestation and contributing to the maintenance of biodiversity (Cocca et al., 2012; Giupponi et al., 2006). These services increase the touristic vocation of mountainous areas, contributing to the economic and social development of rural communities (Scarpa et al., 2010). For these reasons, the maintenance of profitable farms that have adapted to the environmental constraints and are able to guarantee the conservation of traditional land uses is one of the key issues for rural development in mountainous areas (Bernués et al., 2011). Beyond the abandonment of the farming activities due to the employment opportunities offered by other economic sectors (mainly manufacture industries, services, and especially tourism), in the last decades the traditional dairy farming system has searched for changes allowing for an increased economic return, comparable with other sectors, through an increase of herd dimension, and/or an increase of productivity of the cows, and/or investments in new facilities, thus changing deeply the link with the environment and the traditional dairy products.

This paper aims to classify the dairy systems of the Trento Province (Italian eastern Alps) and to analyze them in terms of dairy productivity, milk destination, maintenance of livestock biodiversity, and land use and management. The province of Trento is a good example of the recent evolution of the dairy systems in the Alps; in fact the number of dairy farms decreased from 5749 to 1071 units in the period 1980–2010, whereas the average size of the herds increased from 5 to 23 dairy cows (ISTAT, 2010).

2. Material and methods

2.1. Study area

The survey was carried out in the Autonomous Province of Trento (northern Italy; Fig. 1) which covers an area of 6200 km^2 and consists of 217 municipalities, all classified as mountainous for the national statistical database (ISTAT, 2010). Land morphology is highly variable, with a minimum altitude of 66 m asl and maximum altitude of 3769 m asl. Utilized Agricultural Area (UAA) covers 1372 km^2 and is predominantly characterized by meadows and pastures (81%), followed by orchards and vineyards (17%). Arable crops represent only 2% of land (ISTAT, 2010).

Dairy cattle breeding is the main component of livestock sector in the Trento Province: on a total of 1403

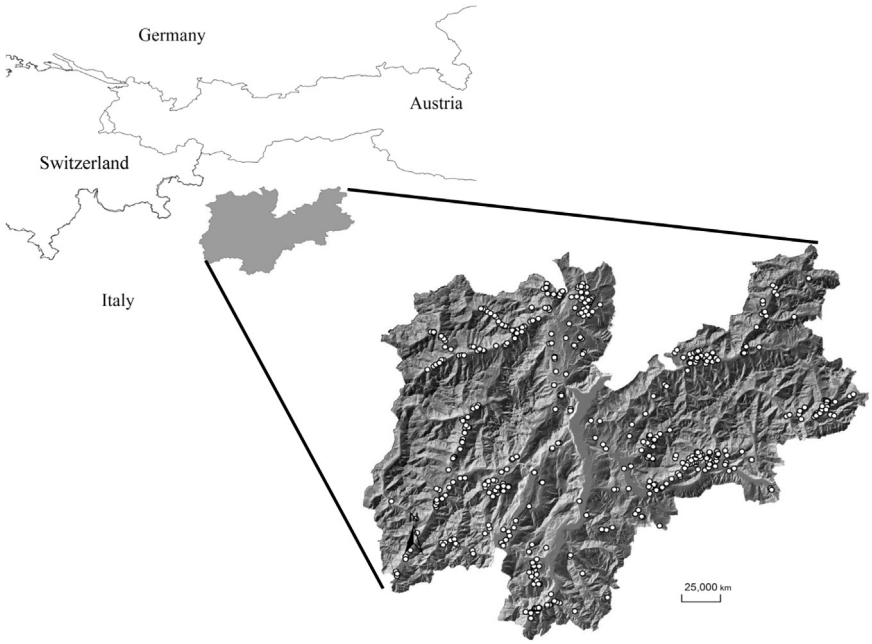

Fig. 1. Study area: white dots indicate the sampled dairy farms.