Highland Summer Pastures Play a Fundamental Role for Dairy Systems in an Italian Alpine Region

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Summary

In the Alps, summer farms are temporary units where the livestock herds are moved during summer to graze on highland pastures. This study aimed to analyze the role of summer farms in the dairy farming systems of the Trento province, in the eastern Italian Alps. Data on the structures and management of the 395 active summer farms were collected from the veterinarian services of the province: 345 summer farms keep dairy cattle (83 only replacement, and 262 also lactating cows). Almost all the replacement cattle and more than one third (8,775 *vs* 24,934 heads) of the dairy cows reared in the permanent farms of the province are still moved to highland pastures during summer. Cows on milk of local and dual purpose breeds are moved to highland pastures more frequently than those of specialized breeds. On 610 permanent farms, we analyzed the differences between the units moving/not moving the lactating cows to summer farms. The traditional farms, with tie stalls, local breeds, small-medium herd size and low productivity used more frequently summer pastures than the "intensive" farms. Transhumance still plays a fundamental role for the dairy sector in this Alpine area, because it allows access to public contribution and is complementary to the management of traditional farms. To better assess its sustainability, these functions should be further investigated in relation with the role of summer farms in the conservation of biodiversity, cultural landscape, and touristic attractiveness.

Key words

dairy systems, summer farms, mountainous areas, highland pastures

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Received: April 23, 2013 | Accepted: July 1, 2013

ACKNOWLEDGEMENTS
The authors thank the Autonomous Province of Trento (Italy) for funding the project (Cowplus project). The authors gratefully acknowledge the support of Claudio Valorz and technicians of FPAT (Federazione Provinciale Allevatori Trento), and CONCAST (Spini di Gardolo, Italy) during data collection.

Aim

In the Alps, the seasonal transhumance of livestock herds to highland summer farms, which follows the seasonal and altitudinal gradient of vegetation growth, has been for centuries an essential practice for complementing the forage budget of the permanent lowland traditional farms (Orland, 2004). In the last decades, however, many traditional farms have been converted to intensive farms, or abandoned (Cocca et al., 2012; Streifeneder et al., 2007). Knowledge on how these processes of intensification and abandoning have influenced the traditional link between permanent farms and summer farms is necessary for devising locally effective agricultural policies, but is surprisingly scarce (Sturaro et al., 2013). The aim of this work was to investigate the role of summer farms in the dairy farming systems of the Trento province, taken as an example for the Alpine areas where livestock farming is still an important economic activity.

Material and methods

The Autonomous Province of Trento, in the north eastern Italian Alps, covers a surface of 6,212 km^2, with an elevation ranging from 66 to 3769 m asl. The utilized agricultural area (UAA) has an extension of 1372 km^2, mainly composed by grassland and pastures (81%), followed by orchards and vineyards (17%); the arable crops represent only 2% (ISTAT, 2010). Dairy cattle farming is the most important livestock sector of the Province. The majority of dairy farms are members of cooperative dairies that produce typical and Protected Designation of Origin (PDO) cheeses (mainly "Trentingrana" PDO cheese, Bittante et al., 2011a and b; Endrizzi et al., 2013). Data on number of livestock heads (year 2011) in summer farms and in permanent farms were provided by the veterinarian services of the Province. Livestock was classified according to species and, for dairy cattle, category (lactating cows and replacement cattle) and breed. In addition, data for summer farms included elevation, amount of milk produced and of milk processed *in situ* for cheese making. We expected that cows of highly specialized breeds were moved to summer farms less frequently than cows of dual purpose or local breeds. To test this expectation, we compared with chi-square the breed composition (% of heads) of the lactating cows herds in summer farms with that of permanent farms. We also tested the Pearson correlation between breed composition of the herd and elevation of summer farms. Our hypothesis was that, with a "traditional" pasture management, the most productive breeds were more frequent in lower (and more productive) pastures.

One other aim of the study was to characterize the permanent farms that use summer farms for lactating cows in comparison with those that have abandoned this practice. For this purpose, we used data from a survey conducted in 2010 on 610 dairy farms (57% of total dairy farms), for a total of 19,531 dairy cows (78% of the total number of cows in the Trento Province), concerning the following structural and management features: type of stalling (tie *vs* free), use of total mixed rations (TMR), use of silages, use of summer farms for replacement and/or lactating cows. Data of milk production and composition (annual average values/farm) and the main destination of produced milk (dairy factories producing/not producing PDO cheese) were obtained from the Consortium of Cooperative Dairies of the Trento Province (CONCAST). The farms were divided into farms using and farms not using summer pastures for dairy cows (see results and discussion for this classification). To test the differences between the two groups we used a GLM analysis (PROC GLM, SAS 2008) for normally distributed variables (elevation, milk yield and quality) and log-transformed variables (number of lactating cows, herd size, agricultural surface and stocking rate). A one-way non-parametric analysis (PROC NPAR1WAY, SAS 2008) was used to analyse the mean proportion of breeds (% of heads) within herd; a chi-square test (PROC FREQ, SAS 2008) was used for the frequencies (use of total mixed ration, use of silages, tie stalls and number of farms conferring to PDO cheese dairy factories).

