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**PINE NUTS PRODUCTION IN THE SHOUF BIOSPHERE RESERVE:
QUALITY AND MARKET PERSPECTIVES**

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Nell'attuale scenario economico e sociale si è affermata l'esigenza di orientare i sistemi di produzione e gli stili di consumo verso nuovi modelli virtuosi di gestione in cui l'innovazione, la qualità e la sostenibilità rappresentano elementi fondanti per la creazione di strategie sapienti e lungimiranti capaci di creare un valore "sostenibile" per tutti gli attori della "rete della vita".

Tale sfida rappresenta un tema ampiamente dibattuto nell'ambito delle Scienze Merceologiche e, in particolare, durante il XXIX Congresso Nazionale di Scienze Merceologiche dove sono stati coniugati contributi teorici con esperienze pratiche in un'ottica di valorizzazione delle conoscenze.

Il congresso ha rappresentato un'occasione di confronto, di condivisione e di approfondimento di percorsi di sviluppo su tematiche fortemente focalizzate sui seguenti aspetti:

- Industria 4.0, analizzata attraverso i binomi di innovazione e imprenditorialità, innovazione, start-up e spin-off, tecnologia e innovazione gestionale, ricerca e trasferimento tecnologico;
- Qualità 4.0, intesa come qualità di sistema e di prodotto e sistemi di gestione per la qualità;
- Sostenibilità e Corporate Social Responsibility, che prende in esame l'analisi del ciclo di vita, i sistemi di gestione per l'ambiente, i metodi e gli strumenti di ecologia industriale, fino al concetto di economia circolare.

Benedetta Esposito è borsista di ricerca presso il Dipartimento di Scienze Aziendali Management and Innovation Systems dell'Università degli Studi di Salerno e cultore della materia in Scienze Merceologiche. I suoi interessi di ricerca sono nell'ambito della Corporate Social Responsibility e della Circular Economy nel settore agroalimentare.

Ornella Malandrino, professore ordinario di Scienze Merceologiche, Direttrice dell'Osservatorio Interdipartimentale per gli Studi di Genere e le Pari Opportunità dell'Università degli Studi di Salerno e Delegata del Rettore all'Orientamento. La sua attività scientifica si focalizza prevalentemente sulla CSR e sulla relazione tra i vari sistemi e strumenti di gestione delle differenti dimensioni della qualità.

Maria Rosaria Sessa, PhD in Management & Information Technology e docente a contratto dell'insegnamento di Gestione Controllo della Qualità dei Servizi Turistici presso il Dipartimento di Scienze Aziendali – Management & Innovation Systems dell'Università degli Studi di Salerno.

I suoi principali interessi di ricerca sono: sviluppo di sistemi di gestione della qualità e dell'ambiente, responsabilità sociale delle imprese, strumenti di valutazione ambientale e certificazione delle competenze.

Daniela Sica, PhD in Scienze Merceologiche e docente a contratto di Gestione Controllo della Qualità dei Servizi Turistici presso il Dipartimento di Scienze Aziendali – Management & Innovation Systems dell'Università degli Studi di Salerno. I principali interessi di ricerca sono rivolti alla sostenibilità dei processi produttivi, al Quality Management Systems e alla CSR.

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PINE NUTS PRODUCTION IN THE SHOUF BIOSPHERE RESERVE: QUALITY AND MARKET PERSPECTIVES

di

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Abstract (in inglese)

Nowadays, pine nuts are grown and consumed in many countries around the world. The growing popularity of Mediterranean food across Europe, especially related to the multiple health benefits, is driving demand for pine nuts. In Europe pine nuts are consumed raw or roasted, or used as an ingredient in breads, candies, cookies, cakes, sauces, meat, fish and vegetable dishes. In this paper, we focus on the production of pine nuts in the Shouf Biosphere Reserve, a protected area in Lebanon, in order to understand future market perspectives, also according quality characteristics. The paper took place within the three-year long project “STONE - restauro e valorizzazione di Sistemi agricoli Tradizionali per lo sviluppo economico e la conservazione ambientale della Riserva dello Shouf”, implemented by *Istituto Oikos* and funded by the Italian Agency for Development Cooperation.

