Certified Quality Systems and Good Practices in the Olive Farming Sector of Andalusia, Spain: Special Focus on Protected Designations of Origin

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Abstract

Producing products of recognised and differentiated quality entails a competitive advantage for agro-food agents since consumers are increasingly demanding high-quality food and control in the production process as a whole in a transparent and verifiable manner. Certification of products and processes through the implementation of Certified Quality Systems (CQS) are voluntary and guarantees standards of quality beyond conventional and mandatory levels. CQS include European, national and regional regulations (such as Protected Designation of Origin – PDO, organic and integrated agriculture), ISO norms (such as 9000, 14001, 19011, and 22000), private protocols (GLOBALGAP, International Food Standard - IFS, Nature's Choice, etc.), and specific regulations for particular products, among others.

This work focuses on the olive growing sector of Andalusia, an agricultural sector of fundamental importance in economic, social and environmental terms in this region of Spain. In fact, Andalusia is the world leading olive region. Although the 'quality strategy' is widely recognised as fundamental in the agro-food system, in the Andalusian olive sector it is only based on the implementation of some few CQS while other are scarcely known and adopted. Moreover, the adoption of a particular CQS does not necessarily entail the implementation of the agricultural practices optimal from an environmental, economic and/or agronomic point of view. Given the current situation of globalisation of the markets and advent of new olive producing regions in the world, and of increasing quality demand from consumers, the competitiveness of the Andalusian olive sector could be at risk in the medium to long term.

In this context, the aim of this paper is threefold: (1) describing the situation of the knowledge and adoption of diverse CQS in the olive farming sector of Andalusia; (2) analysing the factors related to the adoption of PDO; (3) identifying agricultural practices associated to the adoption of PDO and assessing their goodness from an environmental, economic and/or agronomic point of view. The research is based on a survey carried out in 2010 to 200 farmers of the main olive growing zones of Andalusia. Analysed CQS include the most relevant and potentially implementable systems in olive production, but we will specially focus on PDO (Protected Designation of Origin) because for this CQS the adoption rate is the highest to obtain statistically significant results and conclusions and because it has been less examined in the literature. Analysed variables refer to both (a) characteristics, attitudes and opinions of farmers, such as agricultural training, sources of information about CQS, objectives

when producing, objectives when innovating, difficulties to innovate, priorities in R&D, among others; and (b) characteristics of farms, such as location, farm area distribution, yield, type of labour force, destination of the production, slope of the land, among others. Analysed farming practices refer to soil management, irrigation, fertilization, phytosanitary treatments, and harvest.

Keywords: *Olive agriculture, Certified Quality Systems, PDO, good agricultural practices, adoption factors.*

1 Introduction

Andalusia is the most important olive growing region in the world. Olive cultivation in this region of Spain represents 31% of the agricultural area, and 59% of the olive area of Spain, 27% of the EU and 25% of the world (Junta de Andalucía, 2007; MAPA, 2006). Olive growing provides 37% of the Andalusian agricultural gross margin (Junta de Andalucía, 2007), and generates 30% of the Andalusian agricultural employment (Junta de Andalucía, 2002). Factors such as globalization of markets, increasing social awareness and demand of food security and environmental sustainability, supported by EU agricultural policy schemes, are reinforcing a model of European agriculture competitive, multifunctional and sustainable (Diputación Provincial de Jaén, 2007). In the Andalusian olive sector two directions of innovation are observed which are not necessarily divergent: 1) one that focuses its efforts on maximizing production and profitability, and 2) another that seeks to achieve forms of production more sustainable and multifunctional. In the productive trend, irrigation (35.3% of the Andalusian olive according to MARM, 2011) is the more important technology that has contributed to increase production. Mechanization is another important strategy, in this case for reducing costs, which entails the densification of the planting framework and the use of one-foot trees. Also it is important the election of olive varieties more productive, of high oil yield, early entry into production, and mild flavour (Junta de Andalucía, 2002). Regarding the trend towards more sustainable forms of production, a good indicator of its acceptance in the Andalusian olive sector is the high host of CAP Environmental Programs beneficiaries. Special mention in his respect must be paid to integrated and organic agriculture. These alternative forms of production nowadays represent an upward trend in Andalusia (representing 16.4 and 3.0% of total olive area, respectively, according to MARM, 2011), favoured by European, national and regional regulations. Otherwise it is of particular interest the fact that over 60% of the olive groves of the region (58.3% of the declarations and 61.5% in area) would incur in financial losses if the EU subsidies disappear (Junta de Andalucía, 2002). In these potential scenario, or even if subsidies are only significantly reduced, competitiveness through differentiation in the market in general, and through the implementation of CQS in particular, would be even more important for farmers to survive.

