LIVESTOCK BREEDING AND MILK PROCESSING AS KEY FACTORS FOR THE PROMOTION OF AGRITOURISM ACTIVITIES IN BASILICATA

Carmela Lovallo[1], Salvatore Claps[2], Attilio Matera[1], Francesco Genovese[1]
[1]University of Basilicata – School of Agriculture, Forestry, Food and Environmental Sciences (SAFE), Italy
[2] Consiglio per la Ricerca in Agricoltura e l'Analisi Dell'Economia Agraria (CREA), Rome, Italy

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Abstract
Basilicata is a small Italian region with a high percentage of marginal agricultural land, characterized by difficult environmental conditions that pose a challenge for agriculture and livestock farming, but which can become a productive, valuable and profitable resource for local communities and the environment. In a sustainable management approach, considering the potential and limitations of the area, the most appropriate choice is to focus on hardy breeds, which are more resistant and can effectively use fodder resources even if not of excellent quality. Dairy products related to these herds in marginal lands have better nutritional qualities, higher market value and contribute to the achievement of environmental, cultural, recreational, tourism and social benefits. This paper shows some considerations on both dairy farming and processing activities in Basilicata (Southern Italy), and points out their importance in terms of the development of agritourism activities and land promotion, an aspect that has been little investigated so far in this territorial context. The paper focuses on some experiences and case studies carried out in recent years, and on the prospects for further development in terms of safeguarding marginal areas and maintaining agritourism economic activity, as well as land conservation and protection.

Keywords: Rustic breeds, cow's milk, typical cheeses, sustainable systems, rural tourism

Introduction

Marginal lands refer to generally irregular areas characterized by limited soil fertility, high slope, and unproductivity and therefore more at risk of abandonment. In Italy, 39% of agricultural land is classified as marginal and Basilicata, despite its small territorial size, is one of the Italian regions with more than 50% of marginal land (Sallustio et al., 2018). Livestock breeding in marginal areas further enhances the territory and links it to unique, genuine and high-quality livestock production; it also optimizes the use of the natural resources available in marginal land, prevents forest fires and improves climate change mitigation strategies (Hoffmann 2011; Sturaro et al., 2013). In Basilicata, the Caciocavallo Podolico cheese is an example of the valorization of livestock production linked to farms located in marginal territories. This cheese is obtained exclusively from raw milk of Podolica cows (Fig.1) and the various factors that make it unique are: extensive farming system, pasture composition, cheese-making and equipment process (Di Trana et al., 2023). In Italy, approximately 130.000 heads of Podolica cattle are raised, of which 37.000 are registered in the genealogical herd book. Basilicata and Campania (both regions of Southern Italy) have the highest number of farms and animals reared (ANABIC, 2023). This cattle breed, local and rustic, is mainly raised in wild or extensive breeding systems with shelter. Furthermore, it has a very strong link with the territory from a cultural and tourist point of view: "transumanza" is still practiced to date. Transumanza, an Intangible Cultural Heritage of Humanity (UNESCO, 2019) consists in the movement of herds from plain pastures to mountain pastures in the summer season, following old "tratturi", grassy or stony paths originating from the passage and trampling of the herds. The Podolica cattle breed has maintained a marked reproductive seasonality, births are concentrated in spring and summer period, precisely when the quantitative-qualitative characteristics of the pasture are optimal and able to guarantee satisfactory weight increases of the calves. Milking, usually manual, takes place in the morning after the calf's first lactation to stimulate the flow of milk and the lactation period (5-10 liters per day) lasts 6-7 months (Cosentino et al., 2018).

Fig. 1: Podolica cows in typical pastures of the Basilicata Region (on the right spring pasture; on the left summer pasture).

However, these marginal areas, which have low productivity and are often difficult to manage, can be transformed into economic opportunities through sustainable agricultural practices and agritourism projects. Agritourism should not be restricted to just agricultural production; instead, it should incorporate hospitality and cultural experiences to make these areas both productive and appealing to tourists. Therefore, agritourism becomes an "intelligent and sustainable opportunity", promotes the development of rural communities, generates additional income for farmers (Ciolac et al., 2020) and contributes to landscape conservation and local traditions.
This paper presents some preliminary results of experimental activities developed in Basilicata (Southern Italy), aimed at developing a new technological approach for local dairy production, to be integrated into the agritourism context and experience.

