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Production costs of the organic Clementine crop in the region of Valencia (Spain)

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Abstract

The aim of this paper was to analyse the feasibility of the organic Clementine crop in the Spanish autonomous region of Valencia. With this purpose, the production costs schemes comparing the two crop modalities extended in the region (citrus grown with flow irrigation, and citrus grown with drip irrigation systems), have been developed. The cultivar Clemenules was chosen in order to carry out the study. Considering the present market tendencies, organic Clementines should represent a higher value crop for producers, mainly for two reasons: on one hand, consumer preferences for easy-peelers; on the other hand, the possibility of obtaining price premiums for their harvests.

Additional key words: break-even costs, economic analysis, flow or drip irrigation systems, organic farming, small citrus.

Resumen

Costes de producción del cultivo de clementinas ecológicas en la Comunidad Valenciana

El objetivo del presente artículo consiste en aportar una visión, desde un punto de vista económico, del cultivo de clementinas ecológicas en la Comunidad Valenciana. Para ello se estudiaron los costes de producción de las dos modalidades más extendidas en la región: cultivo con sistema de riego a manta y cultivo con sistema de riego localizado. El cultivar Clemenules fue seleccionado para llevar a cabo el estudio de costes. Las clementinas ecológicas pueden ser consideradas como una oportunidad de mercado para los citricultores, dado el valor añadido que los pequeños cítricos tienen ya de por sí.

Palabras clave adicionales: agricultura ecológica, análisis económico, costes de equilibrio, pequeños cítricos, sistema de riego a manta o por goteo.

Introduction

Spain was the fourth citrus producer of the world with 6% of the worldwide production in 2001. At the same time, it is the first producer of the world of citrus for fresh consumption. Oranges represented 51% of a total Spanish harvest of 5.7 million tones in 2001, followed by tangerines with 31%, 18% of lemons and less than 1% of grapefruits that could be considered negligible (MAPYA, 2004a).

Regarding the destination of the Spanish citrus production, of a total harvested of 5.9 million tones during the 2002-2003 season, 56% was exported, 22% was marketed for fresh domestic consumption, 17% was sent to industry and 5% was classified as losses (SGC, 2003). An important share of the harvested oranges and tangerines, concretely 47% and 69% of each variety, was exported for fresh consumption to other EU countries, namely Germany and France.

Citrus growing in Spain is located mainly in four regions: Catalonia, the Comunidad Valenciana or region of Valencia (CV), Murcia and Andalusia. Within the regions, the CV is the most important grower, not only because of the higher crop surface, but also for its longer tradition of citrus farming (see Table 1).

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Table 1. Spanish citrus surface and production in 2001

Region	Total citrus surface (ha)	Total citrus production (Mg)	Tangerine surface (ha)	Tangerine production (Mg)
Catalonia	8,938	125,013	5,039	64,737
Valencian Community	191,085	3,676,864	95,593	1,500,696
Murcia	37,061	719,225	2,930	60,418
Andalusia	62,388	1,175,254	10,478	129,565
Total	299,472	5,696,356	114,040	1,755,416

Source: Data taken from MAPYA (2004a).

In spite of the long orange farming tradition in the CV, there has been a decrease in the orange surface over recent years, due to an increase in the tangerine surface (Mari and Peris, 2004). In fact, the CV is presently the most important tangerine grower of Spain, with 84% of the total surface and 85% of the harvest in 2001 (see Table 1). Considering the whole tangerine selection, Clementines are the most appreciated by consumers because of their colour, flavour and easy-to-peel qualities (Planells, 2003).

Organic citrus crop in the region of Valencia

After explaining the importance of citrus crop in the CV, Table 2 shows the evolution of organic faming, and organic citrus farming in the region for the last years.

Organic farming is regulated at the European level by Regulation (EEC) 2092/91 (OJ, 1991), which was adapted to regional legislation through the Order of 13th June 1994 of the Regional Department of Agriculture and Environment (RDAE) (DOGV, 1994). At the same time, the agro-environmental measures of the Common Agricultural Policy (CAP) rural development programs were activated, first under Regulation (EEC) 2078/92 (OJ, 1992), which was revoked by Regulation (EC) 1257/99 (OJ, 1999). Both former and present rural development programs of the CV considered organic farming as a subsidizable measure.