In this context producing food of recognised and differentiated quality would entail a competitive advantage for agro-food agents. Certification of products and processes through the implementation of Certified Quality Systems (CQS) are voluntary and guarantees standards of quality beyond conventional and mandatory levels. CQS include European, national and regional regulations (such as Protected Designation of Origin – PDO, organic and integrated agriculture), ISO norms (such as 9000, 14001,

19011, and 22000), private protocols (GLOBALGAP, International Food Standard - IFS, Nature's Choice, etc.), and specific regulations for particular products, among others. PDO, that will be especially analysed, is a CQS that guaranties that agricultural products and foodstuffs are produced, processed and prepared in a given geographical area using recognised know-how, and that there is a link between the characteristics of these products and their geographical origin (EC, 2003). Although the 'quality strategy' is widely recognised as fundamental in the agro-food system, in the Andalusian olive sector it is only based on some few CQS (PDO, organic and integrated agriculture) while other are scarcely known and adopted. Moreover, the adoption of a particular CQS does not necessarily entail the implementation of the agricultural practices optimal from an environmental, economic and/or agronomic point of view (Parra-López and Calatrava-Requena, 2006).

The aim of this paper is threefold: (1) describing the situation of the knowledge and adoption of diverse CQS in the olive farming sector of Andalusia; (2) analysing the factors related to the adoption of PDO; (3) identifying agricultural practices associated to the adoption of PDO and assessing their goodness from an environmental, economic and/or agronomic point of view. Analysed CQS include the most relevant and potentially implementable systems in olive production, but we will specially focus on PDO (Protected Designation of Origin) since it is the main quality strategy in the Andalusian olive agriculture and its adoption rate allows to obtain statistically significant results and conclusions and because the adoption and farming practices associated to other important CQS such as organic and integrated have been previously widely analysed in the literature (e.g., Parra-López, 2003; Parra-López and Calatrava-Requena, 2005 and 2006; Parra-López et al., 2007).

2 Methodology

The research is based on a survey to 200 farmers of the main olive growing zones of Andalusia carried out from May to November 2010. This is an advance of a wider survey intended to the agro-food olive sector of Andalusia, including also the olive industries and interviewing more farmers. The survey of the current study consists basically of two parts:

(1) Characteristics of farmers and farms: They are variables that can be related to the adoption of CQS. They are:
    a. Characteristics, attitudes and opinions of farmers, such as agricultural training, sources of information about CQS, objectives when producing, objectives when innovating, difficulties to innovate, priorities in R&D, among others.
    b. Characteristics of farms, such as location, farm area distribution, yield, type of labour force, destination of the production, slope of the land, among others.
(2) Farming practices implemented: They are also variables potentially related to the adoption of CQS. Practices are referred to soil management, irrigation, fertilization, phytosanitary treatments, and harvest.

The analyses carried out on this study and the methodologies implemented are as follow:

- Knowledge and adoption of Certified Quality Systems: It has been carried out a descriptive analysis of the knowledge and adoption degree of the most relevant CQS among olive farmers. Additionally, some farmers' attitudes and opinions regarding R&D are described.
- Adoption factors of Protected Denomination of Origin: PDO is the most widespread CQS in the Andalusian olive sector. A bivariate analysis of the olive farmers' and farms' characteristics and PDO membership has been implemented. The aim is to identify significant differences between PDO farmers and farms and non-PDO ones.
- Comparison of farming practices used by PDO and non-PDO farmers: On the basis of a bivariate analysis between the farming practices and PDO membership, those practices that are significantly different between farmers pertaining to a PDO and the rest have been identified. Additionally, it has been assessed the goodness of practices from an environmental, economic and/or agronomic point of view (Parra-López and Calatrava-Requena, 2006).