Within a perspective of local development based overall valorisation of Lebanese pine nuts, this paper has focused in particular on the following specific objectives: i) to investigate the European market and the value chain of the selected commodity; ii) to understand main requirements and standards for entering the EU market; iii) to provide strength and weaknesses of the value chain, as well as opportunities and threats in the country.

Keywords: Pine nuts; Sustainability; Market analysis; International cooperation; Action-research

Introduction

This paper took place within the three-year long project “STONE - restauro e valorizzazione di Sistemi agricoli Tradizionali per lo sviluppo economico e la conservazione ambientale della Riserva dello Shouf”, implemented by *Istituto Oikos* and funded by the Italian Agency for Development Cooperation. The main objective of the project is to contribute to an inclusive and sustainable development of rural communities bordering on Shouf Biosphere Reserve (Lebanon), through the enhancement of economic opportunities and the protection of local natural resources. In particular, the overall objective of the project is to improve the well-being and the economic opportunities of 1000 families living near the Reserve, through the revitalization of sustainable agronomic value chains with high commercial value.

The Shouf Biosphere Reserve (SBR) is the largest protected area, with the most extensive cedar stands, in Lebanon. The Shouf Reserve covers 50,000 ha and it includes the Al-Shouf Cedar Nature Reserve (GTZ, 2010). SBR is managed by AL Shouf Cedar Society established in 1994, which relies on tourism and other funds to generate income and sustain its operations. Agriculture in the area is generally practiced by Lebanese farmers in small holdings. In addition to small-scale farmers, there are six agricultural cooperative operating in the region, mainly involved in the distribution of the production of Lebanese farmers and in the wholesale and retail activities (INFOPRO Shouf Biosphere Reserve, 2019). Villages are known for their production of summer fruits and vegetables (e.g. apples, cherries, pears, plums, peaches, cucumbers, tomatoes, etc). There are currently 87 different products carrying the label of the Shouf Reserve (Chico Mendes, 2019), produced using agricultural and wild products of the reserve and processed in a traditional way by the local community. Local production of raw vegetables shows eight major production (wheat, cabbage, zucchini, tomato, cauliflower, onion, pepper, apple), other nine minor (peach, melon, watermelon, pear, cherry, plum, walnut, olive, pumpkin) and 2 marginal (cucumber, bean). In addition, regarding processed products, the most produced are jams, apple based products (as apple cider), olive oil, tomato paste and sauce, cedar honey, grape molasses, pomegranate syrup, dried fruit and aromatic/medicinal plants (Infopro, 2019). In the internal market, the bestseller production is honey (representing around the 50% of SBR's sales), followed by jams, syrups, pomegranate molasses, oregano and pine nuts (Chico Mendes, 2019).

In this paper, we focus on the production of pine nuts in SBR in order to understand future market perspectives, also according quality characteristics.

1. Materials and methods

Within a perspective of local development based overall valorisation of Lebanese pine nuts, this paper has focused in particular on the following specific objectives: i) to investigate the European market and the functioning of the value chain of the selected commodity. ii) to go deep about requirements and standards for entering the EU market.

In order to achieve the above-mentioned objectives, in this paper we adopted a methodology based on: i) Desk-based analysis of official reports released by relevant public and private institutions, publications of studies conducted by national and international research centres. ii) Desk-based analysis on relevant database, in order to collect information on production, consumption, import and export of the products. iii) Field mission and conduction of semi-structured interviews within the territory and the supply chain.

