



Choice between alternative investments in agriculture: The role of organic farming to avoid the abandonment of rural areas



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ABSTRACT

Sicily has a long tradition in citrus fruit cultivation that, with vineyard and olive tree, represents the main Mediterranean tree crops. Since many Sicilian farmers in recent years have decided to abandon conventional lemon orchards, in this paper we have evaluated the financial sustainability of organic lemon production by comparing it with the conventional one.

Financial analysis has been carried out in a case study on the northwestern coast of Sicily, considering a 50-year economic life of an orchard. The results, per hectare of area, showed a clear advantage of organic lemon orchard. This was due to fewer labor requirements and to greater market appreciation for organic products that better ensured a premium price. Moreover, financial indicators of organic lemon orchards and the deployment of environmental-friendly inputs in the production process render these farms competitive and eco-friendly.

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1. Introduction

According to the latest available data (FAO, 2015), in 2012 lemon area in the world was equal to 980,949 ha while production amounted to 15.1 million tons, denoting an increase during last ten years both in terms of area (+18.5%) and harvested production (+19.7%) (Table 1).

India, Mexico and China represented the main producers, together accounting for 49.5% of world lemon area and 43.5% of harvested production.

Among main producer countries, China registered the highest increase both for lemon area (+131.6%) and, even more so, for production (+307.1%), whereas Iran and Spain showed the most significant decreases in area (−27.7%) and production (−44.6%), respectively.

Italy, with its lemon area of 25,703 ha and 346,325 tons of production, represented the eighth world producer. Italian lemon orchards are located mainly in Sicily, where 38,941 farms produced lemons (Istat, 2012) covering an area of 23,952 ha (Istat, 2014).

Yet lemon cultivation in Sicily, where pedo-climate conditions are highly adaptable for citrus production, has nevertheless undergone a crisis from the '80s on. In fact, the crisis can be ascribed to less than ideal trade policies and, subsequently, rising lemon imports from other countries whose production and

marketing phases makes them highly competitive (Chinnici et al., 2013). In particular, although lemon orchards have continued to be planted in recent years in Sicily, in many cases farmers have abandoned this agricultural activity, due to a lack of remuneration of production factors, on the one hand, and generational turnover, on the other (Lanfranchi, 2012).

From an economic point of view, in fact, Sicilian lemon farms must bear less favorable production conditions (labor costs, land structure, etc.) that negatively affect their economic performance and commercial flows, leading to their progressive exclusion from domestic, as well as international markets (Rivas and Zamora, 2010). Notwithstanding Sicily's longstanding history and tradition of lemon cultivation, the abandonment of this agricultural activity and the lack of generational turnover have entailed increasing rates of unemployment and decreasing incomes and consumption in the sector. In recent years, however, in response to these trends many lemon orchards have been converted into organic cultivation (Bontempi et al., 2007).

In fact, lemon tree is well adapted to organic farming. Notably, high yields can be maintained (La Rosa et al., 2008) by using natural fertilizers and soil amendments and by introducing suitable systems to prevent, reduce and monitor phytophagous and fungus infestations by way of natural agents or appropriate irrigation systems (Kaval, 2004; Hülsbergen et al., 2001).

Nowadays, about twenty years after adopting Regulation (EC) no. 2092/91, organic farming represents a successful reality in EU member countries and the sector is still growing, despite the international economic recession (Lesjak, 2008).

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Table 1
Lemon area and production.

Countries	2003		2012		% Var. 2012/2003	
	Area (ha)	Production (tons)	Area (ha)	Production (tons)	Area	Production
India	146,200	1,439,600	225,000	2,200,000	53.9	52.8
Mexico	131,668	1,761,552	150,684	2,070,764	14.4	17.6
China	47,500	565,000	110,000	2,300,000	131.6	307.1
Brazil	50,950	981,339	47,349	1,208,275	-7.1	23.1
Argentina	44,000	1,236,280	43,500	1,300,000	-1.1	5.2
Spain	47,368	1,129,594	40,000	625,700	-15.6	-44.6
Iran	47,000	800,000	34,000	600,000	-27.7	-25.0
Italy	30,668	520,128	25,703	346,325	-16.2	-33.4
Peru	21,158	250,229	24,388	234,096	15.3	-6.4
USA	25,010	215,916	22,258	130,000	-11.0	-39.8
Others	236,493	3,729,602	258,067	4,103,302	9.1	10.0
World	828,015	12,629,240	980,949	15,118,462	18.5	19.7

Bold values represent the total or subtotal values.