Material and methods
Often in rural areas, livestock activity alone is not enough, breeders have to resort to the multifunctionality of their companies by carrying out agritourism activities, especially for small farms with few animals (Fratini et al., 2014). The breeders, also called custodians farmers, raise the Podolica breed both for protection and breed safeguard for conservation purposes, and because they enhance it through agritourism activities and marketing of livestock production (meat and dairy products) (Natrella et al., 2023).
Due to the breed seasonality and limited milk production, Podolica breeders only produce cheese at certain times of the year. Therefore, for an agritourism business that organizes events, such as workshops and cheese-making demonstrations, not having milk available all year could represent a limitation. Thus, experimental tests were conducted at the experimental dairy of the University of Basilicata with the aim of studying new technological approaches to the production of cheeses starting from frozen curds. This could give small local farms and agritourism businesses the chance to transform frozen curds into cheeses in real-time during attractive events and practical demonstrations to customers and tourists.
This work focused on optimizing the management of semi-finished products for the production of stretched curd cheese. The technological properties of mozzarella obtained from curds produced with raw milk and pasteurized milk, frozen and stored in controlled atmospheres such as air, nitrogen and vacuum packaged in MAP (Modified Atmosphere Packaging), were studied and analyzed.
The cow‘s milk came from farms located in Basilicata and raw (Fig. 2a) and pasteurized (Fig. 2b) milk curds were produced. For each production, 100 liters of milk were processed.

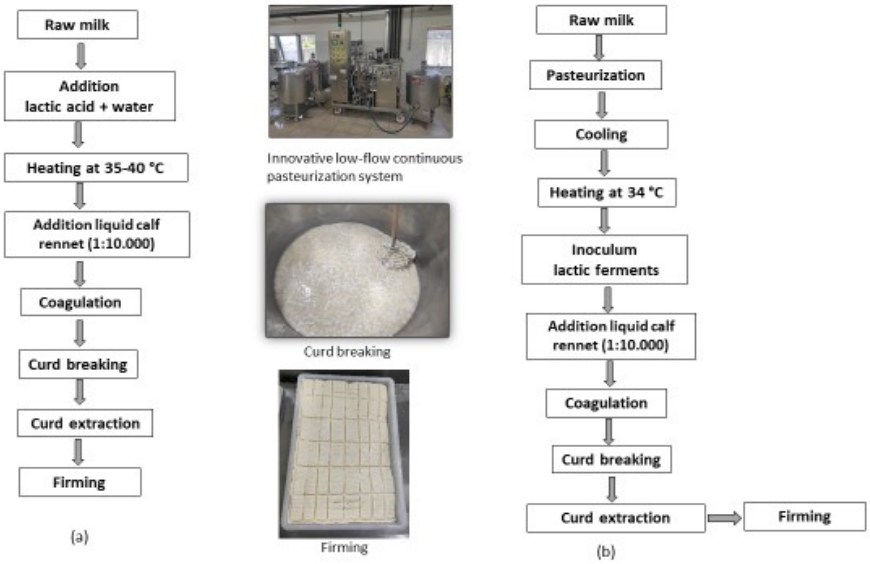

Fig. 2: Production process with raw milk (a) and pasteurized milk (b).

The curd obtained, both from raw and pasteurized milk, was portioned into 1 kg "ingots" and placed in a blast chiller (core temperature of -18 ºC in approximately 4 hours). The curd was subsequently packaged inside polyethylene bags (80 micron thick) in a modified atmosphere (vacuum, 100% CO2, 100% N2), these were stored at -18 °C.
The curd stretching process was carried out after curd production (day 0) and after 30,60 and 90 days of storage. Considering the milk used and the different packaging systems, the yields obtained from the different curds were analysed.

Results and Discussion

Different ways of processing cow's milk were compared for the preparation of curds, frozen for different times and reworked to produce fresh dairy products.
The yields and cheese characteristics varied mainly depending on the coagulation and packaging method used. The results showed that the treatment of milk has a significant effect on yield: the curd obtained from pasteurized milk has a higher yield than the curd obtained from raw milk (Fig. 3). Furthermore, considering the milk used and packaging system, both for raw and pasteurized milk, the amount of water absorbed during spinning for mozzarella production was increasingly greater with the vacuum preservation method (Fig. 4).