Regarding the evolution of the organic regional surface, there has been a considerable increase since 1999, partially influenced by the agro-environmental subsidies of CAP rural development programs. However, the organic citrus surface has remained more or less stable for the last six years (see Table 2). Concretely in 2002, the most extended organic crops were meadows and pastures (44%), followed by rain-fed wooden crops as almonds or bean trees (17%), olive (7%), grapes (7%), cereals and legumes (7%) (Roselló and Domínguez, 2003). The less important crops in surface were citrus, vegetables and orchards, which are at the same time the most important crops in economic terms, and also the most difficult to manage organically.

The organic citrus surface, with 231 ha registered in 2003 (see Table 2), was equivalent to 0.12% of the total citrus surface, which was estimated at 184,457 ha the same year (CAPA, 2004b). Hence, the organic citrus crop is still marginal. There are so many reasons that

Table 2. Evolution of organic citrus crop in the region of Valencia

	1998	1999	2000	2001	2002	2003	2004
Organic citrus surface (ha)	196.35	234.00	230.60	243.61	224.00	231.00	237.00
Organic total surface (ha)	12,179	17,947	18,967	18,188	22,932	24,581	31,375
Citrus/total (%)	1.61%	1.30%	1.22%	1.34%	0.97%	0.94%	0.75%

Source: Data taken from MAPYA (1999) to MAPYA (2003), MAPYA (2004b), CAPA (2004a).

make it difficult for farmers to grow citrus organically, apart from the technical requirements of Regulation (EEC) 2092/91. For example, the lack of physical barriers to isolate the crop naturally, as hills or mountains (citrus growing is mainly focused on the coastal plains in the CV), or even the fact of isolating organic citrus farms, generally small sized, from the intensive plantations (Peris and Juliá, 2005). Other points to be taken into account are the region's long history of intensive production, and the scarcity of available subsidies for organic citrus compared with their high production costs, as it will be demonstrated later.

Table 3 contains the division of the organic citrus surface into species. The most frequently cultivated species are oranges and tangerines, being organic lemons and grapefruits less extended, at least in the CV. However, the organic orange surface is greater than the tangerine one (51.30% versus 33.00%). This means that the organic citrus surface does not follow the tendencies of the intensive citrus farming, that is, to substitute the orange crop while expanding the tangerine surface.

Tangerines are more difficult to manage than oranges. They need lower temperatures to produce optimum yields, but at the same time they are more susceptible to the negative effects of cold. Tangerines are also less resistant to pests or illnesses than oranges. It should also be added, that in order to label their products organic farmers must comply Regulation (EEC) 2092/91 (OJ, 1991), which limits the available inputs to use, as much as their doses. All these factors discourage farmers from producing organic tangerines rather than oranges.

Table 3. Organic citrus surface in the region of Valencia Data from 2003

Species	Surface (ha)[1]	% Total
Orange	112.88	51.30
Tangerine	72.64	33.00
Lemon	32.91	15.00
Grapefruit	1.41	0.70
Total	219.84	100.00

[1] Data taken from the organic holding census updated in February 2003.
Source: CAE-CV (2003).

As with the intensive tangerine surface, the organic tangerine surface is also divided into varieties and selections, whose wide range and different harvesting periods allow farmers and dealers to diversify their marketing strategies. Clementine varieties are the most extended with 68.06% of the organic tangerine surface. Concretely, the selection Clemenules has been chosen to carry out the production costs' analysis. With 29.25 ha, it is the most extended variety with 40.27% of the organic tangerine surface of the region (see Table 4).

Table 4. Organic tangerine surface in the region of Valencia. Data from 2003

Variety	Selection	Surface (ha)	% Total
Clementine	Not specified	4.94	6.81
	Arrufatina	2.10	2.90
	Beatriz	1.26	1.74
	Clemenpons	2.68	3.70
	Clemenules	29.25	40.27
	Fina	0.49	0.68
	Marisol	2.40	3.30
	Oroval	2.37	3.27
	Hernandina	1.60	2.20
	Orogrande	2.07	2.85
	Nour	0.25	0.34
Total Clementine		49.41	68.06
Satsuma	Not specified	6.59	9.07
	Clausellina	1.50	2.07
	Okitsu	2.93	4.03
Total Satsuma		11.02	15.17
Hybrids	Clemenvilla	6.45	8.88
	Ellendale	2.23	3.08
	Fortune	0.18	0.25
	Ortanique	0.74	1.02
	Wilking	0.15	0.20
Total Hybrids		9.75	13.43
Mandarine	Not specified	0.54	0.74
	Afourer	1.72	2.37
	Beckria	0.13	0.18
	Common	0.05	0.06
Total Mandarine		2.44	3.35
Total		72.62	100.00

Source: Data taken from CAE-CV (2003).