3 Results

3.1 Knowledge and adoption of Certified Quality Systems

No olive farmer has adopted or intends to adopt ISO, GLOBALGAP, IFS or Nature's Choice. The knowledge degree of these CQS is low, not exceeding 9.5% for them as a whole (see Table 1). The only quality systems adopted are integrated and organic farming (by 12.5 and 0.5% of farmers, respectively), and prominently membership to Protected Designation of Origin, with an adoption rate of 19.6%.

Table 1. Knowledge and adoption rates of diverse CQS by olive farmers

	Knowledge	Adoption	Intention to adopt
ISO 9000	7(3.5%)/193(96.5%)	0(0.0%)/200(100.0%)	0(0.0%)/197(100.0%)
ISO 14001	5(2.5%)/195(97.5%)	0(0.0%)/200(100.0%)	0(0.0%)/197(100.0%)
ISO 19011	2(1.0%)/198(99.0%)	0(0.0%)/200(100.0%)	0(0.0%)/197(100.0%)
ISO 22000	1(0.5%)/199(99.5%)	0(0.0%)/200(100.0%)	0(0.0%)/197(100.0%)
Other ISO	0(0.0%)/101(100.0%)	0(0.0%)/200(100.0%)	0(0.0%)/98(100%)
GLOBALGAP	2(1.0%)/198(99.0%)	0(0.0%)/200(100.0%)	0(0.0%)/197(100.0%)
IFS	1(0.5%)/199(99.5%)	0(0.0%)/200(100.0%)	0(0.0%)/197(100.0%)
Nature´s Choice	1(0.5%)/199(99.5%)	0(0.0%)/200(100.0%)	0(0.0%)/197(100.0%)
Organic agriculture	n.a.	1(0.5%)/199(99.5%)	n.a.
Integrated agriculture	n.a.	25(12.5%)/175(87.5%)	n.a.
PDO	n.a.	39(19.6%)/160(80.4%)	n.a.
Others	0 (0.0%)/99(100.0%)	0(0.0%)/200(100.0%)	0(0.0%)/97(100.0%)

Note: Figures are absolute frequencies (number of answers) and relative frequencies (% of answers) for yes/no. n.a.= Not available.

Among the sources of information on new olive farming practices and CQS farmers highlight their own personal experience and practice (68.3% of interviewees), suppliers (56.8%), and other farmers (47.7%) (Table 2). This highlights the importance of self-learning and personal contact with near agents and market sources.

Table 2. Attitudes and opinions of olive farmers regarding R&D

	1st factor	2nd factor	3rd factor
Sources of information on new olive farming practices and CQS	Personal experience and practice: 136(68.3%)	Suppliers: 113(56.8%)	Other farmers: 95(47.7%)
Priorities when producing	Economic profit: 192(96.0%)	Obtaining healthy products: 120(60.0%)	Respect for the environment: 102(51.3%)
Objectives of innovation	Improving sale conditions: 67(33.7%)	Lower labour costs per unit of product: 50(25.1%)	Greater production capacity: 31(15.6%)
Factors that difficult innovation	Lack of funds in the farm: 83(41.5%)	Too high cost: 54(27.0%)	Difficulties for external financing: 38(19.0%)
Demanded research topics	Olive genetic improvement: Resistance to *Verticillium* disease: 47(23.6%)	Olive oil in non-traditionally consuming countries: 44(22.1%)	Consumer behaviour in international markets: 31(15.6%)

Note: Figures are absolute frequencies (number of answers) and relative frequencies (% of answers).

Olive farmers when producing give a high priority to the economic profit (96.0% of farmers), but also to obtaining healthy products (60.0%) and respecting the environment (51.3%), as shown in Table 2. However the objectives for innovation are mostly related to a productive focus but not to sustainability or environmental issues: improving sale conditions (33.7%), lower labour costs per unit of product (25.1%), and greater production capacity (15.6%). Main factors that difficult innovation perceived are mainly financial and related to cost but not to lack of knowledge or demand for innovations in the market: lack of funds in the farm (41.5%), too high cost (27.0%), and difficulties for external financing (19.0%). Main research needs are about resistance to diseases (genetic improvement for resistance to *Verticillium*, 23.6%), and olive oil markets (non-traditionally consuming countries, 22.1%; and consumer behaviour in international markets, 15.6%).

