Socio-economic characterization of olive groves in a region in the south of Portugal

Martins, M.B.[1], Simão, B.N.J.[2], Neves, M.A.R. [3]and Lucas, M.R.V.[4]

1. Introduction

Olive oil policy evolved over many years to promoting olive oil production and now strongly focused on improving the quality of the product, and encouraging olive growers to deliver consumer satisfaction. Despite its production-orientate policy and the new marketing-orientate regulation, providing important safeguards for the consumer and allowing producers to maximise the benefits of selling on the basis of quality, the Portuguese olive oil sector is decreasing production and market performances and competitiveness at national and international level.

Portugal is the fourth producing olive oil country in the EU. Olive oil sector widespread throughout the all country and is important for the rural economy, local heritage and the environment. Is it the main source of employment and economic activity in many producing regions, and it has shaped the landscape in the country over many centuries.

The sector consists of growers, cooperatives, pressing mills, refiners, blenders, and companies involved in various aspects of marketing activities. Three broad types of production can be distinguished: traditional groves, often of ancient olive trees; more managed traditional plantations involving a higher use of inputs; and intensive, generally recent, plantations using more mechanisation and other technologies including irrigation. This mix of ancient and modern enterprises helps to explain the different farm sizes, ownership characteristics and processing structures that exist within the country. Likewise, differences in production systems, efficiency and productivity occur within each producing region. In the South of Portugal, Serpa and Moura is the premier producer region. The region has excellent conditions for the activity development with high agricultural potential as well as important agricultural resources that can and should be used and developed, in spite of economic and social depression signs reinforced by demographic difficulties that can lead to desertification in some areas. In the area of Serpa and Moura Councils, olive production driven to obtain olive oil is the main farms' Technical-Economic Orientation (TEO). Some mobilizations traditionally made in olive groves lead to soil erosion and make the farm vehicles mobility much more difficult, namely those used in cultural operations. The maintenance of a soil cover in the olive grove space between lines is good, both because it favours the vehicles mobility, it promotes the rainwater infiltration and, last but not the least, the soil airing.

The objective of this work has been to make a socio-economic characterization of a zone of Serpa and Moura Councils in which a project of soil covers under olive trees is being developed. At the same time cultural accounts were made for the different situations under the study – irrigated olive grove with spontaneous vegetation in the space between lines, irrigated olive grove with seeded vegetation in the space between lines, irrigated olive grove with herbicide application in the space between lines, dry olive grove with spontaneous vegetation in the space between lines, dry olive grove with seeded vegetation in the space between lines and dry olive grove with herbicide application in the space between lines.

2. Research Methods

To reach the goals defined for this study, the research had two phases: an initial with secondary data compilation from different information sources, both statistical and academic ones, followed by a quantitative survey implemented in Serpa and Moura to olives' farmers to obtain comprehensive information about socio-economic and technical description of olive groves production.

The information was collected through personal interviews to olive growers during spring and summer of 2006 with a questionnaire of 26 questions, about the producer, the farm structure, the technology used, the costs and the subsidies received. The councils of Serpa and Moura represent more or less 70% of the Nuts II region Baixo Alentejo in what concerns the TEO olive production driven to produce olive oil. In these councils, we have 1485 farms with this TEO. A quota sampling procedure was implemented. The survey sample size was 10% of this population. The questionnaires were distributed among the members of the farmers' associations that are our project partners. The minimum number for the survey to be representative would be 5% of the population, which meant 75 questionnaires answered. Our response rate was 68.5%, which meant 102 questionnaires answered.

The second phase was the analysis of cost and profits' structure of the different kinds of olive groves present in the area, according to the survey answers.

3. The climatic conditions in the studied area

[1] Assistant Professor, Algarve University
[2] Agronomic Engineer
[3] Assistant Professor, Algarve University
[4] Associated Professor with Agregation, Évora University

The Moura and Serpa councils are located in Alentejo, south of Portugal. This is in the south-west part of Iberian Peninsula, subject to the joint action of three climatic influences: Mediterranean, Atlantic and Iberian (Sobral e Marado, 1987).

