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Review: The link between feeding dairy cows and Parmigiano-Reggiano cheese production area

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ABSTRACT

The aim of the authors is to make a summary of indissoluble relationships between Parmigiano-Reggiano cheese and its production area: how to improve the quality of hay and then that of milk destined for the making of cheese, as well as the yield of cheese. The quality of a cheese product with a designation of origin is the result of close links among production territory, dairy cow nutrition, and human knowledge. The evolution of production processes involving the daily agricultural and zootechnical world and the continuous progress of acquisitions in this area require continuous updates of required operational techniques that are the basis of correct cattle feeding. The focus will be on nutrition and feed characteristics, especially forages; the techniques of production, conservation, and administration to animals have been widely described as being able to positively influence the native lactic microflora of an area, which is essential to cheese-making and ripening.

Key words: Parmigiano-Reggiano protected designation of origin cheese, dairy cow nutrition, forage quality, native microflora, milk quality

INTRODUCTION

Foods linked to their origin have the potential to be part of a cycle of sustainable quality based on the enhancement and protection of local resources. This potential is based on their specific characteristics, the result of a unique combination of natural resources (climatic conditions, soil characteristics, local plant varieties, breeds, and so on), local expertise, historical and cultural practices, as well as the traditional knowledge of the production and processing of products. The first step for local producers is to be aware of this potential, identifying and intensifying the links between product quality and production area (FAO and SINER-GI, 2009).

Some agricultural and food products have specific characteristics that are related to the place where they are produced and that give a reputation to the product itself. Tequila, Parmigiano-Reggiano, Parma Ham, Darjeeling, and Champagne are just a few examples of product brands that have a reputation linked to their geographical origin area. The specific meaning of "quality" is giving the product some features that differentiate it from others of the same category; consumers perceive the brand quality, apart from the fact that the market is local, national, or international.

Typicality is an important element to be considered as a factor of differentiation on the market. The product is not only specific, but also unique because of the combination of natural and human production factors that are linked to the territory. This food production chain cannot be reproduced elsewhere. Typicality is a measure of the level of specificity and connection to the local resources.

Different specific characteristics, both objective and subjective, can be equally important to the consumer. They can be related to the intrinsic qualities (aroma, texture, flavor, shape, and color) and the extrinsic qualities (how to produce, prepare, and consume the product). These provide subjective, material, or symbolic experiences that are emotional (e.g., the sense of being part of a community), ethical and social (e.g., maintaining traditions and expertise; supporting local producers, the environment, and so on), or social (e.g., the product reflects social status).

The Concept of Typicality and Terroir

A "terroir" is a defined geographical area in which a human community has developed, throughout history, a collective production method and corresponding expertise. A terroir is based on a system of interactions between the biological, physical environment and several human factors that express uniqueness and originality, enhancing typicality and generating a reputation for a specific food product (Barham, 2003).

The concept of typicality is a legacy that has historical and geographical origins, anchored to a territory through the cultural identity and heritage (FAO and SINER-GI, 2009).

The place therefore represents the geographical area that brings both natural (physical and biological environment) and human resources, linked to generations of residents

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and producers. This territory is delimited in space and is related to the interaction between people and environment. The term "terroir" is the ability of this territory to give, over the course of time, specificity and uniqueness to the product. Natural resources are often connected to human intervention. The physical environment is shaped by human choices, and changes are made to adapt production methods to the environment, based on cultural heritage and local expertise. This means that the product is attached to a local community and has a dimension of heritage. Consequently, a single person or a single private producer cannot own a specific product, neither its name nor its reputation in the market. On the contrary, the local community acquires a collective right and has the duty to ensure that the product is made according to the rules defined by the community itself.

For instance, the restricted area of Parmigiano-Reggiano cheese production is composed of the provinces of Parma, Reggio Emilia, Modena, Mantua (right side of Po River), and Bologna (left side of Reno River).

Heritage and Expertise

The genetic resources of specific plant varieties or animal breeds, for example, are the result of a deliberate choice by farmers over a period of many years. At the local level, specific techniques have been developed (agronomic characteristics, breeding and processing of raw materials) taking into account the local context and specificity of the materials. This knowledge is often context specific and not formalized (FAO and SINER-GI, 2009).

Environment and Natural Resources

Specific features can be identified in several factors, such as seasonal temperatures, humidity levels, wind, physical–chemical characteristics of soil and water, sun exposure, and composition of forage species. These are the most important natural resources that can confer a specific quality to typical products. Genetic resources are other types of specific local resources. Varieties of plants or breeds of animals capable of adapting to a specific environment over time are often the source of quality specifications that give a typical definition of a food product. For the production of Parmigiano-Reggiano, coming from an area circumscribed and well delineated, when focusing on aspects of type related to animal feeding, the control of all phases of the production process through the application of production guidelines (**PG**; Consorzio del Formaggio Parmigiano-Reggiano, 2011) is indispensable in striving for the acquisition of typicality (Mordenti, 1994). In its first appearance in European Commission Regulations No. 2081/92 (European Commission, 1992) and No. 1107/96 (European Commission, 1996), the close link between the territory of a well-defined production area and the intrinsic characteristics of Parmigiano-Reggiano cheese was described, and a certificate of safety and guarantee was provided to the consumer. To reinforce this concept of typicality, Le Jouen (1997) suggested identifying and protecting traditional techniques, by means of PG, enhancing ties occurring among the environment, humans, and the product.

The provenance from a relatively limited area, the respect and control of all production process phases, and the methodical application of PG represent the fundamental steps for maintaining the hallmarks of a product with a designation of origin (**PDO**), such as Parmigiano-Reggiano cheese (Arsenio et al., 2015). In this context, we can include our theme: dairy cow nutrition is a decisive factor in milk production quality and in the production of dairy products. This theme considers the provision of warnings and good rules to follow for the production, conservation, and use of quality forages for cattle to improve the productivity of farms, animal health, and milk quality.

The evolution of production processes involving the daily agricultural and zootechnical world and the continuous progress of acquisitions in this area require continuous updates of required operational techniques that are the basis of correct cattle feeding. Getting more detailed and referring to the rule in dairy cow nutrition under which the DMI of forages exceeds (or is equal to) concentrates, we can deduce that forages are the fulcrum around which cow feeding revolves. Given the continuous increases in individual production and milk composition (particularly in proteins), we cannot safeguard production parameters without improving quality and safety of forages and maximizing their inclusion in diets, in particular (Mordenti et al., 2005; Mordenti et al., 2007).

A good analysis of physical–chemical and fermentative characteristics of forages is the cornerstone in correctly feeding dairy cows; this is the starting point in achieving health and welfare of animals and maintaining high quality milk standards (Formigoni and Biagi, 2007).

Alais (1984) suggested there are 2 main factors to explain the variability of cheese characteristics: the milk quality and the technological processes that can alter the relationship between various components, such as the effects of microorganisms on the same components. The specific traits of PDO cheeses are related to technology, such as milk characteristics, and are due to differences in (Bertoni et al., 2001) the animal species or breed, the protein content and cheese-making properties, the fat content and its composition in fatty acids, the aromas or other substances from specific feed, and the native microflora that is typical of the environment.

Our focus will be on nutrition and feed characteristics, especially of forages, that can affect the characteristics of milk and accordingly the cheeses produced.

REVIEW AND DISCUSSION

The Native Microflora of the Milk

In the production of hard cheese made from the clotting of raw milk, the native microflora of the milk is of