Table 5 shows the distribution of the organic Clemenules surface in the different provinces and districts that constitute the CV. The crop is located mainly in Valencia, with 90.17% of the total surface. Within the province, it is distributed in two districts, Ribera Alta (17 ha registered, equivalent to 58.05% of the total crop surface) and Vall d'Albaida (3.7 ha, equivalent to 12.63% of the total crop surface). Consequently, the field work stage took place in those mentioned districts.

In addition, an analysis of the structure of the property of the organic Clemenules crop is offered in Table 6. One of the main problems of citriculture in the region of Valencia is the abundance of small-sized holdings, a problem which is much more evident in the case of organic citrus. In fact, 91.67% of the organic Clemenules holdings have a surface lower than 1 ha, while the third size bracket concentrates, with only one holding, the 54% of the registered surface (15.9 ha).

Table 5. Organic Clemenules surface in the region of Valencia. Distribution in provinces and districts. Data from 2003

Province	Surface (ha)	%Total
Marina Alta	0.60	1.90
Marina Baixa	0.90	2.94
Alacant	1.50	4.85
Baix Maestrat	1.50	4.98
Castelló	1.50	4.98
Safor	2.00	6.78
Vall d'Albaida	3.70	12.63
Horta Oest	1.60	5.49
Ribera Alta	17.00	58.05
Foia de Bunyol	1.00	3.40
Camp de Morvedre	1.10	3.82
Valencia	26.40	90.17
Total (regional)	29.30	100

Source: Data taken from CAE-CV (2003).

Table 6. Structure of property of organic Clemenules crop in the region of Valencia. Data from 2003

Size	Surface (ha)	% Surface	No. holdings	% Holdings
Surface < 1 ha	9.90	33.90	44	91.67
1 ha < Surface < 2 ha	3.50	12.10	3	6.25
Surface > 2 ha	15.90	54.00	1	2.08
Total	29.30	100.00	48	100.00

Source: Data taken from CAE-CV (2003).

Material and Methods

The production costs' analysis has been carried out employing the full costing methodology, as in other studies published before (Caballero *et al.,* 1992; Juliá and Server, 2000). All the information needed to calculate the costs of the entire agricultural citrus cycle has been collected through face-to-face interviews with organic citrus farmers and extension specialists of the organic sector. The study is divided in two parts, one for variable and another one for fixed costs. Otherwise, the opportunity costs have been excluded. Apart from their lack in the compulsory record keepings of the organic farming audits, opportunity costs did not add any new information to the objective of the study, which was to compare the production cost schemes between the two organic farming systems present in the region (i.e., crop with drip irrigation and crop with flow irrigation).

Variable costs constitute the first part of the cost scheme. They depend on the activity undertaken, in this case on the way the citrus crop is managed, while fixed costs are directly linked with the farm structure (i.e., facilities, investments, etc.). Consequently, the total variable costs will increase as do the yields obtained, while the fixed costs per unit will experiment a reduction (that is, the fixed costs per unit will decrease as far as higher yields are obtained).

Regarding citrus crop management, the most important items to be considered within the variable costs are inputs such as irrigation water, fertilizers, pesticides, machinery rental or labour. Within the fixed costs, ownership costs of facilities and investments (depreciations, insurance, repairs and maintenance), crop depreciation, holding maintenance (tree substitution, structural repairs of retaining walls, etc.), taxes and insurances (taxes on land property, social security, contributions to the organic farming regional committee, etc.) should be mentioned. Those are common costs for all the holdings, but farms which have a drip irrigation system will also include two other fixed costs: depreciation of the irrigation system, as well as its maintenance and repairing.

Ten holdings fully dedicated to the organic Clemenules crop were surveyed during the fieldwork stage. In addition, five organic extension specialists were also interviewed. The total surveyed surface was 15 ha, equivalent to 51% of the registered surface. Seven of the ten holdings were located in the Ribera Alta district, covering all together a surface of 13.8 ha. The rest of the surveyed surface, that is 1.2 ha, was located in the Vall d'Albaida district. Three of the holdings had a traditional irrigation system (a flow irrigation system), and were located in the Ribera Alta district, while the other seven holdings owned a drip irrigation system and were distributed in both districts.