Alentejo is mainly influenced by the Mediterranean and its weather is characterized by a marked dry season, in the summer, and a suave winter with an average temperature in the coldest month of 9ºC. In the inner land, where our Councils are located, there are 120 to 140 days with temperature above 25ºC and 0 to 19 days with temperatures below 0ºC. There may happen frosts but with different durations and intensity (Sobral e Marado, 1987).

Average temperature in summer is 30ºC sometimes happening absolute maximum temperatures of 40ºC (Carvalho, 1999).

According the national Institute of Meteorology (IM), in average July and August are the hottest months and December, January and February the coldest ones (Table 1).

Annual precipitation is between 400 and 600 mm, from October to May.

Table 1 – Average daily temperatures (ºC) and precipitation (mm) in the period 1961-1990.

Month	Average maximum temperature (ºC)	Average minimum emperature (ºC	Precipitation (mm)
January	13,8	5,4	81
February	14,9	5,9	80
March	17,3	6,6	54
April	19,4	7,9	60
May	23,7	10,1	36
June	28,4	13,2	23
July	32,5	15,1	3
August	32,5	15,4	3
September	29,3	15,1	22
October	23,2	12,3	65
November	17,5	8,5	77
December	14,2	6,0	83
Year	**22,2**	**10,1**	**586**

Source: IM, 2006

The precipitation distribution shows the importance of dams, either small, in the farms, or big irrigation perimeters (Carvalho, 1999).

Our survey reveals that most of the farms have some irrigated area, with water coming from wells, punctures, springs, etc. sometimes with high captation costs (Carvalho *et al*., 1996).

We can see, on table 2, the probability of occurrence of 5 types of years. We will have a very rainy year in winter if precipitation is above 150% the 30 years average. It will be rainy if precipitation is above average plus 5% there is. A medium year will be one with precipitation between 0.95 and 1.05 times the average. A dry year will be one with precipitation less then 95% the average and a very dry year will have less then 50% the average precipitation.

Table 2 – Probability of occurrence of different types of years, according to precipitation in January (data: 1963-1993)

Situation	Precipitation	nº of years	Probability of occurrence	
Very rainy year	> 116,65 mm	10	32,26%	41,94%
Rainy year	81,65 to 116,65 mm	3	9,68%	
Average year	73,88 to 81,65 mm	0	0,00%	
Dry year	38,88 to 73,88 mm	9	29,03%	58,06%
Very dry year	< 38,88 mm	9	29,03%	

In this region it is relevant that almost 42% of the years are rainy or very rainy in winter.

4. The proposed technology - grass in the space between lines

There are many advantages in the permanence of spontaneous vegetation or vegetation seeding (with an early or late mix) in the space between olive groves lines, specially using leguminous to fix nitrogen.

Maintaining several species in the olive grove and minimizing the use of herbicides allows the prevention of soil erosion and compactation, the minimization of fertilization and water use, thus contributing to conserve the soil and raise its properties (COTR, 2004).

Seeds mixtures must take into account the place conditions and the early ones have an advantage, for non-irrigated olive groves – when the soil moisture is low, there is no competition between the olive grove and the cover, since the cover plants are already in their vegetative cycle final phase (Barranco *et al*., 1999).

Most of these farmers point that there is scarce green vegetation in their olive groves. Nevertheless, our survey results pointed that 35.3% of the olive growers are ready to seed a vegetation cover in their olive groves and even a small percentage think that seeding can be useful as pastures or as a nutrient supplier to the soil. In the other hand, 32.4% says that they are not ready to seed arguing that there will be competition with their trees, they will have to spend more money, they can find no advantages and they have no machineries to cut the grass. From these reasons the most important was the first one – the seeded plants will compete with the trees – and it was referred by 17.6% of the olive growers.

The grass cover has many advantages – it has a positive influence on the biocoenosis and as a consequence it avoids the evaporation thus conserving the water in the soil, it raises the soil organic matter, it facilitates the roots system's spreading and it allows a better nutritive equilibrium in the olive grove, promoting a smaller use of nitrogen fertilizers and a raise in the atmosphere nitrogen's biological fixation (COTR, 2004).

Maintaining a grass cover in the soil propitiates the presence of permanent canals on soil structure, formed as a consequence of plant roots' death. Water and nutrients flow in this specialized soil profile's channels reaching deeper soil layers. To maintain the roots is then essential to promote this mechanisms' establishment providing a good airing, rain water drainage and nutrients homogeneity along soil profile (COTHN, 2002).