3.2 Adoption factors of Protected Denomination of Origin

Differences between farmers and farms that belong to PDO and the rest of farmers can be related to the adoption of PDO. Statistically significant differences between both types of farmers are shown in Table 3 and between farms in Table 4. Regarding the characteristics, attitudes and opinions of farmers (Table 3), training of PDO farmers is more based than of non-PDO ones on their personal experience and practice and less on courses and conferences, that is, their agricultural training is less formal. PDO farmers have a more direct legal relationship with the farm, since they are wage earners in a lower extend. They pertain more than the rest to agricultural cooperatives and Associations for Integrated Pest Management. Maybe for this reason PDO farmers are more confident of agricultural associations and other farmers as sources of information and less of confident of suppliers, public research organisations, and conferences, fairs, expositions, etc. In summary, the importance of personal contact with other farmers and agricultural associations near to them is greater for PDO farmers.

Table 3. Differences between characteristics, attitudes and opinions of PDO farmers and the rest

	Statistical correlation p (sign.)
Agricultural training	
➢ Personal experience and practice (+); Courses, conferences, etc. (-)	**
Legal relationship with the farm	
➢ Wage earner (-)	*
Membership to agricultural associations	
➢ Agricultural cooperative (+)	*
➢ ATRIA (Association for Integrated Pest Management) **(+)**	**
➢ Agricultural union (-)	*
➢ Other association **(+)**	**
Sources of information on new olive farming practices and CQS	
➢ Suppliers (-)	**
➢ Agricultural associations (+)	**
➢ Other farmers (+)	*
➢ Public research organisations (-)	**
➢ Conferences, fairs, expositions, etc. **(-)**	*
Priorities when producing	
➢ Assuming a low risk: None (+); Some (+); Much (+); A lot (-)	**
➢ Personal prestige: Little (+); Some (+); A lot (-)	**
➢ Respect for the environment: Some (+); Much (+); A lot (-)	**
➢ Obtaining healthy products: Much (+); A lot (-)	**
Objectives of innovation	
➢ Improving sale conditions (-); Greater production capacity (+)	*
Factors that difficult innovation	
➢ Lack of information about technology (-); Non-demand for innovations (+); Too high cost (+); Dominance of established enterprises (-); Uncertainty about the demand of innovative goods and services (-)	*
Demanded research topics	
➢ Using covers for disinfection of soils affected by *Verticillium* disease (-); Consumer behaviour in international markets (+); Marketing implications of the olive oil differentiation (+)	**

*Note: Bivariate statistical correlation with PDO membership, based on: (1) Corrected Yates 2 for contingent tables when degree of freedom (d.f.)= 1; (2) Pearson 2 for contingent tables when d.f.> 1; (3) 2 for bivariate logit when proof for contingent tables is not statistically reliable. Significance (sign.): ** p < 0.01; * p < 0.05.*

PDO farmers give less importance to assume a low risk when producing, that is, are more risky. They also give less priority to their personal prestige, and surprisingly to the respect of the environment and to obtaining healthy products. The objectives of innovation for PDO farmers are more related than of non-PDO ones to increase production capacity and less to improving sale conditions. It is a common handicap of farmers their exclusive focus on production and their scarce focus on marketing issues and PDO farmers seems to be less concerned with this problem, but the reason could be that they are confident on the agricultural associations they belong. As reasons that difficult innovation non-demand for innovations and high cost are more cited by PDO farmers whereas lack of information about technology is less

referred than by other farmers. Probably for this reason technical research (on *Verticillium* disease) is less demanded by non-PDO growers whereas market analyses (consumer behaviour in international markets, and marketing implications of the olive oil differentiation) are more demanded by PDO.

Regarding the characteristics of farms (Table 4), the most important differences are that PDO farms are located in less favoured zones (Granada instead of Jaen), with higher soil slope, being therefore less productive. Additionally PDO farms use more familiar labour than non-PDO ones and less salaried labour. PDO farms include less conventional olive surface but more integrated than other farms. Destination of olives to first degree cooperative mills is more important for PDO farms.

