The economic performance of organic and conventional olive orchards in Iran

Indicadores económicos de dos sistemas de producción de huertos de olivo en Irán

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ABSTRACT

The present study investigated the economic performance of olive orchards in Rudbar in the province of Guilan in Iran in 2014 using the results from 305 questionnaires that were randomly distributed to regional olive growers. The orchards were divided into three groups of <1 ha, 1-5 ha, and >5 ha in size as small, medium, and large olive orchards, respectively. The information was analyzed using Excel software and the means of the economic indices of total production value, net benefit, benefit-to-cost ratio and economic productivity were calculated. The total production value was estimated as 3316.44 \$ ha⁻¹ and total cost of production was 1806.21 \$ ha⁻¹, regardless of size of orchard. Calculation of economic indices indicates that the best total production values were recorded for small- and medium-sized orchards. The economic efficiency was 2.937 kg \$⁻¹ and the benefit-to-cost ratio was 1.79 for organic olive production. These values were 3.036 kg \$⁻¹ and 1.84, respectively, for non-organic orchards. The figures show that there was no significant difference between organic and non-organic olive production in terms of economic efficiency and benefit to cost ratio in Guilan province, Iran. With the ever-increasing tendency toward organic production of agricultural products, the olive producers and agricultural authorities of Guilan province are recommended to consider seriously non-chemical/organic methods for olive production as the best economic and environmental alternative.

Key words: Olive, orchard, organic, econometric, financial.

RESUMEN

Se realizó la evaluación económica de huertos de olivos cultivados bajo sistema orgánico y convencional. Aleatoriamente, se distribuyeron 305 cuestionarios entre los olivicultores de Rudbar, provincia de Guilan, Irán, durante 2014. Los huertos se dividieron en tres grupos según la superficie de cultivo: <1 ha; 1 a 5 ha, y > 5 ha. Los datos obtenidos fueron procesados con el software Excel 2010 para calcular los indicadores económicos: valor total de la producción; beneficio neto; relación costo-beneficio y eficiencia económica. Los resultados para el valor total de la producción se estimó en 3.316,44 \$ ha⁻¹ y el costo total de producción fue de 1.806,21 \$ ha⁻¹, independientemente del tamaño de la huerta. La eficiencia económica fue de 2.937 kg \$⁻¹ y la relación costo-beneficio fue de 1,79 para la producción en huertos de olivo ecológico. Para los huertos convencionales la eficiencia económica y relación beneficio-costo fue de 3.036 kg \$⁻¹ y 1,84; respectivamente. Los resultados sugieren que no hay diferencia significativa para la eficiencia económica y relación costo-beneficio entre huertos orgánicos y convencionales. Se concluye que se debe incentivar la producción orgánica en huertos de olivo.

Palabras clave: olivo, huerto, orgánico, econométrico, financiera.

Introduction

Olives (*Olea europaea* L.) are consumed as processed fruit and as oil extracted from the fruit (Fernandez-Escobar *et al.*, 2006). The olive is highly regarded for its nutritional benefits and medicinal and industrial applications. About 93% of global olive production is for oil extraction. Olive oil is one of the oldest edible oils, containing large

amount of biological activators. It is a rich source of phenolic and unsaturated fatty acids and is a common ingredient found in Mediterranean diets (Sobhi Sarabi *et al.*, 2011; Ghaemi *et al.*, 2011). The total area worldwide under olive cultivation is 9984919 ha; in Iran it is 30500 ha. Spain is the largest producer of olives, followed by Italy and Greece. Total olive production worldwide is 16584857 t; in Iran it is 40000 t. (FAO, 2012).

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Extensive use of synthetic-chemical inputs is a serious threat for public health and the environment. The annual environmental and health care costs of pesticides in the U.S. are estimated to be about \$10 billion (Pimentel, 2005). On the other hand, organic farming systems have positive health benefits for consumers. They aim to be climate friendly with respect to conventional farming by generating a lower carbon footprint and reduced environmental impacts, as well as decreasing consumption of non-renewable sources (Colantoni *et al.*, 2014; Monarca *et al.*, 2009). However, the financial aspects of organic production of agricultural produce have been debated since its origins. Therefore, for expansion of organic production methods, the monetary features of these farming methods for farmers needs to be clarified (Greer *et al.*, 2008).

Review of the literature shows that the economic and financial performance of organic farming systems has been investigated in relation to yield (Greer *et al.*, 2008; Morris *et al.*, 2001; Mäder *et al.*, 2002; Offermann and Nieberg, 2000; Posner *et al.*, 2008), product prices (Pacini *et al.*, 2002; Morris *et al.*, 2001; Offermann and Nieberg, 2000; Christensen and Saunders, 2003; Sgroi *et al.*, 2015) and production costs (Greer *et al.*, 2008; Morris *et al.*, 2001; Mäder *et al.*, 2002; Klepper *et al.*, 1977; Tzouvelekas *et al.*, 2001; Moran, 2001; Sgroi *et al.*, 2015). Other effective factors also are product, region, farm size and the understanding and application of farming principles, whether organic or not (Greer *et al.*, 2008).