5. Empirical results

5.1. Human capital

The survey results show us that in the studied area most of the farmers are between 55 and 64 years old, followed by those between 40 and 54 years and those that are less then 40 years old. The statistical data from the National Bureau of Statistics – Agricultural Census (INE, 1999) indicates that olive growers are mainly more then 65 years old. In our survey, this category is the less representative, which can be a good indicator of an increased capacity to innovate in the studied region.

The educational level is basically distributed among those who have only the basic education, and those who can only read and write. Only 6.9% of the interviewed farmers had some education on a secondary agricultural school, 5.9% on a polytechnic/superior school and only 1% had professional education in agriculture. According to the Agricultural Census (INE, 1999), farmers have mainly the basic school but these are followed by those that can't read or write and those who can only read and write. As in our survey, the percentage of those who have professional education in agriculture is very low.

Most of the farmers in this area exploits is own land. Sometimes they also rent some land, to increase their areas and gain some scale economies.

Most of the farms have a small number of parcels, although these have big areas. As the Agricultural Census demonstrates (INE, 1999) most of the farmers has between 1 and 5 parcels in their farms.

The survey shows that the olive groves are mainly not consociated with any other activity.

5.2. Machinery capital

According to the bibliography, soils in this region are very heterogeneous, with tendency to be clay and/or loamy-clay, predominantly calcareous. These are very good soils for olive groves but our survey shows that farmers are concerned with these characteristics, as they have mainly tractor with four wheel drive and a high horse power (with higher costs/ha) so the traffic is not compromised when the soil is more compact due to precipitation. The tractors preferred by the farmers have 4 wheels drive and between 50 and 100 hp, followed by those with 2 wheels drive and the same power. Some of these farmers have more then one tractor of the first type and we can also find some who have tractors of 2 wheels drive with more then 100 hp.

The farmer has a special concern not only with is production quality but also, during harvest time, with the possibility of having available machinery and work to harvest and carry the production to the olive-press, as storage of olives compromises the olive oil's quality.

In what concerns olive groves, tradition is certainly a problem for new technologies adoption – many farmers resist to the introduction of new technologies, even when they are commonly used elsewhere (CTM, 2006). It is then important to give farmers information that can aid their decision and allows a critical opinion on equipments and practices to use in their farms.

Mechanization in olive groves implies the use of heavy tractors and implements in a very short period of time when the soil has low mobility capacity. It is then a challenge to create conditions to raise the number of available days for these tractors and implements to work in the olive grove (CTM, 2006).

If the space between lines is covered mobility conditions are raised and the machinery can circulate even

with high moisture levels in the soil. In this kind of olive groves farmers must have the equipment adapted to work in the space covered to minimize the impacts on the soil, mainly the harvesting equipments, in the end of the olive production cycle, since this operation, if not made in the correct time, compromises the quantity and quality of production and then the investment made and the economical viability of the farm (CTM, 2006).

5.3. Olive groves profits and costs

Several accounts were made to analyse the olive groves' annual costs and profits, both in a non-irrigation and irrigation situation. In the first situation, the olive groves have a 7x5 compass while in the second one they have a 10x10 compass. According to our survey, this is the most common situation in the area. In the non irrigated olive groves farmers prefer to have more space between trees since the dry season is very long and very hard.

The accounts made for both situations were the following:

Technology 1 – Irrigated olive grove (7x5) with spontaneous vegetation in the space between lines

Technology 2 – Irrigated olive grove (7x5) with grass seeding in the space between lines

Technology 3 – Irrigated olive grove (7x5) with herbicide application in the space between lines.

Technology 4 – Non-irrigated olive grove (10x10) with spontaneous vegetation in the space between lines

Technology 5 – Non-irrigated olive grove (10x10) with grass seeding in the space between lines

Technology 6 – Non-irrigated olive grove (10x10) with herbicide application in the space between lines.

We concluded that for irrigated olive groves costs are mainly due to amortizations (machinery, plantation and irrigation system) and phyto-sanitary treatments/fertilization. After these, we have costs with harvest and transport and all the other costs are residual. In what concerns investment, it must be underlined that for technologies 1 and 3 almost 59% of the investment is due to irrigation equipment.