Related to the structure of the property, four of the seven holdings placed in the Ribera Alta district were classified in the first size bracket (surface less than 1 ha), two in the second size bracket (surface between 1 and 2 ha), and the last one in the third bracket (surface larger than 2 ha). The holding classified in the third bracket, which yielded 7 ha, has been excluded from the analysis, given its different production costs' scheme if compared to the smaller plots, fact that is mainly due to its larger surface. The three holdings located in the Vall d'Albaida district belong to the first size bracket (surface less than 1 ha).

Results

The average production costs of the organic Clemenules crop, obtained after performing a descriptive statistical analysis to the raw data, are offered in Table 7. Tables 8 and 9 show the results of the univariate analysis for each one of the Clemenules

Table 7. Production costs of organic Clemenules in the region of Valencia. Data from 2003 season

	Flow irrigation		**Drip irrigation**	
	€ ha^{-1}	**%**	**€ ha^{-1}**	**%**
1. Variable costs				
1. Inputs				
1.1 Irrigation water	1,347.87	18.40	594.67	10.39
1.2 Fertilizers	1,400.08	19.11	1,427.68	24.94
1.3 Pesticides, herbicides, fungicides	124.98	1.71	58.21	1.02
1.4 Other inputs (bait-traps, props, etc.)	20.83	0.28	58.70	1.03
2. Machinery rental	391.67	5.35	302.64	5.29
3. Equipment operating costs (fuel, lubricants)	134.45	1.84	48.00	0.84
4. Labour cost	2,587.44	35.32	1,603.32	28.01
Total variable costs	6,007.32	81.99	4,093.22	71.51
2. Fixed costs				
2.1 Equipment ownership costs	497.67	6.79	481.38	8.41
2.2 Crop depreciation	385.90	5.27	250.22	4.37
2.3 Drip irrigation system maintenance	0.00	0.00	150.00	2.62
2.4 Taxes and insurance	435.67	5.95	438.17	7.65
2.5 Drip irrigation system depreciation	0.00	0.00	311.12	5.44
Total fixed costs	1,319.23	18.01	1,630.89	28.49
Total costs (variable + fixed costs)	7,326.55		5,724.11	
Average yields (kg ha^{-1})	21,295.00		21,757.00	
Average costs (€ kg^{-1})	0.34		0.26	
CAP agro-environmental measures subsidy	468.79		468.79	
Total costs perceiving subsidy (€ ha^{-1})	6,857.76		5,255.32	
Average yields (kg ha^{-1})	21,295.00		21,757.00	
Average costs with subsidy (€ kg^{-1})	0.32		0.24	

Source: Data provided for by the surveyed farmers and extension specialists.

Table 8. Univariate analysis. Sample: Clemenules with flow irrigation (n=3[1])

Cost item	Average	Median	Standard deviation	Maximum	Minimum	Range
Irrigation water	1,347.87	1,540.00	746.97	1,980.00	523.60	1,456.40
Fertilizers	1,400.08	1,500.25	283.59	1,620.00	1,080.00	540.00
Pesticides, herbicides, fungicides	124.98	84.24	149.57	290.70	0.00	290.70
Other inputs (bait-traps, props)	20.83	0.00	36.07	62.48	0.00	62.48
Machinery rental	391.67	527.00	344.55	648.00	0.00	648.00
Equipment operating costs	134.45	15.75	219.38	387.60	0.00	387.60
Labour cost	2,587.44	2,450.42	646.34	3,291.30	2,020.60	1,270.70
Equipment ownership costs	497.67	505.00	124.16	618.00	370.00	248.00
Crop depreciation	385.90	385.90	0.00	385.90	385.90	0.00
Drip irrigation system maintenance	0.00	0.00	0.00	0.00	0.00	0.00
Taxes and insurances	435.67	459.00	186.10	609.00	239.00	370.00
Drip irrigation system depreciation	0.00	0.00	0.00	0.00	0.00	0.00

[1] n = number of plots.
Source: Data provided for by the surveyed farmers and extension specialists.