In many cases, consumers appreciate the return to tradition, made of fresh, wholesome food: organic farming means developing production methods that assure fresh produce while respecting natural resources, at the aim of safeguarding the environment and consumer health (Verhoog et al., 2003). Organic farming is highly appreciated by many consumers that consider organic products of higher quality, mainly for the lack of chemical products utilized in the production process or conservation phase, largely employed in conventional farming, allowing a more sustainable and environmental friendly supply chain (Govindan et al., 2014).

Organic farming means protecting the whole agricultural agro-ecosystem and promoting agricultural practices that capitalize on natural soil fertility and environmental biodiversity while limiting or excluding harmful chemical products (Mader et al., 2002; Tiezzi, 1999).

Organic farming practices adopt production processes that are environmental friendly, especially over the long term. In fact, conventional farming methods, above all intensive ones, have always had heavy repercussions on the integrity and performance of natural ecosystems, the impact of which represents a hazard both for the environment and for public health (Cembalo and Caracciolo, 2008; Hafila et al., 2013). The brunt of agricultural production processes borne by the environment actually depends on climate, soil typology and specific agricultural practices, as well as on a host of factors that similarly prove challenging to keep a rein on, making the aggregate impact extremely variable (Agnese et al., 2008). Furthermore, keeping consequences in check require a keen awareness of all the stakeholders involved in production and consumption processes (farm, processing industry and, especially, the consumer), with an overview based on respect for the environment, healthcare and eco-sustainability.

In this context, organic farming aspires to be more climate-friendly than conventional approaches, due to its reduced carbon footprint and lessened environmental burden (Fedele et al., 2014; Trydeman-Knudsen et al., 2014).

As befits the current trend of Sicilian farmers to abandon conventional lemon orchards, in this paper we analyzed the financial sustainability of organic lemon tree in order to evaluate whether the investment proves convenient, given the dynamic and complex economic context. In particular, we considered an organic lemon farm whose techno-economical parameters, relative to production processes, were determined. Moreover, in line with similar studies (Hokazono and Hayashi, 2012; Trydeman-Knudsen et al., 2010; Meisterling et al., 2009), we compared it to conventional lemon, by also hypothesizing the case study managed according to conventional methods, in order to better evaluate the financial results.

2. Materials and methods

A financial analysis was carried out on a case study, so as to evaluate the convenience of organic lemon orchards, and then its conversion to conventional growing was hypothesized. The surveyed farm was chosen according to the objectives of the paper, i.e., to analyze whether the adoption of such organic farming methods could deter the trend towards abandoning Sicilian conventional lemon orchards.

The location of our case study was on the north-western Sicilian coastline, within Trapani and Palermo provinces. The total farm area, divided into two parts, amounted to 23.5 ha, 22.0 ha of which was lemon orchard. *Femminello comune* was the lemon variety present, planted in 1975, with a globular tree form for facilitating fruit production on the lower branches, and a plant spacing of 5 × 7 m (286 trees/ha).

Techno-economic data were collected from the farmer by face-to-face questionnaire (Iotti and Bonazzi, 2014). The surveyed farm belonged to a Producer Organization to which the whole of its production was allocated. This affords farmers a higher selling price with respect to competitors that allocate their products to local markets or to the processing industry.

Financial analysis was referred to a 50-year period, equal to the average economic life of lemon in Sicily (Sturiale, 2006; Calabrese, 2004). In the production cycle of lemon orchards, four phases can be distinguished:

- planting phase, from the first to the fifth year, in which plants are still developing and any revenues do not exceed costs;
- increasing-production phase, from the sixth to the ninth year, in which revenues exceed costs as plants continue to grow;
- maturity phase, from the tenth to the forty-second year, in which plant growth is complete guaranteeing a constant yearly production throughout the period;
- decreasing-production phase, from the forty-third to the fiftieth year, in which average yield decreases.

Economic evaluations refer to 1 ha and applied current prices, i.e. those of the last crop year (2013/2014).

Financial analysis was carried out by determining the net present value (NPV), the internal rate of return (IRR), the discounted benefit-cost rate (DBCR) and the discounted pay-back time (DPBT) and annual profits and cost incurred were calculated assuming that financial conditions remained constant over the whole period (Gasol et al., 2010).

By means of NPV economic convenience, in the investment context, is analyzed with respect to long-term theoretical analysis (Prestamburgo and Saccomandi, 1995; De Benedictis and

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