The County of Rudbar in Guilan province in Iran is the largest producer of olive fruit and olive oil in the country. Its total area under olive cultivation is estimated to be about 2759 ha; its annual production is estimated to be about 8800 ton (TPO, 2012). Initial examination shows disproportionate changes in the size of olive orchards in Rudbar as well as changes in organic/non-organic olive production methods. The majority of olive cultivators in Rudbar use large amounts of chemical input, which negatively affects the economic efficiency of olive production. It is necessary to investigate the effect of production method (organic and non-organic) and orchard size on the economic indices of olive production. It is evident that the results of such investigation can help agricultural authorities in macro-planning to meet regional agricultural objectives.

The present study measured the economic indices of olive production in organic and conventional farming systems in olive orchards of Rudbar,

Iran. This information can be used to improve the economic and environmental management for olive production Guilan province, Iran.

Materials and Methods

This study was carried out in the County of Rudbar in Guilan province in northern Iran in 2014. The County is located in the southern portion of Guilan province, has an area of 2575 km² and lies at an altitude of 1.050 m. Rudbar features the following major districts: Rostam-abad (36.8833° N, 49.4833° E), Central Rudbar (36.35° N, 51.42° E), Manjil (36.7328° N, 49.42035° E) and Loshan (36.6500° N, 49.5333° E). It has an annual average olive production of 12000-15000 t.

The sample size of 305 subjects was determined by assessing the total number of olive beneficiaries in Rudbar using stratified random sampling (Yamane, 1967):

$$n = \frac{(\sum N_h S_h)^2}{(N^2 D^2 + \sum N_h S_h^2)} \quad (1)$$

where n is the required sample size; N is the number of total holdings in the target population; N_h is the number of the population in stratification h; S_h is the standard deviation of stratification h, S_h² is the variance in stratification h, D² is equal to d₂/z₂; d is the precision, where (5%) is the permissible error and z is the reliability coefficient (1.96, which represents 95% reliability).

For economic analysis, total production value, gross profit, benefit to cost ratio, and productivity were calculated for olive fruit production in the research area (Pishgare-Komleh *et al.*, 2011):

$$\text{Total production value} = \text{Olive fruit yield} \times \text{Olive fruit price} \quad (2)$$

$$(\text{kg ha}^{-1}) \times (\text{\$ ha}^{-1})$$

$$\text{Gross return} = \text{Total production value} - \text{Variable production cost} \quad (3)$$

$$(\text{\$ ha}^{-1}) - (\text{\$ ha}^{-1})$$

$$\text{Benefit to cost ratio} = \frac{\text{Total production value}}{\text{Total production cost}} \quad (4)$$

$$(\text{\$ ha}^{-1}) / (\text{\$ ha}^{-1})$$

$$\text{Productivity} = \frac{\text{Olive fruit yield}}{\text{Total production cost}} \quad (5)$$

$$(\text{kg ha}^{-1}) / (\text{\$ ha}^{-1})$$

To calculate the economic indices, all data from olive orchards were analyzed by Excel 2010.

Results and Discussion

The results of data analysis showed that total production value of olive fruit was 3316.44 \$ ha⁻¹, regardless of the size of the orchards. Total cost, net benefit, benefit to cost ratio, and productivity were determined to be 1806.21 \$ ha⁻¹, 1510.24 \$ ha⁻¹, 1.83, 3.003 kg \$⁻¹, respectively. The positive net benefit of olive production in Rudbar County, Iran shows that olive fruit production is economically justified; however, the degree of benefit must be determined based on the benefit-to-cost ratio index. The value of this index shows that the total production value of olive orchards in Rudbar County was 1.83-fold that of the total cost of production.

The economic indices based on orchard size in Rudbar County showed the total production value for small orchards to be 5149.65 \$ ha⁻¹, for medium orchards 1988.75 \$ ha⁻¹ and for large orchards 2272.20 \$ ha⁻¹, which indicates that small-sized orchards have the highest total production value (Table 1). The lowest value for this indicator was for medium-sized orchards. The total production cost was higher for small orchards (2794.86 \$ ha⁻¹) than for medium orchards (1029.45 \$ ha⁻¹) and higher for medium-sized orchards than for large orchards (1376.20 \$ ha⁻¹). The higher labor requirement in old small olive orchards contributed to the higher production cost in small orchards.

