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International Journal of Sustainable Built Environment

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Review Article

# Use of traditional material in farm buildings for a sustainable rural environment<sup>☆</sup>

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Received 6 January 2016; accepted 12 May 2016

## Abstract

The recent increase in the sensitivity about the concept of sustainable development is stimulating the valorisation of the locally available material for agricultural construction, both for housing purpose and for some single components. This traditional building technique has indeed interesting consequences on the rural landscape perception – since the color is similar to the countryside surroundings – as well as on the agricultural environment – this material being, at the end of its useful life, recyclable in the same context. Traditional material could be employed in other agricultural components, *e.g.* for food aging, a technique used since Roman times, involving the use of earthenware amphorae, buried in the soil and used for storing wine and oil. In the present paper, the most diffused traditional building materials currently rediscovered are analyzed, focusing on their utilization opportunities. One of the most interesting traditional construction material is the sun-dried earth brick, made of raw clay soil (so-called, “adobe”), often improved by the addition of fibers to control cracking while drying in the sun. After a general overview about the diffusion of earthen construction within agriculture, the results of experimental tests on adobe bricks reinforced with a natural fiber – Spanish Broom (*Spartium junceum L.*) – are reported.

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**Keywords:** Rural areas; Farm building; Traditional material; Adobe brick; Spanish Broom

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<sup>☆</sup> Presented in part as an invited lecture at the Second International Symposium on Agricultural Engineering – ISAE-2015 – held in Belgrade – Republic of Serbia (9–10 October 2015), with the original title: “Valorization of traditional building material for the sustainable development of rural areas”. Peer review under responsibility of The Gulf Organisation for Research and Development.

<http://dx.doi.org/10.1016/j.ijse.2016.05.005>

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## 1. Introduction

Farm buildings, designed over the centuries in order to fulfill their primary agricultural role, now constitute a widespread heritage that in some cases possesses an unreplaceable architectural value, playing a central role for the sustainability of the rural environment as well. Conceived to host biological production, the farm building constitutes indeed a unique example in the wide epistemological sector of building construction (Picuno, 2012). The birth, growth and development of living vegetal or animal organisms contained *inside* these volumes raise architectural and technical issues that are radically different if compared to those of other building sectors. Aimed at producing optimal environmental conditions for plants and animals, while at the same time protecting the hygiene and health of workers involved in the daily operations for the care of living organisms at different stages of their development, the rural building constitutes therefore a unique and unrepeatable technological model (Fuentes et al., 2010; Fuentes, 2010; Picuno et al., 2015).

The originality of what happens inside the farm building corresponds to what happens *outside*. The role that the buildings have historically played is strictly connected with the surrounding context, due to the need of the farmer to live in close contact with agricultural land and animal husbandry (Cañas et al., 2009; Hernández et al., 2004; Jeong et al., 2012; Lista et al., 2013a,b). While the organization of human beings involved in the activities of the industrial or tertiary sector allowed aggregation in urban centers, the need to live in constant contact with the agricultural production developed a synergetic function of close proximity to the extra-urban land. This aspect led to the spread in rural areas of many examples of buildings that served for farming, storage and processing of agricultural products constituting, at the same time, housing for the farmer and his family. This form of settlement has been, and still is, a unique way by which humans have populated, in harmony with the natural elements, the agricultural land, joining the primary production needed for human nutrition with the control and care of rural land. So, the activities made by the Man have often strongly influenced the agricultural environment and the visual perception of its landscape (Statuto et al., 2014a,b, 2015; Tortora et al., 2015).

The growing interest toward the role that rural areas may play for a more balanced pattern of modern life, under

the currently increasing sensitivity of large segments of the European population about the concept of sustainable development of the built environment, is stimulating the valorization of the locally available material used in agriculture for the realization of constructions, both for housing purpose and for the realization of each single element within the farm. This choice, that was at the time one of the pillars at the base of the formation of rural landscape, has its roots in the tradition left by our forefathers, since they had no choice than realize farm buildings and ancillary elements using the local material. Indeed, even if traditionally based mostly on an economic reason, this has very interesting consequences on the current perception of the rural landscape – since the color of the building is similar to the surroundings (García et al., 2003) – as well on the agricultural environment – this material being, at the end of its useful life, incorporated in the same context.

### 1.1. Agro-food maturing and storing

Today, a technique of aging that is becoming increasingly popular, used since Roman times, involves the use of earthenware amphorae for storing wine and oil. This technique was most popular in Georgia, where large earthenware amphorae were buried and used to allow the first fermentation and then the aging of wines, both red and white. The use of earthenware pots (*Kvevri* in the local language) provides a completely natural treatment and enhances the varietal characteristics. Amphorae, usually made of clay, are produced in different sizes and subjected to different types of treatment (cooking at high temperature, coatings, etc.). They can be buried in the ground, half buried or not buried at all, depending on the system of temperature control installed in the cellars.

Wine contains different chemical substances that influence the sensory characteristics of the final product. Amount and type of these components can be opportunely modified by managing viticultural practices, winemaking process, aging, and type of containers and closures. Phenolic compounds are important components of wine. They not only contribute to their sensory profiles, such as color, flavor and astringency, but may also act as antioxidants, with mechanisms involving both free-radical scavenging and metal chelation. The composition and concentration of phenolic components in wine depends not only on grape variety and wine-making procedures, but also on the

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