Results and discussion

Descriptive statistics for summer farms are given in Table 1. Of the 395 units still active, 345 (87%) keep dairy cattle, and 50 keep sheep and goats. These latter summer farms are located at higher elevations than those with cattle, and use pastures poorly suitable for large ruminants. All the summer farms with cattle keep dry cows and replacement cattle, and 262 (75%) keep also lactating cows. The average herd size is 40 livestock units (LU), for the summer farms keeping only replacement cattle and dry cows, and around 70 for those keeping also lactating cows. These sizes are larger than that of permanent farms (see Table 2), because summer farms are publicly owned (mostly by municipalities), and each unit keeps livestock from different permanent farms (on average, each summer farm receives cattle from 4.3±3.9 different permanent farms).

On a total of 24,894 cattle heads moved to the summer farms of the Trento province, 20,564 came from permanent farms of

Table 1. Descriptive statistics of summer farms

Variable	Number	Elevation (mean ± SD)	LU/unit (mean ± SD)
Total summer farms (n)	395	1664± 250	55 ± 52
Summer farms with dairy cattle	345		
- only replacement cattle and dry cows	83	1653± 287	42 ± 35
- also lactating cows	262	1651± 245	67 ± 43
- with cheese making	92	1661± 235	72 ± 43
- with agro-tourism (bar, restaurant, accommodation...)	39		
Milk processed/milk produced in summer farms (tons)	2,362/6,527		
Summer farms for sheep and goat (n)	50	1799 ± 202	96 ± 83

the same Province (11,789 replacement cattle and 8,775 lactating cows), while the rest came from permanent farms of the bordering provinces. Considering only the Trento province, the total number of heifers moved to summer pastures account for more than 90% of those farmed in permanent farms (11,789 *vs* 13,280), while lactating cows account for 35% of the total (8,775 *vs* 24,934). The milk produced in summer farms is processed *in situ* in 92 units (35% of those producing milk), for a limited proportion (36%) of the total production (Table 1). Dairy factories collect the rest. Only 32 summer farms, all of which produce their cheese for direct marketing, offer agro-tourism services (i.e. bar/restaurant/accommodation for tourists).

The composition of the lactating cows herds in summer farms differed from that of the herds in permanent farms (Figure 1). Specialized breeds, and especially Holstein Friesian, were less frequent in summer than in permanent farms, while the opposite was true for dual purpose (Simmental) and local (Alpine Grey, Rendena) breeds (Chi square =3,809; df=5; p<0.001). This was clearly because only part of the permanent farms with specialized breeds moved lactating cows to summer farms, while almost all the farms with dual purpose and local breeds moved the entire herd (see below).

In contrast with our expectation, the elevation of summer farms did not show any relationship with the proportion of specialized and local-dual purpose breeds in their herds (specialized breeds r=-0.06, P=0.35; local-dual purpose breeds: r=-0.07, P=0.29). Probably, the use of supplementary feeding in summer farms permits the transhumance of high productive cows also to higher elevations (Bovolenta et al., 2009), and in any case the proportion of specialized breeds is always quite low in summer farms.

The permanent farms moving lactating cows to summer farms showed significant structural and management differences from

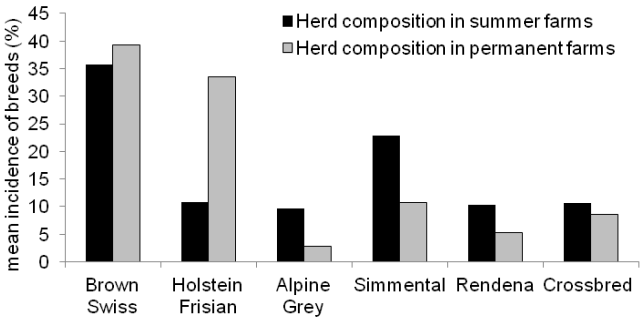

Figure 1. Breed composition (% of heads) of lactating cows herds in permanent farms and in summer farms

those that did not move their lactating cows (Table 2). The first group showed smaller herd sizes, with a lower proportion of specialized breeds and a higher proportion of dual purpose/local breeds, and a lower milk yield. The differences between groups in terms of milk quality, although statistically significant, were small and practically irrelevant. In accord with the smaller herd size, farms moving the dairy cows to highland pastures managed smaller land surfaces as respect to the other group (13.9 *vs* 21.9 ha). However, stocking rates were also lower (2.27 *vs* 2.70 LU/ha), partly because moving the herd, or part of it, to summer farms reduced the average LU presence in the lowland managed area. These farms, finally, were characterized by tie stalls (273 of the 334 farms) and by a traditional feeding strategy, with a negligible use of total mixed ration and silages (Table 2).