It can also be stated that annual costs for technologies 1 and 2 are the same for harvest and transport, cutting, irrigation, treatments and fertilization and vegetation control in the space between lines are exactly the same. The main differences are in amortizations, because in technology 2 we have the plantation amortization and of course those costs that are calculated as a percentage of all the other costs – general costs and entrepreneur remuneration. In what concerns investment costs, these are 6% higher in technology 2 than in technology 1.

For technology 3, the investment cost is the same than in technology 1 and annual costs are 14% lower than those for technologies 1 and 2 because herbicide application is less expensive (considering the herbicide, the machinery/equipment and the work costs) than grass cutting.

Total costs for technologies 4, 5 and 6 are much less expensive then for technologies 1, 2 and 3. Of course this is due to the fact that we don't have in this technologies the irrigation's installation and annual costs but also to the fact that plantation density is much lower (100 trees/ha) which means less resources for plantation, less work and less use of machinery/equipment per ha, which also means less amortization costs. Non-irrigation technologies mean a reduction of 80% on installation costs.

Comparing the same technology, with and without irrigation we can see that maintenance almost double from non-irrigated to irrigated systems and also that there is a better equilibrium between the various classes of costs on the non-irrigated systems.

Without irrigation we have a very extensive system. This means, associated with the lower costs, lower profits and lower subsidies, since the olive oil production subsidy is given in a production basis.

In the non-irrigated system the costs of planting the grass between lines are higher because of the olive grove compass – the space between lines is higher and so we need more seeds, more work and more machinery/equipment time for seeding.

For irrigated systems the profits that come from production, in a maintenance situation, pay all the costs. There is then a positive net margin to pay land and working capital. Subsidies are above this margin and so they work like a buffer for the farmer's net economic result. For non-irrigated systems, the profits coming from production are not enough to pay the costs which mean the payment for land and working capital depend on subsidies.

6. Conclusions

The Serpa and Moura region shows important signs of economic and social depression with a population decrease although it has some interesting potential and resources that could and should be used.

Maintaining populations in rural areas is important; beside the traditional function of producing food, agriculture has a determinant role on the maintenance and evolution of rural characteristic landscapes and on environmental and biodiversity preservation.

The survey's results show us that in this area the age of farmers can be considered a positive aspect which may positively contribute to the innovation capacity of these farmers but the formal education capacity is low, corroborating the statistical data which may be a problem.

Farms in this region are big and this is a positive point for the kind of technological adoption that is being studied since it allows significant scale economies.

Farmers chose the tractors they use mainly by the power needed to overcome difficulties in harvest time. Grass in the space between lines will reduced that problem, with additional outstanding environmental impact,

but farmers in non-irrigated olive groves are afraid of the hydric competition with olives, as well as with the increase of installation and annual costs.

Nevertheless, one of the main worries of farmers in this region is the possibility of not being able to work in the soil at the harvesting period. As Anderson and Dillon stated (Anderson & Dillon, 1992) the farmer's decision making is often not neutral to risk and decisions are influenced not only by the expected value. Due the high probability of occurrence of rainy and very rainy years (49.1%), the risk of crop losses due insufficient availability of days to harvest is very high.

We think that the installation of grass and leguminous in olive groves will become a reality, besides the cost due to the installation and maintenance of herbs, as this technology will allow a significant reduction on the risk farmer faces. For that purpose, demonstration actions will be needed about the best species to grow, economic and feasible cover's growth control techniques and the beneficial agricultural impact of plants in soil and olive conditions.

Acknowledgements

This work was supported by Agro Project nº 802 "Ecological and conventional olive orchards' soil cover – Instalation of demonstration fields".

List of References

ANDERSON, J. e DILLON, J. (1992). *Risk Analisys in Dryland Farming Systems*. Farm Systems Management Series. n.º 2. F.A.O. Roma.

BARRANCO, D.; FERNANDEZ-ESCOBAR, R.; RALLO, L. (1999). *El Cultivo del Olivo*. 3ª edición. Ediciones Mundi-Prensa. Madrid.