Table 4. Differences between characteristics of PDO farms and the rest

	Statistical correlation p (sign.)
Farm area distribution	
➢ Conventional olive: 0 ha (+)	**
➢ Integrated olive: 0 ha (-); (1-5] ha (+); (5-10] ha (+); (10-] ha (+)	**
Province	
➢ Jaen (-), Granada (+)	**
Yield	
➢ 2000-4000Kg olives ha^{-1} (+); 6000-8000Kg olives ha^{-1} (-)	*
Labour	
➢ Only familiar (+); Salaried either temporary or permanent (-)	*
Soil slope	
➢ Low (-); High (+)	**
Main costumer	
➢ Independent oil mills (-); First degree cooperative mills (+)	*

*Note: Bivariate statistical correlation with PDO membership, based on: (1) Corrected Yates □2 for contingent tables when degree of freedom (d.f.)= 1; (2) Pearson □2 for contingent tables when d.f.> 1; (3) □2 for bivariate logit when proof for contingent tables is not statistically reliable. Significance (sign.): ** p < 0.01; * p < 0.05.*

3.3 Comparison of farming practices used by PDO and non-PDO farmers

Differences between agricultural practices implemented by both types of farmers are summarised in Table 5. Although Picual is the main olive variety in Andalusia (CAP, 2008), this is less used by PDO farmers than by non-PDO ones, and on the contrary Hojiblanca and Picudo are more used. The two later varieties have milder flavour and some advantages associated to its lower diffusion in the region such as less competition for labour in the harvesting time, less problems of fruit setting, and less competence in the market. However Picual variety has other important advantages such as higher oil yield, higher rusticity and adaptation to a wider range of conditions, earlier ripeness, easier olives to be picked from tree, and higher olive stability (Barranco, 2008). Therefore it is not possible to determine the superiority of a variety over the other. In any case, PDO farmers seem to be somewhat more oriented than non-PDO ones to external and new markets where milder flavour is more appreciated.

Table 5. Differences between farming practices used by PDO farmers and the rest

	Statistical correlation p (sign.)	Goodness of PDO practices
Main olive variety		
➢ Picual (-); Hojiblanca (+); Picudo (+)	**	-
Soil management		
➢ Bare soil, no tillage, weed control with herbicides (-); Soil covered by spontaneous weed or cultivated plants, and control with herbicides or mechanical cutting (+)	*	↑
Irrigation (-)	**	-
Fertilization		
➢ Method for the application of fertilizers: Direct application to the soil (+); Spray application to the leaves (-)	**	↓
➢ Analysis before fertilization: Soil or leaf analysis (-); None (+)	**	↓
Phytosanitation		
➢ Timing of the phytosanitary treatments: On a fixed calendar basis or with the first symptoms of infestation/infection (+); When the infestation/infection surpasses a threshold or following expert advice (-)	*	↓
Harvesting		
➢ Timing of the harvest: According to a fruit ripeness index (-); On a fixed calendar basis (+)	*	↓
➢ Method for picking the olives from ground: By hand (+); Mechanical means (-)	**	-
➢ Separation of the olives picked from ground and trees (+)	**	↑

*Note: Bivariate statistical correlation with PDO membership, based on: (1) Corrected Yates 2 for contingent tables when degree of freedom (d.f.)= 1; (2) Pearson 2 for contingent tables when d.f.> 1; (3) 2 for bivariate logit when proof for contingent tables is not statistically reliable. Significance (sign.): ** p < 0.01; * p < 0.05. Goodness of PDO practices: ↑: higher than non-PDO; ↓: lower than non-PDO; - : not applicable.*

With respect to soil management, PDO farming practices are more appropriate from an environmental perspective than non-PDO ones since they consist more of soil covered techniques and less bare soil (Table 5). It could be related with the higher slope of the zones where PDO are more frequent than non-PDO farms and it is a requisite to apply for EU subsidies to avoid erosion. Also the separation of the olives picked from ground and trees is more common for PDO farmers, and it is recommended for obtaining a high quality olive oil (Parra-López and Calatrava-Requena, 2006).