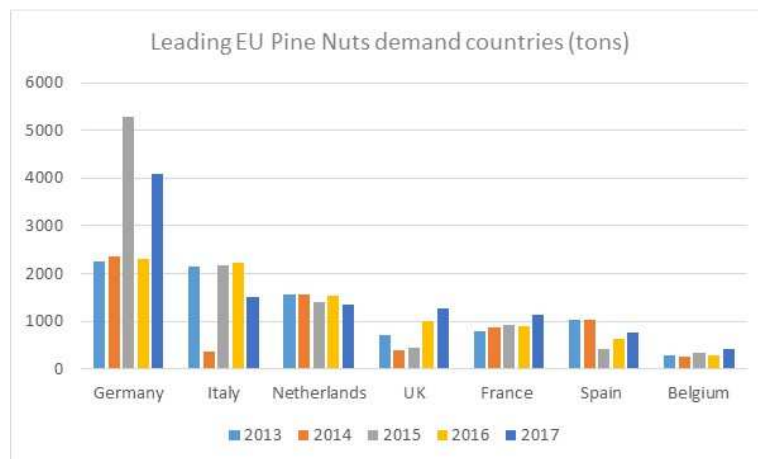
This harmonic range of different methods has undoubtedly allowed diversifying the sources of information, digging deeper in all relevant topics and crosschecking findings and results, in order to obtain a picture on recent trends in the markets of pine nuts and the whole functioning of the value chain.

2. Results and discussion

Pine nuts (Custom HS code 08029050) are decorticated kernels of different species of *Gymnosperm, Pinus*: e.g. *pinea*, *koraiensis*, *sibirica*, *yunnanensis*, *wallichiana*, *gerardiana*, *pumila*. Nowadays, pine nuts are grown and consumed in many countries around the world. The main producers are Asia, China, North Korea, and Russian Federation. Italy leads the production of Mediterranean pine nuts. In fact, pine nut represents a traditional ingredient in Mediterranean dishes and the product is benefitting from a growing consumer interest in Mediterranean cooking. The European Union is the largest market for edible nuts in the world, representing more than 40% of the total world imports and the largest importer of pine nuts (CBI, 2018). The most popular edible variety is the European stone pine or umbrella pine (*P. pinea*), (Masood Awan H. U., 2017). In the near future, the European market for pine nuts is expected to grow. This growth is likely to be driven by changes in consumption patterns of European consumers, including a rising demand for vegetable sources of protein and the popularity of Mediterranean

food (CBI, 2018). The growing popularity of Mediterranean food across Europe, especially related to the multiple health benefits, is driving demand for pine nuts. Pine nuts in Europe are consumed raw or roasted, or used as an ingredient in breads, candies, cookies, cakes, sauces, meat, fish and vegetable dishes. The most popular product in which pine nuts are used is *pesto*, a sauce made of basil, pine nuts, garlic and olive oil. However, pine nuts are also used as an ingredient in many other dishes in the Italian, Spanish, Portuguese, Turkish, Lebanese and Greek cuisines. In Europe, the leading countries in the demand of pine nuts are Germany and Italy, with a consumption of about 4,100 and 1,500 tons respectively in 2017, followed by Netherland, United Kingdom, Spain and Portugal (INC, 2018). However, consumption fluctuates a lot, depending on availability and the highly unstable supply.

Fig. 1. Leading European countries in the consumption of pine nuts. (Source: authors elaboration from INC, 2018)



Current retail prices in most European supermarkets usually vary between €35/kg and €50/kg for small packs of 100 g of brandd packed pine nuts (CBI, 2018).

The basic quality requirements for pine nuts are defined by the criteria in table 1: (CBI, 2019):

Table 1. Source: Authors elaboration from CBI, 2019

	Criteria
Quality	Intact. Clean. Sufficiently developed. With uniform colour.
	Free from pests. Free from damages. Free form moulds. Free from rancidity. Free from smell or taste.
Maximum moisture content	7% for <i>Pinus gerardiana</i> 6 % for <i>Pinus pinea</i> 3.5% for all other pine nuts
Grade	Grade 1 (high quality). Grade 2. Grade 3.
Sizing (according UNECE)	By number of kernels per 100 g
Sensory characteristics	Attributes: mild, strong, spicy, fine, creamy, with resinous flavour.