CARVALHO, M. L. S. (1999). *Efeitos da variabilidade das produções vegetais na produção pecuária – Aplicação em explorações agro-pecuárias do Alentejo*: Situações actual e decorrentes da nova PAC. II edição do prémio de estudos de economia agrícola e agro-alimentar (1º prémio). Associação Portuguesa de Economia Agrária – APDEA. Lisboa.

CARVALHO, M. L. S.; PINHEIRO, A. C.; NETO, M. C. (1996). *O papel do regadio e dos planos de regionalização na agricultura do Alentejo – 2º congresso nacional de economistas agrícolas*.

COTR (CENTRO OPERATIVO E DE TECNOLOGIA DE REGADIO – *Operative and technological center for irrigation*) (2004). *Técnicas de maneio do olival na fase pós-instalação, tendo em vista a redução de custos e a protecção do ambiente*: *influência do coberto vegetal nas características fisicas e químicas do solo e quantificação do desenvolvimento vegetativo da oliveira em função da dotação de rega* [On-Line], Available on the site: http://www.cotr.pt/documentos/RELATÓRIO%20FINAL% 20298.pdf [Last accessed: 16/06/2006].

COTHN (CENTRO OPERATIVO E TECNOLÓGICO HORTOFRUTÍCOLA NACIONAL – *National operative and technological center for horticulture*) (2002). Available on the site: http://www.cothn.pt/portal/index.php?id=2226 [Last accessed: 22/05/2006].

CTM (CIÊNCIA E TÉCNICAS DE MECANIZAÇÃO – *Mechanization science and technics*). (2006). [On-Line], Available on the site: http://mecanizacao.der.uevora.pt [Last accessed: 29/03/2006].

IM (INSTITUT OF METEOROLOGY) (2006). [On-Line], Available on the site: http:// www.meteo.pt/resources/im/pdfs/clim_ac_61_90_Beja.pdf [Last accessed: 10/09/2006].

INSTITUTO NACIONAL DE ESTATÍSTICA (INE). (1999). *Recenseamentos Gerais de Agricultura – Dados comparativos 1989-1999*.

SOBRAL, M. T. e MARADO, M. O. (1987). *Zonas Agro-Ecológicas no Alentejo.* Programa de Drenagem e Conservação do Solo no Alentejo. Direcção Geral de Hidráulica Agrícola. Évora.

Summary

Serpa and Moura region, in the South of Portugal, have important agricultural potential as well as important agricultural resources that can and should be used and developed, in spite of economic and social depression signs reinforced by demographic difficulties that can lead to desertification in some areas.

The main farms' Technical-Economic Orientation (TEO) is olives production, to produce olive oil, since this region has excellent conditions for the activity development.

Some mobilizations traditionally made in olive groves lead to soil erosion and make the farm vehicles mobility much more difficult, namely those used in cultural operations. The maintenance of a soil cover in the olive grove space between lines is good, both because it favours the vehicles mobility, it promotes the rain water infiltration and, last but not the least, the soil airing.

The objective of this work has been to make a socio-economic characterization of a zone of Serpa and Moura Councils in which a project of soil covers under olive trees is being developed. At the same time cultural accounts were made for the different situations under the study – irrigated olive grove with spontaneous vegetation in the space between lines, irrigated olive grove with seeded vegetation in the space between lines, irrigated olive grove with herbicide application in the space between lines, dry olive grove with spontaneous vegetation in the space between lines, dry olive grove with seeded vegetation in the space between lines and dry olive grove with herbicide application in the space between lines.

The survey shows farmers in this area are younger then usual, although they don't have a high level of formal education, general or specific in agriculture. Farm areas are usually high, which can be determinant for the proposed technology adoption.

Installation and operation costs for the olive grove are higher on the irrigated olive grove, but of course expected productions are also higher. For this production technology profits coming from olives production are higher then the operation costs. However, in the dry olive grove technology costs are always higher then the profits, being profitability only due to subsidies. The importance of soil cover maintenance, in this region, beside the benefits in what concerns erosion, infiltration and soil airing, is also due to its capacity to minimize the risk farmer's face.

KEY WORDS: Socio-economic characterization; Olive grove; Soil cover; Farm equipment; Farm costs and profits.