Irrigation is less spread among PDO farmers. This technique has productive advantages since increases production (around 42%) and contributes to employment because it requires a little more labour. However, it has some environmental negative impacts associated to water consumption, which is scarce in the region, soil erosion and water contamination. Therefore it is not possible to establish whether PDO of non-PDO are doing the right thing globally.

Goodness of the rest of practices is lower for PDO farmers than for non-PDO farmers basically due to their higher negative environmental impact. In effect, the method for the application of fertilizers through direct application to the soil is higher and the application to the leaves with spray is lower. Additionally, no analysis before fertilization is more common among PDO farmers, which is not rational from an agronomic and environmental perspective (Parra-López and Calatrava-Requena, 2006). The application of phytosanitary treatments on a fixed calendar basis or with the first symptoms of infestation/infection is more usual instead of when the infestation/infection surpasses a threshold or following expert advice. Finally the timing of the harvest according to a fruit ripeness index is less common among PDO farmers and on a fixed calendar basis is more common than for non-PDO ones, which are not recommended farming practices (Parra-López and Calatrava-Requena, 2006).

4 Conclusions

Certification of products and processes through CQS guarantees quality standards beyond mandatory levels for consumers and entails a competitive advantage for the productive agents implement these systems. Despite this fact, the 'quality strategy' in the olive growing sector is centred in some few quality systems (PDO, integrated and organic agriculture), whereas others are scarcely known and adopted (ISO, GLOBALGAP, IFS, and Nature´s Choice) despite the introduction of ISO in other Andalusian agro-food chains has been very important in the last decade. It is very significant that farmers have not even intention to adopt the latter. The low knowledge and adoption rate of these CQS, that are innovations for these farmers, can be explained at least partially by the fact that they are very concerned with their economic profit and consider that innovations require high costs they cannot afford with their own funds or with external financing due to the difficulties of access to them. Also olive oil is a natural product perceived by consumers as of high quality and probably CQS are not considered by farmers to add too much value. In any case, improved access to credit would probably increase the adoption of CQS. Also knowledge transfer from public research to farmers and agricultural associations on CQS should be promoted.

Quality is a multidimensional and complex concept that can be interpreted from diverse perspectives (Luning and Marcelis, 2009). Therefore the diverse CQS can have different orientations regarding the quality they guarantee to consumers: they can be more linked either to 1) production and profitability, or to 2) sustainability and multifunctionality of agriculture. In the case of organic and integrated olive agriculture previous literature highlight a strong focus on the second orientation, being both CQS superior to conventional agriculture especially from an environmental and sociocultural perspective (Parra-López et al., 2008). However in the case of PDO the results obtained suggest that this CQS is more related to the first orientation of production and profitability. Probably it is conditioned by two facts: 1) PDO farms are more located that the rest in less favoured and productive zones, where physical and climatic conditions restrict the available technical alternatives, and 2) they are more related to local sources of information usually more interested in production issues

such as agricultural associations and other farmers, and less to external sources such as public research organisations, conferences, etc., where the focus is increasingly directed to sustainability. As a consequence, PDO farmers give less importance than the rest to the environment and more to increase production capacity through innovation and the research on marketing and demand analysis of olive oil.

In fact, goodness of most of the analysed farming practices especially from an environmental point of view is lower for PDO farmers than for non-PDO farmers. In effect, apart from soil covering practices to reduce erosion, which is the main environmental problem in the less favoured zones where they are and the separation of the olives picked from ground and trees, PDO farmers are applying in greater extended non-recommended practices of fertilization, phytosanitation and harvesting. However PDO farmers in less favoured regions cover the land which is an important environmental and social objective under the CAP scheme. Therefore although they do not apply the optimal agricultural practices they perform and important role in the rural areas. Moreover differentiation in the market is vital to improve competitiveness of farmers and even more through a PDO certification which is a well-recognised and valued guaranty for consumers. As for CQS in general, if a wider diffusion of this quality system is aimed access to credit should be improved probably channelling it through agricultural associations, which PDO farmers are more related to. Finally it is necessary to qualify that these results are preliminary and that at least the double number of farmers are aimed to be interviewed which can alter some results and conclusions.

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