The percentage of farms conferring milk to cooperative dairies producing PDO cheese was significantly higher for the group moving the cows on milk to highland pastures. Our re-

Table 2. Characteristics of permanent farms using and not using summer highland pastures for lactating cows (LSmeans or frequencies)

Variable	Farms using summer pastures	Farms without summer pastures	P	R^2 (%)/ χ^2
Number of permanent dairy farms	334	276		
Lactating cows (number)	23.3	42.4	<0.001	8.3
Herd size (Livestock Unit, LU)	30.9	55.4	<0.001	7.9
Brown Swiss (% of LU)	48.8	42.6	0.036	-
Holstein Friesian (% of LU)	9.4	36.1	<0.001	-
Simmental (% of LU)	12.2	7.9	0.007	-
Rendena (% of LU)	11.2	2.6	<0.001	-
Alpine Grey (% of LU)	9.8	2.9	<0.001	-
Crossbreed (% of LU)	8.5	8.0	0.530	-
Elevation of permanent farms (m asl)	879	731	<0.001	5.4
Agricultural surface (ha)	13.1	21.9	<0.001	9.1
Stocking rate (LU/ha)**	2.27	2.70	0.067	0.6
Use of total mixed ration (frequencies)	23/334	95/276	<0.001	73.4
Use of silages (frequencies)	13/334	82/276	<0.001	76.6
Tie stalls (frequencies)	273/334	171/276	<0.001	29.8
Milk yield (kg/day/head)	19.1	21.9	<0.001	7.9
Fat content (%)	3.91	3.97	<0.001	1.8
Casein (%)	2.70	2.73	<0.001	1.3
SCS	3.23	3.19	0.528	0.1
Farms producing milk for PDO cheese	203/334	118/276	<0.001	19.7

*: R^2 is given for variables with normal or log-transformed distribution; χ^2 is given for frequencies; **: calculated with exclusion of LU moved to summer farms, for the corresponding summering period, as: total LU – LU moved to summer farms* summering periods (months)/12.

sults indicate that the summer farms in the Trento Province are still important for the permanent dairy farms, although for different reasons than in the past. The practice of transhumance is here supported by public contributes, with no differentiation between lactating cows or replacement cattle/dry cows. To take advantage of this opportunity, almost all the dairy farms move their replacement cattle to highland pastures during summer. Lactating cows, in contrast with replacement cattle and dry cows, can be highly demanding in terms of feeding and milking practices and general environmental conditions (Bovolenta et al., 2008 and 2009). Our results indicate that a large percentage of the traditional farms still move their lactating cows to summer pastures, while a relevant number of intensive, modern farms have abandoned this practice. This can be related to the breed composition of the herds. In both traditional and intensive farms, Brown Swiss is the most frequent breed, because of the good productivity and the very good milk composition and technological properties (Cecchinato et al., 2013), accompanied by a fairly good fertility (Tiezzi et al., 2012). However, in the traditional farms there is also a remarkable proportion of dual purpose, local breeds that are highly suitable to moving and feeding on highland pastures, in contrast with the Holstein Friesian breed, which is kept especially in the intensive farms. In addition, the traditional farms often keep their cows in tie stall, which has two consequences: the animals are used to the milking equipment of summer farms (milking parlours typical of intensive permanent farms are seldom found in summer farms), and the period of free movement during the stay in summer farms is beneficial for their health (Mattiello et al., 2005).

The transhumance of lactating cows to summer farms, when associated to cheese making and direct selling through agro-touristic activities, may significantly increase the added value of the milk (Penati et al., 2011). This opportunity is, however, scarcely exploited in the Trento province. Similarly to what found in the bordering Veneto region (Sturaro et al., 2013), only a minority of the summer farms have been renovated and equipped with the necessary facilities. However, we also suppose that many farmers who sell their milk to PDO cheese dairies are not encouraged to venture into the complications of cheese making and selling, because they already obtain a high price from their milk (in 2012, the average price of 1 kg of milk reached 0.60 Euros).

Conclusion

Our results suggest that the use of summer farms by the dairy permanent farms is now sustained by the access to public contributions and by the traditional dairy farms that still resist to intensification or abandonment. The future CAP reform after 2013 will link the public subsidies to the environmental services of farming (Kaley and Baldock, 2011). To this purpose, transhumance may be beneficial because it reduces the burden of animal biomass on the lowlands, and may contribute to the conservation of grassland habitats that are important for the cultural landscape and biodiversity (Giupponi et al., 2006). In this study we did not address the issue of pasture management in summer farms, but the fact that their elevation, which can be retained as a proxy of productivity, was unrelated to the category and breed of livestock summered suggests that the traditional link between livestock needs and pasture maintenance might have relaxed (Sturaro et al., 2013). In addition, summer farms have value also because they are part of the cultural heritage (Kianicka et al., 2010) and contribute to the touristic attractiveness (Gios et al., 2006). For these purposes, it is important that the traditional practices of milk production and local processing are not dismissed. In conclusion, the link between permanent and summer farms must be maintained, with particular attention to the quality of the pasture management and to the multifunction services that dairy cows can provide in mountainous areas.

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