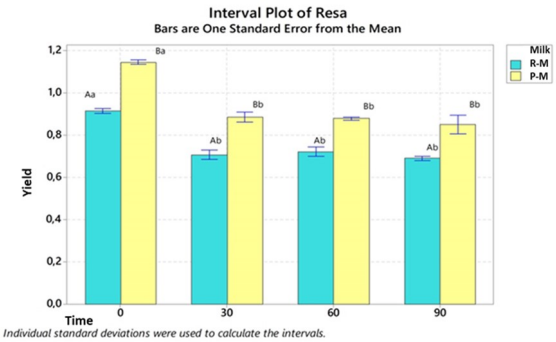

Fig. 3: Evaluation of yield according to milk treatment and storage time. R-M: Raw milk; P-M: Pasteurized milk.

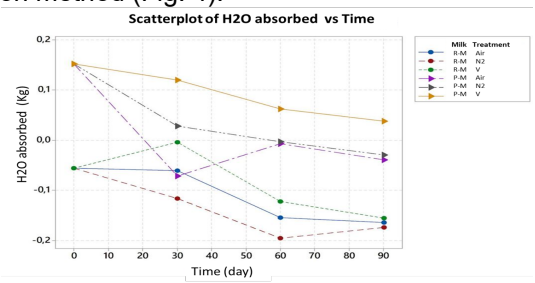

Fig. 4: Scatterplot of the relationship between the retained water and storage time, according to milk treatment and packaging system. R-M: Raw milk; P-M: Pasteurized milk; Treatment: Air, N2: nitrogen; V: vacuum.

Further studies and experimental tests on other types of cheeses starting from frozen curds will be necessary. However, the results are in line with the bibliography. Pasteurization treatment has a positive influence on yield, increasing the yield of cheese obtained (Lau, et al., 1990; Salwa et Galal 2002; San Martín-González et al., 2007). This phenomenon is probably linked to the increase in the moisture content of cheese (Tadjine et al., 2019), moreover pasteurization determines the heat denaturation of whey proteins resulting in an increase in yield of about 0.1-0.4 kg (Lau et al., 1990). Nevertheless, further studies are needed to study microbiological quality and assess whether heat treatment affects other components of milk or changes in protein structures.
The processing of frozen curd will make it possible to overcome logistical problems and to have the possibility of producing cheese even in periods in which there is no milk available. This could be an opportunity for breeders as the marked seasonality of the Podolica cattle breed concentrates lactation in a few months. Obviously, depending on the equipment present in the farm and the cheese typology, the farmer can decide whether to subject the milk to heat treatment before producing the curd to be frozen. Our results suggest that pasteurization increases yield but the best cheese characteristics are obtained with raw milk curd. Anyway, having frozen curd available could give agritourism activities the opportunity to offer cheese-making demonstrations throughout the year.

Conclusion

The objective of this study was therefore to evaluate livestock farming best suited to marginal lands and to characterize and scientifically understand new technological approaches for local dairy production. The multifunctionality of farms should be encouraged because they provide educational, natural and hiking services and allow the integration of the farmer's income. The company can diversify offering additional services such as agritourism activities, offering tourist services such as picnic areas, agri-campsites, walking tours, guided tastings. Introducing educational and environmental projects, promoting "school farms" means raising awareness among young people and bringing them closer to the world of agriculture and food, with workshops and demonstrations activities. These educational opportunities should not be underestimated because they strengthen the link between consumer and farmer while promoting sustainable agriculture and rural tourism. In addition to increasing economic and commercial opportunities for rural communities, the development of short supply chains and the valuation of landscape resources would be encouraged. The Podolica cattle breed, if correctly managed, can represent a heritage for livestock breeding, both for marginal areas's recovery, for difficult pastures, and for superior quality livestock production. In conclusion, breeding local breeds, dairy production and the agritourism activity related to them, play an important role in protecting marginal areas, using available resources, maintaining economic activity, conservation and land management and promoting recreational use of the landscape.

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Souhrn
Chov hospodářských zvířat a zpracování mléka na marginální půdě zhodnocují půdu, kde by bylo obtížné provozovat zemědělství, a představují základní prvky pro místní komunity, životní prostředí a cestovní ruch. Byly porovnávány různé způsoby zpracování kravského mléka pro přípravu tvarohu, který byl různě dlouho zmrazován a znovu zpracováván na čerstvý sýr. Výsledky jsou významné a mohou pomoci zachovat okrajové oblasti a podpořit ekonomickou aktivitu agroturistiky tím, že nabídnou turistům atraktivní zážitky, například ukázky výroby sýra v reálném čase po celý rok.

Contact:
Carmela Lovallo
E-mail: carmela.lovallo@unibas.it