Table 9. Univariate analysis. Sample: Clemenules with drip irrigation (n=6[1])

Cost item	Average	Median	Standard deviation	Maximum	Minimum	Range
Irrigation water	594.67	406.29	474.42	1,520.74	300.00	1,220.74
Fertilizers	1,427.68	1,375.60	386.17	1,828.80	1,077.30	751,50
Pesticides, herbicides, fungicides	58.21	49.14	65.86	178.38	0.00	178.38
Other inputs (bait-traps, props)	58.70	63.00	38.73	120.00	0.00	120.00
Machinery rental	302.64	309.00	166.93	514.00	71.82	442.18
Equipment operating costs	48.00	16.80	67.54	179.95	2.80	177.15
Labour cost	1,603.32	1,709.10	331.21	1,925.40	1,105.90	918.50
Equipment ownership costs	481.38	500.00	109.51	618.00	282.44	335.56
Crop depreciation	250.22	250.22	0.00	250.22	250.22	0.00
Drip irrigation system maintenance	150.00	150.00	0.00	150.00	150.00	0.00
Taxes and insurances	438.17	465.00	235.65	685.00	117.00	568.00
Drip irrigation system depreciation	311.12	311.12	0.00	311.12	311.12	0.00

[1] n = number of plots.
Source: Data provided for by the surveyed farmers and extension specialists.

samples, containing plots with flow and drip irrigation systems respectively.

First of all, the most important costs included in the production scheme are the variables, being on average 81.99% and 71.51% of the total costs using flow or drip irrigation systems respectively. Focusing on variable costs, the costliest inputs are irrigation water, fertilizers and labour, regardless the irrigation system available in the farms. Irrigation water is costlier in those holdings which have a flow irrigation system than in holdings with drip irrigation systems. The reasons are, on one hand, the higher efficiency of drip irrigation systems regarding water use and, on the other hand, the considerable high prices of water per cubic metre, which directly depend on the availability of the resource and the farm location.

Independently of the irrigation system available in the farms, fertilizers represent the highest expenses within all the inputs used. Organic farmers are committed to use in their operations those products authorised by Regulation (EEC) 2092/91 (OJ, 1991). Organic manure, as well as cover crops, are widely employed as fertilizers in the region. Not only is organic manure more expensive and difficult to obtain

than chemical fertilizers, but higher quantities are also needed to supply the requirements of an adult plantation in order to obtain regular harvests.

As a consequence of the organic farming principles, input expenses such as fungicides or pesticides are minimal. Weeds are always hand or mechanically hoed without any chemical product being applied to the crops. The use of hormones for flowering control is also forbidden. Farmers only spray mineral oil once or twice a year, depending on pest's pressure. In addition, they sometimes spread amino acids or micronutrients directly on the leaf surface as a nutritional complement if needed.

Labour cost is the greatest expense in organic farming systems, and concretely in our case study the average is higher in holdings with flow irrigation systems because of their greater labour needs, specially to manage operations as irrigation or cover cropping. There are two common labour costs that reach very high expenses regardless the irrigation system employed. These labour costs are pruning and weed management (as weeds are either mechanically or hand hoed in the organic systems without using any chemical input).

Regarding the machinery costs, the farmers surveyed usually have similar pools which are designed according to the size of their holdings, basically constituted by a lightweight tractor (with a power engine between 6.6 and 10.3 kW), a mower for weed management and a rotary cultivator. Costs of depreciation, taxes, insurances, repairing and maintenance are included in the first item of fixed costs (equipment ownership costs). Otherwise, those operations that require the use of special machinery, for example deep tillages, ridge and furrow ploughings, crushing of groundwood after pruning to form a mulching or ground cover, or even the spread of mineral oil against pests, are always hired out of the farm. The costs of machinery rental and its operator are included in the second item of variable costs.

Crop depreciation is calculated by dividing the investment until the plantation is economically viable into its operating life. It is known that drip irrigation causes young trees to start to produce earlier, so consequently the crop depreciation value will always be lower for holdings with this system. By contrast, their total fixed costs will always be higher than those of holdings with a flow irrigation system, as they have to face two extra fixed costs: depreciation and maintenance of the drip irrigation system.

Finally, after accounting for all fixed and variable costs, and considering the average yield of the holdings surveyed, which are 21,295 kg ha^{-1} and 21,757 kg ha^{-1} depending on the irrigation system employed (flow or drip irrigation system), the average production costs or break-even prices resulted in 0.34 € kg^{-1} and 0.26 € kg^{-1} respectively.

It is also important to analyse how the production costs' schemes are affected by the agro-environmental subsidies for the organic citrus crop, which total in the CV 468.79 € ha^{-1}. Hence, break-even prices with and without the agro-environmental subsidy have been calculated, in spite of the fact that most farmers in the region do not apply for the CAP agro-environmental programs. The reason for that is that farmers consider the profit they should obtain while perceiving the subsidy is not big enough if compared with their production costs.