In Lebanon, *Pinus pinea*, *Pinus halepensis* and *Pinus brutia* cover 28,200 hectares of land, representing approximately 20% of the country's total forest cover. While *P. pinea* is economically exploited for its edible seeds, which are used as a garnish in traditional Lebanese dishes and sweets, other species as *P. halepensis* is only exploited locally and on a limited scale in the Shouf region, mainly for the production of a specific zaatar mix (FAO, 2016).

In terms of international trade, referring to the custom HS code 08029010 "Other nuts, fresh or dried, whether or not shelled or peeled: Other: Pignolia nuts", Lebanon exports fell sharply between 2015 and 2016, from 29 tons to 0.86 tons, with a slight recovery in 2017 exporting 1.3 tons (Trade Map, 2019). It should be noted that, the lack of import data is definitely due to the registration of pine nut imports under another trade category to avoid the payment of a high tariff (FAO 2016). Using the custom code 08028050, results for export to European countries show a strong reduction: 111 kg exported in 2015, 40 kg in 2016, 25 in 2017 and 66 in 2018 (Trade Map 2019). The difference in price between local and imported pine nuts is due to the high cost of production of Lebanese pine nuts compared to the Turkish or Chinese ones, which benefit from large economies of scale, but also because Lebanese pine nuts are highly valued and considered of higher quality by local and international consumers. Indeed, it is this quality profile that has

allowed the Lebanese industry to export its expensive production to international markets (FAO 2016).

White kernels of pine nuts are produced through the collection of cones and the following processing steps:

1. Collection/harvesting of pine cones of the stone pine tree;
2. Extraction of black nut shells from the cones: mainly exposing the cones to sun (early June), or using a drum type machine to induce the opening of the cones (this method is used only by few producers who have enough stock of black nuts and want to benefit a period of high prices);
3. Washing and cleaning of black nut shells: this stage involves washing the black nuts, breaking the hard shells to extract the white nuts, and cleaning the white nuts from the residues of the hard shells and from the soft brown shells;
4. Sorting of the white nuts kernels: white nuts can be graded into three different grades. Grade 3, as well as broken nuts, are sold to bakeries and sweet makers as mixes at around half the price of Grade 1 nuts.

The SWOT in tables 2 outlines the main issues concerning the production and the market of Lebanese pine nuts. In particular, it provides strengths and weaknesses of the value chain as well as opportunities and threats in the country.

Table 2. Source: Authors

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> - High local demand - High sensory profile 	<ul style="list-style-type: none"> - Scarce propensity of the farmers to collaborate within a cooperative. - Lack of adoption of quality control standards. - High costs of production. - Lack of knowledge and scarce application of good agricultural practices (e.g. pruning, tree management practices) and postharvest procedures. - Traceability system not yet in place. - Lack of accredited laboratories to conduct quality analysis for the export.
OPPORTUNITIES	THREATS
	<ul style="list-style-type: none"> -New organic agriculture demand

<ul style="list-style-type: none"> - Training and support projects in the area for the introduction of GAP. - With young farmers could be easier to introduce new agriculture good practices. - Creation of a brand of pine nuts of the Reserve. - Adoption of certifications (e.g. Global GAP, ISO) is important to enter new markets. 	<ul style="list-style-type: none"> - Occasional workers are not Lebanese. Only Syrian refugees. Scarce Lebanese workforce available. - For the local market, no specific quality needed. - Lebanese consumers do not trust in Lebanese organic. - Pest diseases due to climate change
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3. Conclusions and future perspectives

The adoption of quality procedures for Lebanese pine nuts will promote more sustainable behavior and improve engagement between farmers and other stakeholders in the value chain in an important and protected area, such as the Shouf Biosphere Reserve. Finally, considering also their high sensory profile, Lebanese pine nuts, with a systematic application of standardized procedures and with adequate claim and label, could improve their quality, therefore, face changes and seize opportunities in potential European markets.

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