Although the net benefit was highest for small orchards (2354.79 \$ ha⁻¹), there was no significance difference between the medium-sized and large-sized olive orchards (959.29 and 896.00 \$ ha⁻¹, respectively). There was no significant difference in the benefit to cost ratio or productivity for medium-sized orchards (respectively, 1.87 and 3.168 kg \$⁻¹) and small-sized orchards (respectively, 1.77 and 3.036 kg \$⁻¹); however, these indicators were

significantly higher than their corresponding values for large-sized orchards (respectively, 1.44 and 2.706 kg \$⁻¹). This suggests that olive production in small- and medium-sized orchards is more economically efficient than in large-sized orchards. This result was partially due to the youngness of groves in large olive orchards with respect to small old orchards.

In contrast with the results of this research, large tomato farms (>5 ha) in Turkey, large paddy fields in Iran (<1 ha), and large apple orchards in Iran (>5 ha) were more successful in economic performance; but for corn silage production in Iran, the benefit to cost ratio index and productivity of medium farms (5 to 10 ha) was more than those of large (>10 ha) ones (Çetin and Vardar, 2008; Pishgar-Komleh^a *et al.*, 2011; Pishgar-Komleh^b *et al.*, 2011; Fadavi *et al.*, 2011).

Comparison of the economic indices in organic and non-organic orchards showed that the total production value in organic orchards was 2178.84 \$ ha⁻¹ and in non-organic orchards was 3537.78 \$ ha⁻¹ (Table 2). The total production cost for organic olive orchards was higher than that of conventional orchards. Total costs for most organic farming systems were reported to be lower than those for comparable conventional ones, and there were differences in the relative individual cost elements (Greer *et al.*, 2008). The non-use of chemical inputs in organic farms causes reduction in costs of production (Morris, 2001).

According to the results of Table 2, production costs for conventional orchards were higher than for organic ones, which is primarily the result of costs incurred from the use of chemical fertilizers. The net profit, benefit-to-cost ratio and economic productivity were higher for conventional orchards (respectively, 1623.21 \$ ha⁻¹, 1.84 and 3.036 kg \$⁻¹). When standard error is factored in, there were no significant differences in the indices of benefit

Table 1. Economic indices for olive production in different orchard sizes.

Indices*	Unit	Orchard size groups (ha)		
		Small (<1)	Medium (1 to 5)	Large (>5)
Total crop value	\$ ha ⁻¹	5149.65±318.03	1988.75±91.44	2272.20±305.83
Total production cost	\$ ha ⁻¹	2794.86±138.90	1029.45±32.17	1376.20±148.78
Net benefit	\$ ha ⁻¹	2354.79±217.55	959.29±77.23	896.00±160.31
Benefit to cost ratio	---	1.77±0.05	1.87±0.06	1.44±0.04
Economic productivity	kg \$ ⁻¹	3.036±0.264	3.168±0.029	2.706±0.099

All indices are the average of 305 values.

Table 2. Economic indices for organic and conventional olive orchards.

Indices*	Unit	Farming method	
		Organic	Conventional
Total crop value	\$ ha ⁻¹	2178.84±181.43	3537.78±296.50
Total production cost	\$ ha ⁻¹	1211.37±70.17	1914.57±151.98
Net benefit	\$ ha ⁻¹	967.47±61.55	1623.21±125.79
Benefit to cost ratio	---	1.79±0.05	1.84±0.06
Economic productivity	kg \$ ⁻¹	2.937±1.98	3.036±1.32

* All indices are the average of 305 values.

to cost ratio and economic productivity for olive production between the organic and conventional olive orchards. In the study of Sgroi *et al.* (2015), the economic sustainability of organic lemon orchards was found to be higher than those of conventional ones. According to Sgroi *et al.* (2015), the higher profitability of Sicilian organic lemon orchards was attributed to the lesser labor requirement and to the greater market appreciation for organic lemon. However, because of equal prices of organic and conventional olive fruits in the local market of Rudbar County, the economic indices of benefit to cost ratio and economic productivity for organic olive orchards were lower than those of conventional ones.

Since the cost of chemical inputs for conventional production is high, the identification of more accurate amounts of these inputs can lead to better allocation of them and thus decrease production costs in olive orchards. Simple soil testing to identify the amounts of soil macro-elements and consequently the amount of various chemical fertilizers required can allow

their application to be done more accurately. This will improve the economic efficiency of olive production in Guilan province and minimize detrimental environmental effects from excessive use of chemical inputs.

Finally, the equal prices of organic and conventional olive fruits in the local market of Roudbar County is the key factor that had negative impact on total production value and thus the benefit to cost ratio in organic olive orchards. This issue reduces competitiveness and propensity for producing organic olives among gardeners. Thus promoting the benefits of consumption of organic products, supporting the organic olive gardeners through guarantees to sell their products at affordable prices is of high importance.

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