According to the latest calculations, the average production costs for those farmers who applied for the agro-environmental program, would total 0.32 € kg^{-1} for farms with flow irrigation systems, and 0.24 € kg^{-1} for farms with drip irrigation systems. This means that they would slightly reduce their average costs per kilo while participating in the named programs. It could be an interesting fact to consider, specially during the transition period. Organic farmers must face, at least for the three first conversion years, both yield reductions and income losses, given that Regulation (EEC) 2092/91 does not allow them to sell their products certified as organic during that period.

To conclude with this section, the analysis of the surveyed samples also indicates that drip irrigation systems increase the efficiency of holdings, which is valued in our case study in a break-even price reduction of 0.08 € kg^{-1}.

Last but not least, prices higher than the break-even prices obtained will mean profits for farmers, who take advantage selling their harvests in markets where organic products are valued and sold at premium prices. Nowadays the domestic market does not represent an opportunity for organic citrus, which are highly demanded in Northern and Central European countries such as Germany, Austria or Switzerland.

Discussion

After analysing the current situation of the organic Clementine crop in the region of Valencia, it is easy to

realize that it is hardly widespread, whereas it should constitute a good opportunity for citrus growers. According to the latest market tendencies, the small citrus demand is continuously increasing because consumers value overall their agreeable flavour and easy-peel qualities. At the same time, the demand of organic fruit and vegetables has experienced an important growth in the last years.

Comparing our results with those of conventional citrus crop, in a recent study where holdings with similar characteristics and growing the same cultivar were tested, production costs accounted 0.17 € kg^{-1} for plots with flow irrigation systems (Caballero and Fernández, 2002). Not only are the organic average costs higher than those of intensive citrus farms, but the yields are also lower, as the intensive farms' harvests yielded an average of 26,500 kg ha^{-1} (see Table 10).

Other studies published before also confirm that production costs in organic farming systems are higher than those of conventional systems, as well as yields are lower, specially during the transition period (Mc Rae *et al.,* 1990; Klonsky and Livingston, 1994). Thus, organic farmers should do an exhaustive field cost control, trying to obtain, at the same time, as better prices as possible for their certified products. However, it is not easy to manage citrus organically in the region. Some explanatory reasons are listed next: a) a long tradition of intensive citrus farming, whose high productivity rates mean greater profits for farmers; b) the small size of holdings, which is much more evident in the case of organic citrus farms; c) very high production costs, even higher than those of conventional citrus crop as organic farming citrus systems are more intensive in labour requirements, as well as they experiment higher fertilization costs; d) organic citrus growers have to limit their input use to those products authorized by Regulation (EEC) 2092/91, which sometimes are not available, or not easy to provide; e) the low level of the CAP agro-environmental subsidies in the region, which have

Table 10. Production costs of conventional Clemenules in the region of Valencia. Data from 2001 season

	Flow irrigation	
	€ ha^{-1}	**%**
1. Variable costs		
1. Inputs		
1.1 Irrigation water	668.48	15.25
1.2 Fertilizers	438.74	9.99
1.3 Pesticides, herbicides, fungicides	677.56	15.42
1.4 Other inputs (bait-traps, props, etc.)	60.85	1.38
2. Machinery rental	0.00	0.00
3. Equipment operating costs (fuel, lubricants)	58.74	1.33
4. Labour cost	1,530.02	34.84
Total variable costs	3,434.39	78.21
2. Fixed costs		
2.1 Equipment ownership costs	262.94	5.98
2.2 Crop depreciation	365.49	8.32
2.3 Drip irrigation system maintenance	0.00	0.00
2.4 Taxes and insurance	328.39	7.49
2.5 Drip irrigation system depreciation	0.00	0.00
Total fixed costs	956.82	21.79
Total costs (variable + fixed costs)	4,391.21	
Average yields (kg ha^{-1})	26,500.00	
Average costs (€ kg^{-1})	0.17	

Source: Caballero and Fernandez (2002).

an upper limit of 1,000 € ha^{-1} fixed by Regulation (EC) 1257/99 (OJ, 1999); f) lack of demand and distribution channels for organic citrus in the domestic market.

In spite of the structural problems mentioned above, actions such as searching for niche markets or the investment in facilities like drip irrigation systems can help to expand the organic clementine crop in the short term. Furthermore, organic farming could be considered a good option to fight against the negative consequences of intensive agriculture (i.e., lack of biodiversity or nitrate pollution because of the excessive use of chemical inputs). Another important factor to be taken into account is the possibility of obtaining price premiums, since they are organic labelled products.

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